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INTERNATIONAL CONFERENCE ON
Environment
and its Impact on Society

August 18-20, 2013



**BOOK OF PAPERS &
CONFERENCE PROCEEDINGS**

J. D. Birla Institute

AUTONOMOUS (AFFILIATED TO JADAVPUR UNIVERSITY)
“A” GRADE BY NAAC

Depts. of Science & Commerce: 11 Lower Rawdon Street, Kolkata 700020

Dept. of Management: 1 Moira Street, Kolkata – 700017

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Celebrating Glorious 50 Years

INTERNATIONAL CONFERENCE ON ENVIRONMENT AND ITS IMPACT ON SOCIETY

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Golden Jubilee Celebrations (2012-13)

The celebrations of the golden jubilee of J. D. Birla Institute have been marked with events like a 5K walk, “Marathon 2013”, organized as an initiative against child labour; a “Demand Dignity Walk” organized on the occasion of International Women’s Day; the first graduating Fashion Show organized by the Department of Textile Science, Clothing and Fashion Studies; a gala dinner “Alumni Nite, 2012” organized by the Alumni Association on a steamer across the Ganges; a special career counseling session conducted by Mrs. Parven Malhotra and a panel discussion on “Emerging Perspective in Indian Higher Education”. The NAAC-sponsored seminar in ‘Quality Sustenance in Higher Education’ was held in 2013, as was the seminar on ‘Obesity- Complications & Management.’

About the Conference

On completion of 50 years J D Birla Institute is hosting an International Conference on “*Environment and its Impact on Society*” on 18th to 20th August, 2013 at Kolkata, India.

The International Conference is on the subject “*Environment and its Impact on Society*” and would involve participation of academicians, research scholars and students from various institutes and Universities and NGO’s with international participation.

A new vision of the role of education and public awareness in achieving sustainability has emerged during the last few decades. In this period, organizations of all nature have become increasingly aware about achieving and demonstrating sound environmental performance by controlling the effects of their activities, products and services on the environment. Many organizations have undertaken environmental reviews, audits and other procedures to assess their environmental performances. The emerging consensus is that when environmental management systems become a part of running of any organization, only then can an organization survive in the long term.

A gradual shift towards sustainable development is expected to push environmental management systems to the front line of organizational activities. This has already taken place to a large extent in most developed nations. Newly industrialized countries are showing signs of incorporating environmental policies by increasingly encompassing environmental safeguards into their economic activities.

It is at this juncture that our Institute has decided to hold a conference to offer a platform for academicians, teachers, policy makers and entrepreneurs for deliberating over this very important and imperative issue.

A Conference of this nature will highlight successful examples from around the world concerning attempts of integration of education and public awareness into national and local plans and strategies for sustainability, technology, curriculum development, new partnerships and networks.

J.D. Birla Institute
INTERNATIONAL CONFERENCE ON “ENVIRONMENT AND ITS IMPACT ON SOCIETY”
ORGANIZING COMMITTEE

Committees	In-charge
Chairperson	Ms. Rita Bibra
Chief Guests and Other Resource Persons	Dr. Deepali Singhee, Dr. Asit Datta, Mrs. Smita Parekh and Mrs. Keya Ghosh
Security	Mr. N Banerjee
Auditorium	Mr. Srikant Das
Accounts	Mr. Himanshu Binani
Emcee	Ms. Rachana Kejriwal
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Certificates	Ms. Khusboo Thakker, Ms. Sreyashi Chatterjee and Ms. Sreerupa Mondal
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Hospitality for Guests	MC: Mrs. Smita Parekh and Mr. Abhinab Ghosh SC: Mr. Shantanu Chakraborty
Food & Refreshments	MC: Mrs. Samita Gupta, Ms. Damanjit Kaur, Ms. Alifiya Namonbhoy, Ms. Pratyasha Agarwal, Ms. Jincy Abraham, Ms. Jayeeta Paul and Ms. Shrabanti Pal SC: Mr. Madan Mohan Dutta and Mr. Soumajit Adhya
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Press & Publicity	MC: Dr. Deepali Singhee, Mr. N. Banerjee, Mrs. Samita Gupta and Ms. Saba Shamim
Printing & Publication	MC: Dr. Deepali Singhee, Mrs. Amita Dutta, Mrs. Samita Gupta, Ms. Sweta Tuteja, Mrs. Roshmi Banerjee, Ms. Annesha Dutta and Ms. Madhuchanda Das
Decoration	MC: Mrs. Amita Dutta, Ms. Khusboo Thakker, Mrs. Mahua Gunin Pal, Mrs. Sanghamitra Basu, Mr. Prabjoyt Mishra and Mr. Prashant Karan SC: Mrs. Madhu Parsuram
Volunteers & Discipline	MC: Mrs. Basudha Mukhopadhyay, Mrs. Punam Mehra, Dr. Rajashree Sarkar, Mrs. Soheli Ghosh Banerjee, Ms. Megha Jalan, Ms. Nancy Jaiswal SC: Md. Feroz
Crafts Bazaar	MC: Ms. Ankita Chanani and Ms. Yamini Dhanania SC: Ms. Paramita Sarkar
Photographer	MC: Ms. Geetika Sachdeva and Ms. Tانيا Majumdar

CONTENT

• PROGRAMME SCHEDULE	01
• LIST OF DIGNITARIES	03
• PROFILES OF DIGNITARIES	04
• JURY FOR PAPER PRESENTATION	10
• RESEARCH PAPERS	11

CATEGORY: Food & Nutrition

1	FN1	Georgina Anozie	Waste Management Practices Adopted By Female Food Handlers in Umuahia Metropolis
2	FN3	Bandana Nabis Das and Deepanwita Deka	Ethnomedicinal Plants Used as Healers with Reference to Tribes of Kahibama and Khamar Villages Residing in Boko, Kamrup (Rural) District, Assam
3	FN4	Eileen Canday	The Dietary Department Functions and Systems in Public and Private Hospitals of Mumbai
4	FNS	Unnati Shah	To Ascertain the Adequacy of Nutrient Intake among Institutionalized Street Children on Mumbai
5	FN6	V. Lakshmi and V. Raji Sugumar	Correlates of Asthma among School Going Children in Puducherry
6	FN7	Asima Ghosh	Comparative Studies on Sandhyamalati (<i>Mirabilis Jalapa L</i>) and Rajmah (<i>Phaseolus Vulgaris L</i>) Seed Proteins
7	FN9	Sheela Datta Ghatak	Climate Change in Squalid Urban-slums: A Heaven for Dreadful Pathogens Cause Health Hazards
8	FN10	Tanushree Tulsian (Samanta)	Ecofriendly Management of <i>Xanthomonas Oryzae</i>
9	FN11	Malabika Bhattacharjee	Immuno-Molecular Profiling of Liver Tumors Induced by a Chemical Carcinogen
10	FN13	Annalakshmi Chatterjee, Satyabrata Mohapatra, Suchandra Goswami, Anita Mahapatra, Sudip K. Kar, U.V. Mallavadhani and Pratap K. Das	<i>Tephrosia Purpurea</i> – A Wasteland Weed with Potential Anti- <i>Helicobacter</i> Activity
11	FN14	Sonali Ghosh and Shweta Singh	Tannase Extraction from Agro-Waste and its Application in Debittering of Apple Juice
12	FN15	Anuradha Sharma and Ahalya Pai	A Study on Efficiency of Edible Food Packaging on Soft Fruits

CATEGORY: Textiles, Clothing & Fashion

1	TCF4	Ritu Madhan and Deepa Rathi	Dhobi Ghats and their Role in Environmental Degradation
2	TCF5	Kartick. K. Samanta, R.M. Gurjar, S.K. Chattopadhyay, Sujata Saxena, S. Basak and Gayatri T. N.	Water Free Eco-friendly Textile Finishing using Plasma Technology
3	TCF7	Sadhana Sunil Patil	A Study of Consumer Awareness and Action Initiated Regarding Environmental Protection With Regard to Clothing

4	TCF8	Sankar Roy Maulik and Lina Bhowmik	Eco-Green' Batik with Indigo
5	TCF9	Sankar Roy Maulik	Eco-friendly Printing with Vegetable Colour
6	TCF10	Sarika Lanjekar and Pratima Goyal	Comparison of Dye Uptake of Cotton Fabrics using Environment Friendly Single Bath and Traditional Two Bath Wet Preparatory Processes
7	TCF11	Amsamani S and Amsaveni M	Eco Finished Under Arm Pads
8	TCF12	Laxmikanta Nayak	Conversion of Jute Stick into Biomass Energy: A New Approach for Agricultural Waste Management
9	TCF13	Sukriti Patel, Madhu Sharan and D.P.Chattopadhyay	Indian Almond Leaves as a Dye Source
10	TCF14	Isha Jajodia and Amsamani S	Designing Eco-friendly Paper from Water Hyacinth (Eichorina Crassipes)
11	TCF15	Ritu Madhan and Aaisha Shaikh	Developing Hand Bags Using Non Woven Fabric
12	TCF16	Ammayappan L, Sujoy Chakrobarty, Farzana Haque and Supriya Batabyal	Development of Hygienic Jute Textiles by a Novel Method
13	TCF20	Ashis Kumar Samanta, A Bagchi, Reetuparna Bhattacharya(Roy) and Ranjana Chowdhury	Studies on Fire Retardant and Rot Resistant Protective Chemical Finishing of Jute Based Textiles
14	TCF21	Mrinal Kanti Sarkar, Sridev Mete and Sankar Roy Maulik	Value Addition of Traditional Handloom Cotton Fabrics
15	TCFR2	S K Ghosh and T Sanyal	Studies on Jute Geo textile and its Geo-Technical Applications with respect to Eco-Concern
16	TCFR3	Ashis Kumar Samanta and Adwaita Konar	Green Processing of Jute and Other Textiles for Fulfillment of Eco-Criteria and Pollution Control Norm

CATEGORY: Human Development, Family & Society

1	HDFS2	Nazneen Gazdar and Kunjan Trivedi	Factors of Fear and Fantasy in Environment and its Impact on the Children
2	HDFS3	Debmota Sikdar, Nabamita Pandit and Srabani Midya Chowdhury	A Study on Environmental Awareness of Students and Teaching Learning Strategies in Different Schools in Kolkata
3	HDFS4	Susmita Neogi and Ishita Das Roy	A Comparative Study on Environmental Knowledge and Environmental Awareness of Secondary School Students between Different Socioeconomic Statuses
4	HDFS5	Neelima Asthana and Richa Airi	From Environmental Sustainability to Promoting Sustainable Environments: An Initiative by Delhi Schools
5	HDFS6	Nandita Deb	A Study to Find Out the Level of Environmental Awareness among Secondary School Students in West Bengal
6	HDFS7	Anindita Dey	Social Environment and its Psychological Impact on Children and Early Adolescents Belonging to Two Age Groups and Two Different Socio - economic conditions: A Comparative Study
7	HDFS8	Krishnakali Bhattacharyya and Mehnaz Siddiqi	Stigma of Leprosy: A Social Challenge Towards Sustainability

CATEGORY: Architecture & Interior Design

1	AID3	Chhatradhar Das	Role of Environmentalism towards Sustainable Development - A Retrospective Study on Anti Tehri Dam Movement
2	AID5	Vrinda Modi	Sustainable Indoor Landscapes for Enhancement of Indoor Air Quality Application of Contemporary Landscape Design Considerations in Interior Environments
3	AIDR3	Ramesh Singh, Amit Kumar and N.K. Mishra	Electricity Generation 3 in 1 Way by Solar Panel Blade Turbine
4	AIDR4	Anuradha R. Nisal	Man and Environment Interface: A Wake Up Call!

CATEGORY: Commerce & Management

1	CM1	Savita Mishra	Green Economy and its Impact on Environment
2	CM2	Sunita Jaiswal	Outcome and Consequences of the Use of Consumer Products in Relation to Counterfeit Products
3	CM4	Pallabi Priyadarshini	Consumer Products – Is the Lifeline Cutting Short Our Lives
4	CM6	Namrata Shah	Consumer Attitude Towards Green Marketing
5	CM8	Kajal Gandhi and Sreemoyee Guha Roy	Sustainability of Microfinance Institutions in India
6	CM9	Paromita Dutta	Corporate Sustainability: A Case Study on Toyota Motor Corporation
7	CM10	Atreyee Pal	The Trade Off Between Inclusive Growth and Environment Protection in Indian Economy
8	CM12	Pintu Maji, Romana Ali and Madhumala Sengupta	Relationship Between Attitude and Behaviour towards 3R's (Reduce, Reuse and Recycle) for Sustainability: A Case Study
•	REVIEW PAPERS		
1	HDFSR3	Piku Chowdhury	Sustainability and Human Development: Relevance of Tagore's Vision today
2	HDFSR4	Paromita Ghosh	Khana's Sayings: Lyrical Lessons in Environmental Sustainability
3	HDFSR7	Savita Shete	Role of Maharashtra Andhashradhha Nirmulan Samiti for Community Engagement in Environmental Conservation
4	HDFSR9	Advita Deshmukh	Sustainability: Rethinking Human Development in Indian Context
5	CMR1	Papia Mitra and Pritha Sen	Industrialization: Its Impact on the Society and the Environment
6	CMR2	Poonam Kumari	Degradation of Environment: Issues and Challenges
7	CMR4	Ishita Chatterjee and Bipasha Sinha	Green Human Resources: An Effort towards Environment Sustainability
8	CMR5	Madhumala Sengupta, Aparajita Sengupta and Debal Majumdar	Community Supported Agriculture (CSA) as a Strategy for Sustainable Living
•	POSTERS		
1	FNP1	Anamika Ghatak and Lalita Gauri Ray	Production, Characterization and Immobilization of α -Galactosidase from <i>Enterobacter Cloacae</i>
2	FNP2	Pratyasha Agrawal and Tannistha Pathak	A Study on the Nutritional Status of Beneficiaries of Mid Day Meal Programme- An Impact on Society
3	FNP3	Jincy Abraham and Khushboo Agarwala	A Study on the Fortification of Whole Wheat Flour Using Mushrooms Enriched with Vitamin-D through Exposure to Sunlight
4	FNP4	Chitrarpita Saha and Sonali Ghosh	Tannase production from agro waste and its effect on tea

5	FNP5	Megha Jalan and Annalakshmi Chatterjee	Development and Sensory Evaluation of Fermented Tea using Yeast and Sunlight as a source of Vitamin D
6	FNP6	Samir Narayan Chaudhuri and Aditi Roy Chowdhury	Climate Change Affecting Mother-Child Health-Nutrition Outcomes in Poor Communities of West Bengal
7	FNP7	Mayuri Sen and Damanjeet Kaur	Influence of Household Determinants and Environmental Factors on the Incidence of Malnutrition in Children of Low Income Group (1-5 Years)
8	FNP8	Mariyah Irfan and Alifiya Nomanbhoy	Analysis of Microbial Contaminants, Nutritive and Sensory Quality of Milk Based Indian Sweets from Renowned Retail Outlets of Kolkata
9	HDFSP1	Ishita Biswas and Nancy Jaiswal	Identifying the Physical and Behavioural Symptoms of Stress among nurses working in shifts in private hospitals of Kolkata
10	TCFP1	Samita Gupta and Pratibha Sanganeria	A Study on Acceptability of Lined Jackets Made From Jute Blend and Union Fabrics
11	TCFP2	Deepali Singhee and Aanchal Barasia	A Study on Printing of Cotton Fabric using Natural Dyes by Batik Method
12	TCFP3	Deepali Singhee, Dipika Baid and Ashis Kumar Samanta	A Study on the Application of Mixture of Natural Dyes on Silk Fabric and its Different Characteristics
13	TCFP4	Deepali Singhee, Yamini Dhanania and Ashis Kumar Samanta	Dyeing of Silk Fabric with Waste Material Using Unconventional Methods

J. D. Birla Institute
GOLDEN JUBILEE: INTERNATIONAL CONFERENCE ON
Environment and its Impact on Society

PROGRAMME SCHEDULE

DAY 1 (August 18, 2013): - Inauguration

·	BREAKFAST	:	8:30 a.m
·	Welcome and Brief introduction of College by Shri S.K. Birla	:	10:00 a.m
·	Lighting of Lamp	:	10:20 a.m
·	Address by Chief Guest	:	10:25 a.m
·	Keynote Address	:	10:45 a.m
·	Vote of Thanks by Mrs. Sumangala Birla	:	11:30 a.m
·	BREAK FOR TEA	:	11:35 a.m
·	Plenary Session-1 (1 hrs 45 min)	:	12:00 p.m
·	BREAK FOR LUNCH	:	1:45 p.m
·	Plenary Session-2 (1 hrs 45 min)	:	2:30 p.m
·	TEA	:	4:15 p.m

DAY 2 (August 19, 2013): - Parallel Sessions and Paper Presentation

MAIN CAMPUS

Paper Presentations in Food & Nutrition Category, Textile, Clothing & Fashion Category, Human Development, Family & Society Category and Architecture & Interior Design Category

Poster Presentations

·	BREAKFAST	:	8:30 a.m
·	Parallel Session-I	:	10:00 a.m
·	BREAK FOR TEA	:	11:10 a.m
·	Parallel Session-2	:	11:30 a.m
·	Crafts Bazaar Inauguration	:	12:40 p.m
·	BREAK FOR LUNCH	:	1:50 p.m
·	Parallel Session-3	:	2:30 p.m
·	Parallel Session-4	:	3:40 p.m
·	TEA	:	4:50 p.m

CATEGORY	SESSION-1	SESSION-2	SESSION-3	SESSION-4
Food & Nutrition	10:00 a.m to 11:00 a.m	11:30 a.m to 12:20 p.m	2:30 p.m to 3:40 p.m	—
Textiles, Clothing & Fashion	10:00 a.m to 11:00 a.m	11:30 a.m to 12:20 p.m	2:30 p.m to 3:40 p.m	3:40 p.m to 4:50 p.m
Human Development, Family & Society	10:00 a.m to 11:00 a.m	11:30 a.m to 12:20 p.m	2:30 p.m to 3:40 p.m	—
Architecture & Interior Design	10:00 a.m to 11:30 a.m	—	—	—

SATELLITE CAMPUS

·	BREAKFAST	:	8:30 a.m
·	Special Lecture by Prof. Sarmila Banerjee	:	10:00 a.m
·	Parallel Session-I	:	10:45 a.m
·	BREAK FOR TEA	:	11:55 a.m
·	Parallel Session-2	:	12:20 p.m
·	BREAK FOR LUNCH	:	1:35 p.m
·	Parallel Session-3	:	2:15 p.m
·	TEA	:	3:25 p.m

CATEGORY	SESSION-1	SESSION-2	SESSION-3	SESSION-4
Commerce & Management	10:45 a.m to 11:55 am	12:20 p.m to 1:35 p.m	2:15 p.m to 3:25 p.m	—

CRAFTS BAZAAR AT MAIN CAMPUS

19th August, 2013 - 12:40 p.m to 05:00 p.m

20th August, 2013 - 12:40 p.m to 05:00 p.m

DAY 3 (August 20, 2013): Valedictory Session

·	TEA	:	8:30 a.m
·	Arrival of Dignitaries	:	10:20 a.m
·	Welcome Address by Mr. Birla	:	10:30 a.m
·	Address by H.E Shri M.K Narayanan	:	10:40 a.m
·	Address by Dr. APJ Abdul Kalam	:	10:50 a.m
·	Announcement of Best Paper Awards	:	11:50 a.m
·	Vote of Thanks by Mrs. Sumangala Birla	:	11:55 a.m
·	National Anthem	:	12:00 p.m
·	Transfer to Main Campus	:	12:30 p.m
·	LUNCH AT MAIN CAMPUS	:	1:45 p.m

DIGNITARIES

CHIEF GUEST – INAUGURAL SESSION

Shri. Somnath Chatterjee
Former Speaker; Lok Sabha

CHIEF GUEST – VALEDICTORY SESSION

Dr. A.P.J. Abdul Kalam
Former President of India

GUEST OF HONOUR– VALEDICTORY SESSION

H.E. Shri. M.K. Narayanan
Governor of West Bengal

KEYNOTE SPEAKER

Dr. Wieczorek A J
Sustainability Transitions: A New Direction in Environmental Science

RESOURCE PERSONS FOR THE PLENARY SESSIONS

Joanne Miller Pearson,
Involvement by Home Economists in Sustainability and Human Development Issues of the United Nations

Dr. B. Sesikeran
Changing Environments, Lifestyles and prevalence of Obesity in India

Prof Abdullah
Ecological and Economic Attributes of Jute and Natural Fiber for Sustainable Eco-Management

Mr. J.P. Agarwal
Sustainable Urban Development & Green Building

Mr. Stephen Joss Brooks
Remembering the Future Garden Peace

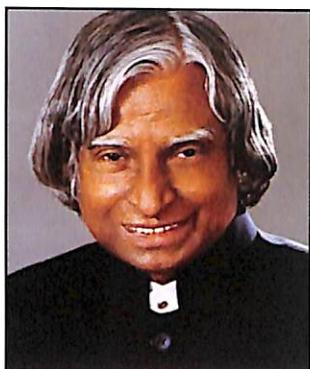
Dr. Vinod Kumar Jain
Climate Change: A Global Environmental Issue

Mr. Nirmal Basu
It Is Wealth Management, Not Waste Management

Mrs. Karuna A Singh
Environment and Youth

Prof. (Dr.) Sarmila Banerjee
Economy and Ecology: Emergence and Decay of East Kolkata Wetlands

PROFILE OF DR. APJ ABDUL KALAM



Former President of India

Born on 15th October 1931 at Rameswaram in Tamil Nadu, Dr. Avul Pakir Jainulabdeen Abdul Kalam, graduated in Science from St. Joseph's College, Trichy in 1954 and specialized in Aeronautical Engineering from Madras Institute of Technology (MIT) in 1957. Dr. Kalam is a pioneer in fibre glass technology and has led a young team to initiate this effort in ISRO from design and development leading to production of composites rocket motor cases. Dr. Kalam made significant contribution as Project Director to develop India's first indigenous Satellite Launch Vehicle (SLV -3) which successfully injected the Rohini satellite in the near earth orbit in July 1980 and made India an exclusive member of Space Club.

He was responsible for the evolution of ISRO's launch vehicle programme, particularly the PSLV configuration. After working for two decades in ISRO and mastering launch vehicle technologies, Dr. Kalam took up the responsibility of developing Indigenous Guided Missiles at Defence Research and Development Organization as the Chief Executive of Integrated Guided Missile Development Programme (IGMDP). **He was responsible for the development and operationalisation of AGNI and PRITHVI Missiles. He enabled the building of indigenous capability in critical technologies through networking of multiple institutions. One of his significant contribution was the creating Research Centre Imarat for advanced technologies. He was the Scientific Adviser to the Defence Minister and Secretary, the Department of Defence Research & Development from July 1992 to December 1999. During this period he led the weaponisation of strategic missile systems and the Pokhran-II nuclear tests in collaboration with the Department of Atomic Energy, which made India a nuclear weapon State. He also gave thrust to self-reliance in defence systems by progressing multiple development tasks and mission projects such as Light Combat Aircraft.**

As Chairman of Technology Information, Forecasting and Assessment Council (TIFAC) and as an eminent scientist, he led the country with the help of 500 experts to arrive at Technology Vision 2020, giving a road map for transforming India from the present developing status to a developed nation. Dr. Kalam has served as the Principal Scientific Advisor to the Government of India, in the rank of Cabinet Minister, from November 1999 to November 2001 and was responsible for evolving policies, strategies and missions for many development applications. Dr. Kalam was also the Chairman, Ex-officio, of the Scientific Advisory Committee to the Cabinet (SAC-C) and piloted India Millennium Mission 2020.

In the bio-medical area, Dr. Kalam along with his team collaborated with medical specialists in the development of Kalam-Raju stent during 1994 – 1996. Kalam – Raju cardiac stent, after qualification trials, has been fitted to many needy patients. This development has further led to the creation of a production unit of state-of -the-art stents. Also, he had intimated the use of carbon-carbon and carbon-polymer materials for production of floor reaction orthosis calipers which reduced the weight of the caliper to 1/10th of the original weight during 1995-1996. Over 50,000 children have been fitted with these calipers.

Dr. Kalam took up academic pursuit as Professor, Technology & Societal Transformation at Anna University, Chennai from November 2001 and was involved in teaching and research tasks. Above all he took up a mission to ignite the young minds for national development by meeting school students across the country. During the last decade, Dr. Kalam has addressed over five million youth below the age of 17 and inspired them to become an active participant of India Vision 2020. He has addressed several children science congresses across the country.

Dr. Kalam is passionate about bringing rural prosperity through PURA (Providing Urban Amenities to Rural Areas), in which science and technology play a key role. Based on his diverse experience he has been propagating the concept of World Knowledge Platform through which the core competencies of organizations and nations can be synergized to innovate and create solutions and products for the challenges of 21st century.

In his literary pursuit Dr. Kalam authored a number of books, such as "Wings of Fire", "India 2020 – A vision for the New Millennium", "My journey" and "Ignited Minds – Unleashing the power within India", "Indomitable Spirit", "Guiding Soul", "Envisioning an Empowered Nation", "Inspiring Thoughts", "Children Ask Kalam", "You are born to blossom", "Family and the Nation", "Turning Points" (2012), "Squaring the Circle – Seven steps to Indian Renaissance" (2013), "Life Tree" and "The Luminous Sparks"- a collection of his poems. Many of them have become household names in India and among the Indian nationals abroad. These books have been translated into many Indian and foreign languages.

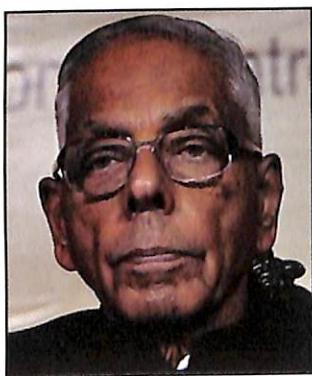
Dr. Kalam is one of the most distinguished scientists of India with the unique honour of receiving honorary doctorates from 45 Universities and institutions from India and abroad. The Honorary Doctorates include Nyenrode Business University, Netherlands; Nanyang Technological University, Singapore; Carnegie Mellon University, Pittsburg USA; University of Wolverhampton, UK; University of Kentucky, USA; Oakland University, Michigan USA; University of Waterloo, Canada; University Sans Malaysia, Malaysia University of Sydney, Australia and the Simon Fraser University, Vancouver.

He has been awarded with the coveted civilian awards – Padma Bhushan (1981) and Padma Vibhushan (1990) and the highest civilian award Bharat Ratna (1997). He is a recipient of several other awards and Fellow of many professional institutions.

The Royal Society, UK has awarded Dr Kalam with the "King Charles-II Medal" for Science and Technology in October 2007. He received the Woodrow Wilson Award in 2008. The Royal Academy of Engineering, London conferred on him the International Medal 2008 in June 2009 at London. The Hoover Board of Awards presented him the Hoover Medal 2008 at New York in April 2009. The Aerospace Historical Society in collaboration with the Graduate Aerospace Laboratories (GALCIT) at the California Institute of Technology awarded him the "2009 International Von Karman Wings Award" in September 2009. On 24th May 2013 the National Space Society, USA has awarded him with its most prestigious award THE WERNHER VON BRAUN MEMORIAL AWARD at San Diego, California.

Dr. Kalam became the 11th President of India on 25th July 2002. After five eventful years he demitted office on 25th July 2007. His focus is on transforming India into a developed nation by 2020. His accent is on constructive networking and excellent human resources for an economically developed, prosperous and peaceful society.

PROFILE OF DR. SHRI M. K. NARAYANAN



Hon'ble Governor of West Bengal

Shri Mayankote Kelath Narayanan was born in New Delhi in 1934. He had his early education in Delhi and Shimla before he went to Madras for his High School and University education. He is an alumnus of the Loyala College, Madras, and holds a Master's Degree in Economics from the University of Madras. Shri Narayanan was Director of the Intelligence Bureau from 1987 to 1992 and also served as the Chairman of the Joint Intelligence Committee of the Government of India. Shri Narayanan was awarded the prestigious national award – Padma Shri – in 1992 for his services to the country. In January 2005, he assumed charge as the National Security Advisor to the Prime Minister of India. As the National Security Advisor, his responsibilities included advising the Prime Minister on foreign policy and defense matters, national security issues, including internal security and intelligence, and nuclear and space matters. He also led India in institutionalized security and strategic dialogues with several countries including Brazil, France, Japan, Sri Lanka, Germany, Russia, UK and the USA. He was also the Prime Minister's Special Representative for boundary talks with China. Shri Narayanan took over as the Governor of the State of West Bengal on January 24, 2010.

PROFILE OF SHRI SOMNATH CHATTERJEE



Former Speaker of Lok Sabha

Mr Somnath Chatterjee is an eminent politician and a former member and a stalwart of the Communist Party of India (Marxist) or CPI (M). He became the 14th Lok Sabha Speaker. He received his early education at Mitra Institution School. Later he went to Presidency College and then to the University of Calcutta. He studied B.A in 1952 and M.A in 1957; both degrees were done in law at Jesus College, Cambridge. Somnath was qualified as an Advocate by the Middle Temple University in London. Mr Chatterjee, recently, published his autobiography titled “Keeping the faith: Memoirs of a Parliamentarian”. He won the “Outstanding Parliamentarian Award” in 1996 for his works. He also became the chairman of West Bengal Industrial Development Corporation (WBIDC). He promoted Foreign Direct Investment or FDI in West Bengal by frequently visiting foreign shores. He has also written various books on varying subjects. He has also written articles in leading news dailies and various print media, including Lok Sabha publications. He has constantly worked over the years toward improving medical facilities in villages near Saniniketan and has also played an important role in development projects in Bolpur. As the Speaker, he introduced a lot of parliamentary reforms.

PROFILE OF ANNA J. WIECZOREK



Anna J. Wieczorek works at the Institute for Environmental Studies at Vrije Universiteit Amsterdam (IVM/VU) and the Innovation Studies Group of Utrecht University. For the last 12 years, she has been an executive officer of the Industrial Transformation Science Project of the International Human Dimension Program. Within this task, Anna facilitated research on applying insights from the emerging stream of system innovation in the context of analyzing economic and environmental transitions occurring in developing Asia. Her main empirical domains are energy and mobility. In the context of her scientific work Anna acquired and coordinated a number of European and international projects and was involved in the design of numerous educational programs. She is now a member of the Steering Group of a European Research Network on Sustainability Transitions (STRN www.transitionsnetwork.org). She also serves as a co-designer and a mentor of the Pioneers into Practice – a professional educational program of the Climate-KIC, Europe’s largest public-private innovation partnership.

PROFILE OF JOANNE M. PEARSON



Joanne M. Pearson graduated from the University of Massachusetts in 1964 with a BS in Home Economics Education. She began graduate work at Iowa State University, where she received an MS in 1969 and a PhD in 1971. In 1985 she completed an MS in Human Nutrition and Foods from Virginia Tech. Her employment history includes work as a home economist for the US Department of Agriculture (USDA) in Hyattsville, MD, Assistant Professor-Part Time in Home Economics at Hood College in Frederick, MD, Assistant Professor in Vocational Technical Education at Virginia Tech, Blacksburg, VA and Associate Professor in Health Sciences-Dietetics at James Madison University in Harrisonburg, VA. She was promoted to Full Professor and retired in 1998. Following retirement she was a Fulbright Scholar at the Technical University in Chisinau, Moldova in 2001. She has been a member of the International Federation for Home Economics (IFHE) since 1972. In 1998 she became active in the Outreach to Central and Eastern European Countries Programme Committee of IFHE. In 2006 she was elected Member Representative for the Region of Americas on the IFHE Executive Board and in 2010 she was elected Vice President for the Region of Americas, her present position.

PROFILE OF DR. B. SESIKERAN



Dr.B.Sesikeran, Director of the National Institute of Nutrition, Indian Council of Medical Research has been a nutritional pathologist of repute for over 30 years. He has an MBBS degree from Stanley Medical College, Chennai and an MD in Pathology from Gandhi Medical College, Hyderabad. He has joined the National Institute of Nutrition in 1977 and has been serving as the Director of the Institute since 2006. His areas of research interest where he has made significant contributions are in nutritional pathology, diet and cancer, micronutrients and apoptosis and iron absorption from the gut. Before assuming charge as the Director of NIN he was the Co-ordinator for the Pre-clinical Toxicology Unit at the Institute which is now known all over the country for its excellence. He served as Secretary, Indian Association of Pathologists & Microbiologists of AP and Joint Secretary for Nutrition Society of India. He is a Fellow of the A.P. Akademi of Sciences, National Academy of Medical Sciences and International Medical Scientists Academy. He has to his credit over 50 publications in national international journals, monographs, several technical reports, papers in proceedings of conferences and popular articles. He is a recipient of many awards and honours.

PROFILE OF DR A. B. M ABDULLAH



Dr A. B. M Abdullah is the Executive Director of JDPC. His qualifications include a B. Sc (Honors) in Chemistry with Applied Chemistry, 1966 and an M.Sc in Chemistry (Organic), 1967 from Dhaka University. He is a PGD in Textile Technology UMIST, UK. He completed his Ph.D in Photo Degradation and Photo Stabilization of Jute from Manchester University, UK and his Post Doctorate Study in Stabilization of Jute is from UMIST, UK. He started as scientific officer in Bangladesh Jute Research Institute (BJRI) under Ministry of Agriculture, Government of Bangladesh in 1969 and has held several eminent posts after that, including the post of the Director and Executive Director of the Bangladesh Jute Research Institute from 1995-2009 .He has been awarded the Jebunessa Mahabubuzzaman Jana Kalyan award in 1986 for contribution in science & technology. He is the recipient of the Gold Medal for the Innovation of Designed Biodegradable Jute Geo-Textiles and its applications in 1993 by the Honorable Prime Minister of Government of Bangladesh. Dr. Abdullah is associated with several organizations, like the Dushtha Shasthya Kendra (DSK), National NGO; he is a life member of the Bangladesh Chemical Society .

MR. JAYPRAKASH AGRAWAL



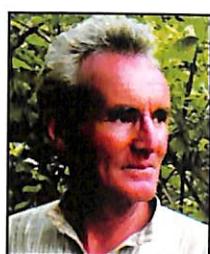
Mr. Jayprakash Agrawal is a highly regarded architect who has been practicing since 1988 under the banner of ‘Agrawal & Agrawal’, a now-reputed establishment in the field of architecture with branches at Kolkata and Baroda. He qualified his B. Arch. (A.I.I.A.) from M.S.University (Baroda) in 1986. He specializes in designing ‘green’ buildings. His eminent designs include the first Platinum and Gold rated green building of Eastern India. He designed “INFINITY”, the first software park of West Bengal. He has been awarded 2 gold medals for best designs and overall best performance in the final year of architecture. His testimonials include prestigious awards like “Spectrum A+D Award”, “Ultratech Excellence Award” & “Achiever’s Award” by IADF’11. He has also been honoured with “Better City Better Life” award for his contribution in the field of “GreenArchitecture”. He has designed ‘Platinum rated and Gold rated’ Green buildings for the city. His project “Sherwood” was awarded “Best housing Project in the Eastern Region” by CNBC India. His work has been published in the book “Golden Hands, the power of Architecture” which has covered 15 selected architects from all over India, all of them selected among 20 prominent architects of India by Society Interiors. His Project “Infinity” was recognized as Top three landmarks of Kolkata City by leading News Paper survey.

PROF. SARMILA BANERJEE



Sarmila Banerjee is at present the Rajiv Gandhi Chair Professor of Eco-systems and Sustainable Development in the University of Calcutta. She is in the faculty of Economics of the same institution for more than three decades. She obtained her Ph.D. degree in Economics from the University of Florida, Gainesville, USA and carried out her post-doctoral research on Environmental Economics in the University of California, Santa Barbara, USA. Her teaching interest is around Econometrics and Environmental Economics. Her research interest is mostly on Quantitative aspects of Social Sector Development. She is the coordinator of UGC-SAP program in her Department and Convener of Ph.D. Program in Economics of the University of Calcutta. She is connected with different academic institutions and research networks in India and abroad through her active involvement in capacity building and curriculum development.

MR. STEPHEN JOSS BROOKS



Joss Brooks grew up in the Australian state of Tasmania, a place full of wild natural beauty and wide open empty spaces. After living in Europe and Africa he came to Auroville near Pondicherry in 1970 to participate in the early pioneering work of the newborn community. In 1973 he established Pitchandikulam dedicated to restoring the eroded 60 acres of Auroville Green Belt land to its former green cover. Now it is a vibrant forest with more than 600 species of plants, many with medicinal value and a nursery that grows the endangered species of the almost extinct Tropical Dry Evergreen Forest found along the Coromandel Coast. In 1993, associating with the Foundation for Revitalization of Local Health Traditions (FRLHT) he developed the medicinal plant conservation Park at Pitchandikulam which served as a base for work with the village communities and traditional healers living around the Kaluveli wetland, north of Auroville. In 2002, the Nadukuppam Environment Education Center was founded. In 2004, Pitchandikulam Forest Consultants was created to implement restoration work in other areas of Tamil Nadu including the city of Chennai.

PROF. (DR.) VINOD KUMAR JAIN



Prof. (Dr.) V. K. Jain is an eminent faculty of the school of environmental science, Jawaharlal Nehru University. He is a former alumnus of Aligarh Muslim University and Sussex University. Some of the feathers in his academic career include JRF from the Council of Scientific and Industrial Research and National Scholarship to study abroad from Ministry of Education, Government of India. His research interest are centric towards the study of Instabilities in magnetized Plasmas, Beam-Plasma interactions-Linear and Non Linear effects, Environmental (Energy, Noise and Air Pollution. He has been a member with various academic bodies including various academic councils of UGC. Further he has 84 national and International publications to his credit, along with a supervision experience of numerous Ph.D and M.Phil Thesis.

MR. NIRMAL BASU



M. B. Nirmal is the founder and chairman of Exnora International which is a civic movement in Chennai, India, which deals with environmental issues. In addition to his involvement in Exnora, Nirmal is also involved in consumer advocacy, afforestation programmes, and rehabilitation of convicts among others. He has been a regular guest and visiting faculty to deliver inspirational and motivational lectures on various subjects in the specialties related to Behavioral Science and Creativity at the National Level Apex Training Institutes, such as the Staff Colleges of Reserve Bank of India, State Bank of India, most of the Nationalized Banks, Petroleum Corporations, Air Lines, LIC, etc. and the Staff Training Colleges of many corporate organizations. He is a powerful motivating speaker has addressed meetings on topics of global concern, in the UN bodies, World Bank and US government Organizations, etc. He chaired Sessions of UNCHS at Shanghai, China and Asia Pacific Cities Forum in Cebu, Philippines. He is author of twelve books in Tamil and six books in English written for individual and societal development.

MRS. KARUNA A. SINGH



Karuna A. Singh, Country Director for Earth Day India, joined Earth Day Network in March 2010, after working for 24 years at the State Department's US Consulate at Kolkata. A senior executive with them, her major portfolio focus was on environmental affairs. She organized seminars with environmental experts, workshops, film screenings, and other events to build awareness about climate change and other environmental issues among a wide spectrum of audiences, from senior-level policy makers to grassroots NGOs. Ms Singh worked to inspire youth to work for the environment, and organized special media events on environmental reporting. She also helped to put together cross-border programs on subjects such as Coastal Zone Management. Her work area covered 12 states of eastern and northeaster India. Ms Singh is one of a small group of persons trained by former U.S. Vice President and Nobel Laureate Al Gore to make presentations on climate change issues. She has also been invited to be a Member of the National Steering Committee of the Global Environment Facility/UNDP/Government of India Ministry of Environment and Forests Small Grant Program and to Chair the Committee for the North East Region of India.

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FOOD & NUTRITION
(Research Papers)

Waste Management Practices Adopted By Female Food Handlers in Umuahia Metropolis

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ABSTRACT

The major purpose of the study was to investigate the waste management practices of female food handlers in Umuahia metropolis. Two research questions were answered. The Population was made up of all the female food handlers in and around the major market in the town. Purposive sampling technique was employed and this yielded a total of 255 female food handlers who formed the sample for the study. Questionnaire, interview and Focus Group Discussion (FGD) were used for data collection. Mean scores were used for the analysis of the research questions, while the FGD results were analyzed qualitatively. The findings revealed among other things that personal sanitation facilities were lacking in their food establishments and the environmental condition of most of these food establishments were poor. Based on the findings, suggestions for improvement were made.

Key Words: Waste, Management, Environmental sanitation, Female food handlers

INTRODUCTION

Effective waste management is central to sustainable environment as the latter leads to sustainable development. A healthy environment is essential to the health and well being of its inhabitants who depend on it for their basic needs. If ones environment is properly managed, it can be geared towards productive, domestic, aesthetic, and even spiritual requirement^[13]. Conversely, if poorly managed, the environment could easily become hazardous and threatening to human survival^[3]. Environment is continuously degraded as a result of poor management of its resources. Environmental pollution, deforestation, improper waste disposal, unchecked population growth and other environmental problems are on the increase. All these problems and other related factors are issues that threaten the physical environment and even constitute services threats to development and human life^[7]. These features of the environment have over time been subjected to varying degrees of changes through mans activities.

Women have a close link with the protection or destruction of our environment in circumstances which are dictated by their position within the Nigerian culture. The women's role in shaping the environment is reflected by their participation in agricultural and pastoral production, provision of food and water, meeting of energy needs and environmental sanitation^[14]. Access to adequate sanitation is a fundamental right and a condition for basic health. It is in recognition of this, that the United Nations declared 2008 International Year of Sanitation. Yaradua (2008) also saw the need for adequate sanitation in the country and re-introduced sanitary inspectors in the country^[18]. It has also been reported that in the developing world, one person in three lacks safe drinking water and sanitation^[15]. In these nations, an estimated 80% of all diseases and over one- third of the deaths are caused by consumption of contaminated water and food. This is highly connected to poor sanitation. Sanitation is any arrangement concerned with the safety of individuals. It involves the cleanliness of the surroundings, individuals and protection of the health of the individuals or public. Anyakoha and Eluwa (1999) defined sanitation as a process of effecting healthful and hygienic measures in places of abode or business^[2]. Sanitary practices include efficient disposal of refuse, personal and environmental cleanliness, good water supply, cleanliness of the facilities and equipment^[1, 12].

Hygienic disposal of all garbage is also a very important aspect of sanitation. When solid and liquid wastes are

not properly disposed it can cause environmental pollution which leads to food contamination [4]. Environmental sanitation is therefore an important principle of food hygiene. When the environment is dirty, it can provide a breeding ground for flies and other pests which help in the contamination of foods. An outbreak of food poisoning is particularly likely to occur in those places where foods are cooked in bulk, stored, served and preserved under poor conditions which allow pathogens to multiply as in the case of fast food industry.

Umuahia, the capital of Abia state and also a commercial centre with its numerous activities is characterized by many business men and women who depend on food handlers for part of their meals. These food handlers who are mostly women are mainly located around the markets and parks. It is unfortunate that many of these food handlers do not know the principles of food hygiene due to poor educational background [11]. The environment in which these food establishments operate is often poor and this increases the risk of food contamination. The activities of these food handlers and the quality of foods they present to the public are not monitored or supervised in any way. As a result of this, food and water borne diseases like diarrhea, dysentery, typhoid fever and food poisoning are common among the inhabitants. Preliminary investigations carried out by the researcher in some of the major hospitals in the town revealed cases of food and water borne diseases. Many of these outbreaks can be traced to poor sanitation practices adopted by food handlers [4]. These outbreaks however have significant health and economic implications and need to be addressed seriously. This study was therefore designed to investigate the waste management practices of female food handlers in Umuahia metropolis with a view to evolving strategies for improvement. To achieve this objective, two research questions were used.

AIMS AND OBJECTIVES

The major purpose of the study was to investigate the waste management practices of female food handlers in Umuahia metropolis with a view to evolving strategies for improvement. Specifically, the study was aimed at investigating the environmental sanitation practices adopted by food handlers in Umuahia metropolis.

METHODOLOGY

This study employed a survey research design on the personal and environmental sanitation practices adopted in food establishments.

Area of the Study: The area of the study was Umuahia, capital of Abia State in the South Eastern Nigeria. Umuahia is characterized by many businessmen and women who patronize the food handlers.

Population for the Study: The Population of the study comprised all the food conveniences in the area of the study. Private entrepreneurs manage most of these food conveniences. Majority of them set up simple facilities or stalls within and around the major markets, streets and offices in Umuahia. Others have more organized fast food restaurants in buildings around the streets and markets.

Sample for the Study: Purposive sampling technique was employed to determine the sample for the study. The major market in the area under study was purposively selected because there were many food establishments around the market. A total of 255 food managers formed the sample for the study.

Instrument for Data Collection: Structured questionnaire was developed in line with the research questions. FGD guide was also developed to get in depth information to support the data collected from the questionnaire. The questionnaire was also used as an interview schedule for non-literate respondents. The instrument was face-validated to ensure the appropriateness of the instrument chosen. For the validation of the instrument, five experts from the department of home Economics/ hotel management and tourism, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria were used. The reliability of the instrument was determined using the Cronbach's alpha procedure as it dealt with multiple choice items.

Data Collection Techniques: Distribution and collection of the instrument were by hand. Four research assistants were used for data collection. Out of 255 copies of the questionnaire distributed, 223 were duly completed and returned. Five FGD sessions were also organized. Each focus group had 12 participants both young and old with different educational backgrounds. They were also drawn from the sample for the study.

Four trained assistants and the researcher acted as facilitators. The facilitators used pre-determined questions in line with the research questions.

Data Analysis Techniques: Mean scores were used for answering the research questions. The analysis was done using the computer based statistical package for social sciences (SPSS version 6.0). Each item in the questionnaire was regarded as "Always Practiced" if the mean was up to 2.5 and above. Items whose means fell below 2.5 were considered as "Never Practiced" The outcome of the FGD was analyzed qualitatively as explained in the discussion.

RESULTS AND DISCUSSION

Table 1 show that items 9 and 19 with means 3.67 and 3.59 were the environmental sanitation practices always adopted by the food establishments. They met the cut-off point of 2.5 and above. The SD ranged from 0.42 to 0.48 indicating closeness of responses. The findings revealed that poor sanitation practices were adopted by some of the food establishments in Umuahia.

Results on the environmental sanitation practices adopted by food handlers revealed that food presented to the public is poorly managed in some food establishments. Very low ratings were obtained in Table1.

Staff personal hygiene facilities like toilet and bathroom were not available in the food establishments as found out from the FGD. This situation was not surprising as most of this fast food industries use make shift structures. This was not in agreement with the assertion of Food and Agriculture Organization (FAO) who noted that sanitary conveniences provided for staff must be adequate, suitable, functional and clean to guarantee that high personal hygiene standards are maintained [5]. Similarly, Fox and Cameron (1990) observed that when proper facilities are made available, it makes it easier for staff to maintain a high standard of personal and communal cleanliness and minimize food contamination [6]. This is also in agreement with the findings of Nwana who asserted that staff handling foods should be disallowed from such dirty habits as they constitute danger to health of the consumer [8]. This is because these personal hygiene habits enable the consumers to be provided with food prepared and served in proper hygienic conditions.

Table 1 revealed that the respondents adopted 2 out of 20 environmental sanitation practices identified for the study. The respondents rated using working surfaces that are easy to clean very highly as a very good practice. This is consistent with the laid down requirements that working or preparation surfaces must be made of hygienic impermeable material that is easy to clean and in good condition [16]. This is always adopted in food establishments as found out through the FGD. Using this help them to save the time and money they should have wasted in washing off stains from materials all the time and changing the material due to constant washing. When the material is also easy to clean, it helps them during the rush hour periods to clean and also serve many impatient customers. Keeping money collected from customers far from the food was rated very low by the respondents as shown in Table 1. The food managers do not practice this and money can easily harbour harmful bacteria as noted earlier [8].

Putting solid and liquid waste together in the same container is a common practice among the food handlers as shown in the Table 1. FGD revealed that the reason for doing this is to have time to serve as many customers as possible during the rush hour periods. They also asserted that a lot of time is being wasted separating waste. This could equally be the reason while items 1, 4, 6 and 7 of Table 1 were rated very low by the respondents because they do not see the need of keeping refuse bin with lid and this was why the environmental conditions of the sale points was very poor (Items 4, 10 and 14 of Table 1). These findings were generally expected as the environmental conditions of many places around the market were very poor [9, 10]. The residents were so much in a hurry to make money than to attend to the aesthetic and sanitary aspects of the environment. The surroundings of the sale points should be kept clean and litter free.

This will make the site more attractive to customers and prevent further pollution of the environment and contamination of the food from the environment. Changing washing water and washing equipment and utensils always with soap and water received very low ratings by the respondents as shown in Table 1. Through the FGD it was discovered that these food establishments spend so much money buying water for their businesses

and as such when they buy water, they manage it so that it will be enough for each day. Our dependence on water makes it an ideal vehicle for numerous pathogens. The WHO recorded 1.7 million daily due to infectious diarrhea alone^[16, 17]. Because of this, important efforts should be invested in increasing the utilization of clean water in carrying out different activities especially those things that enter the mouth. Item 5 of Table 1 showed that most of these fast food industries do not store drinking water properly. Water can become contaminated during storage and handling^[16].

Table 1: Mean scores of the responses of food managers on the environmental sanitation practices they adopt.

S.N	Personal Sanitation practices	Mean	SD	Remarks
1	Having proper waste disposal facilities	2.12	0.43	NP
2	Having proper toilet facilities	2.27	0.61	NP
3	Buying ingredients in clean surroundings	2.34	0.62	NP
4	Maintaining clean environment	2.31	0.60	NP
5	Keeping drinking water in protected stainless steel containers	2.14	0.63	NP
6	Using refuse bins with lids	2.31	0.60	NP
7	Using refuse bins made with impermeable materials	2.12	0.43	NP
8	Using working surface covered with hygienic materials	2.27	0.61	NP
9	Using working surfaces that are easy to clean	3.67	0.42	AP
10	Cleaning working surface after every operation	2.39	0.69	NP
11	Washing equipment and utensils always with soap and water	2.15	0.48	NP
12	Covering the utensils for displaying food for sale always	2.33	0.68	NP
13	Keeping waste far from the meal preparation and service area	2.15	0.48	NP
14	Keeping the surroundings of the sale points clean and litter free	2.27	0.53	NP
15	Keeping money far from the prepared food	2.12	0.43	NP
16	Putting solid and liquid waste separate in different containers	2.07	0.35	NP
17	Washing and disinfecting refuse bin at the end of each day	2.31	0.65	NP
18	Changing washing up water often	2.48	0.70	NP
19	Emptying dirty water inside the gutter	3.59	0.48	AP
20	Putting foods for sale in hygienically clean and protected container	2.23	0.48	NP

N = 446, SD= Standard deviation, NP= Never practiced, AP = Always practiced

CONCLUSION

The food establishments lack personal sanitation facilities like toilet and bathroom. They also lack personal sanitation competencies required in food handling. The environmental condition of most of these food establishments is very poor. Most of the solid and liquid wastes generated from the food establishments are not properly disposed. Liquid and solid wastes are packed together in the same container, dumped into gutters or along the roads. Cooked foods and money are handled together by the same staff. All these practices are sources of food contamination and should be properly addressed.

RECOMMENDATIONS

The following are therefore suggested to improve on their sanitation practices.

1. Public health authorities and other health related agencies in the State should organize workshops and short courses for the food establishments on the personal and environmental sanitation practices they need to adopt for effective management of the food they present to the public.
2. Local government authorities should provide enough public refuse disposal facilities in and around the major markets to help the food establishments in the proper disposal of waste. They should also enforce the use of correct refuse bins with lids by penalizing the defaulters. Prompt evacuation of these refuse disposal facilities is also very necessary to avoid the breeding of dangerous pests on them.
3. The urban development board in the state should consider the food establishments in urban planning so as to locate them properly and also provide them with staff personal sanitation facilities.
4. The activities of the food establishments should be properly monitored by the local government authorities and environmental sanitation officers to curtail their excesses.
5. Food establishments should be encouraged by the local government authorities to have transparent glasses in between the food preparation area and serving area to make it possible for consumers to see what is going on inside the kitchen. This will help the food handlers to improve on their activities and also help the customers to make the right choice of where to eat.
6. Wearing of special out fits such as work uniforms, overalls, aprons and hair covers should be introduced in the food establishments by the local government authorities to reduce the possibility of contamination.

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Ethnomedicinal Plants Used as Healers with Reference to Tribes of Kahibama and Khamar Villages Residing in Boko, Kamrup (Rural) District, Assam

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ABSTRACT

The Kahibama and Khamar Villages of Boko occupied by tribal people, situated in Kamrup district of Assam. The village is endowed with lots of plants due to the favorable climatic conditions of Boko. Plants have been used both in the prevention and cure of various diseases of humans in Kahibama and Khamar Villages of Boko. North East India is provided with lots of endemic medicinal plants which are getting great importance from the economic point of view. Large number of medicinal plants used by different tribes is yet to be explored for economical uses. The people residing in the Kahibama and Khamar Villages of Boko in Assam mostly depend on the vegetation around them for the treatment and prevention of diseases and ailments. In the present study, the tribes of Kahibama and Khamar Villages, viz., Garo, Bodo, Rabha and Koch, in Boko, Kamrup (Rural) District have been considered and important medicinal plants used in the cure of different diseases following various methods have been documented. Our study includes 25 species of medicinal plants belonging to 23 families, used as healers by the local tribal people of Kahibama and Khamar Villages of Boko, Kamrup, Assam.

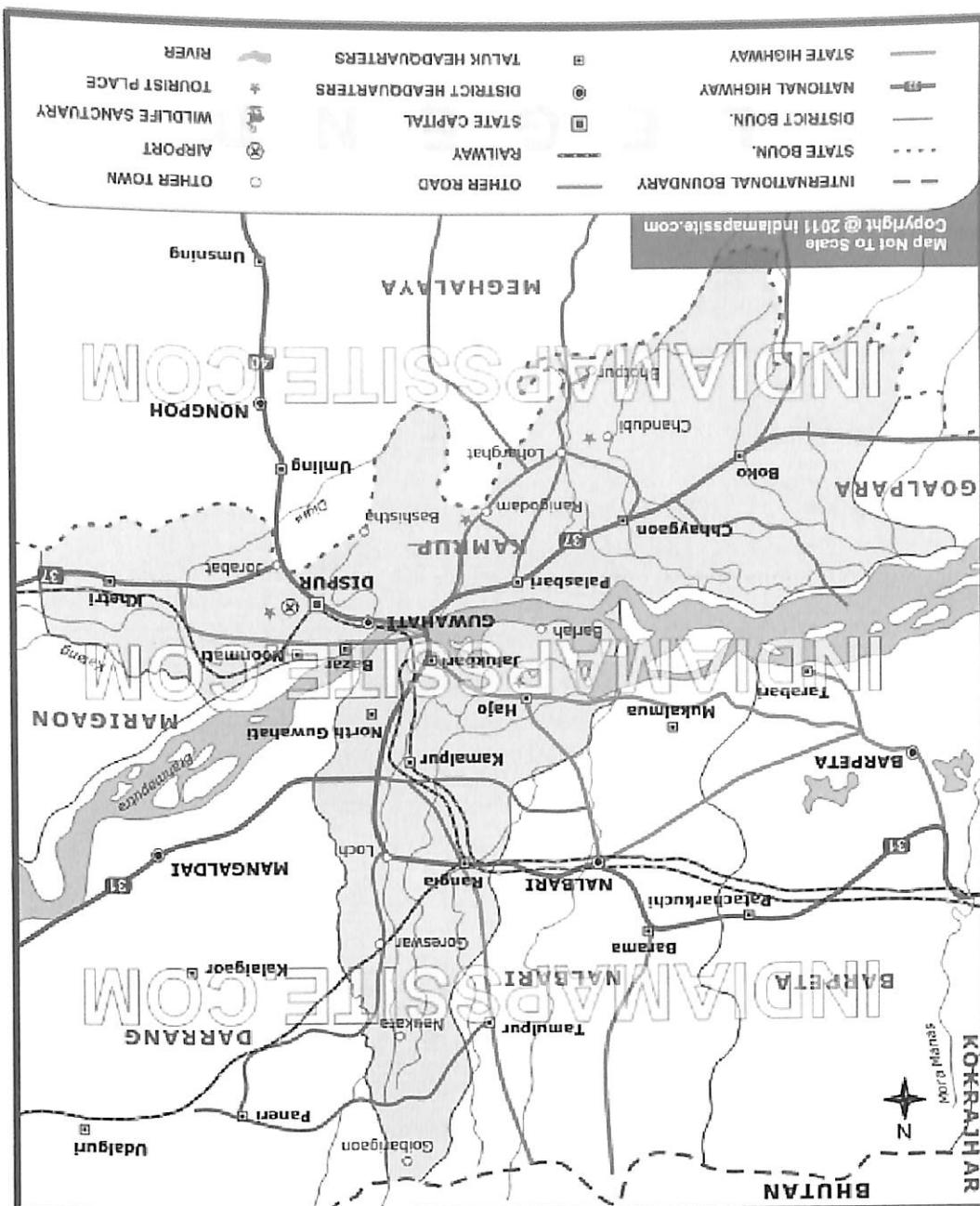
Key Words: Ethnomedicinal plant, Endemic plant, RET plant.

INTRODUCTION

North East India is bestowed with a rich wealth of medicinal plants. Northeastern region of India covers a total geographic area of 262,230 sq. km sharing about 8% of the country's total area. It has a forest area of about 26% to the total geographical area and represents 50% of the total flora of Indian sub-continent [4]. Since time immemorial man has been using various parts of plants in the treatment and prevention of many ailments [2]. Traditional medical practice has been recognized by the World Health Organization (WHO) as a building block of Primary healthcare [1]. North East is very rich in plant biodiversity as well as in ethnic diversity and has a great traditional knowledge base in plant resources. It is inhabited by a considerably large number of tribal people and they lead an intricate life totally dependent on forest resources particularly plants [6]. The leaves and fresh parts of the plant were used most frequently on the external surface to cure wounds by the people in Darikal gaon (Tezpur) [3]. 302 plants from 96 families were recorded as being used by the indigenous Mizo (and other tribal communities) in Mizoram over ten years [5]. North East India is provided with lots of endemic medicinal plants which are getting great importance from the economic point of view. Large number of medicinal plants used by different tribes for various purposes is yet to be explored. Many plants are increasingly becoming threatened due to human exploitation and as such most plants are being categorized for conservation and management purposes. Many economically important plants are also becoming Rare, Endangered and Threatened (RET) day by day due to habitat destruction. As a result the medicinal property of many plants remains unknown.

AIMS AND OBJECTIVES

Considering all the above mentioned factors, the present study was carried out. The objective of the present study was to conduct an ethnomedicinal survey of the plants used for the cure of different diseases by the local tribal people of Kahibama and Khamar villages in Boko, Kamrup (Rural) District, Assam, North East India.



Methods: The study was carried out randomly from January, 2013 to February, 2013 through questionnaires, interviews and detailed discussions with the local people particularly with the medicine men of the villages. These medicine men are quite knowledgeable about the medicinal uses of plants. The discussions were conducted by conducting awareness drive among the local people.

Area of Study: The Kamrup district of Assam is bestowed with natural beauty and archaeological treasures. Kamrup District is situated between 25.46° and 26.49° North Latitude and between 90.48° & 91.50° East Longitude. The District is bounded by North - Dhalguri and Baksa District, South - Meghalaya, East - Darang District and Kamrup Metropolitan District, West - Goalpara District and Nalbari District. The present study was conducted in Kachibama and Khamar Village of Boko, Kamrup (rural), Assam. The villages are situated 6 miles ahead from Chaiagon. The Kachibama and Khamar Village of Boko are occupied by tribal people, who have certain ideas regarding disease and illness prevalent in their society. The village is endowed with lots of plants due to the favorable climatic conditions of Boko.

METHODOLOGY

RESULTS AND DISCUSSION

The present course of investigations has revealed the usage of 20 medicinal plant species used by the Local tribal people viz., Garo, Bodo, Rabha, Koch, Kalita living in Kahibama and Khamar Village of Boko, Kamrup (Rural) district of Assam. The information on scientific name, vernacular name of the plants used and their mode of application in different diseases have been provided (Table-1).

Table 1: Different Plants used as Medicine by Local Tribal People of Kahibama and Khamar Village of Boko

Mode of Application	Disease
<i>Name of the Plant: Azadirachta indica A. juss • Family: Meliaceae • Vernacular Name: Neem</i>	
Leaves are boiled in water and cooled, later used in shower after an attack of measles; leaves fried with a little mustard oil, are taken as an antidote to round worm and bark of trees is powdered to consume to cure malaria.	Malaria, measles, round worm.
<i>Name of the Plant: Adhatoda vasica Linn • Family: Acanthaceae • Vernacular Name: Ellot</i>	
Juice of leaves consumed to cure cough	Cough
<i>Name of the Plant: Alstonia scholaris (L) R. Br. % Family: Apocynaceae % Vernacular Name: Sokchuan</i>	
Bark of juice used	As an antidote to fertility in women.
<i>Name of the Plant: Acorus calamus Linn • Family: Araceae • Vernacular Name: Memblum</i>	
Rhizomes are crushed and wrapped in a fine piece of cloth and is kept hanging from neck of a baby to cure.	Cold attacks.
<i>Name of the Plant: Artemisia vulgaris • Family: Asteraceae • Vernacular Name: Khelbijak</i>	
The herb is boiled in water and cooled and used as a tonic.	It has stimulant and slightly tonic properties, and is of value as a nervine and emmenagogue, having also diuretic and diaphoretic action. and also in fever
<i>Name of the Plant: Ananas comosus Linn • Family: Bromeliaceae • Vernacular Name: Anaros</i>	
Delicate parts of the spathe (leaf) is warmed and softened near fire, juice is extracted and mixed with guava leaf juice and the mixture is consumed to cure stomach upsets or, only the juice of spathe is given to children to cure.	Stomach upset and worm infestation and vomiting
<i>Name of the Plant: Abroma augusta Linn • Family: Sterculariaceae • Vernacular Name: Gorokhia koroi or Ulat kambal</i>	
Bark of the Plant, considered to be a valuable emerogogue and uterine tonic, useful in neurologic dysmenorrhoea.	Dysmenorrhoea and piles.
<i>Name of the Plant: Asparagus racemosus wild • Family: Liliaceae • Vernacular Name: Shatmul</i>	
Juice is extracted from roots and consumed to cure rheumatism.	Rheumatism
<i>Name of the Plant: Bryophyllum pinnatum (Lam) Kurz % Family: Crassulaceae % Vernacular Name: Pate gaja</i>	
Juice of leaves	Jaundice and diabetes
<i>Name of the Plant: Bambusa pallida • Family: Poaceae • Vernacular Name: Bah</i>	
Young shoots are crushed and taken raw.	Good for health and skin
<i>Name of the Plant: Bacopa monnieri (L) Pennell • Family: Scrophulariaceae • Vernacular Name: Brahmi</i>	
The whole plant is used to make a paste from which juice is extracted.	Sleeplessness and "Mirgi"

Mode of Application	Disease
<i>Name of the Plant: Catharanthus roseus (L) G. Don • Family: Apocynaceae • Vernacular Name: Nayantara</i>	
The juice of leave is applied on the affected area.	Wasp sting
<i>Name of the Plant: Cynodon dactylon Pers • Family: Poaceae • Vernacular Name: Dubari</i>	
Pulp of the whole plant is applied on the affected area.	Cuts and bruises.
<i>Name of the Plant: Cassia fistula Linn • Family: Lythraceae • Vernacular Name: Sonaru</i>	
part of the seed is applied on the tongue of babies	To cure ulcers
<i>Name of the Plant: Curcuma longa Linn • Family: Zingiberaceae • Vernacular Name: Halodhi</i>	
Rhizome is ground to make a fine paste warmed up a little and applied on sprains.	Sprains
<i>Name of the Plant: Cauroupita guianensis Aubl • Family: Lecithidaceae • Vernacular Name: Nagchampa</i>	
Leaves boiled and the water is taken to cure stomach ache	Stomach ache
<i>Name of the Plant: Euphorbia neriifolia Linn • Family: Euphorbiaceae • Vernacular Name: Siju</i>	
Juice of leaves is used to cure tuberculosis and cough	Tuberculosis and cough
<i>Name of the Plant: Saraca asoca Roxb • Family: Caesalpinaeaceae • Vernacular Name: Ashok</i>	
Tonic prepared from bark. Bark is astringent, decoction,	Used in uterine disorders especially in monorrhoea and leucorrhœa
<i>Name of the Plant: Centella asiatica (L) • Family: Apiaceae • Vernacular Name: Bor manimooni</i>	
Juice is prepared from the whole plant	Used in stomach trouble, blood purifier, skin diseases.
<i>Name of the Plant: Clerodendron colebrookianum) • Family: Verbenaceae • Vernacular Name: Nefaphu or bolmichek garo</i>	
Leaves steamed and consumed	Antihypertensive
<i>Name of the Plant: Acacia arabica • Family: Fabaceae • Vernacular Name: Raudraksha</i>	
Bark is used	It is reportedly used as for its astringent properties, to treat bleeding, bronchitis, diarrhea, gonorrhea, leprosy, typhoid and upper respiratory tract infections.
<i>Name of the Plant: Tinospora cordifolia • Family: Menispermaceae • Vernacular Name: Jomor lakhuti</i>	
Juice of bark is extracted and used.	The plant oil is effective in reducing pain and edema and in gout and skin diseases. The herb accords longevity, enhances memory, improves health, and bestows youth
<i>Name of the Plant: Terminalia chebula • Family: Combretaceae • Vernacular Name: Silikha</i>	
The dry nut's peel and bark are used	Used to cure cold-related nagging coughs. The bark peel of the nut is placed in the cheek. Its fruit has digestive, anti-inflammatory, cardiotonic, constipation, piles, cough and cold.
<i>Name of the Plant: Withania somnifera • Family: Solanaceae • Vernacular Name: Ashwagandh</i>	
Mainly root is used Rheumatism	Applied to tumors, tubercular glands, ulcers and
<i>Name of the Plant: Boerhavia diffusa • Family: Nictaginaceae • Vernacular Name: Punarnava</i>	
The whole plant is used	In low eyesight. It used in diabetes to lower blood sugar

Table 2: Chemical Basis of the Plant Species used by Local Tribal People of Kahibama and Khamar Villages of Boko

Name of the Plant Species	Chemical Basis
<i>Abroma augusta</i> Linn	Essential oil
<i>Acacia arabica</i>	Gum
<i>Acorus calamus</i> Linn	Bitter Principle Acorine
<i>Adhatoda vasica</i> Linn	Vascine
<i>Alstonia scholaris</i> (L) R. Br.	Flavonoids
<i>Ananas comosus</i> Linn	Bromelain
<i>Artemisia vulgaris</i>	Santonin
<i>Asparagus racemosus</i> wild	Saponin
<i>Azadirachta indica</i> A. juss	Nimbin, Nimbinin, Nimboil, Bimbidin.
<i>Bacopa monnieri</i> (L) Pennell	Saponin
<i>Boerhavia diffusa</i>	Flavonoid
<i>Bryophyllum pinnatum</i> (Lam) Kurz.	Flavonoid
<i>Cassia fistula</i> Linn.	Anthroquinones
<i>Catharanthus roseus</i> (L) G. Don	Alkaloid
<i>Cauoupita guianensis</i> Aubl..	Stigmasterol
<i>Centella asiatica</i> (L)	Triterpenoids, Asiaticoside
<i>Clerodendron colebrookianum</i>	Saponins, flavonoids, alkaloids, tannin, glycosides
<i>Curcuma longa</i> Linn	Curcumin
<i>Cynodon dactylon</i> Pers	β - sitosterol, β - carotene, vitamin C, palmitic acid, triterpenoids, arundoin, friedelin, selenium
<i>Euphorbia neriifolia</i> Linn.	Essential oil
<i>Saraca asoca</i> Roxb.	Essential oil
<i>Tinospora cordifolia</i>	Pyrralol type tannin.
<i>Terminalia chebula</i>	Benrine
<i>Withania somnifera</i>	Withaferin, withanolide

Table 3: Occurrence of the Medicinal Plants used by Local Tribal People of Kahibama and Khamar Villages of Boko

Name of the Plants	Occurrence
<i>Abroma augusta</i> Linn	Sporadic
<i>Acacia arabica</i>	Sporadic
<i>Acorus calamus</i> Linn	Frequent
<i>Adhatoda vasica</i> Linn	Frequent
<i>Alstonia scholaris</i> (L) R. Br.	Frequent
<i>Ananas comosus</i> Linn	Sporadic
<i>Artemisia vulgaris</i>	Sporadic
<i>Asparagus racemosus</i> wild	Sporadic
<i>Azadirachta indica</i> A. juss	Frequent
<i>Bacopa monnieri</i> (L) Pennell	Frequent
<i>Bambusa pallida</i>	Frequent
<i>Boerhavia diffusa</i>	Frequent
<i>Bryophyllum pinnatum</i> (Lam) Kurz.	Frequent
<i>Cassia fistula</i> Linn.	Abundant
<i>Catharanthus roseus</i> (L) G. Don	Frequent
<i>Cauoupita guianensis</i> Aubl..	Sporadic
<i>Centella asiatica</i> (L)	Abundant
<i>Clerodendron colebrookianum</i>	Sporadic
<i>Curcuma longa</i> Linn	Abundant
<i>Cynodon dactylon</i> Pers	Abundant
<i>Euphorbia neriifolia</i> Linn.	Frequent
<i>Saraca asoca</i> Roxb.	Sporadic
<i>Tinospora cordifolia</i>	Sporadic
<i>Terminalia chebula</i>	Frequent
<i>Withania somnifera</i>	Sporadic

CONCLUSION

The information generated from the present study regarding the medicinal plant use by different tribes living in Kahibama and Khamar village, need a thorough phytochemical investigation including alkaloid extraction and isolation along with few clinical trials. This could help in creating mass awareness regarding the need for conservation of such plants and also in the promotion of ethno-medico-botanical knowledge within the region besides contributing to the in-situ and ex-situ preservation and enrichment of the germplasm conservation of such economically important plant species before they become Rare, Endangered and Threatened (RET) or are lost forever.

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The Dietary Department Functions and Systems in Public and Private Hospitals of Mumbai

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ABSTRACT

The aim of the study was to examine the functions and systems of the dietary department, in public and private hospitals of Mumbai. A questionnaire was administered to dietitians of 30 hospitals including public n = 4 as well as private n = 26. In the present study 77% of the hospitals were not accredited, while 23 % were certified, all of which were from the private sector. 13.3% of the dieticians from the public sector and 43.3% from the private sector worked in either one or two shifts. In the present study 53.3% of the hospital's chief dieticians were of the opinion that they were adequately staffed, 46.7% of the chief dieticians expressed the need of additional staff. The need was greater from public sector hospital, with the requirement ranging from one to as many as nine additional dieticians, while in private sector the need for additional dietitian ranged from one to five. 50% of the public hospitals and 69% of the private hospitals spent about 10 to 20 minutes with the inward patients. 25 % public hospitals and 23.1 % private hospitals spent < 20 to 30 minutes with the inward patient. 75% of the public hospitals and 80.8 % of the private hospitals spend about 15 to 30 minutes with the patients in the OPD. Hence it can be concluded that hospital environment could influence the recovery of patients and the dietitian is an important link in the hospitals' health care system.

Key Words: Dieticians, Public, Private Hospitals.

INTRODUCTION

A dietitian was described as “a person who specializes in the knowledge of food and can meet the demands of the medical profession for diet therapy [8].

Dietitians help to promote healthy food choices and prevent disease by increasing awareness of the link between nutrition and health. Dietetics is the interpretation and communication of the science of nutrition to enable people to make informed and practical choices about food and lifestyle, in both health and disease. Registered dieticians translate the science of nutrition into everyday information about food [5].

Dietetics is the science and art of feeding individuals based on the principles of nutrition. It can also be said to be the “science and art of nutritional care.” Diet therapy and its application in patient related settings is major focus of dietetics. The role of dietitian has come a long way since the early 1900s. Their role is still unknown to a lot of people. Some think that dietitians, as their name implies, only give out diets to make individuals lose weight, whereas this is a small part of their role. The dietitian is the link between the patient and medical team or physician in assisting difficult decisions making about nutrition care. A dilemma occurs when the disease state of the patient confound the adequacy of nutritional support, which has resulted in the patient’s malnourishment [9].

Less attention has been given to the effect that the hospital environment has on the wellbeing and productivity

of healthcare staff themselves. As part of its efforts to meet demands for competent clinical dietetic practitioners, the American Dietetic Association (A.D.A) conducted a role delineation study for entry-level clinical dietetic personnel. A.D.A's efforts in role delineation are situated in the history and future needs of the profession [1].

There is clearly an opportunity for health trusts with large property estates to consider these issues – in particular improvements in the working environment – when planning interventions around the efficiency, cost, environmental impacts, and health outcomes for patients. Most of the technicians reported they were functioning in positions requiring backgrounds primarily in nutrition care or with equal emphasis on food service management and nutrition. Few were in positions with a food service management emphasis. Supervisor's ratings indicated the technician's performance was satisfactory to above average, with general to little or no supervision needed [7].

Dietitians were perceived as not performing a role consistent with respondents' expectations. Activities related to the professional development, education, and research role of dietitians yielded higher disparity than did activities related to the provision of nutritional care [6].

Despite sufficient food provision, most of the hospitalized patients did not cover their estimated needs. Since insufficient food intake was often attributed to causes other than disease, there should be potential to improve the hospital meal service [2].

The main causes for inadequate nutritional care were lack of instructions to deal with these problems, and lack of basic knowledge with respect to dietary requirements and practical aspects of the hospital's food provision. Patient-related aspects and the system of food provision also contributed, but only to a small degree. These findings form the basis of the strategy to improve nutritional care in these hospitals [3].

Nutrition therapy is mostly unidisciplinary; the concept of a NST and its roles is wrongly perceived; education and training are eagerly awaited. Defining quality patient care is a complex and often confusing issue [5].

The 10-step continuous quality improvement initiatives do work, and practitioners can use the practice experience presented here as a conceptual framework to justify or validate the quality of patient nutrition care in their own institutions [5].

In order to assess the prevalent situation of diet and dietetic departments in the hospitals of India, a questionnaire was mailed to hospitals selected from the directory of hospitals. The studies indicated the scope for improving the dietetic department in Indian hospitals [4].

AIMS AND OBJECTIVES

1. To examine the functions and systems of the dietary department, in public and private hospitals of Mumbai.
2. To examine the dietary department functions and systems in public and private hospital of Mumbai.
3. To understand the shifts the dieticians work in.
4. To understand the number of dieticians employed by the public and private hospitals.
5. The current nutritional protocol followed by dietitians in the hospitals of Mumbai.

METHODOLOGY

Research Design: The research design included administration of a questionnaire to all the chief dieticians. All questionnaires were administered after obtaining consent of the concerned authorities.

Criteria for Sample Selection:

Inclusion Criteria:

1. Multi-specialty as well as specialty hospital will be in the scope of study.
2. Hospitals with/without a structured dietary department will be included.
3. 'Dietetic Services' would include Clinical Dietetics (area of nutrition that focuses on diet therapy, incorporating normal/modified diet to the patients in the hospital).

4. Food Service Management functions, Out Patients Department (OPD) functions and Continuous Medical Nutrition Education (CMNE) programmes would also be studies.
5. In hospitals without a Dietetic department the study will be carried out with managers heading the ‘Dietetic services’.
6. All hospitals were within the geographical boundaries of Mumbai.

Sample Size: A total of 65 hospitals in the public and private sector hospital of Mumbai were approached. Out of which 30 hospitals gave consent to conduct the study.

Sampling Technique: Purposive sampling technique

Research Methods: Interview method - personal and structural interview using a questionnaire method.

Tools and Techniques:

Questionnaire: A detailed questionnaire was administered to all the participants to obtain information on the following:

- a. *Part I* - On the dietetic department functions and systems, roles and responsibilities, and job description/specifications of dieticians in the hospital.
- b. *Part II* - On the nutritional protocols followed by dieticians and ‘Dietetics services’ of the hospital.

RESULTS AND DISCUSSIONS

In the present study, the role of dieticians and ‘dietetic services’ in public and private hospitals of Mumbai was studied.

The results obtained have been discussed under the following headings.

- The dietary department functions and systems in public and private hospitals of Mumbai.
- The existing role of the dieticians in the hospitals.
- The current nutritional protocol followed by dietitians in the hospitals of Mumbai.
- ‘Dietetic services’ at public and private hospital of Mumbai.

The questionnaire was administered to 30 hospitals; of which 13.4% were public hospital (n=4) and 86.6 % were private hospital (n=26).

The Dietary Department - Functions and Systems in Public and Private Hospitals of Mumbai:

Table 1: Hospitals with Accreditation or Certifications and Shifts of Dieticians

Public Sector	4 (13.3)	0 (77)	4 (13.3)
Private Sector	26 (86.7)	6 (23)	13 (43.3)

Data is presented as number (percent)

In the present study 77% of the hospitals in did not have any kind of accreditations or certifications, while 23 % were certified, all of which were from the private sector. This study also brought out the fact that in the hospital dietetic department, dieticians who worked in either one or two shifts were 13.3% from the public sector while 43.3% from the Private Sector. While the remaining hospitals in this study worked in any other duty timings.

In the present study the hospitals the number of employed dieticians in the hospitals had a mean of 2.97 ± 2.71 dietitian staff employed as show in Figure 1.

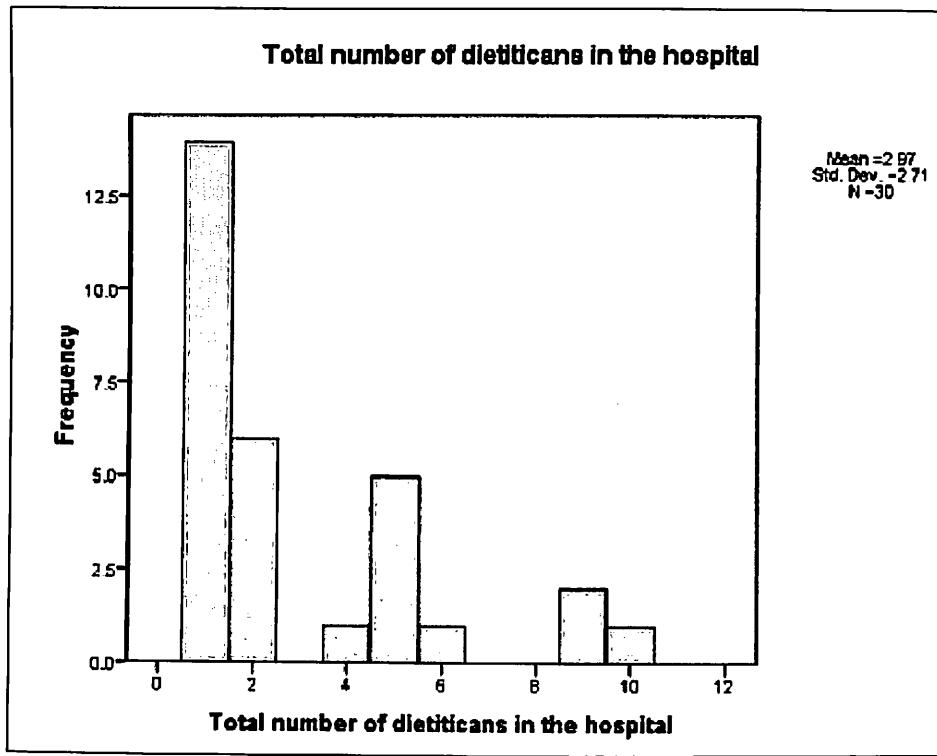


Figure 1: Dietician Staffing

Table 2: Anticipated Additional Staffing Requirements by the Chief Dieticians of the Hospital

Number of more staff are required	Public Hospitals $n = 4$ (f)	Private Hospitals $n = 26$ (f)	All Cases $n = 30$ (f)	All Cases $n = 30$ (%)
0	1	15	16	53.3
1	0	5	5	16.7
2	1	5	6	20.0
4	1	1	2	6.7
9	1	0	1	3.3

In the present study 53.3% of the hospital's chief dietitian was of the opinion that they were adequately staffed. 46.7% of the chief dieticians analyzed the need of additional staff requirement. Highest among the need for additional staff need was from public sector hospital, with the need anticipated from one to as many as nine additional dieticians while five hospitals in the private sector anticipated the need of minimum one additional dietitian and the other five anticipated the need of additional two dieticians

The Existing Role of the Dieticians in the Hospitals:

In the present study, all the hospital ($n=30$) Dieticians in public and private sector, as show in table 3 are the job specifications/activities carried out as departmental function.

The following activities of the dietetic departments done by the dieticians have been observed.

- Provides diet counseling to patients.
- Provides discharge diets to referred patients.
- Respects lifestyle, opinions, beliefs and values of patients.
- Uses communication effectively.
- They also consider biochemical parameters before planning diets.

In this study, in the public hospital sector, the least among of the jobs activities done were that of selecting the appropriate food/meals for patients during hospital stay, meeting every admitted patients and providing a discharge diet to every admitted patients even if not referred by a doctor.

In the private hospital sector the least of the activity done were meeting every admitted patient in the hospital.

Table 3: The Existing Role of the Dieticians in the Hospital

.Job specifications various activities carried out by dieticians in hospitals	Public hospital	Private hospital	Total
	n= 4 (f)	N = 26 (f)	N = 30 (f)
Assess the nutritional status	4	16	20
Helps patient to select appropriate food items (during hospital stay)	0	11	11
Discusses the diet with the patients	0	21	21
Screening patients (nutritional deficiencies)	4	24	28
Considers biochemical parameters before planning diets	4	26	30
Develops a diet plan	1	18	19
Communicates to other team members	2	20	22
Monitoring the effect of nutrition intervention	4	19	23
Assessing the patient's food acceptance.	2	19	21
Provide diet counseling	4	26	30
Implement nutrition care plan	2	22	24
Solves Nutrition problems of individual	3	19	22
acquires and utilized dietary supplements	4	20	24
Meet all patients daily	0	9	9
Detailed diet history	2	21	23
Provides a discharge diet to referred patients only	4	26	30
Provides a discharge diet to all patients even if not referred	0	2	2
Maintains a departmental record	4	15	19
Supervise diet assistants/clerks	2	17	19
Accept direct supervision from senior dietitians	1	11	12
Respects the lifestyles, opinions, beliefs and values	4	26	30
Understands the need for team effort.	2	24	26
Seeks appropriate avenues for continuing education (seminars, conferences)	4	23	27
Uses communication effectively (to ward and kitchen)	4	26	30

The Current Nutritional Protocol followed by Dietitians in the Hospitals of Mumbai:

In the present study, the amount of time spent with patients as given figure 2, shows the time spent by the dietitian per patient for inward patients. It has been observed that 50% (n = 4) of the public hospitals and 69% (n = 26) of the private hospitals spent time per patients admitted to inward is 10 to 20 minutes. It has also been observed that 25 % (n=4) of the public hospitals and 23.1 % (n = 26) of the private hospitals spent < 20 to 30

minutes per patient admitted to inward, whereas time spent by the dietitian per patient for OPD patients was 15 to 30 minutes in 75% ($n = 4$) of the public hospitals and 80.8 % ($n=26$) of the private hospitals. In the public hospital 50% ($n = 4$ and 38.5% ($n = 26$) of the private hospitals counsel patients for 10 to 20 minutes in the OPD.

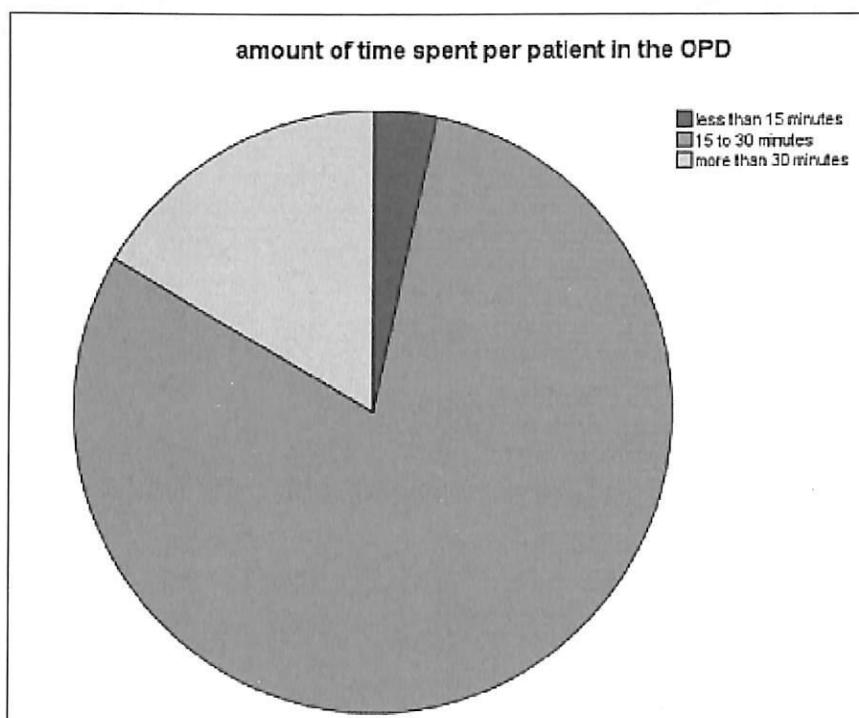


Figure 2: Time Spent by the Dietician with the Patient in the OPD

In the current study as shown in (figure 3) 50% ($n = 4$) of the public hospitals and 50% ($n = 26$) of the private hospitals conduct nutritional assessments for the patients only for referred patients, while 50% ($n = 4$) of the public hospitals and 46.2% ($n = 26$) of the private hospitals conduct nutritional assessments for all the patients met by the dietitian. The mean number of nutritional assessments conducted by dieticians is in public and private hospitals is 15.53 ± 24.288 ($N = 30$)

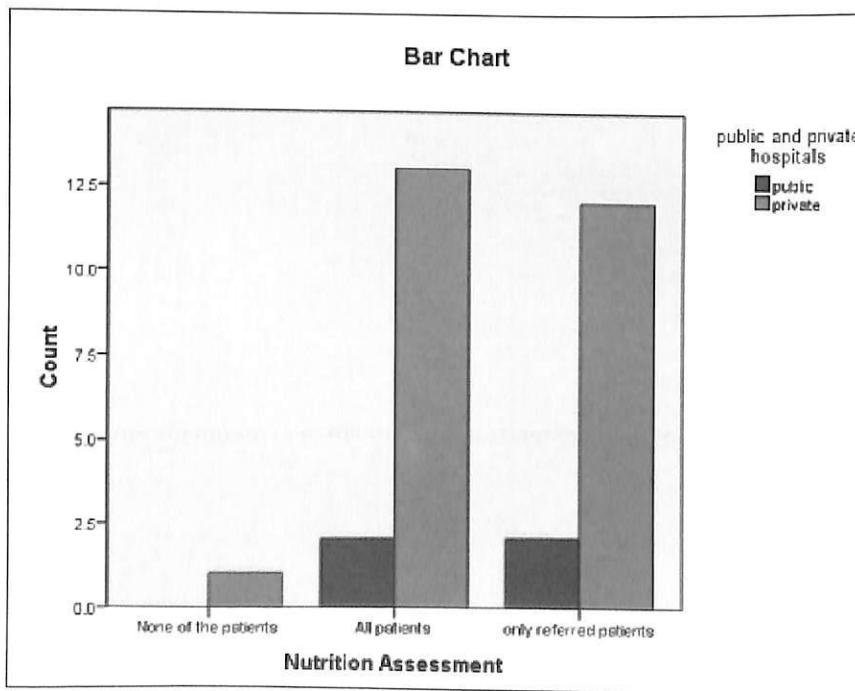


Figure 3: Nutritional Assessment for the Patients

CONCLUSION

Many experienced health professionals, hospital administrators and the human resource departments of the hospitals have only a vague idea of the role of trained clinical dietitian. This study has helped to understand the dietetic department, the dietitian's role and the dietetic services of the hospital.

The present study had brought out facts of the dietetic departments in hospitals of Mumbai, which is as follows:

- The present study also highlight the importance of accreditation of hospital dietary department for standards as they promote safe, effective, and efficient food and nutrition services based on evidence-based practice. They provide for improved health care and food and nutrition service-related outcomes. Also ensure continuous quality improvement. Promotes dietetics research, innovation, and practice development.
- Dietician in the hospitals work in one or two shifts.
- However this study brings out an important fact that the dietitian to patient ratio in most hospital of Mumbai is very poor and that step need to be taken to improve it. There is inadequate dietetics staffing for nutrition care and also a high anticipation of additional staff requirements.
- Some of the hospitals need to have set guidelines of the number of dieticians that a hospital would need depending on the of job activity required to be executed.
- In this study dietician give adequate time for patient counseling.
- This study has notices that many dieticians take personal responsibility for professional performance and also seek strategies to increase the credibility and visibility in clinical dietetics. This study it has been observed that dietitians could move from one area of practice to another (food service to public health, for example) without additional training. Dieticians provide diet counseling to patients and counseling to patients referred on discharge. Dieticians respect lifestyle, opinions, beliefs and values of patients. They use communication effectively.
- In many hospitals part time employment opportunities have emerged and many hospitals are employing dieticians as consultants and not full time employees.
- This study should help to provide guidelines to various bodies such as hospitals, Dietetic Association, Government bodies, and Accreditation boards with regards to role of dieticians in hospitals.
- This study further could help all other clinical dietitian to review the protocols in their own hospital set up.

LIMITATIONS

1. The number of hospitals in the public sector was very few ($n = 4$), since it was difficult to get permissions form the municipality and government hospitals.
2. Among the private hospital some hospitals permission was not granted.
3. Bed strength of the hospitals was in a wide range.
4. The questionnaire was administered only to the chief dieticians of the hospitals hence the views in the study are only of the chief dieticians and not of all the staff dieticians.
5. This study was conducted only in hospitals which already had dieticians employed hospitals which did not have dieticians were not included.

RECOMMENDATIONS

1. Equal number of public and private hospital to be included.
2. Hospitals without dietetic department could be included as well.
3. Further studies could include inter-city hospitals.
4. Role of dieticians in other healthcare sectors could be studied.

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To Ascertain the Adequacy of Nutrient Intake among Institutionalized Street Children on Mumbai

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ABSTRACT

Social service agencies, health centers and voluntary organizations have responded by initiating various environmental programs for public particularly homeless street children to obtain food, shelter and primary health care. The aim of the study was to ascertain the Adequacy of Nutrient Intake among Institutionalized Street Children in Mumbai. One objective of the study was to describe existing hygiene and cooking practices followed in public institutes dealing with street children. Study design was descriptive, cross sectional and observatory. Purposive sampling, interview schedule and observation method was used for data collection. A total of 30 street children between the ages of 9 to 18 years residing in two institutes participated in the study. Fourteen children (46.7%) were orphans and reported no family member to look after. Only five children (16.7 %) reported presence of both parents. None of them were working and their basic necessities were provided by these institutes. Findings indicate anthropometric measurements below 95th centile despite residing in shelters and consuming four meals a day. Male street children in all age groups were consuming less than 50% of RDA for energy, children in the age group of 10-12 years met 95 % of RDA for protein intake. Female street children in all age groups were consuming above 50% but below 85% of required RDA for energy, protein intake was maximum in children below 12 years (51.73%). Children above 12 years were consuming less than 50 % of required RDA for protein. Hygiene standards followed were good. Kitchen premises were clean, food and water was covered. However the storage conditions cooking practices were poor. There is an utmost need to provide nutritious food and not just food in these institutes. Involving Dietitian into these institutes could improve the hygiene and cooking practices and thereby health of this public sector.

Key Words: Institutionalized street children, Public Institute, Hygiene, Nutrient intake

INTRODUCTION

Children are an asset for any society. It is the responsibility of the society to nurture them through various phases of their development, to enable them to make meaningful contribution. Yet there are millions of children throughout the world who live on street, an unfriendly environment.

During the recent years cities have undergone rapid changes that have transformed the urban environment as well as lives of millions of people who live in this setting. Growing urbanization, migration from rural areas, disintegration of traditional family and community structure have ushered in changes in socioeconomic scenario which have given rise to new vulnerable group of children in metropolitan cities residing on streets called ‘street children’. The street children phenomenon was first noticed in Kenya in 1969 [1].

The rapid population growth could be associated with an increase in number of children living alone on urban streets or spending most of their days on the streets in quest of survival. Other factors that contribute to street

children phenomenon include poverty, unplanned pregnancies, parent's death, HIV / AIDS and drug abuse especially alcohol [1].

In India while no accurate and authentic estimate of their number is available it is safe to assume that their number is substantial and is ever increasing. Highest numbers of street children are found in Maharashtra [3]. A study in India found 65.9% of the street children lived with their families on the streets. Out of these children, 51.84% slept on the footpaths, 17.48% slept in night shelters and 30.67% slept in other places including under flyovers and bridges, railway platforms, bus stops, parks, market places and four lakh street children reside in Bangladesh alone [5].

The definition of street children varies although much research distinguishes two groups: Home based – children who usually return home at night, Street based – children who remain on street and have no family support. These include orphans, runaways and refugees.

UNICEF defines street children in the following three categories:

1. Children on the street with continuous family contact and stay with parents on street.
2. Children who spend their entire day on street and return home at night or spend some nights on street and have occasional family contact.
3. Children who do not have any family contact, they are known as children of the street.

Street children are found to be deprived both socially and physically in most of the studies. The most common diseases among Street children examined were malnutrition, especially between the ages of 12 and 13, dental caries, skin problems, urinary problems, bone fractures [4] trauma and certain infection are found to be more common in children who are street based than in home based children [18] upper respiratory tract infection, skin diseases [1] and malaria [6].

Although there have been no assessments of dietary adequacy or nutritional status among street children in Mumbai, studies of homeless populations in other developed countries have consistently revealed inadequate dietary intake. A situational analysis of street children in Pakistan reported stunted and wasting in 32% of population [7]. A significant difference in nutritional status was observed in street children and school children, street children were more nutritionally vulnerable as compared to school children [2]. The ways these children acquire food have also shown some association with nutrition vulnerability [7].

Social service agencies, health centers and voluntary organizations have responded by initiating various environmental programs for public particularly homeless street children to obtain food, shelter and primary health care. Despite these efforts street children appear to be locked in daily struggle to survive and are undernourished. In order to improve nutritional status it may be useful to increase nutritional awareness and hygiene importance among cooks and workers dealing with public institutes. Although much of the researches have been done on beneficiaries of NGOs, very less focus has been shifted over to knowledge and awareness among cooks, who are actually the main person of the program and whose knowledge and skills in cooking food and following good hygiene practices do have a direct impact on the health of street child. Thus there is an utmost need to understand the existing environmental benefits for the homeless public sector particularly with regards to the food provided and the nutritional status of the beneficiaries, hygiene and cooking practices followed at these public institutes.

AIM AND OBJECTIVES

Studies of homeless populations in other developed countries have consistently revealed inadequate dietary intake, but no assessments of dietary adequacy or nutritional status among institutionalized street children in Mumbai is available. Though for street children poverty is a major constraint but still this population cannot be neglected to meet their basic food requirement. Thus this study is proposed with following aim and objectives

- a) To ascertain the adequacy of nutrient Intake among institutionalized street children in Mumbai.

- b) To calculate protein and energy consumption among institutionalized street children using 24 hour dietary recall.
- c) To compare the nutrient intake as per RDA age groups.
- d) To examine the differences in nutrient intake among institutionalized male and female street children.
- e) To record anthropometric measurements among institutionalized street children and to compare the same with ICMR standards.
- f) To study hygiene and cooking practices followed at public institutes dealing with street children.

METHODOLOGY

Study Area: The study was conducted in Mumbai.

Study Population: Study population included institutionalized street children and organizations deals with street children.

Study Design: Descriptive, cross sectional and observatory.

Sample and Sample Size: Thirty Institutionalized street children between the age group of 9 to 18 years constituted the sample for the study. Fifteen male street children and fifteen female street children were recruited. Two institutions dealing with street children were studied for hygiene and cooking practices.

Inclusion Criteria:

- a) Street children residing in NGO or in shelters
- b) Between the age group of 9 to 18 years
- c) Willing to participate voluntarily
- d) Institutes dealing with street children

Sampling Method - Purposive Sampling: Organizations in Mumbai, known to have close experience with street children were approached. Protocol of the study was explained and approved by these organizations. Street children recorded in their list and willing to participate were enrolled in the study.

Ethical Considerations: Heads of participating NGOs and Shelter homes were approached for consent. Study was explained to street children; those willing to participate were recruited. All necessary permissions and ethical clearances were obtained from concerned bodies.

Data Collection and Duration: Data was collected at institutes where the street children resided. Entire duration of study was four months.

The following data were collected from street child:

- a) General information
- b) Background information
- c) Food intake
- d) Anthropometric measurements

The following data was collected from institutes:

- a) Hygiene practices followed
- b) Cooking practices followed

Tools and Techniques Used for Data Collection: An interview schedule was designed to collect data from street children with regards to General information and Background information. Latter part of schedule was used to record anthropometric measurements, and 24 hour dietary recall.

Anthropometric Measurements: Height was measured in centimeters using a standardized measuring rod. Weight was recorded in kilograms using calibrated electronic scale. BMI was derived from above information. All the above recordings were compared with Indian reference standards.

24 hour Dietary Recall: A 24 hour dietary recall was taken from all street children. Street children were asked to mention their previous day's intake. The serving size was determined by using live models of different sizes and thickness for chapatti / bhakri / parantha, standardized cups and standardized spoons. Estimates were made for energy and proteins. Dietary data was converted to kilocalories per day for energy and grams per day for proteins. Calculations were done using 'Nutritive Value of Indian Foods' published by ICMR. Calculated values were compared with the reference daily intake. Observation method was used for data collection from institutes. During the period of data collection from street child, the kitchen area was carefully observed by the researcher in these institutes for presence of cobwebs, cleanliness, cooking practices followed, and storage conditions.

RESULTS AND DISCUSSIONS

The aim of the present study was to ascertain the Adequacy of Nutritional Intake of Institutionalized Street Children in Mumbai. Age group for the study was 9 to 18 years. A statistical package of social sciences (SPSS) version 16 was used for analysis of data.

Street children were asked to mention their previous day's intake. The serving size was determined by using live models of different sizes and thickness for chapatti / bhakri / parantha, standardized cups and standardized spoons. Estimates were made for energy and proteins. Dietary data was converted to kilocalories per day for energy and grams per day for proteins. Calculations were done using 'Nutritive Value of Indian Foods' published by ICMR. Anthropometric measurements (height, weight and BMI) were taken.

Parents play a vital role in the upbringing of the child, one of the factors leading the child alone on street and attached to these institutes was death of parents. Fourteen children (46.7 %) of these children had no parents, eleven children (36.7 %) had single parent to look after and only five children (16.7 %) reported presence of both parents (Figure 1). 30 % of street children reported death of parents as factor leading to this area.

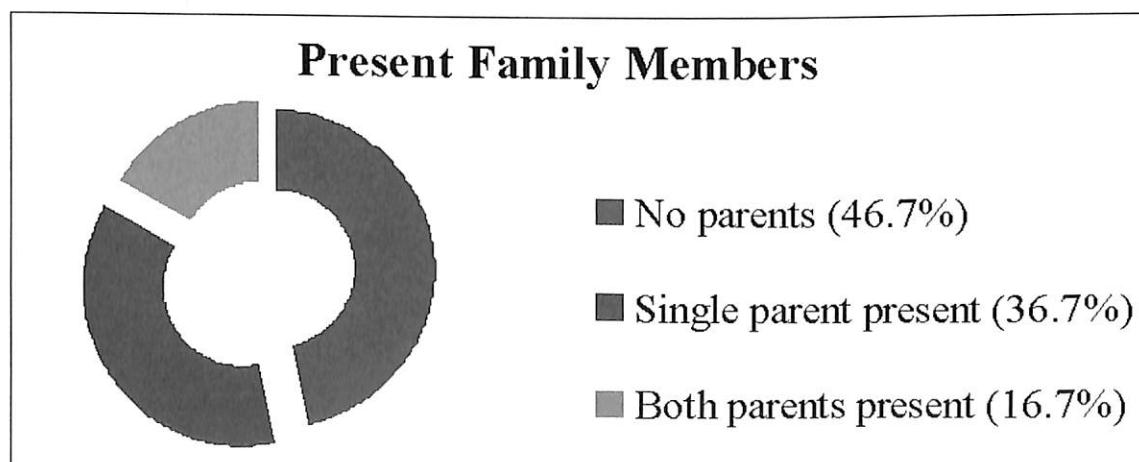


Figure 1: Present Family Members

Descriptive statistics for the entire sample with regards to age, energy intake, protein intake, height, weight and BMI were calculated (Table 1). The minimum age of the entire sample was 9 years and maximum 18 years, mean age was 14 ± 2.18 years. Mean energy intake was $1229 \text{ Kcals} \pm 398.37$, protein intake $30.31 \text{ grams} \pm 14.37$, height reading $148.28 \text{ cms} \pm 14.99$, weight reading 37.81 ± 10.15 and mean BMI was $16.82 (\text{Kg/m}^2) \pm 1.75$.

Table 1: Mean Values of Age, Energy Intake, Protein Intake, Height, Weight and BMI among Institutionalize Street Children

Variable	Minimum	Maximum	Mean	Std. Deviation
Age (years)	9.00	18.00	14.00	2.18
Energy Intake (KCals)	290.00	1967.00	1229.40	398.37
Protein Intake (Grams)	6.70	75.20	30.31	14.37
Height Reading (cms)	122.00	170.00	148.28	14.99
Weight Reading (Kg)	20.20	55.00	37.81	10.15
BMI (Kg/m ²)	12.43	19.72	16.82	1.75

Two institutes dealing with street children were studied, first institute enrolled only male children and second enrolled girl child, and therefore both institutes were studied in order to enroll both the genders. Gender wise distribution of sample was equal. Fifteen subjects were male and fifteen were female, total sample size was 30 street children.

Descriptive statistics with regards to age, energy intake, protein intake, height, weight and BMI were also calculated gender wise (Table 2).

Table 2: Mean Values of Age, Energy Intake, Protein Intake, Height, Weight and BMI among Female and Male Institutionalize Street Children

Variable	Gender	Number	Mean	Std. Deviation
Age (years)	Female	15	13.06	2.25
	Male	15	14.93	1.70
Energy Intake (KCals)	Female	15	1384.70	254.11
	Male	15	1074.10	460.95
Protein Intake (Grams)	Female	15	23.82	4.68
	Male	15	36.81	17.77
Height Reading (cms)	Female	15	137.47	11.07
	Male	15	159.10	9.60
Weight Reading (Kg)	Female	15	31.21	7.50
	Male	15	44.42	7.99
BMI (Kg/m ²)	Female	15	16.28	1.95
	Male	15	17.37	1.38

Independent sample t test was used to associate age, energy intake, protein intake, height, weight and BMI gender wise. There was a significant association between male and female street child with regards to age ($p = < 0.05$), energy intake ($p = < 0.05$), protein intake ($p = < 0.05$), height ($p = < 0.01$) and weight ($p = < 0.01$).

The mean age 14.93 ± 1.70 years of male street children was significantly more by 1.87 years as compared to female mean age 13.06 ± 2.25 . With regards to food intake, mean energy intake 1384.7 ± 254.11 KCals of female street children was significantly more by 310 KCals than males 1074.1 ± 460 KCals but mean protein intake 36.81 ± 17.77 grams of male street children was significantly more by 12.99 grams than females 23.82 ± 4.68 grams.

Calculated mean values of energy and protein intake were compared with the reference daily intake as per the RDA age groups for males (Figure 2) and females (Figure 3)

None of the groups had an intake as per the RDA. Male street children in all age groups were consuming less than 50% of RDA for energy, protein intake in each age group was above 50 % and children in the age group of 10-12 years met 95 % of RDA for protein intake.

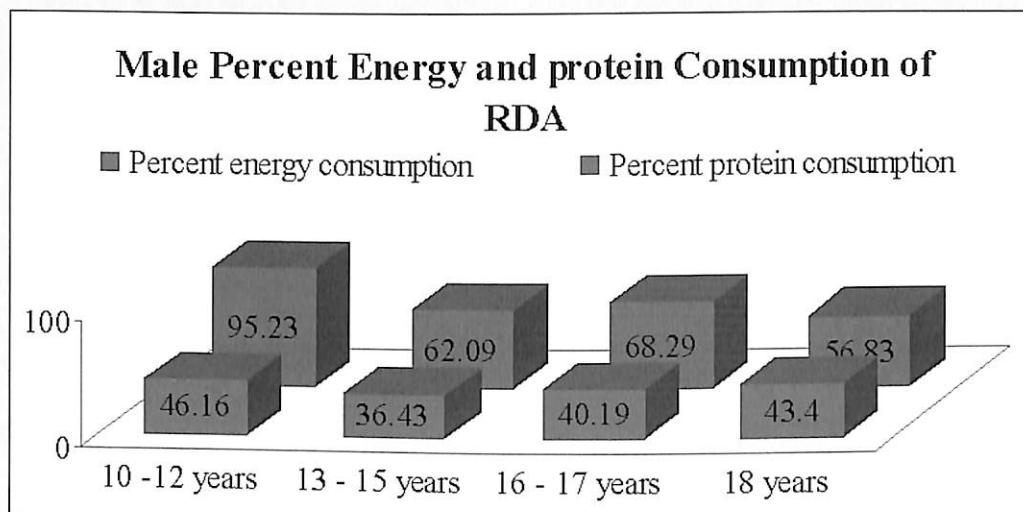


Figure 2: Mean values of energy and protein intake for males

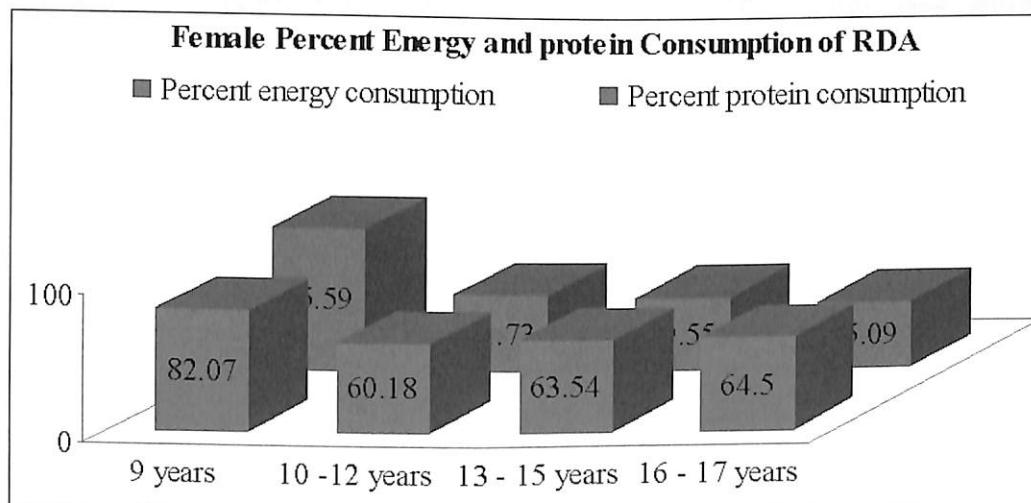


Figure 3: Mean values of energy and protein intake for females

Female street children in all age groups were consuming above 50% but below 85% of required RDA for energy, protein intake was maximum in children below 12 years (51.73%) and only one 9 year old child was meeting above 95 % of required RDA for protein. Children above 12 years were consuming less than 50 % of required RDA for protein.

All the subjects were not working and were dependent on the institutes for food and shelter. All their basic necessities were provided by these institutes. Thus providing nutritious food is crucial in these institutes.

With regards to anthropometric measurements mean height, weight and BMI for each age were below the 95th centile values indicating all street children were not matching the standard reference values as per ICMR standards despite of residing in shelters where they were provided four meals a day.

However both the institutes were not having dietitian working with them. Shelter house / NGO personnel were unaware of their own nutrition requirement, nutrient loss during cooking as a result even cooks of these institutes were unaware of the nutrient loss during cooking. Undesired cooking practices followed at both institutes were:

1. Washing vegetables after peeling
2. Cooking vegetables in open pan
3. Serving the morning leftover food at evening
4. Drinking untreated water

Hygiene standards followed were good. Kitchen premises were clean, food and water was covered. However the storage conditions were poor. Reason being lack of space and unawareness about perishability.

CONCLUSION

Thus there is an utmost need to provide nutritious food and not just food, to meet the RDA requirements and thereby help in growth of these children. This can be achieved by following good hygiene and cooking practices in these public institutes. Safe drinking water and sanitary environment helps in prevention of illness. Drinking water can be treated as an item of food and access to potable water should be addressed on urgent basis. Also there is a need for dietitians to work with these institutes in order to improve the hygiene and cooking practices followed. Infrastructure is already available in these institutes, involving a resource person from the nutrition field into this existing environment might improve the nutrient intake as purpose of food is not merely to assuage hunger but improvement in nutritional status and health.

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Correlates of Asthma Among School Going Children in Puducherry

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ABSTRACT

Asthma is the most common chronic inflammatory disease in children and is a major global health problem which exerts a substantial burden on the family, health care services and on the society as a whole. The objective of the study was to study the prevalence of asthma and its associated factors among school going children in Puducherry. A cross sectional study was carried out among 1633 school children between the age group of 11-16 yrs from two rural and two urban government schools of Puducherry. A self-administered questionnaire was used to seek socio-demographic details, dietary pattern and health profile, followed by anthropometric measurements. Peak expiratory flow meter which functions under the principle of pressure and external force was used as an indicator for the assessment of asthma. Percentages and statistical tools were used to analyse the data. The study revealed that out of 1633 children, the respiratory discomfort was experienced by 26% of the respondents of which 17% were boys and 37% girls. PEFR values increased with height and chest circumference. Children with parental history of asthma, frequent consumption of chilled food, low physical activities, low consumption of water and rearing of pets at home had lower PEFR. The p values were 0.00 for these variables.

Key Words: Asthma, PEFR

INTRODUCTION

Asthma is the most common chronic inflammatory disease in children and is a major global health problem which exerts a substantial burden on the family and on the society as a whole. Prevalence of bronchial asthma among children in New Delhi was 11.9 percent [2]. Like most diseases, asthma is also socially patterned with environmental exposures, socio economic status, genetic, and host factors. Environmental exposures during the early years and airway obstruction that develop during this time, in conjunction with genetic susceptibility, are important factors in the development of persistent asthma in childhood. Childhood asthma is increasing day by day globally supported by different studies in different countries. Though prevalence of childhood asthma was low in India but recently a study reported that between 4 – 20 percent of school going children in India suffer from asthma [1]. The incidence of asthma is higher in rural areas than in urban areas and that it is more common among women than men [5]. Bronchial asthma can occur at any age but children and young adults are the commonly affected age groups and 5-10% of children with mild asthma go on to develop severe asthma later in life [4]. Although asthma cannot be cured, clinical episodes can largely be prevented and controlled by proper management. Peak Expiratory Flow Rate is one of the best indicators to study the prevalence and risk of asthma. The literatures documented in this field of research in this area are very minimal. Hence, this study was carried out.

AIMS AND OBJECTIVES

1. To assess the prevalence of asthma among school going children between 11 and 16 years of age
2. To delineate the variables associated with asthma.

METHODOLOGY

The study was carried out among school children of two rural and two urban government higher secondary schools in Puducherry. Stratified random sampling method was adopted to pick samples. Accordingly, 1633 school children (870 boys and 763 girls) who belonged to 11-16 years of age were selected for the study. The period of PEFR assessment lasted for three months and the temperature during this period was between 35 and 40 Degree Celsius. A self administered questionnaire was used to seek details on socio-demographic, health profile and dietary pattern. Standard prescribed equipments like stadiometer, weighing scale, and flexible tape were used for assessing anthropometric measurements. Peak expiratory flow meter which functions under the principle of pressure and external force was used to measure the Peak Expiratory Flow Rate (PEFR) which is an indicator to study the respiratory discomforts. It measures the speed of air forced out from the lungs. The best of three attempts (blow) of PEFR of each sample was recorded for the study. Anthropometry measurements and socio-economic conditions, environmental factors, physical activity, dietary habits were the independent variables and prevalence of asthma was the dependent variable. Regression and correlational method were adhered to compare various sets of independent variables with dependent variable.

RESULTS AND DISCUSSION

Anthropometric measurements and PEFR (L/min) of the study group: Anthropometry measurements like height, weight and chest-circumference were observed and mean PEFR values was noted.

PEFR in relation to Height: It is well established that height is the main factor affecting PEFR and found to have effect on the ventilator function of the lungs of the healthy subjects. The result of mean PEFR values in relation to height is represented in Table 1

Table 1: Distribution of mean PEFR in relation to height

Height in cms	N (1633)	PEFR L/min	Height in cms	N (1633)	PEFR L/min	Height in cms	N (1633)	PEFR L/min
130	9	186.66	146	49	217.14	161	61	234.91
132	9	241.11	147	70	220.89	162	43	254.88
133	11	200	148	71	211.97	163	36	278.57
134	11	211.81	149	67	215.37	164	25	268.4
135	6	236.66	150	63	230.03	165	16	293.12
136	14	220	151	44	225.22	166	15	266.66
137	20	209.5	152	66	217.72	167	16	258.12
138	18	225	153	72	225.69	168	21	268.09
139	36	184.16	154	71	215.21	169	12	265.83
140	19	212.63	155	65	223.07	170	8	265
141	19	203.15	156	75	225.33	171	15	286
142	33	216.36	157	78	227.92	172	6	280
143	52	221.92	158	61	223.72	173	7	325.71
144	26	211.92	159	98	222.68	174	4	357.5
145	30	225.66	160	58	248.1	175	3	460

Correlation between height and PEFR ($r=0.55$, $p=0.000^*$) * - significant

It is evident that the mean PEFR values correlated well with height. PEFR values increase in more or less in linear fashion with respect to height in centimetres in different age groups.

PEFR in relation to Weight: Weight measurements to assess growth and development, particularly in young children, are the most widely used indicators of nutritional status in a community. However, changes in body measurements are sensitive to many factors including intake of essential nutrients, infections, altitude, stress and genetic background.

Table 2: PEFR in relation to Weight

Weight Measurement (kg)	Boys		Girls		p-value
	N	PEFR L/min Mean (SD)	N	PEFR L/min Mean (SD)	
21 – 30	142	215.2 (65.1)	98	201.5(61.1)	0.260 ^{NS}
31 – 40	320	248.1 (73.4)	317	196.1 (65.2)	0.000*
41 – 50	271	263.5 (77.5)	268	207.1(64.3)	0.000*
51 – 60	112	270.6 (89.4)	65	210.3 (55.1)	0.000*
61 – 70	26	264.2 (84.6)	15	232 (47.9)	0.653 ^{NS}

* - p<0.001(Significant), ^{NS} – p>0.001(Not Significant)

From the Table 2, it is evident that the major clusters of the selected children were under the weight intervals of 31 to 40 and 41 to 50 kg respectively. A parallel progressive increase in weight and PEFR was observed among both the sexes. PEFR showed significant difference between the sexes at most weight intervals except at weight intervals 21-30 and 61-70 kg where PEFR became significantly higher in boys than girls.

PEFR in relation to Chest Circumference: Chest measurement is emerging as an important indicator to evaluate the physical status of individuals and populations which in turn highlights the nutritional status of the children. The following Table 3 depict the relation between PEFR and chest circumference of both the sexes.

Table 3: PEFR in relation to Chest Circumference

Chest Measurement (cms)	Male		Female		p-value
	N	PEFR L/min Mean (SD)	N	PEFR L/min Mean (SD)	
Below 40	43	340 (88.9)	4	207.5 (40.3)	0.036 ^{NS}
41 – 60	114	244.3(65.8)	18	220.5 (70.3)	0.582 ^{NS}
61 – 80	716	248.2(76.3)	510	200.7 (65.1)	0.000*
81 – 100	136	263.7(85.1)	231	205.1 (59.6)	0.000*

* - p<0.001(Significant), ^{NS} – p>0.001(Not Significant)

The chest circumference within the range of 61-80 cms and 81-100 cms ($p < 0.001$) the PEFR was significantly higher in boys than in girls.

Correlation coefficient (r) and level of significance between PEFR (l/min) and anthropometric parameters: The details pertaining to the correlation coefficient (r value) and the level of significance between different anthropometric parameters and PEFR in case of boys and girls are presented in the Table 4.

Table 4: Correlation coefficient (r) and level of significance between PEFR (l/min) and anthropometric parameters

Parameters	Gender (n)	Dependent Variable	Correlation co-efficient	P - value
Height (cms)	Boys (870)	PEFR	r = 0.703	< 0.001
	Girls (763)		r = 0.696	< 0.001
Age (years)	Boys (870)	PEFR	r = 0.698	< 0.001
	Girls (763)		r = 0.676	< 0.001
Weight (kg)	Boys (870)	PEFR	r = 0.694	< 0.001
	Girls (763)		r = 0.673	< 0.001
Chest Circumference (cms)	Boys (870)	PEFR	r = 0.627	< 0.001
	Girls (763)		r = 0.609	< 0.001

The positive correlation of PEFR with height, age, weight and chest circumference was observed in both the boys and girls which means that the value of PEFR increased with increase in those anthropometric parameters. The most significant correlation was observed between PEFR and height similar to other studies. Thus the height had been found to provide a good basis for prediction of normal values of PEFR.

Age had positive correlation with peak flow rate (PEFR) in the present study. Correlation coefficient values were less than that of the height but greater than the values observed in relation to weight and chest circumference.

The levels of significance on comparing PEFR with body weight and with chest circumference were less than that of height and age parameters.

Socio-economic profile Vs PEFR: In the present context the variables like region, type of family and birth order were strongly associated with PEFR values and the same is depicted in Table 5.

Table 5: Socio-economic profile Vs PEFR

Socio-economic Profile	N (%)	Male		Female		p-value	
		Mean (L/min)	SD (L/min)	N (%)	Mean (L/min)		
Region							
Urban	458(52.6)	275.2	77.7	338(44.2)	190.9	54.8	0.000*
Rural	412(47.3)	224.1	68.7	425(55.7)	211.9	68.5	0.000*
Type of family							
Joint	109(12.5)	264.4	80.8	110(14.4)	195.2	70.4	0.000*
Nuclear	761(87.4)	249.1	77.3	653(85.5)	203.8	62.47	0.000*
Birth order							
First child	463(53.2)	261.5	78.1	361(47.3)	200.4	61.2	0.000*
Middle child	249(28.6)	235.1	75.1	251(32.8)	202.8	66.6	0.000*
Last child	81(9.3)	259.4	76.6	77(10.0)	203.8	65.2	0.000*
Only child	77(8.8)	230.2	74.9	74(9.6)	211.1	64.3	0.084 ^{NS}

* - p<0.001(Significant), ^{NS} – p>0.001(Not Significant)

PEFR in relation to Gender: The peak expiratory flow rate varies according to gender at any age and the normal range of PEFR is 500 to 700 L/min for males and 380 to 500 L/min for females. PEFR in an average sized male is at least 50 percent higher than the PEFR in an averaged-sized female ^[6].

Table 6: Distribution of mean PEFR and Height Vs Gender

Male (N=870)			Female (N=763)		
Height in cm	N	PEFR L/min	Height in cms	N	PEFRL/min
139	17	195.29	139	19	209.47
141	15	208.00	145	20	200.55
142	14	249.28	146	31	198.06
143	23	259.13	147	35	200.28
146	18	237.22	148	39	197.94
147	35	222.35	149	35	206.00
148	32	245.93	150	34	217.94
149	32	255.31	151	22	185.00
150	29	253.86	152	35	223.71
151	22	240.00	153	41	203.00
152	31	237.41	154	28	208.57
153	30	230.00	155	26	207.69
154	42	226.34	156	35	222.85
155	39	244.61	157	36	203.42
156	40	252.00	158	32	204.19
157	42	252.14	159	52	206.15
158	28	243.57	160	24	211.25
159	46	243.91	161	27	186.29
160	34	282.64	162	17	185.29
161	34	243.23	167	7	231.85
162	26	280.76	168	4	157.50
163	30	284.66	169	2	250.00

From the Table 6 it is obvious that PEFR values in both male and female children increase with height and male children have higher PEFR values than female children. The probable reason for lower PEFR values in females is the less lung volume for the same height in comparison to males. However, the factors that determine PEFR, are predominantly expiratory muscle effort, lung elastic recoil pressure and air way size. The muscle effort intern depends on the physical strength and physical activity. It is possible that this lower value in girls were due to physiological reason and better performance of the boys.

Health Attributes Vs PEFR: Cough, cold, wheezing, shortness of breath, chest tightness, allergic rhinitis are the predominant symptoms for asthma in children. Seasonal variation is associated with decreased lung function and increased prevalence of respiratory disease symptoms in young children.

Table 7: Health Attributes Vs PEF

Health Attributes	N	Male			Female			
		Mean (L/min)	SD (L/min)	N	Mean (L/min)	SD (L/min)		
Respiratory Symptoms								
Allergy								
Smoke	287(32.9)	220.6	63.4	321(42.1)	197.6	78.6		
Dust	331(38.0)	238.4	79.3	258(33.8)	207.3	69.1		
Food items	57(6.5)	295.3	52.9	47(6.1)	204.8	51.7		
Breathlessness								
Chill weather	228(26.2)	232.3	50.6	396(51.9)	219.4	83.4		
Food items	329(37.8)	252.2	81.2	227(29.8)	178.6	52.6		
Climbing stairs	43(4.94)	270.4	77.4	64(8.39)	221.7	77.9		
Stress	8(0.9)	249.7	79.1	41(5.37)	202.9	76.6		
Cold/ cough								
Chest congestion	421(48.3)	298.4	52.7	527(69.1)	193.4	53.7		
Persistent cough	327(37.5)	306.8	68.3	87(11.4)	221.8	71.5		
Wheeze with cold	122(14.0)	163.2	49.4	149(19.5)	197.2	82.4		
Seasonal Variation								
Summer	129(14.8)	237.3	83.2	124(16.3)	237.6	83.7		
Winter	678(77.9)	181.6	54.9	583(76.4)	184.7	55.2		
Consumption of fruits	6(0.6)	337.1	83.4	9(1.1)	209.1	83.9		
Consumption of refrigerated items	44(5.0)	241.6	75.2	32(4.1)	214.6	76.4		
Sweating	13(.14)	257.2	69.1	15(1.9)	203.5	69.7		

From table 7, it can be inferred that 14% of male and 19.5% of females had higher frequency of cold. Likewise persistent cough among 37.5% males and 11.5% females; chest congestion among 48.3% male and 69% female. Smoke, sprays, burning of mosquito coils are the triggering factors in 33 percent of males and 42 percent of females.

History of Asthma and other Diseases: Many research studies have shown that family history of asthma and allergy increases the risk of asthma in children.

Table 8: History of Asthma and other Diseases

History of Asthma/other diseases	Male		Female	
	N (%)	Mean L/min	N (%)	Mean L/min
Family history of asthma				
Father	6(40)	240.6	2(28.6)	241.4
Mother	3(20)	248.3	2(28.6)	248.9
Paternal grandparents	2(13.3)	246.4	1(14.2)	249.3
Maternal grandparents	4(26.7)	249.1	2(28.6)	247.2
Past history of other diseases				
Measles	324(37.2)	207.2	311(40.7)	204.9
Malaria	128(14.4)	167.4	148(19.3)	174.2
Viral fever	24(2.7)	214.9	21(2.7)	210.4
Typhoid	57(6.5)	221.5	68(8.91)	229.1

A meagre 1.4 percent of children had positive family history of asthma. Among those respondents, lower PEFR values was found in children whose father had asthma (boys-40%, girls-28.6%), followed by paternal grandparents, mother and maternal grandparents. Early incidence of measles, malaria, typhoid and viral fever were higher in girls than boys.

PEFR as an indicator for Asthma: PEFR is highly sensitive and accurate index of airway obstruction for predicting acute exacerbation of asthma and its management. If PEFR value is below 50 percent of normal it indicates danger (red zone), 80-50 percent as caution (yellow zone) as and more than 80 percent as normal (green zone). These values were obtained from the instruction manual on purchase of PEFM during 2011.

Table 9: PEFR as an indicator for Asthma

Gender	Danger (Red)		Caution (Yellow)		Normal (Green)	
	N (%)	Mean	N (%)	Mean	N (%)	Mean
Male (870)	145 (33.8)	39.8	468 (54.1)	65.1	257 (75.8)	91.5
Female (763)	284 (66.2)	39.2	397 (45.9)	62.5	82 (24.2)	91.3
Total	429 (100)		865 (100)		339 (100)	

From Table 9 and Figure 4 and 5, it is obvious that, more than three fifth (66%) of girls and two fifth (33.8%) of boys came under red zone indicating danger levels. Nearly, 54 percent of boys and 46 percent of girls recorded values with in yellow zone indicating caution. Overall prevalence of asthma was around 26 percent, among which 17 percent were boys and 37 percent were girls. This indicates that girls were more prone for respiratory discomfort which included asthma.

Physical Activities Vs PEFR: The risk is greatest when children exposed to both outdoor and indoor activities like emissions from cars, smoke, dust mites, cockroaches, pets with fur or feathers, household pests, mould, household sprays etc., [3].

Table 10: Physical Activities Vs PEFR

Physical Activities	Male		Female		Mean (L/min)	SD (L/min)	p-value
	N (%)	Mean (L/min)	N(%)	Mean (L/min)			
Outdoor game							
Yes	822(94.4)	250.6	77.1	716(93.8)	201.8	63.5	0.000*
No	48(5.5)	257.7	90.7	47(6.1)	214.4	64.9	0.004*
School sports							
Yes	824(94.7)	250.2	77.3	723(94.7)	202.6	63.9	0.000*
No	46(5.2)	266.5	87.1	40(5.2)	201.7	59.1	0.000*
Pets in home							
Yes	437(50.2)	245.3	75.3	375(49.1)	198.8	66.2	0.000*
No	433(49.7)	256.7	180.1	388(50.8)	206.5	60.9	0.000*
Mode of transport							
Cycling	144(16.5)	232.9	75.6	148(19.3)	210.5	62.3	0.004*
Walking	616(70.8)	256.4	79.0	515(67.4)	207.8	67.5	0.000*
Others	110(12.6)	244.5	70.5	100(13.1)	199.3	63.2	0.005*

* - p<0.001(Significant)

The mean PEFR values were higher for both males and females who participated in outdoor games and sports. Overall, the study found more similarities than differences in activity participation of males and females.

CONCLUSION

The present findings highlights that out of 1633 enrolled children, the respiratory discomfort was experienced by 26% of the respondents of which 17% were boys and 37% girls.

RECOMMENDATION

School health records should measure PEFR along with other anthropometry measurements which would be a perfect check over the prevalence of asthma. Good ventilation in class rooms, setting room humidifiers, making physical education classes mandatory in schools can be some of the preventive measures for asthmatic complications.

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Comparative Studies on Sandhyamalati (*Mirabilis Jalapa* L) and Rajmah (*Phaseolus Vulgaris* L) Seed Proteins

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ABSTRACT

Conversion of waste into wealth is as old as civilization. Nowadays to cater to the spiraling increase in demand for food due to population explosion researchers are in search of alternative protein from waste-land, forest and bio-waste. In the present study an effort has been made to study the nature of Sandhyamalati (Family: Nyctaginaceae) seed protein and to compare it with Rajmah (Family: Fabaceae) seed protein in animal model. Isolation of Sandhyamalati and Rajmah seed proteins were performed and were administered on animals. Male mice (20-25gm.) were divided into 3 groups of ten animals in each group. Group-A served as normal and was administered casein orally as protein. Group-B served with Rajmah seed protein and Group-C served with Sandhyamalati seed protein. Several biochemical parameters like blood glucose, total protein, albumin, urea, creatinine, lipid profile were done by colorimetric method. All groups showed an increase in body weight. Group-B and Group-C exhibited hypoglycemic activity. Non-significant changes occurred in total protein, albumin and creatinine. A significant decrease in urea level of both treated group indicate that Sandhyamalati seed protein was devoid of hepato-toxicity and nephro-toxicity initially. But Sandhyamalati seed protein indicated hypercholesteric whereas Rajmah seed protein resulted hypo-cholesteric activity. Considering all these factors, it appears that the Sandhyamalati seed protein may act as a good source of edible protein.

Key Words: *Mirabilis jalapa* L seed protein, *Phaseolus vulgaris* L. seed protein, Mices, Plasma, Liver, Biochemical parameters, Histological parameters

INTRODUCTION

With the spirally increase in population in the developing countries, the gap between the supply and demand in food is increasing day by day. Hence identification of the alternative sources of food mainly protein is the need of the hours. In developing countries, the main nutrient (protein) comes from the plant kingdom, which infers that the plant proteins are exploited for the use of livelihood of human beings. However, this may pose another problem due to non-availability of land and paucity of tracts. Seeds of forest plants, waste lands, can act as worthy protein resources which can play an important role in dealing with this problem.

The plant *Mirabilis jalapa* L. (Nyctaginaceae) is a tall herbaceous climbing plant with opposite leaves, large showy flowers, small round black seeds, obovoid fruits and prominent tuberous roots and is planted as ornamental plant throughout India, tropical America and other Asian countries [4,15]. The plant is used as folklore medicine

to treat wound healing, stomachic, liver problem, dysentery, diarrhea, muscular pain and abdominal colic pain [12].

AIMS AND OBJECTIVES

The present paper is concerned with the studies of seed proteins of *M. jalapa* L. on which not much work has been reported. In our previous study we have found that seeds of *M. jalapa* L. contain an appreciable amount of nitrogen as well as protein [6]. It needs mention that the seeds of *Phaseolus vulgaris* L. (Family: Fabaceae) or Rajmah find wide application as a standard vegetable source of protein. The present work is a humble effort to study the comparative nature of seed proteins of *M. jalapa* L. which is used in India as a "model" and to compare their status with the seed proteins of *P. vulgaris* L.

METHODOLOGY

Collection of Seeds: Dry seeds of *P. vulgaris* L. were collected from the Food Department of Government of India whereas *M. jalapa* L. were purchased from the Forest department of India Government. Professor N. D. Paria, Department of Botany, Calcutta University, India identified these seeds. A specimen voucher PV1 and MJ1 has been preserved in the herbarium of the Botany Department of Calcutta University.

Isolation of *M. jalapa* L. and *P. vulgaris* L. seed protein: Both air-dried, powdered seeds were defatted with n-hexane by Soxhletting for 48 hrs separately. 1 N NaOH was added to the seed powder separately in the ratio 1:10, the mixture was stirred for half an hour and then centrifuged at 10000 x g for 10 min. The pH of the supernatant was adjusted to pH-4.0 using 1 N Trichloro acetic acid (TCA) and kept it overnight in refrigerator. Then it was again centrifuged at 10000 x g for 10 min and the supernatant was discarded. The residue was washed several times with distilled water by centrifugation and freeze dried [11].

Animals: 30 male mice (body weights ranging from 20-25 gm) were equally distributed into three groups A) casein feeded group/normal, B) Rajmah seed protein feeded group, C) Sandhyamalati seed protein feeded group, each group consisting of ten animals. They received the diet according to Table 1 in normal laboratory conditions. Water was given *ad libitum*. Body weights were recorded at one week intervals. All the animals were acclimatized to laboratory condition for a week before the commencement of experiment.

Table 1: Diet of Experimental animals

Ingredients	Group-A/ Normal Group	Group-B / Treated I Group	Group-C / Treated II Group
70% Amylam (gm%)	Wheat	Wheat	Wheat
18% Protein (gm%)	Casein	Rajmah seed protein	Sandhyamalati seed protein
3.6 % Salt mixture (gm%)	Hobwell salt mixture	Hobwell salt mixture	Hobwell salt mixture
6.4% Fat	Ground nut oil	Ground nut oil	Ground nut oil
2% Vitamin (gm%)	Becosule Capsule	Becosule Capsule	Becosule Capsule

Animal Sacrifice and Sample Preparation: After completion of 28 days the animals were made to fast overnight prior to sacrifice by destruction of retino-orbital plextures between 9.00 AM to 11.00 AM to minimize diurnal variation and no anesthesia was used before the time of sacrifice of animals because of the reported effects of anesthetics on the neuroendocrine axis. Blood was collected in heparin zed tubes and plasma was immediately separated by centrifugation (3000 x g for 5 mins.) to avoid erythrocyte glycolysis which may change the glucose level. The obtained clear sera were stored at -20° C for subsequent measurement of Plasma glucose, protein, albumin, urea, creatinine, cholesterol, triglyceride, HDL, LDL and liver glucose, protein, albumin, cholesterol were estimated by using colorimetric assay kits, Accurex Biochemical Pvt Ltd according to manufacturer's instruction.

Histological Studies: Pieces of Liver from each group were fixed in 10% neutral formalin for a period of at least 24 hrs, dehydrated in graded (50-100%) alcohol, embedded in paraffin, cut into 4-5 μ thick section and stained with hematoxylin-eosin.

Statistical Analysis of Data: Results were analyzed by one way analysis of Variance, and significance of difference between sample means tested with least means square means tests with significance at < 0.05 (Tukey <0.05) using the Minitab statistical software package.

RESULTS AND DISCUSSION

Body weight and PER:

Table 2: Change in body weight of the experimental animals after completion of experimental period (Each group N=10) (Mean \pm standard deviation)

Group	Initial body weight (gm.)	Final body weight (gm.)	% change in body weight (gm)	PER
A	22.4 ± 1.58^a	33.1 ± 2.18^b	$47.78^{*!?!}$	0.34 ± 0.02
B	22.0 ± 1.49^c	26.8 ± 1.40^d	$21.82^{*!?!}$	0.26 ± 0.02
C	23.2 ± 1.75^e	24.6 ± 1.27^f	$10.81^{*!}$	0.16 ± 0.02

a-f: Values in the same row with different superscripts are significantly different (Tukey <0.05)

Table 2 shows a sharp increase in body weight for the normal group (Group-A) whereas for both treated groups (Group- B&C) no such sharp increase are observed, although all the groups received same quantity of proteins.

Weight gain and protein efficiency ratio (PER) are highest for Group-A, followed by Group-B and lowest for Group-C. Probably this is due to the fact that the normal group receive casein which contains all essential amino acids whereas the diet of the other two groups are lacking in two important essential amino acids, tryptophan and methionine⁶. So, it may be presumed that Sandhyamalati seed protein have no negative effect on body weight of mice.

Glucose Level:

Table 3: Effects of protein isolates on glucose levels in plasma, liver of each experimental groups (Mean \pm standard deviation) (N=10)

Group	Plasma (mg/dl)	Liver (mg/gm of tissue)
A	157.2 ± 9.77^a	22.25 ± 1.14^d
B	33.1 ± 1.6^{b1}	$2.7 \pm 0.0.67^{e3}$
C	124.0 ± 2.94^{c2}	16.15 ± 2.68^{f4}

*a-f: Values in the same column with different superscripts are significantly different (Tukey <0.05)
(When Group A was separately compared with Group B and Group C)*

1-4: Values in the same column with different superscripts are significantly different (Tukey <0.05) (When Group B was compared with Group C).

Group B shows a five fold significant decrease in plasma glucose level in comparison to Group A. No sharp decrease is observed in case of Group C. Similarly a decreased level of glucose is observed in liver tissues for both the treated groups in Table 3.

The results indicate that Rajmah seed proteins exhibits relatively strong hypoglycemic [9, 13] and Sandhyamalati seed proteins have a mild hypoglycemic effect when fed to mice. It may be claimed that the present investigation is the first to claim that Sandhyamalati seed proteins have a mild hypoglycemic activity although, it is not clear whether it stimulates a cell of pancreas or inhibits or promotes glycogenolysis or gluconeogenesis.

Table 4: Effects of protein isolates on total protein and albumin levels in plasma and liver of each experimental groups (Mean ± standard deviation) (N=10)

Group	Plasma Protein gm/dl	Liver Protein (gm/gm.of tissue)	Plasma Albumin gm/dl	Liver Albumin (gm/gm.of tissue)
A	6.22 ± 0.42 ^a	0.22 ± 0.02 ^b	3.53±0.25 ^c	0.15±0.03 ^d
B	6.41±0.59 ^{a1}	0.19 ±0.03 ^{b2}	3.76 ±0.7 ^{c3}	0.19±0.05 ^{d4}
C	6.13±0.48 ^{a1}	0.19 ±0.26 ^{b2}	3.63±0.26 ^{c3}	0.19±0.02 ^{d4}

a-d: Values in the same column with different superscripts are significantly different (Tukey<0.05) (When Group A was separately compared with Group B and Group C)

1-4: Values in the same column with different superscripts are significantly different (Tukey<0.05) (When Group B was compared with Group C).

Table 4 indicates that non-significant change occurred in plasma protein, plasma albumin, liver protein and liver albumin levels in both treated groups. Protein status of an individual closely interacts with its utilization and metabolism [2]. According Stuchi and Harper proteins of high nutritional value consist of approximately 33% essential and 66% non-essential amino acids, while those of low nutritional value contain 25% essential and 75% non-essential amino acids [14]. Harper also suggests that diets containing inadequate proportions of amino acids led to decrease intake and growth alteration [7]. As a result comparatively less growth (body weights) was observed in Sandhyamalati seed proteins-fed groups.

Moreover, the proportion of essential amino acids of approximately 50% in Rajmah seed protein resulted in its moderately good nutritional value where as in case of Sandhyamalati seed protein the proportion of essential amino acids of approximately 25% resulted in its low nutritional value.

Albumin in both the group was found to be more than 50% which is a natural phenomenon and Albumin: Glubulin was found to be greater than 1 which clearly indicates that no significant disorder occurred in the treated animals.

Urea and Creatinine:

Table 5: Effects of protein isolates on urea and creatinine levels in plasma, liver each experimental groups (Mean ± standard deviation) (N=10)

Group	Plasma urea mg/dl	Liver urea (mg/gm.of tissue)	Plasma Creatinine mg/dl	Liver Creatinine (mg/gm.of tissue)
A	39.4± 4.82 ^a	2.001 ± 0.60 ^d	0.442 ± 0.053 ^g	0.125 ± 0.010 ^f
B	34.43 ± 3.32 ^{b1}	4.25 ± 0.41 ^{e2}	0.421 ± 0.40 ^{g3}	0.116 ± 0.010 ^{f4}
C	31.21 ± 5.75 ^{c1}	5.08±0.89 ^{f2}	0.448 ± 0.132 ^{g3}	0.133 ± 0.031 ^{f4}

a-g: Values in the same column with different superscripts are significantly different (Tukey<0.05) (When Group A was separately compared with Group B and Group C)

1-4 Values in the same column with different superscripts are significantly different (Tukey<0.05) (When Group B was compared with Group C).

Generally severe nephro-and hepato-toxicity are detected by increased urea and creatinine level [5]. A significant decrease of plasma urea level and insignificant change of plasma creatinine and liver creatinine level in comparison with that of normal group indicated that MJS seed protein was devoid of nephrotoxicity initially. But significant increase of liver urea levels makes it difficult to come to a conclusion about hepatotoxicity and nephrotoxicity at this stage (Table 5).

Lipid Profile:

Table 6: Effects of protein isolates on lipid profile in plasma of each experimental groups (Mean ± standard deviation) (N=10)

Group	Cholesterol mg/dl	Triglyceride mg/dl	VLDL mg/dl	HDL mg/dl	LDL mg/dl
A	123.4±6.42 ^a	73.6± 4.41 ^d	14.72±0.98 ^f	61.9±6.33 ⁱ	46.8±6.60 ^l
B	108.8±7.66 ^{bl}	68.0±7.59 ^{d3}	13.18±1.52 ^{f5}	69.6±6.48 ^{j7}	26±7.18 ^{m8}
C	138.1±6.61 ^{c2}	97.5±10.91 ^{e4}	19.15±2.20 ^{g6}	69.4±4.06 ^{k7}	49.6±6.57 ^{l9}

Table 7: Effects of protein isolates on lipid profile in liver of each experimental groups (Mean ± standard deviation) (N=10)

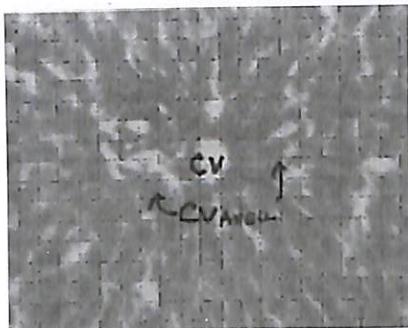
Group	Liver Cholesterol (mg/g of tissue)
A	8.15 ± 0.97 ^a
B	3.5 ± 0.71 ^{bl}
C	13.2 ± 2.97 ^{c2}

a-l: Values in the same column with different superscripts are significantly different (Tukey<0.05) (When Group A was separately compared with Group B and Group C)

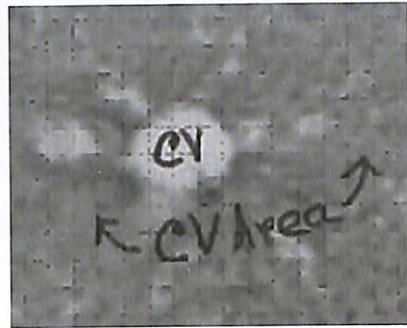
1-9: Values in the same column with different superscripts are significantly different (Tukey<0.05) (When Group B was compared with Group C).

Table 6 reveals a significant increase in plasma cholesterol, TG, VLDL, LDL of group C with respect to Group A whereas Group B shows a reverse result except for HDL. The liver cholesterol content of group B shows a significant decrease whereas liver of group C shows a significant increase (Table 7). Except HDL, other lipid profile like total cholesterol, triglyceride, VLDL and LDL show a significant increase in group C when compared to Group B. Carroll and Halmiton ^[3] proposed that vegetable proteins have hypocholesteremic effect on rabbits and human but Andersol *et al.* ^[1] reported that vegetable proteins have no significant effect on cholesterol level of adult. The mechanism of hypocholesteromic effect of vegetable protein is not yet clear. Probably cholesterol synthesized endogenously or free cholesterol is delivered to the liver by lipoprotein. This results in the synthesis of bile acids, leading to reduction in plasma cholesterol levels. Results of Group B corroborated with this observation. Moreover, the fibrous nature of Rajmah seed proteins ^[8] are also responsible for its hypocholesteremic nature because increased excretion of bile acids which help for the catabolism of cholesterol may be responsible due to their high fiber content. However, the present study by shows a hypercholesteremic effect of *M. jalapa* seed proteins. This raised a very interesting question and concern about such generalization as mentioned earlier. Further work of Neves *et al.* clearly indicates that plant protein does not have hypocholesteremic effect compared with that of dietary animal proteins ^[10]. Probably the excess ketogenic amino acids present in the protein (*M. jalapa* L.) are converted to cholesterol via mevalonic acid pathway. Possibly this ketogenic amino acid produces cholesterol through the mevalonic acid pathway and thus showed a hypercholesteremic action in group C. On the other hand, it can be said that decrease excretion of bile acids lead to such elevation in plasma cholesterol and triglyceride levels.

Thus it may be possible that the significant increase of HDL for group B and group C as observed reduces the chances of cardiovascular tissue damage, although *M. jalapa* is found to be apparently hypercholesteremic in nature.



A) Liver of Group-A showing general appearance



B) Liver of Group-B showing general appearance with slight enlarge central vein



C) Liver of Group-C showing general appearance with sight irregular enlargement of central vein

Figure 1: Photographs of the transverse section (5 micro meter thick) of liver and kidney with heamatoxylin eosin (H & E X 100).

Histological Studies: Ultrastructural studies of experimental animals further confirmed that Rajmah or Sandhyamalati seed proteins do not produce such abnormalities (figure 1). Therefore, it can be concluded that Sandhyamalati seed protein might be partly fortified with other limiting essential amino acids and used as a whole protein substitute.

CONCLUSION

It will be worthwhile to mention that the seed protein of Sandhyamalati may be utilized where protein resources are not sufficient to provide nutrition.

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Climate Change In Squalid Urban-slums: A Heaven For Dreadful Pathogens Cause Health Hazards

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ABSTRACT

Climatic change in unhygienic slums cause chronic atmospheric deteriorations and are a serious threat to human life. The major reasons of morbidity and mortality in the sub-urban squalid areas in Horizone basti in Jalpaiguri Town, North Bengal mostly because of direct and indirect exposure of the human body to some atmospheric pathogens, which are likely to involve and cause health hazards. An alarming danger is due to the development of asthma and allergy causing micro-arthropods because of the increased temperature and high humidity specially in the living houses in slum areas, which are not at all ventilated properly. This paper presents an account of the occurrence of a large number of allergy causing house dust mites mainly Pyroglyphid and Cheyletid mites which cause irritation of the respiratory tract, leading to adverse effects on health. These mites were found to attain their peak populations at different seasons of the year. The basic approach adopted here is to develop an equitable health care service that will meet the need of people in slums, using appropriate technologies to develop health information and awareness throughout society as a whole and also to strengthen individual and collective inspector responses to control over health issues.

Key Words: Dreadful-microarthropods, Squalid-slums, Edaphic-parameters, Seasons, Hygienicity, Allergy.

INTRODUCTION

Unhealthy environmental problems relate not only to an individual person but also to its immediate ecological factors. The stress resulting from a change in edaphic factors produces strain within the human body to establish the physiological autonomic behavioral regulation. The harmful effects of house dust inhabiting mites are manifold. The tiny delicate organisms known as mites exhibits extreme diversity in structure, habitat and behaviour. These micro arthropods are cosmopolitan in distribution, causing damage to stored materials and can seriously affect animal and human health. Some species of mites entering the respiratory system by inhalation can cause pulmonary infestations in human beings.

Joy and Datta (1987) and Voorhorst et al. (1969) pointed towards the seasonal dampness of poorly constructed houses a major factor for increased incidence of asthmatic complaints and attributed high number of dust mites to be responsible for the house dust allergy [3, 6]. They also found a clear correlation between dampness of houses and number of mites in house dust. Several Astigmatid and Cheylatid species are economically also very important because of their destruction of stored food materials and above all as potential allergy causing organisms. The occurrence of house dust mites is undoubtedly related the hygienicity of the household. Lack of proper education and adequate income are the main reasons that can lead to such unhygienic conditions. The economic conditions also restrict people of slums from arranging enough living space for their family members. In low income sections of the community like Harizone basti people leads to easy contamination of materials and transmission of diseases by many pathogenic microorganisms like mites etc.

AIM AND OBJECTIVES

The present investigation was designed mainly with the following definite aims

- a) To study the prevalence of potential allergy causing species among the general dust mite fauna in the area of investigation.
- b) To compare the seasonal distribution of dust mites.
- c) To correlate the changes in the density of dust mites with the changes of environmental parameters.
- d) To compare the abundance of *Dermatophagoides* sp. and *Cheyletus* sp. in houses with and without chronic asthmatic patients.
- e) To follow population of major Astigmatid and Prostigmatid species in relation to environmental factors.

A comparison of the population structure and abundance of major groups of dust mites in different houses can indicate any qualitative and quantitative deviation from their general trend due to specific characteristics of a particular house. Also information on the abundance of potential allergy causing species of dust mites can be verified for their role in producing chronic asthmatic and other acute respiratory problems among the inhabitants.

METHODOLOGY

This investigation was conducted on a thickly populated squalid slum areas in Harizone basti area of approximately 1.5 square km in Jalpaiguri, West Bengal to avoid any major differences in the climatic parameters mainly, with special emphasis on the community structure, population and fluctuation of house dust mite and their major allergy causing species cause health hazards to the indigenous people. Six different houses (low quality concrete building with tin shed or hay thatching) were selected for the survey, where three were occupied by chronic asthmatic patients. The investigation was done for consecutive twelve months.

The method of extraction was followed by a modified suspension and centrifugation method and extracted micro-specimens were sorted out into major taxonomic categories. Adult mites were identified upto generic and specific level but juvenile and hypopi stages could not be identified. Simultaneous to the sampling of dust important ecological parameters like temperature, relative humidity of the living rooms at the time of sampling were estimated. In addition to the indoor readings also outdoor ecological parameters including rainfall were obtained from the observatory for comparison and correlation studies with the density of dust mites. Important statistical analysis was done on the tabulated data obtained from individual houses. This was aimed at comparing the dust mite community inhabiting different houses under low socio-economic, micro and macro climatic conditions and to work out the association among major species of house dust mites.

RESULT AND DISCUSSION

The natural population of house dust mite varies considerably in different houses depending upon the climatic and other conditions. Housewise distribution of different groups of house dust mites showed that Astigmatid group was dominant in all the houses and Prostigmatid was the second highest group, whereas the number of Cryptostigmata and Mesostigmata were very low (Figure 1). The rate of rainfall was moderate to high during June to September and so the atmospheric humidity was also highest in those months. In general, in Jalpaiguri the onset of rainfall during summer months maintained a high humidity level till the next dry winter season. The distribution of dust mites with reference to incidence of chronic asthma indicated predominance of total dust mites, Astigmata and Prostigmata in WAP houses (Table 1). *Dermatophagoides* sp. predominated over other species throughout the year in different houses. High number of *Dermatophagoides* sp. could be observed in WAP houses, Predatory mite *Cheyletus* sp. occupied the highest position among prostigmatids in different houses (Table 2).

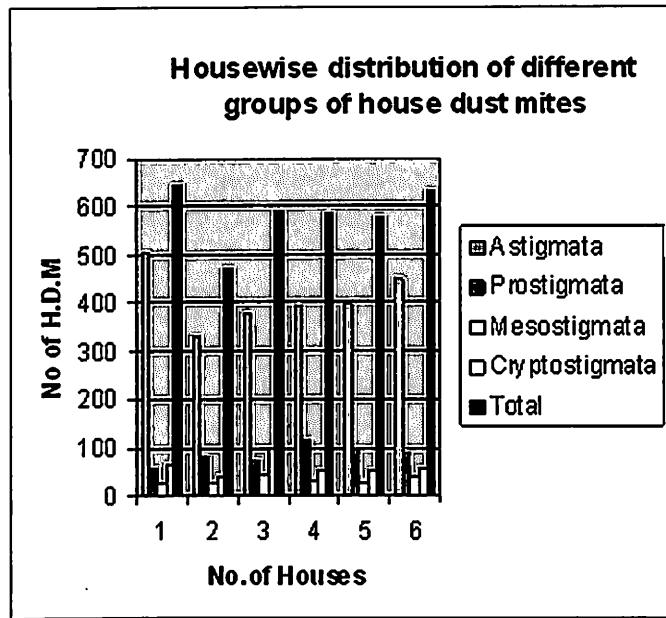


Figure 1: House wise distribution of different HDM groups

Table 1: Density of total dust mites, Astigmatids and Prostigmatids in individual houses

Dust in gm	No of total HDM	Average no/gm.	Total Astigmatids	Average no/gm	Total Prostigmatid	Average no/gm
28.45	646	22.71	504	17.72	55	1.93
28.07	471	16.78	332	11.83	77	2.74
35.6	589	16.54	376	1056	71	1.99
29.55	587	19.86	393	13.3	114	3.86
33.55	575	17.14	398	11.86	100	2.98
27.5	634	23.05	448	16.29	91	3.31
181.72	3502	19.27	2451	13.49	508	2.8

Table 2: Seasonal distribution of *Dermatophagoides* sp. and *Cheyletus* sp. (no./gm dust)

Species	Seasons	House-1	House-2	House-3	House-4	House-5	House-6
<i>Dermatophagoides</i> sp.	Winter	21.71	17.07	15.51	14.43	21.02	30.75
	Summer	19.42	3.78	5.53	17.94	10.19	7.7
	Rainy	10.7	4.32	2.33	5.15	8.82	9.15
	Total	51.83	25.17	23.37	37.52	40.03	47.6
<i>Cheyletus</i> sp.	Winter	0.93	1.2	2.25	0.57	0.15	5.48
	Summer	6.68	6.76	2.93	3.25	4.47	2.48
	Rainy	0	2.43	1.26	0.29	0.16	0.77
	Total	7.61	10.39	6.44	4.11	4.78	8.53

The seasonal dynamics of different species can vary in the same geographical area. Lang and Mulla (1978) showed that *Dermatophagoides pteronyssinus* was abundant from July to December, while *D. farinae* was more prevalent from August to early spring [4]. The combined population of house dust mites other than Astigmata obtained a significant increase with respect to the total dust mite population in the rainy season. Relative abundance (%) of four major groups in six houses with and without asthmatic patients was calculated and obtained a clear picture of the presence of different groups in dust (Figure 4).

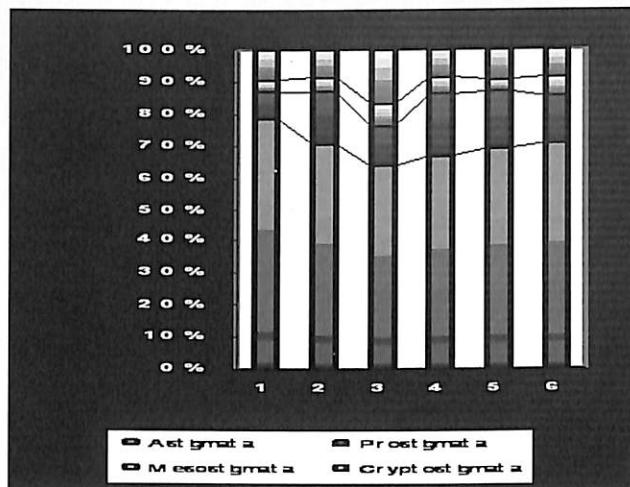


Figure 4: Relative abundance (%) of major 4 groups in NAP & WAP houses

It appears to be a positive association between mites and fungi in house dust, firstly because fungi is a major food source of these micro arthropods and secondly because the humid and hot microclimatic conditions and nutrient status of house dust are favourable growth of both mites and fungi.

It could be observed in the laboratory also that *Aspergillus* sp. growing at 75-80% relative humidity can support the growth of *Dermatophagoides* sp. in a natural environment. Also used dried yeast powder for nutrition of the culture.

During observation it could be noticed that abundance of *Dermatophagoides* sp. more in house with pet animals than houses without them. In this zone people use to keep their domestic pets like goat, pig, pigeon etc. which are often allowed their entry within their living room also, without any concern about their role as carriers of mites and similar unpleasant organisms.

CONCLUSION

The serious health hazards and clinical importance of house dust mites led to various attempts to control their population in domestic conditions. Their population can be minimized by regular exclusion of dust from beds and bedrooms by establishing a sanitary standard, which can be maintained by good house keeping in a routine manner. Reduction of moisture by keeping packets of Silica gel, reduced humidities associated with good house construction and central heating, atmospheric conditions can reduce mite density as well as dust allergen [1].

Use of fungicides like Nipagin can effectively control house dust mite population through elimination of their fungal food. However, application of acaricides and other pesticides may produce certain side effects on sensitive patients on a long term basis.

Warren et al. (1983) emphasized on the allergenic importance of storage mites in house dust [7]. Terho et al. (1982) and Datta Ghatak (2013) also found that storage materials like hay could maintain large populations of Astigmatid mites including Cheyletids [2,5]. Therefore, the present study indicated that in squalid slums stored grain and hay can act as a possible source for entry of mites into the house dust. The basic informations on the abundance and importance of specific important species of dust mites will help detailed future researches on

clinical, biochemical and immunological aspects of house dust mite allergy in our country.

This reliable data on the predominance of potential allergy causing species of dust mites in any particular season or condition can help to avoid the chances of allergic and similar health hazards.

IMPLICATIONS

- a) A proper knowledge on the intensity of potential allergy causing organisms inhabiting house dust may therefore, help people aware of their possible harmful effects and to reduce the chances of chronic respiratory and other allergic problems in our country by adopting efficient and cheap control and preventive measures.
- b) A proper understanding on the direct or indirect role of indoor and outdoor climatic parameters in regulating the dust mites population can be made use for controlling the populations of the pathogens by selectively modifying the microclimate and intensity of responsible factors.
- c) The findings of the present ecological investigation on the house dust mite fauna in Jalpaiguri provides an inspiration to design certain advanced studies on the functional role of these potential allergy and asthma causing microorganisms.

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Ecofriendly Management of *Xanthomonas Oryzae*

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ABSTRACT

The potential of indigenous medicinal plants as alternative chemical pesticides for controlling bacterial leaf blight (BLB) of rice was tested in the present study. The present study was planned to screen different plant extracts for the control of bacterial leaf blight disease of rice. *Xanthomonas oryzae* pv. *Oryzae*, the causal agent of the bacterial leaf blight of rice, was characterized through different biochemical tests and assays. Isolates gave dome shaped, yellow colonies on nutrient agar plates. Gram staining showed that the pathogen is Gram negative and rod shaped, also potassium hydroxide test was performed in order to support the results of Gram staining. Endospore staining showed that the isolated pathogen is a non-spore forming bacterium. Starch hydrolysis test, egg yolk reaction, gelatin hydrolysis test and oxidase test gave negative results. Four different and easily available medicinal plant species such as *Adhatoda vasica*, *Lantana camera*, *Allium sativum* and *Citrus limon* were screened for antibacterial activity against the isolated pathogen. In this study, antibacterial activity of *Citrus limon* extract against Bacterial Leaf Blight disease caused by *Xanthomonas oryzae* pv. *Oryzae* in rice is showed. Based on the biochemical responses and also the activity against different plant extracts, it may be concluded that the causal agent is the same for the bacterial leaf blight of rice in the chosen fields of Purba and Paschim Medinipur and there is no significant difference between the pathogenicity and activity of the isolates from the different fields put to test.

Key Words: BLB, *Xanthomonas oryzae*, *Citrus limon*, *Adhatoda vasica*

INTRODUCTION

Rice (*Oryza sativa*) is life for millions of people and possibly the oldest domesticated food grain [2, 3]. Over 90% of the world rice is grown and consumed in Asia, where 60% of the world's population lives. Rice accounts for up to 60% of the energy intake of around 3 billion Asians [8]. India has the largest area under rice cultivation (43 million hectares) and with production of 87.80 million tons, next to China. The major rice growing states of India are West Bengal, Uttar Pradesh, Madhya Pradesh, Andhra Pradesh, Karnataka, Kerala, Haryana, Tamil Nadu etc.

Rice crop is prone to number of bacterial diseases among which bacterial leaf blight or BLB caused by *Xanthomonas oryzae* pv. *oryzae* is a serious problem and threat to rice production in both tropical and temperate rice growing regions due to its high epidemic potential [15]. The disease occurs in the host plant at the seedlings, vegetative and reproductive stages but bacterial leaf blight at the tillering stage causes severe blighting of leaves resulting in yield loss up to 75% depending on weather, location and particular rice cultivar used [18].

The pathogen is seed-borne [21] and has been considered as an important quarantine organism in many countries. Sowing infected seeds can lead to reduced germination, vigor and yield. Thus, seed-borne bacteria act as a primary source of inoculum and may lead to extremely high field incidence. A seed infection usually occurs during the three distinct phases of seed production, seed development and seed maturation. The pathogen can infect the seed and developing plant leading to systemic infection [14]. More complete knowledge of the mechanism

of transmission may lead to better method of controlling the disease.

Thus, one of the aims of the present study is to find out bacterial leaf blight incidence across rice growing regions of Purba and Paschim Medinipur of West Bengal and to characterize *Xanthomonas oryzae* pv. *oryzae* biochemically from the isolates collected from different agro-climatic regions of the state.

Unsuccessful attempts have been made to manage this disease using chemotherapeutics, which prompted us to develop alternative management strategies. Several broad spectrum bactericides have been recommended as prevention against the bacterial leaf blight. However, the chemicals are expensive and they also affect the beneficial microorganisms present. Plant origin ‘bioside’ are non-phytotoxic, systemic and easily biodegradable [9, 12, 20, 21]. The active compounds from plant act on the pathogen directly [1, 3] and induce the systemic resistance in growing plants, which in turn reduce the disease development [17, 19]. Induced systemic resistance activates the multiple defence mechanisms which include increased pathogenesis related (PR) proteins (Peroxidase, chitinase etc.) [25]. Phenylalanine ammonia lyase (PAL) and peroxidase are the main enzymes involved in the phenyl-propanoid metabolism [25].

Therefore, in the present study, an attempt has been made to use plant extracts in place of synthetic chemicals not only to reduce the *Xanthomonas oryzae* pv. *oryzae* incidence, but also to improve the seed quality, evaluate the antibacterial activity of the plants under in vitro and greenhouse conditions and to study the potential induction of systemic resistance in rice by some easily available medicinal plant extracts.

AIMS AND OBJECTIVES

Realizing the side effects of chemical pesticides on human health and environment and the competition of world market to get high quality and disease free products, the present study is planned to screen out different plant species extracts for the control of bacterial leaf blight disease. Hence the objectives of the present study are:

- a) To determine the ability of antimicrobial activity of different plant extracts against *Xanthomonas oryzae* pv. *Oryzae* on rice plant.
- b) To determine the ability of the bacteria isolated from the rice plant.
- c) To find out the alternative control measure (biological control), which is effective and affordable and cheaper than the chemical pesticides.
- d) To determine the effectiveness of biological pesticides on this particular organism.
- e) To observe the effects of plant extracts by in vitro testing.

METHODOLOGY

Identification of the Diseased Leaves: The identification of the BLB infected leaves was done [22]. Infected rice field is shown in the figure 1.

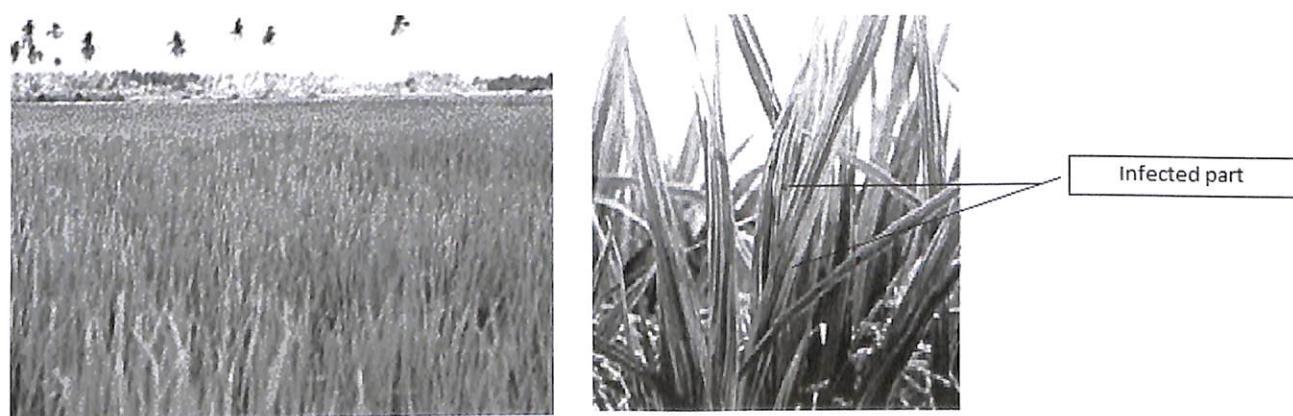


Figure 1: Field Infected by *Xanthomonas Oryzae*

Collection of Diseased Leaves: A survey of various rice fields of undivided Midnapore district of West Bengal was done for the collection of leaf samples of rice that are infected with bacterial leaf blight. Five samples of such diseased rice leaves were collected from the fields visited during the harvesting season.

Isolation of *Xanthomonas Oryzae*: Infected leaves of rice plants were cut into small pieces of and were cleaned in tap water, and were air dried. These leaf pieces were then sterilized with 1% Sodium hypo chloride solution for three minutes, followed by sterilized distilled water. Now the leaf pieces were dried on sterile blotting paper and were transferred to Nutrient agar medium (NA media) and were incubated at 28-30°C for 24 hrs.

Pathotype Evaluation: The leaves were preserved for further use in sterile distilled water for short time preservation; and for long term preservation, silica gel has been used^[24] in the leaf cutting method.

Diagnostic Tests:

Hypersensitivity Reaction: To determine the pathogenic nature of the isolates, hypersensitivity reaction was studied on healthy rice plants. Approximately 24 hours old culture of the isolated strain was injected with a hypodermic syringe into the surface of leaf^[10].

Biochemical Characterization of Xanthomonas Oryzae

Gram Staining: Gram staining was performed and the slides were examined under microscope at 100 X oil immersion^[6].

Endospore Staining: Endospore staining was done with Malachite green and examined under microscope at 100 X oil immersion.

Potassium Hydroxide (KOH) Test: Gram staining results were confirmed by potassium hydroxide (KOH) test^[23].

Starch Hydrolysis Test: Starch hydrolysis test is used to identify the bacterial species having the property of amylase production^[5].

Egg Yolk Reaction: The Lipase enzyme hydrolyzes the fats within the egg yolk, which results in a sheet on the colony surface^[13].

Gelatin Hydrolysis Test: Use of gelatin is accomplished by the enzyme gelatinase. When gelatin is used; the medium changes from semisolid to liquid and cannot be resolidified.

Tetrazolium Salt Tolerance Test: Aqueous 1% triphenyl tetrazoliumchloride (TTC) solution was prepared by adding 1 gm TTC reagent in 100 ml sterile distilled water.

Oxidase Test: Nutrient agar was supplemented with 1% glucose, sterilized, dispensed, and poured in the plate with a loop full of bacterial suspension, and incubated for 24 hours at 37°C^[11].

Catalase Test: Organisms utilize oxygen to produce hydrogen peroxide. This hydrogen peroxide is toxic to their enzyme system. Hence these organisms produce an enzyme, called catalase, which converts the hydrogen peroxide to water and oxygen.

Conc. Sulfuric Acid Test: An overnight culture of the isolated strain was placed on the grease free slide, and then concentrated sulfuric acid was applied drop by drop on this specimen. If the culture becomes transparent then the test would be said to be positive.

Physical Characterization of Xanthomonas Oryzae:

Growth Curve: The density of cell suspension is expressed as absorbance or optical density (OD) which is directly proportional to the cell concentration and is measured in spectrophotometer. OD is a logarithmic value and is used to plot a graph of bacterial growth. Finally growth curve was prepared by plotting in terms of OD against time (hours).

Transverse Leaf Section of Infected Paddy Leaf: The transverse sections of the infected leaves were done and observed under microscope at 10X.

Antimicrobial Activity of Selected Plant Extracts on *Xanthomonas Oryzae*:

Selection of Medicinal Plants: In the present work, *Citrus limon*, *Adhatoda vasica*, *Lantana camara*, and *Allium sativum* has been studied.

Plant Extracts: The extracts of all the selected medicinal plants were used to determine the titer value on BLB. The medicinal plants have been collected from different regions of Midnapore, West Bengal.

Common Names of the Plants Studied	Scientific Name of the Plants Studied	Plant Parts that have been Used	Prepared Extracts of These Plants Parts
Basak	<i>Adhatoda vasica</i>	Leaf	Aqueous and Ethanolic extracts
Bhoot bhairabi	<i>Lantana camara</i>	Leaf	Aqueous and Ethanolic extracts
Garlic	<i>Allium sativum</i>	Bulb	Aqueous and Ethanolic extracts
Lemon	<i>Citrus limon</i>	Juice	Aqueous extract

Extraction Methods

Preparation of Extracts: All the plant parts were cleaned and surface sterilization was done. They were again washed with sterile distilled water for 20 minutes, and then air-dried. The materials were ground to fine powder. These powdered materials were used for the preparation of aqueous and ethanolic extracts.

Preparation of Aqueous Extracts: Plant extracts were filtered in muslin cloth and the filtrate was then centrifuged at 2000 rpm for 10 minutes. The supernatant was then collected and stored at 4°C. Aqueous extracts of all the four plants were processed in the same way.

Preparation of Ethanolic Extracts: At first, 15 gm of dry powder of plant samples were taken in an airtight container with 100 ml of 95% ethanol, and then it was kept for 4-5 days in a rotary shaker. The plant extracts were then filtered by muslin cloth and the filtrate was then centrifuged at 2000 rpm for 10 minutes. The supernatant was collected and stored at 4°C. Ethanolic extracts of the following three plants *A. vasica*, *L. camara*, *A. sativum* parts were also processed in the same way.

Antibacterial Assay

Determination of Titer Value by Minimum Inhibitory Concentration (MIC): MIC of plant extracts would be determined depending on their inhibition of the growth of the organism. The turbidity was measured in terms of optical density by spectrophotometer at 630 nm.

Agar-well Diffusion: The sensitivity against these plant extracts was tested on this organism. The effectiveness was based on size, inhibition zone. However, zone may vary due to diffusibility of extracts, size of inoculum, type of medium, etc.

Paper Disk Method: The effectiveness of each extract was determined accurately by disc diffusion method.

RESULTS AND DISCUSSIONS

Isolation of *Xanthomonas Oryzae*: Five different samples were taken from five different regions of undivided Midnapore districts of West Bengal. The bacterial culture was grown in nutrient agar medium. They produced colonies that were yellow, convex, mucoid and shiny in texture as shown in figure 2.

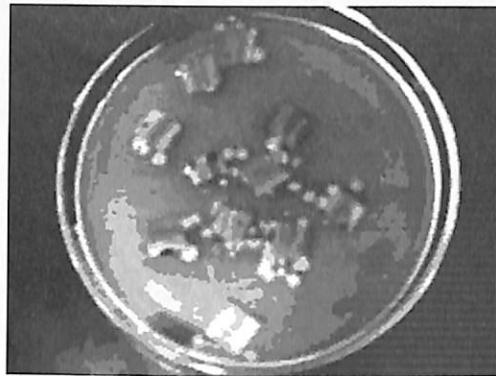


Figure 2: Isolation of *Xanthomonas Oryzae*

Disease Assessment: The length of the lesion of cut leaf tip was measured in centimeters (cm) on 18th day after inoculation. The lesion length of 0-6cm has been classified as resistant (R) and that which is more than 6cm has been classified as susceptible (S).

A. Physical Characterization of *Xanthomonas oryzae*

- a) *Morphology of Infected Leaf:* Infected leaf has yellow water soaked lesions at the margin of its leaf blade can be seen in figure 3.
- b) *Transverse Leaf Section of the Infected Leaf:* Below the hypodermal zone mycelial mat can be seen in figure 4.

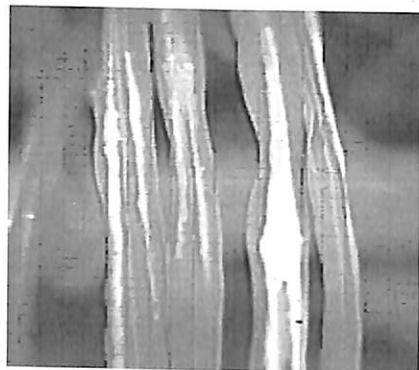


Figure 3: Showing the Bacterial Leaf Blight Infected Leaves of a Rice Plant

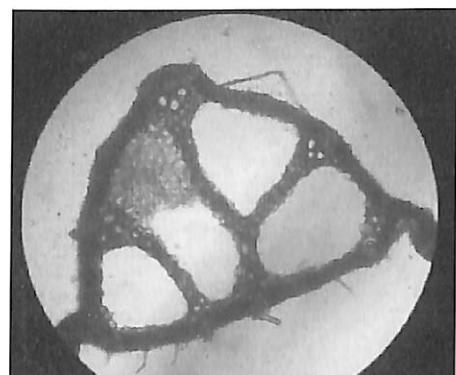


Figure 4: Showing the Infected Areas on the Leaf Blade of the Studied Rice Plant

- c) *Growth Curve:* Lag phase exists for 12 hrs. Then it moves to log phase as shown in the graph. Then to stationary phase which exists for 18 hrs (figure 5).

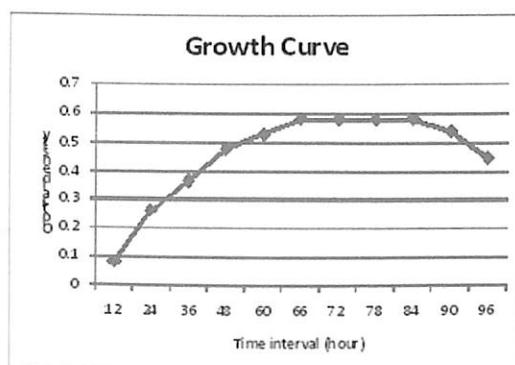


Figure 5: The Growth Curve of the Isolated Strain of *Xanthomonas Oryzae*

- d) *Colony Morphology:* Colonies were found to be light yellow in color, slime in nature, circular, convex, and smooth in appearance as seen in figure 6.

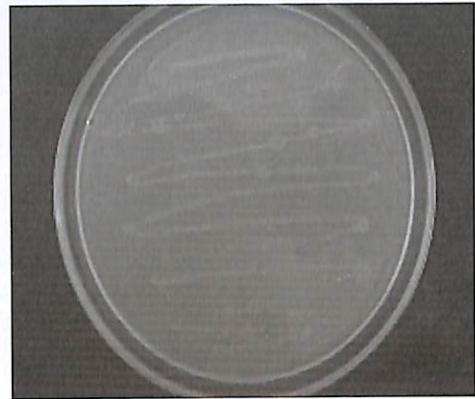


Figure 6: Isolated Strain of *Xanthomonas oryzae* (a) Spread Plate (b) Streak Plate

- e) *Hypersensitivity Reaction Test:* The isolated strain of *Xanthomonas oryzae* showed typical hypersensitive reaction on a leaf (figure 7). After 24 to 48 hr of injection the injected leaf area became necrotic and in 3-4 days, the treated tissue was entirely dry and yellow.

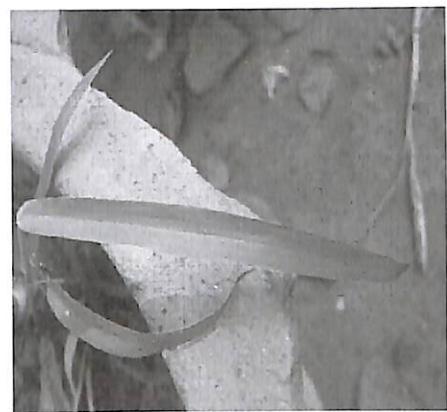


Figure 7: The Hypersensitivity Reaction on a Leaf (a) Before Injection (b) After 48 hrs

B. Biochemical Characterization

- a) *Gram Staining:* The overnight culture of isolated strain of *Xanthomonas* showed that the organism is Gram-negative, rod shaped bacterium with a polar flagellum (figure 8).
- b) *Endospore Staining:* The endospore staining of the isolated strain of *Xanthomonas oryzae* showed it to be a non-spore forming organism (figure 9).



Figure 8: Gram Stained Slide of the Isolated Strain



Figure 9: Endospore Stained Slide of the Isolated Strain (100X)

- c) *Most Probable Number (MPN)*: The MPN test performed with the isolated strain of *Xanthomonas oryzae* that it is not a coliform bacteria (figure 10).

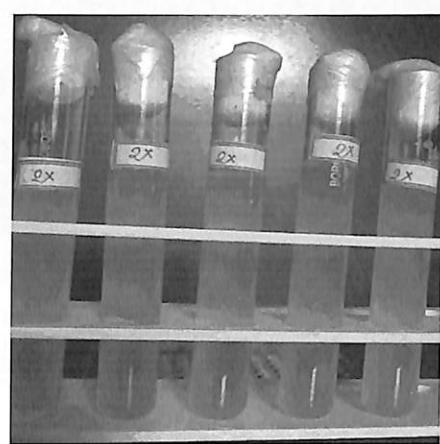


Figure 10: MPN Done with Different Dilutions of the Overnight Culture of the Isolated Strain of *Xanthomonas Oryzae*
in (a) 1X Lactose Broth, (b) 2X Lactose Broth

- d) *Potassium Hydroxide (KOH) Test*: This test was performed to confirm the Gram stain result. This supported the fact that the isolated bacterium is Gram negative in nature.
- e) *Starch Hydrolysis Test*: After the addition of iodine the absence of clear zone indicates the absence of starch hydrolysis (figure 11).
- f) *Egg yolk Reaction Test*: The test was positive as the bacteria formed white opaque colonies (figure 12).



Figure 11: Starch Hydrolysis Test for the Isolated Strain of *Xanthomonas Oryzae*

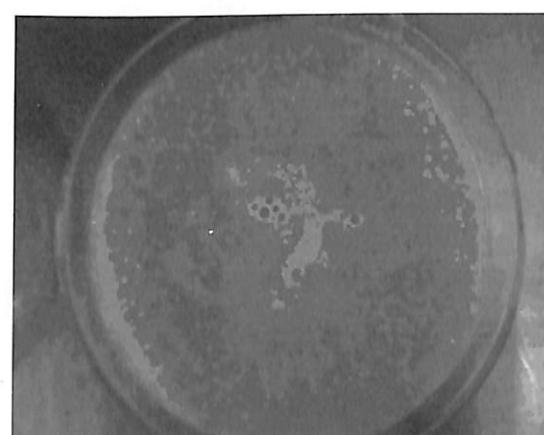


Figure 12: Egg Yolk Reaction Test for the Isolated Strain of *Xanthomonas Oryzae*

- g) *Gelatin Hydrolysis Test*: By this test it was seen that gelatin was not hydrolysed by the isolated organism (figure 13).
- h) *Tetrazolium Salt Tolerance Test*: It was found that most Xanthomonads were inhibited at 0.01% and 0.02% triphenyl tetrazolium chloride (TTC) but completely inhibited at 0.1% concentration of the same.
- i) *Oxidase Test*: Oxidase test proved to be negative in case of the isolated strain of *Xanthomonas oryzae* (figure 14).

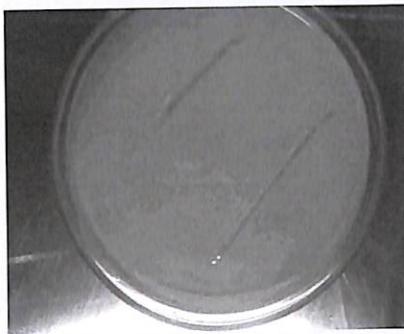


Figure 13: Gelatin Hydrolysis Test of the Isolated Strain *Xanthomonas Oryzae*

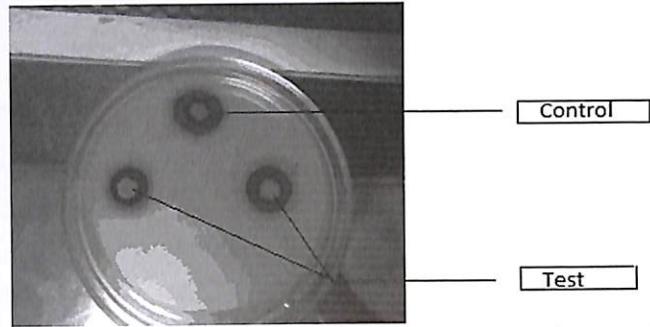


Figure 14: Plate Showing Oxidase Test for the Isolated Strain of *Xanthomonas Oryzae*

- j) *Catalase Test:* The bacterium *Xanthomonas oryzae* gave a positive catalase test. Hence, the results of the biochemical tests can be summarized as below in table 1.

Table 1: Summary of the Results of Biochemical Tests

Biochemical Tests	Results
Gram staining	Negative
Endospore staining	Non-spore forming
Most probable number (MPN)	No gas formation(they are non-coliform)
Potassium hydroxide test	Gram negative confirmed
Starch hydrolysis test	Negative
Egg yolk reaction test	Positive
Gelatine hydrolysis test	Negative
Tetrazolium salt hydrolysis test	Totally inhibited at 0.1% of triphenyl tetrizolium chloride(TTC)
Oxidase test	Negative
Catalase test	Positive

C. Antimicrobial Activity of Selected Plant Extracts on *Xanthomonas Oryzae*:

- a) *Determination of Titer Value by Minimum Inhibitory Concentration (MIC):* The following data was observed after the MIC performed with aqueous (Table 2, 3, 5 and 7) and ethanolic extracts (Table 4, 6 and 8) of different plant species put to test. The results can be seen in figure 15 to 21.

Table 2: Data of MIC with *Citrus Limon* (Aqueous Extract)

Sl. No.	Dilution Number	Optical Density
1	10 ⁻¹	0.09
2	10 ⁻²	0.15
3	10 ⁻³	0.20
4	10 ⁻⁴	0.23
5	10 ⁻⁵	0.21
6	10 ⁻⁶	0.14
7	10 ⁻⁷	0.11
8	10 ⁻⁸	0.07

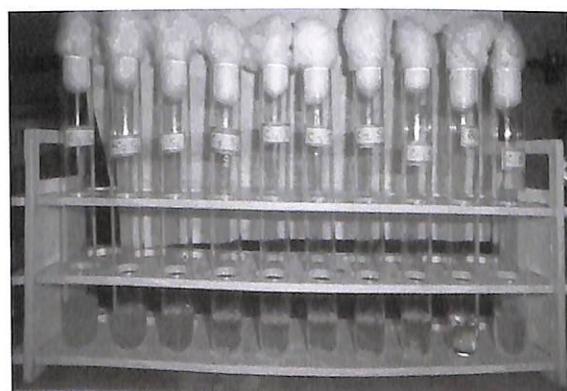


Figure 15: Showing the MIC Done with *Citrus Limon* (Aqueous Extract)

Table 3: Data of MIC with *Allium Sativum* (Aqueous Extract)

Sl. No.	Dilution Number	Optical Density
1	10^{-1}	0.09
2	10^{-2}	0.52
3	10^{-3}	0.46
4	10^{-4}	0.41
5	10^{-5}	0.39
6	10^{-6}	0.38
7	10^{-7}	0.36
8	10^{-8}	0.34

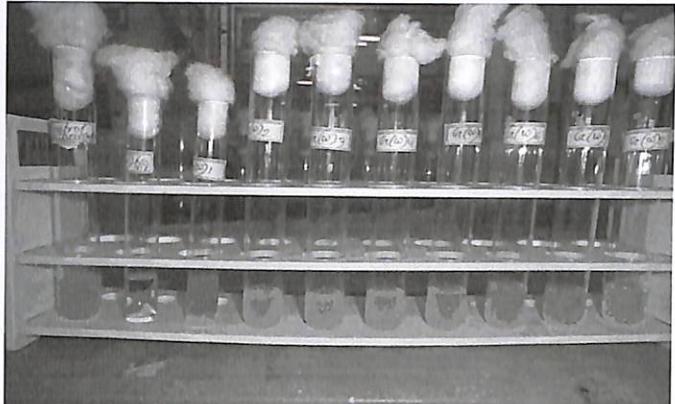


Figure 16: MIC Done with *Allium Sativum* (Aqueous Extract)

Table 4: Data of MIC with *Allium Sativum* (Aqueous Extract)

Sl. No.	Dilution Number	Optical Density
1	10^{-1}	0.02
2	10^{-2}	0.04
3	10^{-3}	0.24
4	10^{-4}	0.26
5	10^{-5}	0.29
6	10^{-6}	0.27
7	10^{-7}	0.24
8	10^{-8}	0.22



Figure 17: Showing the MIC Done with *Allium Sativum* (Ethanolic Extract)

Table 5: Data of MIC with *Lantana Camara* (Aqueous Extract)

Sl. No.	Dilution Number	Optical Density
1	10^{-1}	0.21
2	10^{-2}	0.22
3	10^{-3}	0.23
4	10^{-4}	0.26
5	10^{-5}	0.24
6	10^{-6}	0.23
7	10^{-7}	0.20
8	10^{-8}	0.21



Figure 18: Showing the MIC Done with *Lantana Camara* (Aqueous Extract)

Table 6: Data of MIC with *Lantana Camara* (Ethanolic Extract)

Sl. No.	Dilution Number	Optical Density	
1	10^{-1}	0.01	
2	10^{-2}	0.05	
3	10^{-3}	0.06	
4	10^{-4}	0.08	
5	10^{-5}	0.15	
6	10^{-6}	0.07	
7	10^{-7}	0.05	
8	10^{-8}	0.04	

Figure 19: Showing the MIC Done with *Lantana Camara* (Ethanolic Extract)

Table 7: Data of MIC with *Adhatoda Vasica* (Aqueous Extract)

Sl. No.	Dilution Number	Optical Density	
1	10^{-1}	0.22	
2	10^{-2}	0.28	
3	10^{-3}	0.32	
4	10^{-4}	0.26	
5	10^{-5}	0.16	
6	10^{-6}	0.15	
7	10^{-7}	0.13	
8	10^{-8}	0.10	

Figure 20: Showing the MIC Done with *Adhatoda Vasica* (Aqueous Extract)

Table 8: Data of MIC with *Adhatoda Vasica* (Ethanolic Extract)

Sl. No.	Dilution Number	Optical Density	
1	10^{-1}	0.01	
2	10^{-2}	0.09	
3	10^{-3}	0.14	
4	10^{-4}	0.13	
5	10^{-5}	0.12	
6	10^{-6}	0.06	
7	10^{-7}	0.03	
8	10^{-8}	0.02	

Figure 21: Showing the MIC Done with *Adhatoda Vasica* (Ethanolic Extract)

- b) *Agar Well Diffusion Method*: The agar well diffusion test was done and the results obtained from the plant extracts are summarized in Table 9. In Fig 22, The results with different extracts can be seen.

Table 9: The Results Obtained from the Respective Plant Extracts

Plant Extracts put to Test	Diameter of the Obtained Clear Zone (cm)
<i>Citrus limon</i> (aqueous extract)	1.9
<i>Adhatoda vasica</i> (aqueous extract)	1.9
<i>Allium sativum</i> (aqueous extract)	0.8
<i>Lantana camera</i> (ethanolic extract)	0.2

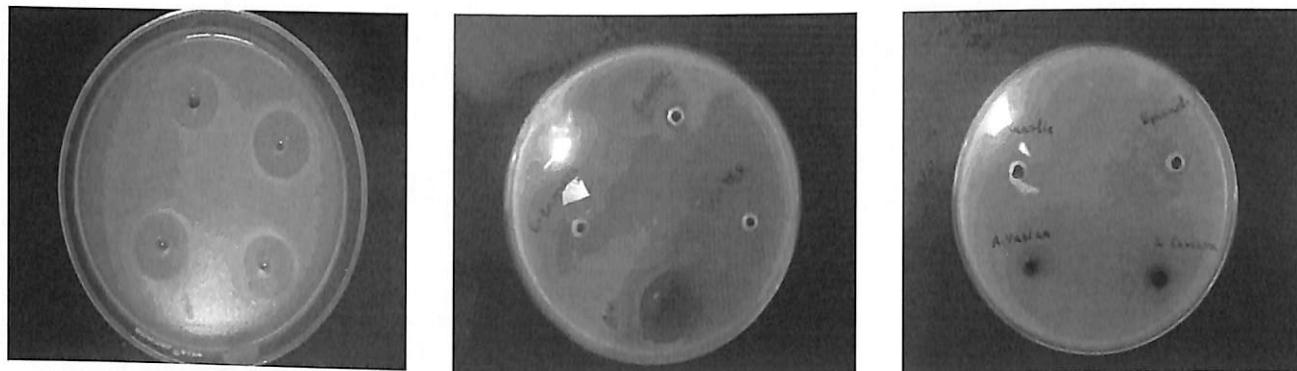


Figure 22: The Plates Show the Results of Agar Well Diffusion(a) Activity of *Citrus Limon* (Aqueous Extract); (b) Activity of Aqueous Extracts; (c) Activity of Ethanolic Extracts

- c) *Paper Disc Method*: It also showed similar results as the agar well diffusion.

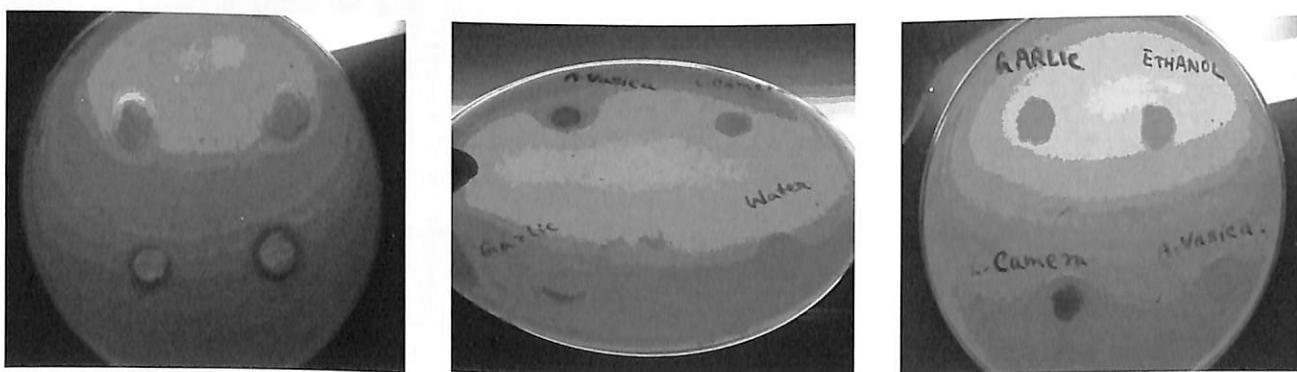


Figure 23: Plates Show the Results of Paper Disc Method with The Plant Extracts on the Isolated Strain of *Xanthomonas oryzae*(a) *Citrus Limon* (Aqueous Extract); (b) Aqueous Extracts; (c) Ethanolic Extracts

The causal bacterium *Xanthomonas oryzae* was isolated from green rice leaves with BLB lesion from five different regions of undivided Midnapore district. The disease occurs in the host plants at the seedling, vegetative and reproductive stages, but BLB infection at the tillering stage causes severe yield loss of upto 75% depending on weather, location and particular rice cultivar [18]. In our study none of the field surveyed were free from disease (BLB).

In an attempt to screen and confirm different rice leaf samples for the incidence of *Xanthomonas oryzae*, we have used diagnostic tests like hypersensitivity reaction and biochemical tests like Gram staining, endospore staining, KOH test, starch hydrolysis test, egg yolk test, gelatin hydrolysis test, tetrazolium salt tolerance test,

oxidase test, catalase test and conc. H_2SO_4 test. Physical characterization was also done using growth curve analysis and transverse leaf section of infected paddy leaf. These results suggest that the isolates obtained from different field do not differ in their degree of virulence. These results correlate with study of Ghasemie *et al.*, (2008) [7].

Aqueous extract of *Citrus limon* and *Adhatoda vasica* was found to be highly effective in inhibiting the growth of *Xanthomonas oryzae* compounds to the aqueous extracts of *Allium sativum* and *Lantana camera*. Narasimham *et al.*, (1995) and Kagale *et al.*, (2004) have reported antibacterial activity and management of bacterial diseases with use of different plant extracts in other crops [9, 16].

The present study clearly demonstrates that leaf blight disease is prevailing in all the surveyed regions of the Midnapore with varied degree of disease incidence.

In this study, we have demonstrated antibacterial activity of *Citrus limon* extract against Bacterial Leaf Blight disease caused by *Xanthomonas oryzae* pv. *Oryzae* in rice.

Hence, the present work suggests that use of *Citrus limon* and *Adhatoda vasica* extract is safe in the management of Bacterial Leaf Blight disease in rice.

Future studies are needed to understand the mode of infection of this pathogen and ecological behaviour of *Xanthomonas oryzae*, and its host cultivar is required to develop sound control strategies.

CONCLUSION

Xanthomonas oryzae pv *oryzae* has been isolated from green leaves of paddy plants with Bacterial leaf blight lesions. The isolated organism has been studied both physically and biochemically. The botanical study of plant is important for modern day medicine but its usefulness cannot be overemphasized if methods are not standardized to obtain comparable and reproducible results. At present, many scientists are investigating for plant products with antimicrobial properties. It would be advantageous to standardize methods for extraction and *in vitro* antimicrobial efficacy testing so that the search for new biologically active plant products could be more systematic and interpretation of results would be facilitated. Among all the plant extracts used in our study, two plant extracts such as *Citrus limon* (aqueous extract) and *Adhatoda vasica* (aqueous extract) showed maximum inhibitory effects on the causal organism of Bacterial leaf blight of rice.

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Immuno-Molecular Profiling of Liver Tumors Induced by a Chemical Carcinogen

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ABSTRACT

N-Nitrosodiethylamine (DEN), is an important environmental carcinogen inducing liver tumors. Exposure of man to DEN occurs through the diet, in certain occupational settings and also due to the use of tobacco products, cosmetics, pharmaceutical products and agricultural chemicals. The present work aimed at screening the immuno-molecular changes, through a span of 8 months, occurring in DEN induced liver tumor mice- models. Peripheral Blood Lymphocytes (PBL) and macrophages were isolated from the different experimental groups. Lymphocytes were screened for the immune markers-CD4 and CD8; the pro-inflammatory cytokines- IFNg, IL-2 and the anti-inflammatory cytokines-IL-4 and IL-10. The macrophages were screened for IL-12. During the 4th and 5th month, CD8+ve T-lymphocytes increased followed by a sudden decrease, while the CD4+ve T-lymphocytes increased from 6th month onwards. Heightened expression of all the 3 pro-inflammatory cytokines viz. IFN α , IL-2 and IL-12 were observed from 3rd month to 6th month after which their expression rapidly declined and was taken over by the anti-inflammatory ones- IL-4 and IL-10. Thus the developing tumor mass was indeed capable of inducing a pro-inflammatory to anti-inflammatory shift in the immune system of tumor bearing animals. This unprecedented data can thus be used for future reference to formulate effective immuno-therapeutic protocols in managing liver tumors.

Key Words: Liver tumors, DEN, Environmental carcinogen

INTRODUCTION

N-Nitrosodiethylamine (DEN), an important environmental carcinogen induces liver tumor (Hepatocellular Carcinoma [HCC])^[3,5,7,8,11,13]. N-nitrosamines are produced by the reaction of amines, principally secondary amines with nitrosating agents and N-nitrosodiethylamine is released into the environment from some industrial sources, principally the rubber, dyes, and metal industries and cigarette smoke. It is also contained in some rubber products and food items. The general population may be exposed to N-nitrosodiethylamine by inhalation of cigarette smoke and from the air in new cars, as well as ingestion of some foods. Occupational exposure would be by inhalation and dermal contact^[14]. This environmental carcinogen when inside the body is metabolized into an alkylating agent that induces DNA damage and mutations as well as hepatocyte death resulting in hepatocarcinogenesis. Hepatocellular carcinoma (HCC) is one of the most deadly human cancers because of its high incidence of metastasis. Even with combination chemotherapy, any response observed is typically partial and temporary and the long-term survival of patients with advanced HCC is poor, with a 1-year survival of 17 to 44% and 3-year survival of 8 to 17%^[12]. In humans, HCC almost inevitably develops in the setting of cirrhosis, conditions in which hepatocytes are killed and resident inflammatory cells (Kupffer cells), as well as newly recruited inflammatory cells (macrophages, neutrophils, Natural Killer cells and cytotoxic T cells), are found to act in favor of the developing tumor mass. Cytokine, an important component of the immune system play an important role in promoting the HCC carcinogenesis and progression^[6].

AIMS AND OBJECTIVES

In the present work we have tried to screen the immune profile of animals bearing hepatocarcinoma induced by a chemical carcinogen diethyl nitrosamine (DEN). For the purpose two important immune cells were selected-the peripheral blood lymphocytes (PBL) and the macrophages(Mf). Lymphocyte population can be preliminary divided into B and T lymphocyte. Further there are two well-defined subpopulations of T lymphocytes: T helper (T_H) and T cytotoxic (T_C) cells. T helper and T cytotoxic cells can be distinguished from one another by the presence of either CD4 or CD8 membrane glycoproteins on their surfaces. T cells displaying CD4 generally function as T_H cells, whereas those displaying CD8 generally function as T_C . Thus in our study the lymphocytes were screened for the CD4 and the CD8 markers. Further the lymphocytes were screened for -proinflammatory cytokines: IL2 and IFNg; and the anti-inflammatory cytokine: IL-4 and IL-10. IL-12 expression was assayed in the macrophages. The present work is first of its kind where detailed step by step screenings of the aforementioned regulators have been conducted during liver tumor development. The purpose was to come up with any fruitful conclusion that would help us to deduce the point from which the immune system is going berserk on administration of an environmental carcinogen.

METHODOLOGY

Animal Grouping: Healthy new born white albino mice of both sexes, 2-3 days old, were procured from Dr. Sagartirtha Sarkar, Reader, Department of Zoology, and University of Calcutta and maintained there. Maintenance and Animal experiment procedure strictly followed 'Principles of Laboratory Animal Care' (NIH publication No. 85-23, revised in 1985) and also local 'Ethical Regulations' and as per the regulation of Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) [Registration Number: 885/05/CPCSEA].

The following groups were maintained: (In each group "n"= 6 animals/ experiment).

- a) Normal untreated Control (N) sacrificed after maturity .
- b) DEN animals sacrificed after 1st month – DEN1.
Age matched normal animals sacrificed after 1st month=N1
- c) DEN animals sacrificed after 2nd month – DEN2.
Age matched normal animals sacrificed after 2nd month=N2
- d) DEN animals sacrificed after 3rd month – DEN3.
Age matched normal animals sacrificed after 3rd month=N3
- e) DEN animals sacrificed after 4th month – DEN4.
Age matched normal animals sacrificed after 4th month=N4
- f) DEN animals sacrificed after 5th month – DEN5.
Age matched normal animals sacrificed after 5th month=N5
- g) DEN animals sacrificed after 6th month – DEN6.
Age matched normal animals sacrificed after 6th month= N6
- h) DEN animals sacrificed after 7th month – DEN7.
Age matched normal animals sacrificed after 7th month=N7
- i) DEN animals sacrificed after 8th month – DEN8.
Age matched normal animals sacrificed after 8th month=N8

Induction of Chemical Carcinogen: Liver tumor was induced with single intraperitoneal injection of N-Nitrosodiethylamine (DEN) at a dose of 200mg/kg body weight in saline. Two weeks after DEN administration,

the carcinogenic effect was promoted by 0.05% phenol-barbitol, which was supplemented to the experimental animals through drinking water for up to 16 successive weeks [9].

Isolation of Peripheral Lymphocytes: 2 ml of heparinised blood was collected and laid over Petri dish (Corning, USA) and incubated for 20 minutes. The non-adherent cells were collected and laid over equal proportions of lymphocyte separation media- histopaque and centrifuged for 15 minutes at 3000xg. The band was collected from the interface, washed with PBS and resuspended in RPMI media [4, 10].

Isolation of Macrophages: 2 ml of heparinised blood was collected aseptically and poured in petridishes. After 30 minutes incubation at 37°C in a humidified atmosphere of a CO₂ incubator, nonadherent cells were washed off with Phosphate Buffer Saline (PBS) and adherent cells were collected by washing with Phosphate Buffer Saline Ethylene-diaminetetraacetic acid (PBS-EDTA) and then washed with PBS and finally suspended in 1 ml media.

Immune Phenotyping (By FACS):

Labeling of Cells and Flow Cytometric Analysis: Single color analysis was used for CD4 and CD8. For the surface antigens CD4 and CD8, 2 batches, each of 1x10⁶ cells/ml of lymphocytes (isolated by the above procedure) were directly incubated with the primary antibodies (CD4 and CD8) for 45 mins at 4°C. The cells were then washed (thrice in PBS) and resuspended in PBS after which the cell suspensions were then tagged with compatible PE conjugated secondary mAb and again incubated for 30 minutes at 4°C in the dark. Isotype control was PE conjugated mouse Ig-G₁k. After incubating, the cells were resuspended in PBS and subjected to flow cytometric analysis in a FACS caliber (Becton Dickinson, USA). For each sample, 40,000 events were scored [1, 2].

Western Blotting: Isolated lymphocytes and macrophages were taken and washed once with ice-cold PBS and lysed by incubating for 30 minutes on ice (2x10⁷ cells per ml. of lysis buffer) in NP-40 Cell Lysis Buffer (50mM Tris-HCl pH 8.0 150mM NaCl 1% NP-40). After centrifugation at 15,000 rpm for 15 minute extracted proteins were separated on a 12 or 15% SDS- polyacrylamide gel and electrophoretically transferred to a PVDF membrane (Immunobillon Millipore). The membrane was blocked with 5% non-fat milk-TBST [10mM Tris-HCl 0.15M NaCl, 8mM sodium azide, 0.05% Tween-20, pH 8.0] containing 5% skim milk for 1 hour at room temperature, and each primary antibody [in this case IL-2, IFNg, IL-4 and IL-10{for lymphocytes} and IL-12{for macrophages} (diluted 1: 1000 in blocking buffer)] was applied overnight at 4°C in the same blocking solution. After incubation, membranes were washed with TBST and again incubated with anti-rat IgG-AP and washed 4 times for five minutes (per wash with TBST at room temperature). The membrane was then incubated with BCIP-NBT substrate. After approximately 20-30 minutes when the band begins to appear, (careful vigilance was made as the reaction time varied) the membrane was then rinsed with distilled water to stop further development. The membrane was then scanned by a HP scanner. For every loading, α actin was used as the loading control [1, 2].

RESULTS AND DISCUSSION

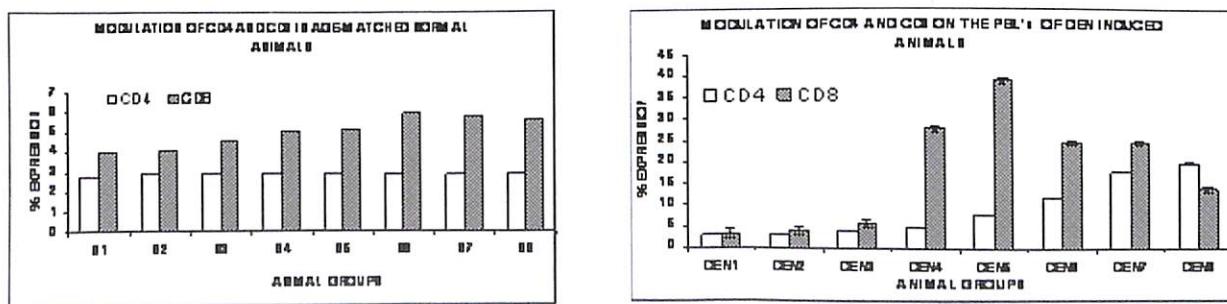


Figure 1A & 1B: Flow cytometric expression of CD4 and CD8 in the peripheral blood lymphocytes isolated from the age-matched normal and the DEN induced different experimental animal groups. The graphical representation of the expression pattern of CD4 and CD8 is given.

As compared to the normal animals (Figure 1A) the CD4 expression increased in a linear manner in 4th, 5th, 6th and 7th month of DEN induced animals (Figure 1B). With the availability of the tumor antigens in the 4th, 5th, 6th and 7th dose, the CD4+ve population of T lymphocytes is activated. When the CD8 expression was studied a similar picture was obtained but the rise in expression of CD8 population was far more radical and elevated as compared to CD4 population, (Figure 1A and Figure 1B) clearly indicating that the CD8+ve lymphocytes were put forwarding a direct cytotoxic effect towards the ensuing tumor mass. Interestingly in the 8th dose, CD4 expression was much higher as compared to CD8 expression hinting towards the possibility that the tumor mass was indeed capable of overcoming the cytotoxic effect of CD8+ve lymphocytes and were in turn modulating the host's immune system in their favor.

Cytokine Profile:

Pro-inflammatory cytokines: The lymphocytes were screened for the two pro-inflammatory cytokines - IL-2 and IFNg. The macrophages were screened for IL-12. All the aforementioned pro-inflammatory cytokines showed a much heightened expression (as evidenced by the intensified bands of the corresponding cytokines) in the 3rd, 4th, 5th and 6th month of tumor development indicating their functional status.

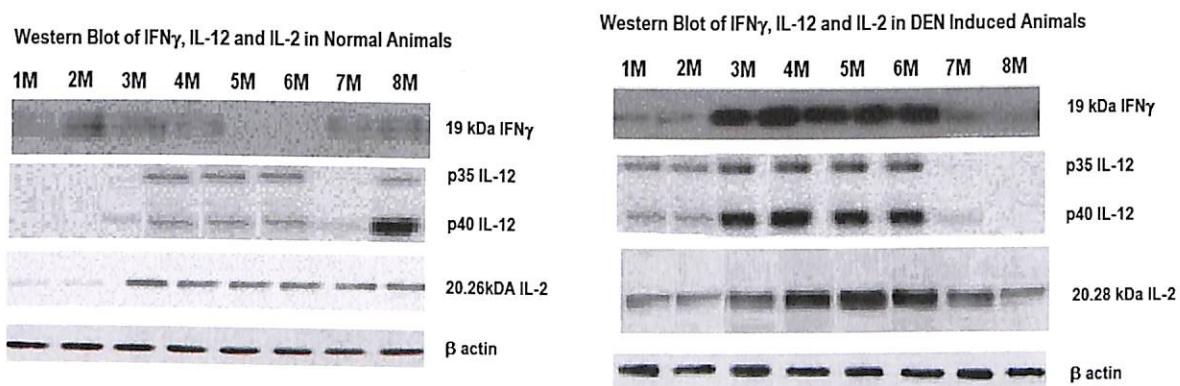


Figure 2A: Western Blot of IL-2 and IFNg expression in the peripheral blood lymphocytes and IL-12 expression in the peripheral blood macrophages isolated from the age- matched normal and the DEN induced different experimental animal groups.

Anti-inflammatory cytokines: The lymphocytes were also screened for the two anti-inflammatory cytokines - IL-4 and IL-10. Expression of both the anti-inflammatory cytokines increased in tandem from the 6th month of tumor development and henceforth overriding the expression of the pro-inflammatory cytokines in the 7th and the 8th month (as evidenced by the intensified bands of the corresponding cytokines).

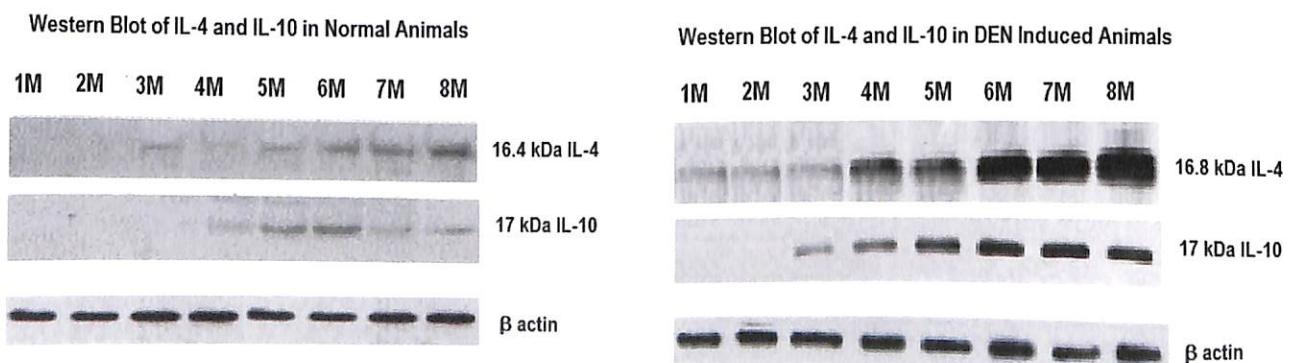


Figure 2B: Western Blot of IL-4 and IL-10 expression in the peripheral blood lymphocytes isolated from the age-matched normal and the DEN induced different experimental animal groups

CONCLUSION

As stated earlier that there are two well-defined subpopulations of T lymphocytes: T helper (T_H) or the CD4+ve T lymphocytes and T cytotoxic (T_C) or the CD8+ve T lymphocytes. With the availability of the tumor antigens form the 4th month onwards in the DEN induced animal, the CD4+ve populations of T lymphocytes are activated (Figure1B). The CD4+ve T helper (T_H) cells on activation by the tumor antigens now differentiate into two effector populations- T helper 1(T_{H1}) and T helper 2 (T_{H2}). The differences in the cytokines secreted by T_{H1} and T_{H2} cells determine the different biological functions of these two subsets. A defining cytokine of the T_{H1} subset, IFN- γ activates macrophages, stimulating these cells to secrete cytokines such as IL-12, which further induces T_H cells to differentiate into the T_{H1} subset. T_{H1} cells produce IL-2 and IFN- γ cytokines that promote the differentiation of and activation of CD8+ve T cytotoxic (T_C) lymphocytes. Finally, IFN- γ inhibits the expansion of the T_{H2} population. Thus the switching on of the cell mediated immunity is accomplished. Comparing and contrasting the expression of the cytokines-IL-12, IL-2 and IFN- γ with that of CD4 and CD8 surface marker expression in the T lymphocytes in both the tumor induced animals and their normal counter parts, it is evident that in the 3rd, 4th, 5th and 6th month when the tumor is gradually progressing, the immune surveillance is in its full swing. The immune microenvironment on recognizing the tumor antigens in the process harnesses its killer cells- CD8+ve T cytotoxic (T_C) lymphocytes (as evidenced by their high expression in the 4th months) which in turn starts assaulting the target tumor cells. But with the transition of 4th to 5th month, the scenario changes which can be attributed to the simultaneous increase in expression of the anti-inflammatory cytokines.

As a tumor survival strategy to overcome and take reigns of the host immune system, the ensuing tumor mass starts secreting immunosuppressive factors such as PGE-2 (Prostaglandin E-2) and TGF- β , which now actively down regulate T cell responsiveness, surface marker expression, cytotoxicity and proliferation, in turn, favor the neoplastic cells to escape the immune attack. The immune suppressive factors in the tumor microenvironment switch on the T_{H2} subset of the CD4+ve T helper population. The activated T_{H2} subset now starts emanating anti-inflammatory cytokines-IL-4 and IL-10, the expression of which now starts controlling the internal microenvironment. Whereas as compared to normal animals, the IL-4 and IL-10 expression starts increasing significantly from 4th month of DEN induced animals reaching peak expression in 7th and 8th month of tumor development. In the 6th month of DEN induced animals it was observed that IL-4 and IL-10 expression is overriding the expression of IL-2 being produced from the CD4+ve T_{H1} subset and IL-12 produced from the macrophages. In the 7th and the 8th month very negligible expression of all the three pro-inflammatory cytokines occurs (including IFNg). The cytokine expression levels thus clearly indicate that the growing tumor mass is indeed capable of inducing a Th1 - Th2-type cytokine shift and in the process is successful in shifting the focus of the hosts immune system from cell mediated immunity to the humoral immunity thereby buying time for its own proliferation.

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Tephrosia Purpurea – A Wasteland Weed with Potential Anti-Helicobacter Activity

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ABSTRACT

Tephrosia purpurea is a species of flowering plant, which is a common wasteland weed, and it is under cultivation as green manure crop. Since this weed has traditional use in curing different types of wounds including gastroduodenal ulcers, it was of interest to evaluate the *in vitro* anti-*Helicobacter pylori* activity profile of the plant extract and its fractions with a view to examining its therapeutic potential, if any. Employing clinical isolates and standard strains of *Helicobacter pylori*, the extract and fractions were bioevaluated in terms of MIC and MBC values, acid stability, time-kill kinetics and drug resistance. The methanolic extract showed promising activity against clinical isolates and standard strains of *Helicobacter pylori*, including metronidazole-resistant strains. Fractionation of the extract revealed the n-hexane and chloroform fractions to possess marked activity. The extract and the less polar fractions remained functionally active in acidic condition similar to stomach environment and exhibited consistent bacteriostatic activity during repeated exposure. Apolar fractions of *Tephrosia purpurea* may have therapeutic potential in combating *Helicobacter pylori* mediated gastroduodenal disorders.

Key Words: MIC (Minimum Inhibitory Concentration), MBC (Minimum Bactericidal Concentration)

INTRODUCTION

In Ayurvedic system of medicine, the plant *Tephrosia purpurea* is known as ‘Sarwa wranvishapaha’, which means that it has the property of curing all types of wounds [10]. The plant and its parts have been used by traditional healers for different types of gastroduodenal disorders. The root bark of the plant is taken in stomach pain [3] and the decoction of the same is believed to be efficacious against dyspepsia, chronic diarrhea and colic [8]. *Helicobacter pylori* is a global human pathogen and the major cause of gastritis and associated diseases like gastric ulcer, duodenal ulcer, non-ulcer peptic dyspepsia, gastric cancer and primary gastric B-cell lymphoma [13]. The eradication of *H. pylori* drastically reduces the pathological symptoms and is therefore considered essential to treat gastric ulceration [11]. However, the rising prevalence of treatment failure, owing particularly to antibiotic resistance and ulcer recurrence [5], necessitates searching for better and/or alternate medication that should also be safe and economic. An *in vitro* investigation was therefore carried out employing both clinical and standard strains of *H. pylori* with a view to characterizing the nature of anti *H. pylori* activity.

METHODOLOGY

Plant Material: *Tephrosia purpurea* was shade dried and powdered plant materials were subjected to extraction with three different polar solvents such as methanol, aqueous-methanol (1:1) and water. Since the activity was

found mainly in the methanol extract, this methonolic extract (TPME) was further subjected to successive fractionation with *n*-hexane (TPME-Fr H), chloroform (TPME-Fr C), *n*-butanol (TPME-Fr B) and water (TPME-Fr W).

Bacterial Strains and Culture Conditions: A total of ten strains of *Helicobacter pylori*, four standard strains and six clinical isolates, were employed in this study. *H. pylori* were routinely subcultured for 48-72 h according to Glupczynski [4]. Two Gram-positive and three Gram-negative bacteria were also used for the evaluation of general antibacterial activity. For experimental purpose, overnight cultures of the bacteria in Mueller Hinton broth were used.

Determination of MIC and MBC: To evaluate the anti *H. pylori* spectrum, MICs were determined by agar dilution [1] as well as microbroth dilution assay [6]. The agar and microtitre plates were examined visually and the lowest concentrations showing inhibition of growth were recorded as the MIC. For the determination of MBCs, aliquots (10 ml) of 72-h culture in which no growth had been detected were taken from the wells of the above microtitre plates and used to streak on fresh agar plates. Such plates were visually inspected after further incubation for 72 h at 37°C and the point where no growth appeared was considered as the MBCs [12].

Antibacterial Activity: Serial 2-fold dilution of the antibiotics or of the extract and the fractions were prepared in Mueller Hinton agar plates. Five microlitre of the appropriately diluted culture was streaked on the plate and incubated under aerobic conditions at 37°C for 18 h.

Acid Stability of Samples: A 100 µl stock of the extract, or of *n*-hexane and chloroform fractions was treated with 20-30 µl of 0.12 N HCl so as to bring the pH of the solution to ~ 2.0, and kept at 37°C for 2 h [2]. Such acid-treated samples were then serially diluted with medium in 96-well microtitre plates. The MIC/MBC values were determined by microbroth dilution assay as detailed above.

Time-kill Kinetic Studies: The rate and extent of killing efficacy of the extract and the *n*-hexane and chloroform fractions were assessed in shake culture media [9]. In 50-ml flasks, five ml of brucella broth and different samples at concentrations 1-8 times the MIC were inoculated with *H. pylori*. The culture was shaken at 150 rpm inside the incubator in an otherwise same growth conditions as stated before. At different time periods (0, 3, 6, 9, 12 and 24 h), 100 µl each of the cultures were taken out and the viable bacteria were counted by inoculating appropriately diluted cell suspensions onto agar plates. Colonies were counted after 3-4 days of incubation, and the rate and extent of killing were assessed in terms of decrease in cell count (cfu/ml) over 24 hour.

Drug Resistance Study: To investigate the development of drug resistance, the parent extract and the two most active fractions were prepared as 2-fold serial dilutions with medium in 96-well microtitre plates. *H. pylori* strains were inoculated into each dilution series at an inoculum size of ~10⁶ cfu/well. After 3 days of incubation, the culture from each series with the highest concentrations of the extracts and showing turbidity was subcultured in a fresh series of the same drug. This procedure was repeated ten times [7].

RESULTS AND DISCUSSION

Initial investigations indicated that the methanolic extract of *Tephrosia purpurea* (TPME) has potent anti *H. pylori* activity as compared with aqueous extract (TPWE) or 50% hydroalcoholic extract (TPMWE) of the plant material, and therefore all the studies were carried out with methanolic extract only. In order to identify the active fractions, the methanolic extract of *T. purpurea* (TPME) was fractionated successively with *n*-hexane, chloroform, *n*-butanol and water to generate various nonpolar and polar fractions. Preliminary chemical tests revealed that the *n*-hexane and chloroform fractions contain flavonoids and steroids, whereas the *n*-butanol and water fractions contain flavonoids and glycosides.

Table 1: Antibacterial activity of TPME and its four fractions against a panel of *H. pylori* strains and common aerobic bacteria

	MIC ($\mu\text{g/ml}$)							
	TPME	TPME-Fr H	TPME-Fr C	TPME-Fr B	TPME-Fr W	CLAR	AMOX	MTZL
<i>H. pylori</i> (standard strains)								
ATCC 700392	50	100	25	200	200	0.063	0.0625	1.56
ATCC 43504	100	100	50	400	200	0.032	0.0625	50
ATCC 49503	100	50	25	400	200	0.016	0.032	1.56
ATCC 43629	100	50	25	400	100	0.05	0.063	1.56
<i>H. pylori</i> (clinical strains)								
80A	200	50	25	200	200	0.016	0.032	100
121A	200	50	25	200	200	0.032	0.032	>100
PCR-148	100	25	25	400	100	<0.020	0.016	100
PCR-155	100	25	25	400	100	0.040	0.016	100
PCR-156	50	25	25	200	100	0.080	0.016	25
PCR-216	50	100	25	200	100	0.080	0.016	25
MIC range	50-200	25-100	25-50	200-400	100-200	0.016-0.06	0.016-0.063	1.56-100
MIC_{50}	100	50	25	200	100	0.03	0.016	100
Aerobic bacteria (Gram +ve)								
S. aureus ML159	400	200	400	800	400	>0.200	<0.313	200
B. cereus	>1600	>1600	>1600	>1600	>1600	0.1	>10	400
Aerobic bacteria (Gram -ve)								
S. typhi NCTC 74	>1600	>1600	>1600	>1600	>1600	>0.2	>2.5	400
E. coli DH5á	>1600	>1600	>1600	>1600	>1600	>0.2	>5	>400
K. pneumoniae	>1600	>1600	>1600	>1600	>1600	0.4	>10	>400

Employing agar dilution assay, MICs of crude TPME and its fractions were determined against a panel of ten *H. pylori* strains. Six clinical isolates, all sensitive to clarithromycin but resistant to metronidazole, were used. As judged by MIC values, anti *H. pylori* activity appeared to get enriched in chloroform fraction (TPME-Fr C) followed by *n*-hexane fraction (TPME-Fr H), both of which exhibited 2-4 fold higher activity as compared with *n*-butanol (TPME-Fr B) and aqueous fractions (TPME-Fr W), and also the parent extract (TPME). The MIC_{50} values of TPME, TPME-Fr H and TPME-Fr C appeared to be 100, 50 and 25 mg/ml respectively, the chloroform fraction showing the best potency (Table 1). The anti *H. pylori* spectrum (MIC range 25-50 mg/ml) indicated further the effectiveness of the chloroform fraction. Both the fractions TPME-Fr H and TPME-Fr C appeared to be active against metronidazole resistant as well as sensitive strains. Further, when examined against other bacteria, the extract as well as the fractions did not show any antibacterial activity indicating that perhaps these plant components could be selective against *H. pylori* (Table 1). The MIC and MBC values of TPME and the two active fractions (TPME-Fr H and TPME-Fr C) were determined also by microbroth dilution assay employing the clinical strain 80A and the standard strain ATCC 43504. The MBC values of both the fractions appeared at ~ 200 $\mu\text{g/ml}$ as compared with the parent extract, which exhibited an MBC value of 400 $\mu\text{g/ml}$. Further, such

bacteriostatic as also bactericidal activity was found to remain consistent even after exposing the samples to strong acidic environment (Table 2), as reflected by marginal increase in MIC and MBC values of the samples compared with those of the untreated samples. This observation may be taken to mean that such samples would remain effective in the acidic pH prevailing in the stomach.

Table 2: Anti *H. pylori* activity of TPME and its two active fractions in normal and acid treated condition

Sample	MIC ($\mu\text{g/ml}$)		MBC (mg/ml)	
	ATCC 43504	80A	ATCC 43504	80A
TPME	100	200	400	400
Acid treated TPME	200	200	400	400
TPME-Fr-H	50	50	100	200
Acid treated TPME-Fr-H	50	100	200	200
TPME-Fr-C	50	50	200	200
Acid treated TPME-Fr-C	50	100	200	200
Clarithromycin	0.04	0.01	0.08	0.02

The kill kinetics study of the extract and the two active fractions against ATCC 43504 in shake culture media exhibited dose-dependent inhibition (Figure 1). The efficacy of TPME-Fr C (panel c) appeared to be the strongest, killing the bacteria completely at 200 $\mu\text{g/ml}$ within 24 h, and also causing significant lowering of cell count to $\sim 10^3$ cfu/ml at 100 $\mu\text{g/ml}$ in 24 h. In contrast, with TPME-Fr H at 100 $\mu\text{g/ml}$ dose, no significant reduction in cell count was observed even after 24 h (panel b), while it exerted almost the same inhibitory potential as TPME-Fr C at 200 $\mu\text{g/ml}$ and above. Further, with the extract TPME (panel a), complete inhibition was not achieved within 24 h even at 400 $\mu\text{g/ml}$, although a significant reduction of cell count to $\sim 10^3$ cfu/ml was evident. Clarithromycin under the same experimental condition exhibited complete killing within 24 h (panel d) at 0.08 $\mu\text{g/ml}$, exerting strong inhibitory potential than the extract and the fractions.

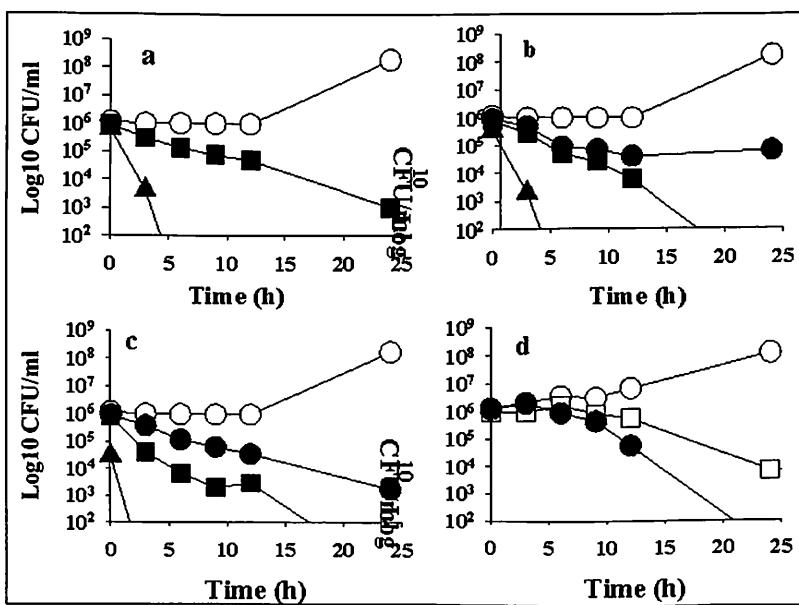


Figure 1: Kill kinetics of *H. pylori* ATCC 43504 strain by the extract and its two fractions

Considering drug resistance as the primary cause of failure of *H. pylori* treatment, the parent extract and the two active fractions were further examined to see if there is any development of insensitivity towards the

bacteria upon repeated subculture. Employing one standard strain (ATCC 43504) and one clinical isolates (80A), both metronidazole resistant, ten repeated transfers of the bacteria were carried out in the media containing the samples at sub-MIC ($0.5 \times$ MIC) concentrations. The hexane fraction TPME-Fr H did not show any alteration of MIC value in either of the strains despite such repeat transfers. Only about 2-fold increase was noted in MIC values of the extract and the chloroform fraction (Figure 2). In comparison, the antibiotics clarithromycin, amoxicillin and metronidazole generated 4-8 fold increase in MIC values with clinical strain and 2-4 fold with standard strain, under identical experimental conditions. The observation may therefore be taken to mean that such samples and the putative active principle would not be expected to develop any resistance and, therefore, could prove to be useful in treating *H. pylori* infection advantageously.

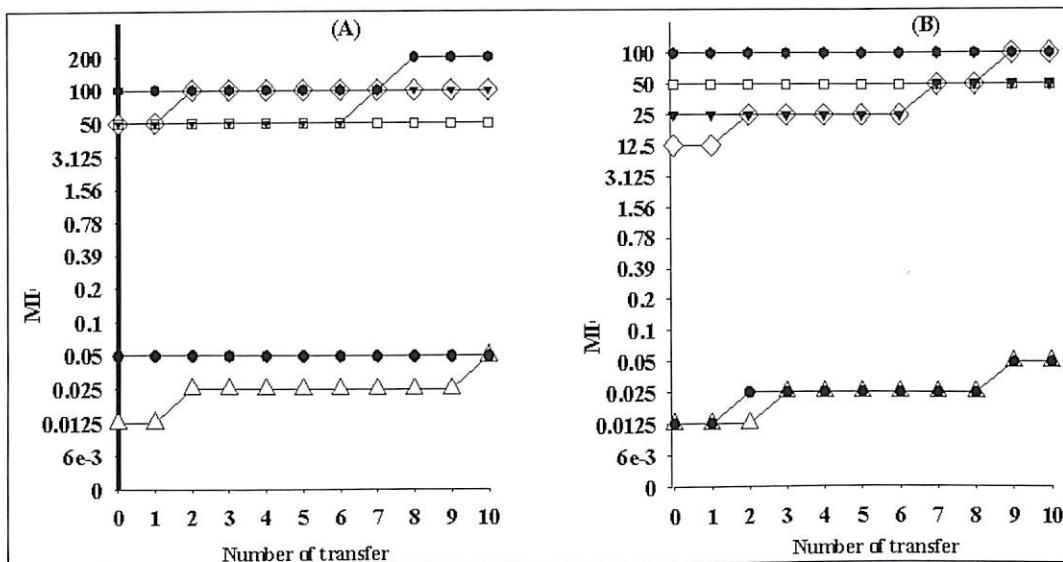


Figure 2: Study of drug resistance of ATCC 43504 (A) and clinical strain 80A (B) to parent extract

CONCLUSION

The methanolic extract of *Tephrosia purpurea* and its two relatively less polar fractions showed potent and selective anti *H. pylori* activity against clinical as well as standard strains, demonstrated efficacy at acidic pH mimicking stomach environment, killed the bacteria efficiently, and did not develop drug resistance upon repeat exposure. It is therefore reasonable to conclude that *T. purpurea* contains effective anti *H. pylori* principle(s) that can be exploited in making phytomedicinal preparation for the therapeutic management of *H. pylori* induced gastroduodenal ulceration. The efficacy of the chloroform fraction in particular in killing various antibiotic-resistant clinical strains, and its stability at low gastric pH and synergistic potential with antibiotics indicate possible presence of some putative active principle(s), which requires further delineation. The investigation also tends to justify the ethnomedical use of this plant in gastroduodenal ulcers, which is a type of inner wound, for which the plant is known to be very useful in traditional literature.

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Tannase Extraction from Agro-Waste and its Application in Debittering of Apple Juice

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ABSTRACT

*Tannins are responsible for haziness and bitter taste in apple juice, making it commercially unacceptable. Industrial techniques for debittering apple juice are expensive. Therefore an initiative was taken to debitter apple juice by cost effective process using tannase isolated from an agro waste. Extracellular tannase was extracted by solid-state fermentation (mSSF) from the fermented agricultural waste of red gram husk, using *Aspergillus niger*. The crude enzyme was purified using acetone precipitation followed by DEAE cellulose chromatography. The enzyme was detected in gel localization study and lastly it was treated (100 U/ml) on apple juice to assess the debittering effect. The enzyme was purified 21.36 fold and gave a band at 72kD in SDS-PAGE. The native form of the purified tannase was detected at 180 kDa (approx). Treatment of the apple juice by the enzyme resulted in 81% degradation of tannins when compared with the control juice. The results were encouraging as the overall acceptability of the juice was satisfactory with minimal loss of nutritional constituents in the treated juice. The present study provides a new cost effective avenue for efficient production of tannase from agro waste and its use for safer and healthier food products.*

Key Words: Tannase, Tannin, Apple Juice, *Aspergillus niger*, Red Gram Husk, Chromatography

INTRODUCTION

Growing concern about pollution that occurs from agricultural and industrial wastes has motivated in converting waste materials into commercially valuable products. The agro-food industry produces large volumes of solid and liquid wastes resulting from the production, preparation and consumption of food. Besides their pollution and hazardous aspects, in many cases, food processing wastes might have potential for recycling raw materials or for conversion into useful product of higher value [7, 10, 13, 15].

Tannin acyl hydrolase, commonly referred to as tannase (E.C: 3.1.1.20), is an enzyme that cleaves ester linkages in hydrolysable tannins [1, 2] producing glucose and gallic acid by various filamentous fungi. Several agro-industrial waste and by-products such as orange bagasse, sugarcane bagasse, wheat bran, red gram husk, rice straw and other food metabolites are effective substrates for enzyme production. Tannase is used industrially as a catalyst in gallic acid manufacturing. It is also potentially utilized as a clarifying agent in instant tea, wine, beer, beverage and fruit juice processing. Apples are rich in tannin (polyphenols) and the processing of apples juice do not effectively decrease tannins which when exceeds the limits causes haze and bitterness. There is an increased concern in the fruit juice industry about the loss of market due to bitterness and haziness in the juice [18].

Industrial clarification procedures for juices typically involve physico-chemical processes which are laborious and expensive, considered harmful and require special handling and disposal procedures. Enzymatic treatment of fruit juice has got advantage over conventional industrial procedures in clarification of juice and increases its shelf life [14].

Under these circumstances it was thought that it would be ideal to search for sources exhibiting tannase activity suitable for commercial use. So the present study deals with the production, partial purification and characterization of tannase by utilization of some agro-wastes with *Aspergillus niger* and *Aspergillus oryzae*. Based on the potential use of tannase to reduce tannin levels in apple juice, first time efforts were made for debittering of apple juice by controlling its bitterness without significant loss of quality and increase the mean life expectancy of the product. We presume our methodology will be a cost effective, stable alternative method, which can be successfully exploited commercially.

AIMS AND OBJECTIVES

The present study aims to purify tannase from agro waste and thereby use it to debittering of apple juice.

METHODOLOGY

Chemicals: The chemicals used in this study were purchased from Sigma Chemicals, Merk and SRL.

Sample Collection: Canned apple juice was purchased from Real (Dabur food products). Fresh apple, Red gram husk, rice straw and sugarcane bagasse were procured from the local markets of Kolkata. *Aspergillus niger* from college laboratory and *Aspergillus oryzae* (MTCC 634) from IMTECH, Chandigarh.

Substrate Pre-treatment: Sugarcane bagasse, rice straw and red gram husk were sun dried, pulverized and stored in air tight containers for further use [11].

Preparation of Spore Inoculums: Spores of *A. niger* and *A. oryzae* were raised on potato dextrose agar slants sporulation medium [11].

Substrate and Solid State Fermentation: 5 gram red gram husk and a mixture of 5 gram red gram husk and 5 gram rice straw powder with sugarcane bagasse powder (1:1 ratio) was moistened with 10 ml of salt solution. The contents were sterilized by autoclaving. The solid substrate was inoculated with 1ml of *Aspergillus niger* spore inoculums and incubated at 37°C for 72hrs.

Extraction and Analysis of Crude Enzyme: Tannase was extracted from the fermented substrate by adding 0.05M citrate buffer and crushed with mortar and pestle, centrifuged at 8000 rpm 20 min at 4°C and filtered. The filtrate was collected and stored at 4°C.

Tannase Activity Assay: Tannase activity was measured by a spectrophotometric method at 310nm [3].

Protein Assay: Protein was estimated following Lowry's method [9].

Acetone Precipitation & Concentration of Tannase: To the crude enzyme was concentrated by cold acetone precipitation and thereafter centrifuged in a centricon membrane filter with a 50 kDa molecular mass cut off. The concentrated extract was dialyzed in 0.02M acetone buffer pH 5 overnight and subjected to tannase assay.

Anion Exchange Chromatography on DEAE Cellulose Column: Dialyzed diluted sample was applied to DEAE cellulose chromatography column, equilibrated with 20 mM acetate buffer (pH 5). It was eluted with 50 mM acetate buffer (pH 5) by linear gradient of NaCl containing 0.1-1 M NaCl at the rate of 1ml/10mins. The eluted fractions were collected and only the fractions possessing tannase activity were pooled together [12].

Molecular Mass Determination by Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis (SDS-PAGE): The samples were analyzed in 10% SDS-PAGE [4].

Gel localization of Tannase Activity: Gel localization of tannase was done according to the method described earlier [12].

Juice Preparation: Fruits were washed, cut into pieces and then juice was extracted by homogenizing in a blender followed by filtration through strainer [14].

Treatment of Juice with Purified Tannase: 10 ml of juice was treated with 1 ml of tannase (100U/ mL). The

control sample received 1 ml of water. Test tubes were then incubated at 37° C with gentle shaking up to 120 mins. They were then placed in water bath at 50° C for 10 mins to deactivate the enzyme [14].

Tannin Assay: The tannin content in the fruit juice was measured following the protein precipitation method by tannins [14].

Measurement of Total Phenolics: Total phenolics estimation was carried out with Folin-ciocalteu reagent [12].

Measurement of Total Sugar: Glucose estimation kit was used for the estimation of sugar level. Absorbance was measured at 500 nm.

Measurement of Total Titrable Acidity: The juice was centrifuged for 10 min at 5,000 rpm, to obtain a supernatant and then the titrable acidity was measured [14].

Determination of pH: pH of the fruit juice was measured by pH meter.

Ascorbic Acid Content: The ascorbic content of fruit juice was measured by a spectrophotometric method [17].

Sensory Evaluation: The organoleptic evaluation of controlled and test sample of fresh apple juice was performed [14], based on nine point hedonic scale.

Statistical Analysis: All data are presented as the mean \pm SD of three independent tests. The Student's t test was used to evaluate the difference between treated samples and controls.

RESULTS AND DISCUSSION

Optimization of Process of Fermentation: Optimum tannase production was achieved after 72 hrs at 37°C, pH 5.5. The decrease in the enzyme activity may reduce due to reduced level of medium affecting enzyme activity and enzyme synthesis [6]. It was found that tannase obtained from the fermenting mass consisting red gram husk and *Aspergillus niger* was higher as compared to *Aspergillus oryzae* and sugarcane bagasse: rice straw. The activity measured in the crude extract was found to be 14.4 U/ml. The activity of crude tannase produced extracellularly is similar to the earlier report [11]. One more set of experiment was conducted to confirm the viability of red gram husk as a fermenting substrate, where it was inoculated with *Aspergillus oryzae* at pH 5.5 for 72 hrs. This fermenting mass resulted in an activity of 12 U/ml (Figure 1). The rise in activity may be attributed to solid material's dual roles, supply of nutrients to the microbial culture and maximum enzyme production with red gram husk.

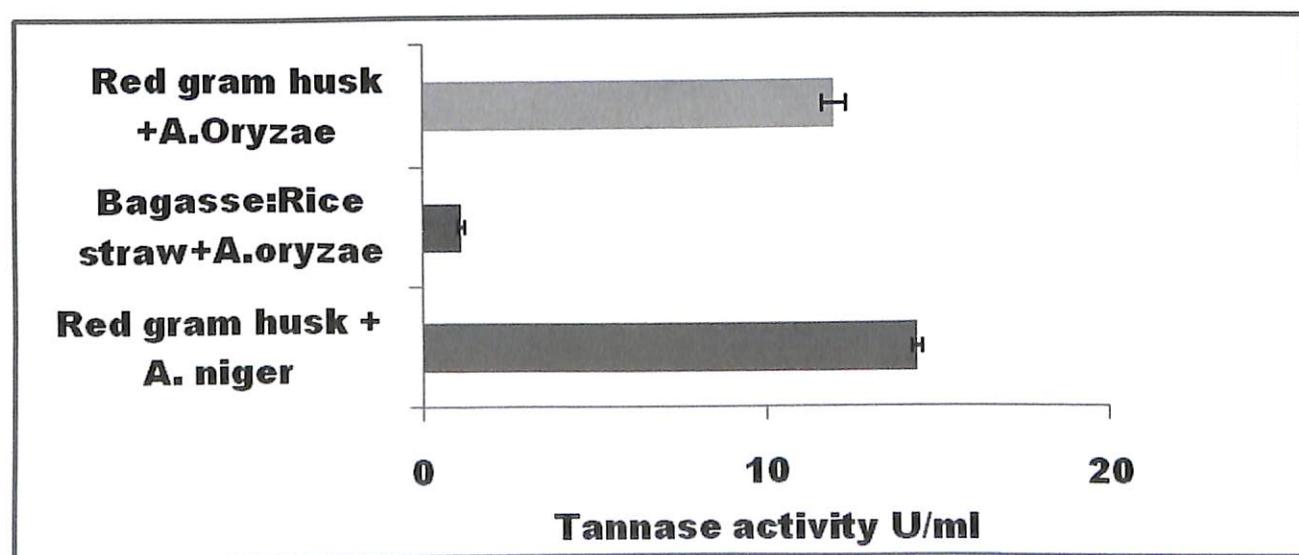


Figure 1: Extracellular tannase produced by different fungal strains *Aspergillus niger* fermented with redgram husk, *Aspergillus Oryzae* fermented with sugarcane bagasse"rice straw and *Aspergillus niger* fermented with red gram husk. T=37°C pH=5.5; t=72 hrs Error bars indicate standard deviation from triplicate determinations.

Purification of Tannase from the Fermented Mass: The crude extract obtained by fermenting red gram husk with *Aspergillus niger* was partially purified by acetone precipitation at 4°C. The fractional purification procedure increased the activity of the enzyme to 42 U/ml and the protein content was 5.8 mg/m. Other method of precipitation like ammonium sulphate precipitation was also tried but it yielded very less volume of enzyme with lower activity (3.8 U/ml). This was followed by ultra filtration (50 kDa cut off) which resulted in a higher activity (70 U/ml) and protein (8.8 mg/ml). Centricon concentration is an alternative step for gel filtration chromatography which separates protein according to their molecular weight.

Tannase was further purified by DEAE-cellulose column chromatography (Figure 2) which led to an overall purification of 21.3 fold with a yield of 23% (Table 1). The tannase yield of 23% obtained in the present work was higher as compared to 20% yield reported by others [5, 8].

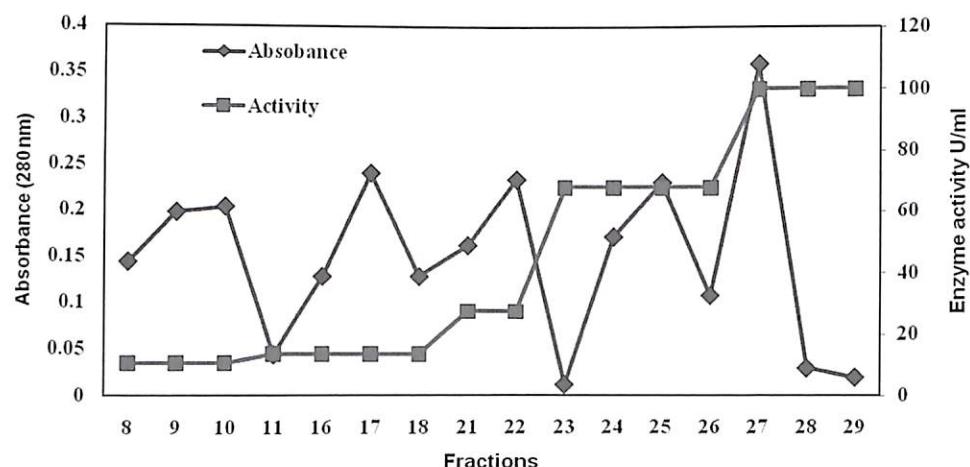


Figure 2: Elution profile of tannase produced by *A. niger* on DEAE cellulose using NaCl solution as eluant. The enzyme solution obtained from acetone precipitation and concentrated by ultrafiltration by centricon membrane was loaded onto DEAE cellulose column equilibrated in 0.2-M acetate buffer, pH 5.0. The flow rate was adjusted to 1 ml/min and 0.5-ml fractions were eluted with NaCl solution of linearly increased molarity (0.1 to 1 M)

Table 1: Purification of Tannase Extracted from the Fermentation Medium Containing Red Gram Husk and Aspergillus Niger at Each Step

Purification steps	Volume (ml)	Protein (mg/ml)	Activity (U/ml)	Total Protein (mg)	Total Activity (U)	Sp Activity (U/mg)	Purification (Fold)	Yield (%)
Crude Extract	30	4	14.4	120	432	3.6	1	100
Acetone precipitation	10	5.8	42	58	420	7.2	2	97
Centricon concentration	1.5	8.8	70	13.2	105	7.9	2.19	24
DEAE-C	1	1.3	100	1.3	100	76.9	21.36	23

Characterization of Purified Tannase by SDS-PAGE: Tannase containing fractions were pooled and were subjected to SDS-PAGE. The purified enzyme migrated as a single protein band corresponding to molecular mass of 72 kDa (Figure 3).

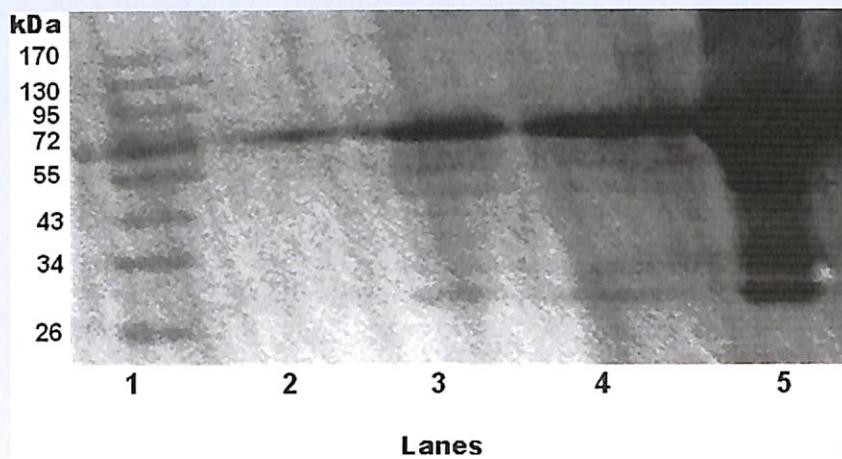


Figure 3: SDS –PAGE showing the Molecular weigh marker (Lane 1), crude extract (Lane 2), acetone precipitated sample (Lane 3), centricon concentration sample (lane 4), after purification by DEAE –C column (Lane 5). *The SDS-PAGE analysis shows different fraction of enzyme obtained through subsequent purification.*

Gel Localisation of Tannase Activity: Native gel detection method of tannase concluded that the native purified tannase is a dimeric protein of 180 kDa (approx). The insoluble tannic acid – quinine complex gave a white colouration to the gel with a transparent band confirming the existence and position of tannase (Figure 4).

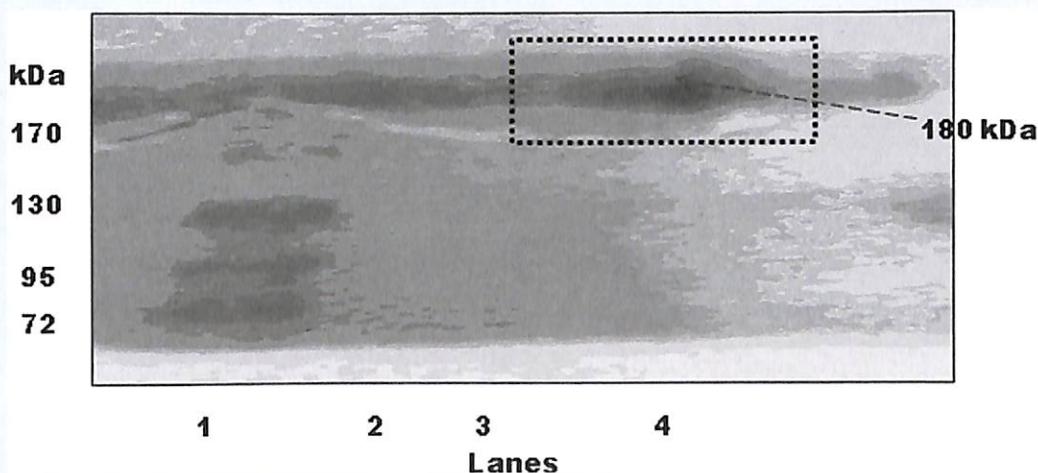


Figure 4: Gel localisation of tannase acitivity. Prestained protein marker (lane 1), crude extract (lane 2), acetone precipitation fraction (lane 3) and DEAE-C sample (lane 4). *The fourth lane indicates the presence of native tannase of 180 kDa (approx) molecular weight.*

Estimation of Tannin in Apple Juice: Apple juice is a refreshing treat, but lags behind as a beverage due to its appearance and bitter taste. The bitterness factor in apple juice is result of their tannin content thus, it was essential to record the tannin content of both fresh and packed apple juice. The tannin levels present in fresh apple juice was 32 mg/100 ml and packed juice was 23 mg/100ml. The packed juice which has already undergone processing is also showing high tannin content. This can be attributed to polymerization of the tannins in presence of air. Therefore, it is essential to remove the tannins by a more superior process [16].

Debittering of Fresh and Packed Apple Juice with Purified Tannase: An 81 % decrease in the tannin content of fresh apple juice was observed after 2 hrs treatment of the juice by purified tannase at 37°C (Figure 5) ($p<0.001$). It was observed that the debittering efficiency of tannase gradually increased with time interval, reaching maximum after 2 hrs of incubation. The purified tannase also reduced the tannin content of packed apple juice significantly (Figure 6). This study is in support of previous studies which were reported to reduce tannin content by 35% and 24% in pomegranate and anola juice respectively [14, 16]. The present study led to a higher percentage of tannin degradation (81%) and thereby aimed to be more efficient for reducing bitterness.

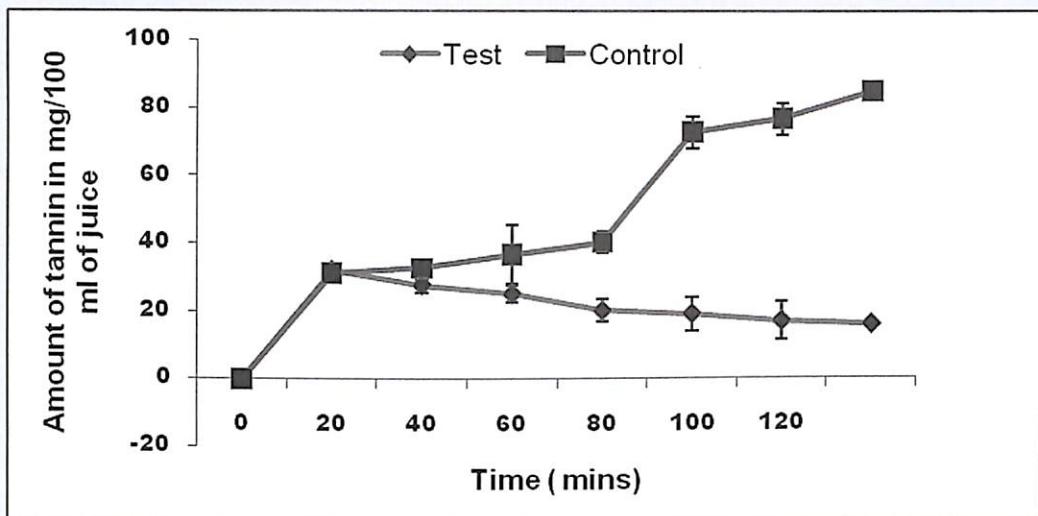


Figure 5: Effect of Tannase (1ml and 100 U/ml) on tannin degradation at different time in Fresh apple juice. Error bars indicate standard deviation from triplicate determination.

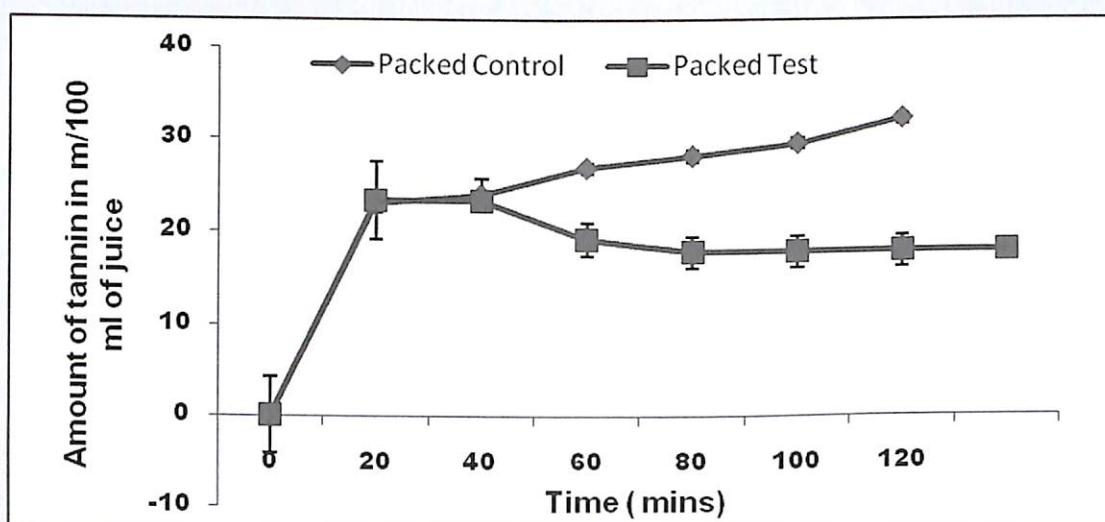


Figure 6: Effect of Tannase (1ml and 100 U/ml) on tannin degradation at different time in Packed apple juice. Error bars indicate standard deviation from triplicate determination.

Chemical and Sensory Evaluation: In order to determine the change in quality due to treatment with debittering aids, the control and treated samples of both fresh and packed juice was subjected to analysis of ascorbic acid content, total phenol, pH, total sugar and titratable acidity (Table 2).

The total sugar content was increased significantly by 20% and 30% in both packed and fresh juice respectively. Hydrolysis of tannins yields glucose and gallic acid. Therefore, increase of sugar levels in the juice is due degradation of tannin in apple juice (Table 2).

The quality index showed 11% loss in fresh tested sample whereas packed test sample showed a loss of 10%. However, the vitamin C content in citrus juices after filter aids treatment leads to a measurable loss of up to 33% depending on types of filter aids and processing condition [14].

Successful tannin degradation was supported by the fact, as there was an increase in the total phenol levels indicating that the purified tannase acted on the available tannins in the juice and hydrolyzed it to gallic acid.

Sensory evaluation of the juice before and after treatment was performed, based on the quality parameters. Sensory score for appearance, colour, taste, astringency, odour and overall acceptability of the fresh apple juice treated with purified tannase protein by the trained panel are shown in figure 9. It was evaluated that the acceptance of the juice has increased after treatment.

Table 2: Effect of Tannase on the Chemical Parameters of Fruit Juice

Parameters	Control Juice		Treated Juice	
	Fresh	Packed	Fresh	Packed
Total sugar (mg\100 ml)	83	37.5	100	50
Vit C mg\ml	0.81	0.19	0.72	0.17
Titrable acidity (gm\lt)	2.17	2.08	2.09	1.97
Total phenol (gm\100ml)	0.017	0.029	0.042	0.042
pH	4.8	3.9	4.3	3.7

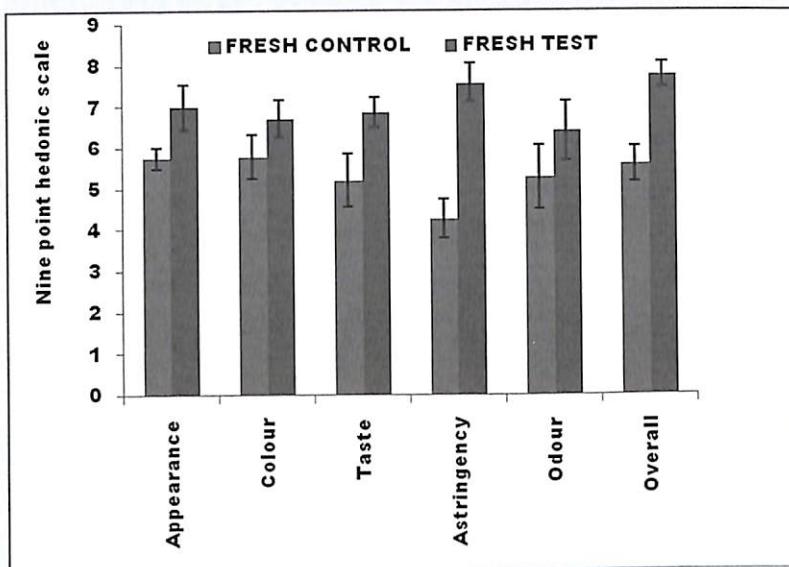


Figure 7: Sensory evaluation of fresh treated juice. The Apple juice was incubated with purified tannase of an activity of 100 U/ml for 2 hrs. Sensory parameters were evaluated on the basis of Nine point hedonic scale by semi trained panel members. Error bars indicate standard deviation from triplicate determination.

CONCLUSION

The present study suggests that tannase produced by *Aspergillus niger* under optimized condition from agro residue (Red gram husk) could be successfully used as a clarifying as well as debittering agent in apple juice. It also clearly states that the treatment done had no negative impact on the biochemical and quality attributes of the fruit juice.

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A Study on Efficiency of Edible Food Packaging on Soft Fruits

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ABSTRACT

Edible food packaging was prepared using gum arabic and was tested for increase in post-harvest life of the sample (tomato). The results obtained show that the coated fruit had a longer ripening period as compared to control fruit, which increased with the proportion of the coating solution. Functional properties of the fruit like the antioxidant activity and vitamin C content was also seen to be maintained. Most of the best results were seen in the 10% gum arabic coated fruits in the 18 day cycle though it was expected in the 15% coated fruit. Due to much delayed ripening of the 15% gum arabic coated fruit, the sensory characteristics, lycopene and vitamin C content did not develop in the fruit, and thus even other characteristics like titratable acidity and soluble solids content were affected.

Key Words: Edible food packaging, Post harvest quality, Shelf life, Gum arabic, Shelf life, Soft fruit.

INTRODUCTION

Fruits and vegetables are highly perishable but most important commodity for human diet due to their high nutritional value. These are available in surplus only in certain seasons and availability in different regions. In peak season due to improper handling practices, marketing, storage problems around 20-25% are spoilt in various stages. Hence, proper post harvest management handling and processing is required in horticulture crops [11].

The concept of using edible coatings to extend shelf life of fresh and minimally processed produce and protect them from harmful environmental effects has been emphasized based on the need for high quality and the demand for minimal food processing and storage technologies. Edible coatings have demonstrated the capability of improving food quality and prolonging shelf life of fresh produce [5].

AIMS AND OBJECTIVES

The main aim of the present study is to find that edible food packaging helps to protect the fruit from various biochemical changes that occur during ripening of a fruit and thus helps to improve the post harvest life of the same. The present study was undertaken to find that edible food packaging when applied on rapidly perishable fruits has ability to bring a significant change in the post harvest life of the fruit with the following main objectives:

1. To find that is there a significant difference between the control fruit and the coated fruit.
2. To find out which concentration of edible food packaging shows best results in terms of increasing the post harvest life.
3. To examine that is there extension in the ripening period of the fruit.
4. To examine that the edible food packaging provides safety against microorganisms.
5. To examine that the functional properties are also safeguarded by the coating.

METHODOLOGY

Preparation of Fruit: Freshly harvested tomato fruits at the mature-green stage of ripening were selected. The fruits were visually selected for uniformity in size, colour, absence of blemishes and fungal infection, and transported to the laboratory. Before treatment was applied, fruit were washed with a solution of sodium hypochlorite (0.05%) for 3min, and air-dried at ambient temperature [6].

Preparation of Edible Food Packaging Material: To prepare gum Arabic coating solutions at 5, 10, and 15 % (w/v), 5, 10 and 15 g of powder was dissolved in 100mL purified water. The solutions were stirred with low heat (40 °C) for 60 min on a magnetic stirrer, and then filtered to remove any undissolved impurities using a vacuum flask. After cooling to 20 °C, glycerol monostearate (1.0%) was added as a plasticizer to improve the strength and flexibility of the coating solutions. The pH of the solutions was maintained at 5.6 using 1N NaOH. The coating treatments were selected according to preliminary experiments in tomatoes to assure adherence and steadiness of the coatings [6].

Six fruits were immersed in each concentration of gum Arabic coating solution (5, 10, and 15%) for 2–3 min and the coating solution was applied uniformly on the whole surface, while control fruit were dipped in purified water. After treatment, fruit were air-dried, packed in cardboard boxes and stored at room temperature for 18 days. The data were recorded before treatment (day 0) and at 3-day intervals for 18 days. The entire process was repeated for 3 times and average of the 3 readings was taken the analysis [6].

Sensory Evaluation: 12 panel members were asked to perform the sensory evaluation throughout the assessment period and the same panel was maintained. They were asked to compare the given sample with fresh tomato used in salads. The tomato pieces were presented in front of the panel members and they were asked to evaluate and fill the sensory evaluation form. Sensory evaluation of the fruit for pulp colour, texture, flavour and overall acceptability for all the samples was done at each interval of 3 days. The evaluation was scored on the basis of 9 point hedonic scale [9].

Weight Loss Percentage: Tomato samples were weighed at day 0 and at the end of each storage interval. The difference between initial and final fruit weight was considered as total weight loss during that storage interval and calculated as percentages on a fresh weight basis by the standard AOAC (1984) method [8].

$$\text{Weight loss percentage} = \frac{\text{Difference with Day 0}}{\text{Initial Weight}} \times 100$$

Colour Lycopene Test: The low volume hexane extraction method (LVHEM) was performed as in Fish et al. (2002). Approximately 0.6 g (determined to the nearest 0.01 g) duplicate samples were weighed from each puree into beakers that contained 5 ml of 0.05% (w/v) butylated hydroxytoluene (BHT) in acetone, 5 ml of 95% USP grade ethanol, and 10 ml of hexane. Purees were stirred on a magnetic stirring plate during sampling. Samples were extracted by rotating by hand in orbital manner for 15 min on ice. After shaking, 3 ml of deionized water were added to each beaker and the samples were shaken for an additional 5 min on ice. The solution was then transferred to separating flask through filter paper and was then left at room temperature for 5 min to allow for phase separation. The absorbance of the upper, hexane layer was measured in a 1 cm path length quartz cuvette at 503 nm blanked with hexane. The lycopene content of each sample was then estimated using the absorbance at 503 nm and the sample weight [1]. The lycopene content of the tissue was estimated by the following relation [2]:

$$\begin{aligned}\text{Lycopene (mg/kg tissue)} &= \frac{A_{503}}{17.2 \times 10^4 / \text{M} \times \text{cm}} \times \frac{536.9 \text{ g}}{\text{mole}} \\ &\quad \times \frac{1 \text{ L}}{10^3 \text{ mL}} \times \frac{10^3 \text{ mg}}{1 \text{ g}} \times \frac{10.0 \text{ mL}}{\text{kg tissue}} \\ &= \frac{A_{503} \times 0.0312}{\text{kg tissue}} = \frac{A_{503} \times 31.2}{\text{g tissue}},\end{aligned}$$

Soluble Solids: The tomatoes from each treatment were ground in a blender and juice from the fruit was used to determine the soluble solids concentration (SSC) using a Pocket Refractometer. The machine was standardized using purified water before readings were taken [6].

Titratable Acidity: 10mL of the tomato juice was pipetted into a 50mL beaker. The pH probe was inserted into the tomato juice. It did not fully immerse, however once the titration began it was covered. The initial reading of the NaOH 0.1M on the burette was noted to an accuracy of 0.1mL. Titrating was done with NaOH from the burette, swirling the beaker so that the juice and NaOH mix, and that the pH probe was fully wetted. Titrating was continued until the pH is approached 7.5. Titrating was stopped and the pH was allowed to stabilise. Then NaOH was added drop wise until the pH approached 8.2. The final burette reading was noted down to an accuracy of 0.1mL. The initial was subtracted from the final to calculate the volume required for the titration. This volume was multiplied by 0.64, to determine the titratable acidity expressed as g/L of citric acid at and end point of pH 8.2 [3].

Ascorbic Acid Test: 10 ml standard ascorbic acid solution was taken in the pipette and 1 ml of the dye in the test tube. To the test tube, 1-2 drops of glacial acetic acid was added. Then the dye was titrated with the standard ascorbic acid solution till the colour disappeared. This pink colour has to persist to 30 seconds. The volume of the required ascorbic acid solution was recorded to standardize the dye. The titration was repeated 3 times to get concordant value.

Titration of unknown tomato sample: Tomato paste was centrifuged in cold for 15 min at 15000 rpm. The superficial liquid was poured in a beaker and 10 ml of it was taken in the pipette and 1 ml of the dye in the test tube. To the test tube, 1-2 drops of glacial acetic acid was added. Then the dye was titrated with the sample till the colour disappeared. The volume of the required sample was recorded to standardize the dye. The titration was repeated 3 times to get concordant value [10].

Calculation:

Titration of dye with standard Ascorbic acid solution:

$$V_1 S_1 = V_2 S_2$$

V_1 = volume of known ascorbic acid solution

S_1 = Strength of ascorbic acid solution

V_2 = Volume of dye

S_2 = Strength of dye

$$S_2 = V_1 \times S_1 / V_2$$

Titration of dye with unknown sample:

$$V_1 S_1 = V_2 S_2$$

V_1 = volume of unknown sample

S_1 = Strength of unknown sample (ascorbic acid content)

V_2 = Volume of dye

S_2 = Strength of dye

$$S_1 = V_2 \times S_2 / V_1$$

Microbiological Analysis: Serial dilutions of the tomato samples were prepared. The tubes were mixed well before each transfer. Transfer of 1 ml of the dilutions (10^{-5}) was carried out to nutrient agar plates (sabaraud media), and the plates were labeled according to the sample being used. The inoculum was spread evenly on the entire surface of the nutrient agar plates until the medium no longer appears moist. The petri plates were inverted and kept in incubator at $37^\circ C$ for 72 hours and total plate count was taken and recorded [4].

Antioxidant Activity: 2 gm tomato puree with 20 ml distilled water was centrifuged at 8000 rpm for 15 minutes and supernatant was separated. Various measures of supernatant (0.5, 1, 1.5, 2, 2.5 ml) in deionized

water were mixed with phosphate buffer (2.5 ml) and potassium ferricyanide (2.5 ml). The mixture was incubated at 50 °C for 20 min. Aliquots of trichloroacetic acid (2.5 ml) were added to the mixture, which was then centrifuged at 3000 rpm for 10 min. the upper layer of solution (2.5 ml) was mixed with distilled water (2.5 ml) and a freshly prepared ferric chloride solution (0.5 ml). The absorbance was measured at 700 nm. A blank was prepared without adding extract. Ascorbic acid at various concentrations (0.5-2.5 ml) was used as standard. Increased absorbance of the reaction mixture indicates increase in reducing power [7].

RESULTS AND DISCUSSIONS

Sensory Evaluation: The overall acceptability has been towards 10% coated sample till the end of cycle and the other samples had similar scores as for taste and texture. Overall acceptability depends on the different parameters like taste, colour, texture, and smell, and the results show that the taste, smell and texture were maintained best in the 10% sample.

Microbial Contamination: Microbial contamination was seen maximum in the control sample and 15% coated sample till the end of cycle. It was expected that control sample will develop microbial contamination, but 15% sample was expected to have minimum plate count. There was visible contamination on the fruit by the end of cycle with cottony growth. Some of the fruits were eaten up by the contaminants to some extent. This led to more weight loss, off smell and probably texture loss also in the 15% samples. 10% mostly had low scores except for day 12. May be this was due to manual error as one of the readings showed 114 total plate count which increased the average. 5% sample also had considerable amount of contamination seen after day 6.

Weight Loss Percentage: Weight loss percentage was highest in 15% sample, though weight loss increased gradually in all samples. As explained earlier microbial contamination had eaten up the fruit with 15% coating till some extent which also caused severe weight loss to occur. 10% sample always had lower weight loss percentage but strikingly most of the times 5% sample had more weight loss percentage as compared to control sample beyond day 12. This shows that 5% coating is not sufficient in counteracting the vapour pressure of the atmosphere. Though 10% sample had lower percentage it was not considerably lower than control sample.

Ascorbic Acid Content: Earlier studies show that in tomato fruit, ascorbic acid content increases with maturity and stage of ripening. However once fruit reach the full ripe stage, ascorbic acid content starts to decline. Similar trend was seen in control sample. After day 12 the vitamin C content started deteriorating. Same trend was seen in 5% coated sample, but the vitamin C content always remained much lower. This trend came because the average of day 9 for 5% was lower as compared to other samples as shown in figure 1. 10% was always on the increasing trend and has not reached the peak in the 18 day cycle. A longer cycle had to be tested to know proper results in this regard. 15% sample too had good scores but peak is not visible in the results because the day 15 reading came lower and proper anticipation cannot be done in this regard.

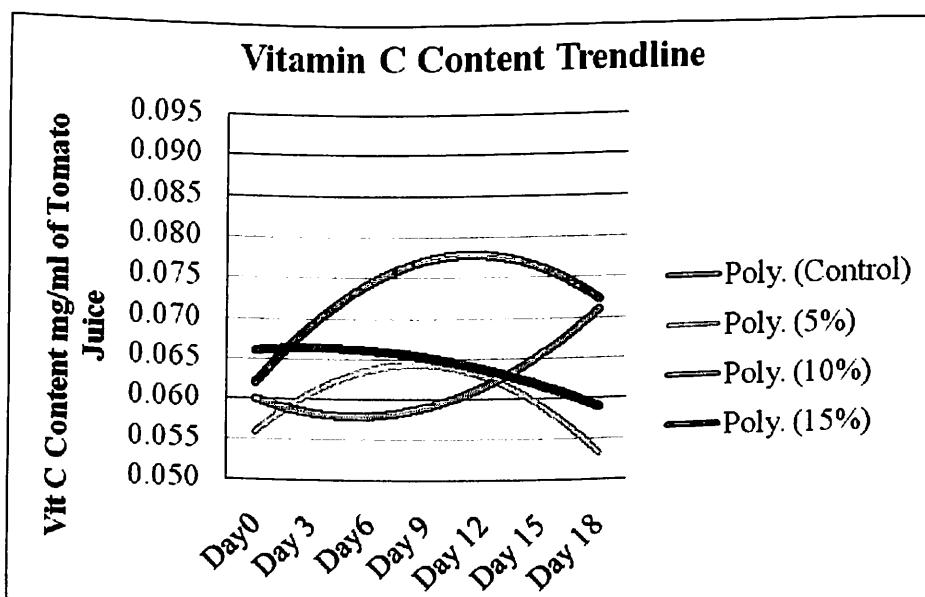


Figure 1: Vitamin C content of tomato juice

Soluble Solids Content: In general, there was a gradual increase in Soluble Solids Content during the 18 day cycle. The Soluble Solids Content was significantly higher in control compared to coated fruit and the reduction in Soluble Solids Content in coated fruit was directly proportional to the concentration of the coating. The lowest Soluble Solids Content at the end of the storage period was recorded in fruit coated with 15% gum arabic.

Titratable Acidity: The values show that minimum deviation was seen in 10% sample. The low level of TA in control fruit compared to coated fruits suggests that the gum arabic coating delayed ripening by providing a semi-permeable film around the fruit. Since organic acids, such as malic or citric acid, are primary substrates for respiration, a reduction in acidity is expected in highly respiring fruit.

Lycopene Content: Lycopene is the red pigment and antioxidant in tomato which is known to increase as the fruit ripens. The obtained data shows that control sample had highest lycopene content as compared to coated samples and the lower lycopene content was always proportional to the percentage of the edible coating (figure 2). Most of the 15% coated samples remained green till 15th or 18th day of the cycle. This clearly shows that ripening was delayed with the help of edible coating.

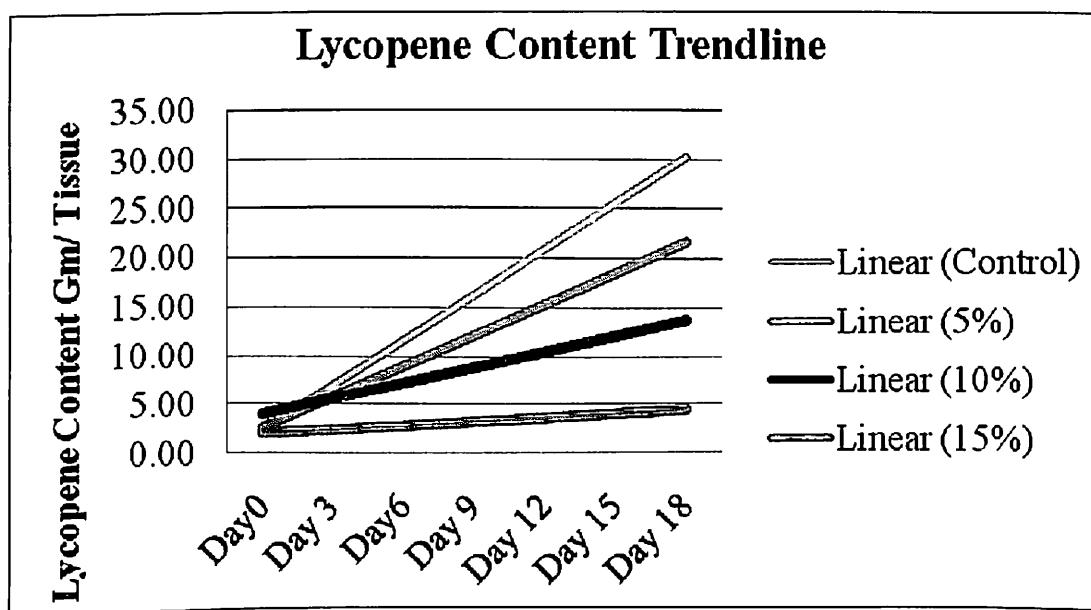


Figure 2: Lycopene content of tomato juice

Antioxidant Activity: The antioxidant activity as shown by the sample had a similar trend as vitamin C. It increased in the samples as fruit ripens and then deteriorated after a peak activity level. This is due to the fact the vitamin C is an antioxidant and is found in considerable amount in tomato. Control sample showed peak activity on day 12 and the activity was not high as compared to day 0. After day 12 there was considerable fall in the activity level and day 18 had the lowest values. 5 % coated sample showed peak activity on day 15 and day 18 activity level was almost similar to day 9. It was seen that there was considerable reduction on day 3 then activity increased thereafter. The 10 % coated sample showed peak on day 12 and 15 and the day 18 activity level was also considerably high. The 15% coated sample had even higher antioxidant activity till the end of cycle as compared to 10% sample and its peak occurred in day 12. Vitamin E and α -carotene are other antioxidants present in tomato which should be responsible for high antioxidant activity in 15% coated sample. Day 15 values were little less than 10% values and day 18 antioxidant activity was also considerable.

CONCLUSIONS

The results show that edible food packaging helps to increase the post-harvest life of the rapidly perishable fruit, tomato. It has not only extended the ripening period but has also helped in maintaining good levels of functional properties of the fruit. In all cases the results were proportionately better with the increase in edible coating percentage, with little exceptions for 15 % coated sample.

5 % coated sample had better results than control fruit but there wasn't a considerable difference in most of the cases and weight loss was seen higher than control fruit. Therefore 5% solution of the edible food packaging was not sufficient enough to control fruit deterioration. Although the results for 5% coated sample indicate that edible food packaging does help but a higher concentration will be required.

10% coated sample had best results in most of the experiments. Most importantly it was the preferred sample in the sensory evaluation till the end of the 18 day cycle. Consumer preference is one of the most prominent factors to decide whether the technology can be commercialized or not. Apart from sensory qualities, it has also extended ripening considerably well, improved functional qualities (Vitamin C, Antioxidant activity), and there was considerable less microbial contamination seen.

The only setback is that 10% sample did not counteract the vapour pressure of atmosphere thus there was not considerable difference with regard to weight loss percentage. A combination of gum arabic with another edible packaging material may help to overcome this problem. Thus, further research is required.

15% coated sample had very delayed ripening, probably due to this, this sample never scored high in the organoleptic properties in the sensory evaluation. It also showed high microbial contamination and low vitamin C content. Thus, this concentration cannot be accepted for edible food packaging even though the results were comparably better in regards to lycopene content, titratable acidity, soluble solids content and antioxidant activity content.

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TEXTILES, CLOTHING & FASHION
(Research Papers)

Dhobi Ghats and their Role in Environmental Degradation

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ABSTRACT

In India, the concept of commercial washing has existed for a long time in the form of Dhobi Ghats, where the soiled linen would be collected, washed, pressed and the clean clothes would be delivered. With the advent of commercial mechanized laundries, the dhobis majorly cater to individual households. Currently, the dhobis work on an individual basis, following their own clients and style of working. The objective of the study was to observe the laundering procedures followed in dhobi-ghats, evaluate the quality of water and assess the amount of chemicals present in the drain water.

The study was conducted in dhobi-ghats in Mumbai. Tools employed to collect the data were multi-method such as interview schedule, sample collection and testing (fresh water and drain water samples). Tests were conducted to evaluate the quality of water and to assess the nature and amount of residual chemicals in the drain water. The results of the study reveal that the washer-men do not maintain any standardization in the wash process. Results from the water quality assessment show that the fresh water used by the dhobi-ghats is of a very good quality. However the drain water results show that the residual chemicals in the drain water exceed the specified limits as standardized by the Pollution Control Board. The results also indicate the factors affecting the residual chemicals in the drain water.

INTRODUCTION

Soiling of clothes and linen can result in much more than poor aesthetics. The extent of soiling in a tropical country like India is very high, therefore making the laundry industry very vital². The sight of clothes drying in long rows by the river banks, popularly known as ‘Dhobi Ghats’ is still not a lost sight^[6].

In India, the concept of commercial washing has existed for a long time in the form of Dhobi Ghats, where the soiled linen would be collected from households as well as commercial establishments, washed, pressed and the clean clothes would be delivered^[1]. In Mumbai, the Municipal Mahalaxmi Dhobi-Ghat is one of the largest dhobi-ghats with more than 750 dhobis attached to it. This dhobi-ghat occupies an area of 10 lac sq. feet. This dhobi-ghat has featured in the Guiness Book of World Records in 2010, for the maximum number of dhobis (785 dhobis) washing clothes at the same time and same place. Earlier these dhobis collected linen from commercial organizations as well as individual households, but with the advent of commercial mechanized laundries, they now majorly cater to individual households. Currently, the dhobis work on an individual basis, following their own clients and style of working. There are many small dhobi-ghats in Mumbai at Colaba, Tardeo, Juhu and Bhayander.

AIMS AND OBJECTIVES

The effects of utilization of resources on the environment are a cause of concern for many researchers in the present day. Laundry is an essential function for all households/ institutional housekeeping departments, not only contributing to comfort and aesthetics, but also assisting in infection control. Laundry has been traditionally associated with the washing and pressing of garments/linen. Laundering of linen/clothes utilizes enormous

amount of resources. Laundry processing because of its high level of energy, chemical and water consumption also has a significant impact on the environment and economic resources. Thus, the objectives of the study are:

1. To observe the laundering procedures followed in dhobi-ghats
2. To evaluate the quality of water used in the process of laundering.
3. To assess the amount of chemicals in the drain water after the process of laundering.

METHODOLOGY

This study employed a multi-method (face-to-face interview, observation and collection & testing of water samples) and multi-agent design (trustees of dhobi-ghat organizations and washer-men - dhobis).

The sampling technique used was that of “reliance on available subjects”. All those who fulfilled the inclusion criteria, namely, a person nominated to be a member of the dhobi-ghat association with a minimum experience of five years, and agreed to participate in the study were selected for the study.

Of the six dhobi-ghats in Mumbai, only two were included in the study. The remaining four dhobi-ghats were not contacted as the number of washer-men working there were few and the number ranged from 5 – 18. Also the remaining four dhobi-ghats did not have any association / governing body formed.

The study was conducted in two parts, i.e., data collection on the existing laundry procedures followed by the washer-men at the dhobi-ghats and water quality assessment.

The first stage comprised of collecting information from the dhobi-ghats through interview method and observation. Tool was formulated for collection of information through the questionnaire method, however it could not be implemented as the washer-men working in the dhobi-ghats did not follow any standardized procedures. The elected/ nominated persons of the dhobi-ghats were contacted for the information. Since the procedures followed by the washer-men at the dhobi-ghats varied, some washer-men were also interviewed in the course of the study.

The second part of the study assessed the water quality and the amount of chemicals present in the drain water. To accomplish this, fresh (one sample) and drain water (three samples) samples were collected from the participating hotels and tested. The tests conducted were in accordance with the Environment (Protection) sixth Amendment Rules, 2009, Ministry of Environment and Forests. The tests conducted were pH, BOD (Biological Oxygen Demand), Oil & grease and Total Suspended Solids.

Fresh and drain water samples were collected from both the dhobi-ghats. The drain samples were collected from washer-men following a similar pattern of washing clothes, so as to get a balanced representation of the sample. The total number of samples drawn and tested was eight.

RESULTS & DISCUSSION

Some of the observations made during the course of the study were:

Work Area

Each washer-man is assigned a square cubicle (enclosure), approximately one and half meter in size, for the washing of clothes. The enclosure is made of bricks and cement. The enclosure has a height of about two feet. There are about seven to twelve enclosures in every row. There are taps situated at regular intervals, with specific number of washer-men assigned to using a particular tap. The taps are attached with meters which indicate the amount of water consumed by the washer-men. The enclosures have an opening for the water to flow, which is connected with the drainage system. However the opening can be covered to block the water flow for soaking / rinsing of garments.

A single big stone is placed the every enclosure which is used for the beating of garments in the process of washing.

Work Aids: The soaps used in the process of washing also differ from one washer-man to another washer-man, with most of them using a local formulation known as "Kala-Sabun" (black colored soap bars). This soap is black in colour and hence referred by the name. Kala Sabun is cheaply available in the form of bars costing about Rs. 25 – 30 per kilogram. Apart from Kala Sabun, some of the washer-men (20%) also use commercially available formulations like Surf, Rin, Tide, Nirma, etc.

Besides the soap used, the washer-men also use locally produced bleaches. These bleaches are formulations of hydrogen peroxide in varying concentrations, costing about Rs. 20 per liter. Stain removers in the form of white powder are also used. Small packets weighing about 200 gms are available for about Rs 10. These powders are directly applied onto the white fabric, left for some time and washing of garments is then carried out using the regular process. Direct application of the powder is not done on colored fabric; however, it is diluted with water and then used.

Rectangular brushes having metal wires on one side are used for scrubbing of garments and the garments are beaten on a stone in the enclosure to remove the soil from the garment being laundered.

Wash process: Lack of standardization is observed in the procedure for washing. Some aspects observed by the researcher were:

- a) Type and quantity of soap used for washing varies from one wash cycle to another. Same washer-man uses different qualities of soap based on the charges levied to the customers.
- b) The soaking time of the garments is also not standardized and varies according to the number of garments the washer-man receives on a given day. More the number of clothes, less the soaking time and vice-versa.

Type of linen washed: Most of the washer-men wash clothes collected from households (85%), very few wash clothes of commercial organizations (15%). Commercial organizations include garment export houses which send the stitched garments before delivery for wash so that the stains acquired during stitching of the garment can be removed.

Water usage by the washer-men: Single meter has been installed by the Brihan Mumbai Corporation for the water usage. Individual meters are installed by the society to assess the water usage of each of the washer-men.

- a) Amount of water used by the washer-men is not fixed and varies on the basis of the number and type of linen / garments being washed.
- b) Since the dhobis pay individually for the usage of water, the water filled in the enclosure at one time is used to rinse many garments. Each of the garment may not be rinsed repeatedly / multiple times in order to save on the amount of water used.

Health: Owing to the varied types of qualities of soap used, local bleaches, stain removers and constant exposure to water and chemicals, the hands and feet of about 90 per cent of the washer-men are affected. The skin on the hands and feet develop small cuts, which are not given the due medical attention. Any infection developed in these cuts may be transferred to the wash water.

Living conditions: Poor health and sanitation conditions were observed by the researcher of the washer-men and their families. All the washer-men live in small rooms (6 feet X 4 feet) close to their area of work with their families (5 – 8 members on an average). The distance between the cubicle for washing and their room is barely 1 ½ feet. The accommodation, which is a single room, is used for all purposes (cooking, eating, sleeping, etc) through the day. Most of the drains are open and drain water overflows from the sewage pipes and flows very close to the rooms in which the washer-men live. Due to all these factors the washer-men and the members of their family are exposed to the unhygienic conditions.

The number of washer-men has remained consistent through the years. Children observe their fathers / uncles carry out the work and as they are old enough, they continue the work done by the earlier generation. The average age of the children when they start working is about 14 – 16 years. Very few children complete their schooling. Many of them (65%) drop out of school between the 4th – 7th standard.

Working Environment: Constant exposure to water and chemicals, very poor hygiene and prolonged work hours contribute to a very detrimental working environment.

Test results of fresh and drain water samples are as follows:

Results of Dhobi-Ghat I

The results of all the parameters of fresh water samples fall within the specified limits of the Ministry of Environment and Forests. The average results of drain water samples show that the values of pH and oil & grease fall within the specified limits. However, the values of BOD and total suspended solids far exceed the specified limits of the Ministry of Environment and Forests as indicated in Table No. 1

Table No. 1 Results of fresh & drain water samples of Dhobi-Ghat I

Parameters	Standards as indicated in the Environment (Protection) sixth Amendment Rules (A)	Reading of Fresh water samples (B)	Inference	Average reading of drain water samples (C)	Inference	Difference (C - B)
pH	5.5 – 9.0	7.2	Within range	8.7	Within range	1.5
BOD, 3 days, 27°C	0 – 30 mg/l	6	Within range	99	More than specified limit	93
Total suspended solids	0 - 50 mg/l	<1	Within range	134	More than specified limit	133
Oil & grease	0 - 10 mg/l	Nil	Within range	Nil	Within range	0

Results of Dhobi-Ghat II

The test results of fresh and drain water samples of Dhobi-Ghat II are presented in Table No. 2. It can be seen that the values for all the parameters of fresh and drain water samples fall within the specified values of the Ministry of Environment and Forests, except the pH value for drain water. This value falls at the highest upper limit of the specified values.

Table No. 2 Results of fresh & drain water samples of Dhobi-Ghat II

Parameters	Standards as indicated in the Environment (Protection) sixth Amendment Rules (A)	Reading of Fresh water samples (B)	Inference	Average reading of drain water samples (C)	Inference	Difference (C - B)
pH	5.5 – 9.0	7.4	Within range	9	Within range	1.6
BOD, 3 days, 27°C	0 – 30 mg/l	0	Within range	6	More than specified limit	6
Total suspended solids	0 - 50 mg/l	<1	Within range	25	More than specified limit	24
Oil & grease	0 - 10 mg/l	Nil	Within range	Nil	Within range	0

Comparison of test results of both Dhobi-Ghats:

Test results of fresh water: On comparing the test results of the fresh water samples drawn from the two dhobi-ghats, it can be seen from Table No. 3 that the results of both the dhobi-ghats fall within the ranges specified by the Ministry of Environment and Forests. The only exception was the pH value of dhobi-ghat II which is higher by 0.2, while the BOD value is higher for dhobi-ghat I.

Table No. 3 Comparison of test results of fresh water samples of Dhobi-Ghats

Parameters	Standards	Reading of Fresh water samples (B)	Inference
pH	5.5 – 9.0	7.2	7.4
BOD, 3 days, 27°C	0 – 30 mg/l	6	0
Total suspended solids	0 - 50 mg/l	<1	<1
Oil & grease	0 - 10 mg/l	Nil	Nil

Test results of drain water samples: As indicated in Table No. 4, a comparison of the average test results of the drain water samples drawn from the two dhobi-ghats shows that though the pH values for both the dhobi-ghats fall within the specified limits, but they fall towards the upper limit specified by the Ministry of Environment and Forests.

Values of BOD and total suspended solids obtained from the test results of drain water samples of dhobi-ghat I are considerably higher than the specified limits. However values for the same parameters for dhobi-ghat II fall within the specified limits. The values for oil & grease for both the dhobi-ghats is nil.

Table No. 4 Comparison of test results of drain water samples of Dhobi-Ghats

Parameters	Standards	Reading of Fresh water samples (B)	Inference
pH	5.5 – 9.0	8.7	9
BOD, 3 days, 27°C	0 – 30 mg/l	99	6
Total suspended solids	0 - 50 mg/l	134	25
Oil & grease	0 - 10 mg/l	Nil	Nil

BOD is a measure of the amount of oxygen used by micro-organisms in the oxidation of organic matter. High values of BOD indicate lesser amount of oxygen is available for aquatic organisms. High levels of Total Suspended Solids reduce visibility and absorb light, which can increase stream temperatures and reduce photosynthesis which in turn impedes aquatic plant photosynthesis reduces the amount of food, habitat and dissolved oxygen available for other species. Fine particles may also clog and abrade fish and insect gills and tissue and interfere with egg and larval development [5].

The wide difference in values of dhobi-ghat I and II may be attributed to the wide-spread use of “Kala sabun” by the washer-men at dhobi-ghat I in comparison to the very limited use of the same at dhobi-ghat II. The test results obtained may also be collaborated with the observations made by the researcher, having stated that the level of mechanization and use of commercial formulations for washing of linen / garments is higher at dhobi-ghat II in comparison with dhobi-ghat I. It has also been mentioned by the researcher that the quality of washed linen / garments is better at dhobi-ghat II in comparison with dhobi-ghat I.

CONCLUSION

Some of the conclusions drawn from the study, based on the data collected, show that the wash process is not standardized with washer-men following methods used by the earlier generations. There is no training imparted to the washer-men, children learn by observing / helping their fathers. The chemicals and equipment used by

most of the washer-men is locally produced. There are no quality checks or technical support given to the washer-men. All this contributes to a detrimental work environment.

The results obtained from the fresh water samples from both the dhobi-ghats are within the specified values, indicating a good quality of water. The water to both these institutions is supplied from the same source i.e., Brihan Mumbai Corporation.

The results of the drain water samples show that the values for the parameters of pH and oil and grease for both the dhobi-ghats fall within the specified limits. However the values of BOD as well as total suspended solids are considerably higher than the specified limits. The high values can be attributed to the excessive use of locally produced formulations, low level of mechanization as well as non-standardization of the wash process.

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Water Free Eco-friendly Textile Finishing using Plasma Technology

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ABSTRACT

It well known that during the wet chemical processing of textile, industry causes significant water pollution. Approximately, 100 litres of water is used to process 1 kg of textile, which is finally discharged as an effluent contaminated with unutilized dyes, pigments, and other hazards chemicals. Due to the more environmental awareness, textile industries are now slowly moving towards the implementation of water-less (dry) or low water based processing technologies, such as digital printing, spray & foam finishing and plasma processing. Plasma, an ionized gas, can be used for nano-scale surface engineering of textile substrate without using water and it has potential to be commercialized in textile, if the existing challenges associated with plasma generation could be solved. In this study, cotton textile was plasma treated in an indigenously developed atmospheric pressure plasma reactor in presence of helium (He)/fluorocarbon gases. Optical emission spectra (OES) showed the strong atomic lines of He at 705 nm, 655 nm, 587 nm, 666 nm & 725 nm. After the plasma treatment, hydrophilic cotton turned into highly hydrophobic. As a result of this, a water droplet of 37 μ l did not get absorbed by the fabric even after 1800s, whereas in the untreated sample, the water droplet get absorbed by only 3s. Water contact angle was found to increase from $\sim 0^\circ$ to 142° in the untreated to plasma treated samples, respectively. ATR-FTIR spectra showed the presence of -CF_x molecule. SEM-EDX showed the presence of 4% fluorine atom on the surface of the plasma treated sample. Secondary ion mass spectrometry (SIMS) analysis showed the strong molecular peak of F at 19 a.m.u. in addition with decrease of OH molecular peak at 17 a.m.u. in the plasma treated sample. SEM image (physical) and SIMS image (chemical) showed, there was no blockage of inter fibres spacing of fabric. This is important for the fabric to maintain its air & moisture vapour permeability i.e. comfort properties. Therefore, it can be said that plasma technology can be used to impart hydrophobic functionality in the cotton textile without using water, while addressing the environmental issue.

Key Words: Plasma, Textile, Surface modification, Eco-friendly, Hydrophobic

INTRODUCTION

It well known that during the wet chemical processing of textile, industry causes significant water pollution. Approximately, 100 litres of water is used to process 1 kg of textile, which is finally discharged as an effluent contaminated with residual dyes, pigments, and other hazards chemicals. Due to the more environmental awareness, textile industries are now slowly moving towards the implementation of water-free (dry) or low water based processing technologies, such as digital printing, spray & foam finishing and plasma processing. Plasma, an ionized gas, can be used for nano-scale surface engineering of textile without using water. It has potential to be commercialized in textile, if the existing challenges associated with plasma generation could be solved. Surface modification of textile using plasma is carried out by attaching special elements such as oxygen, nitrogen, fluorine etc. or by plasma reaction with molecules containing hydroxyl, carbonyl or carboxyl groups.

Generation of radicals on the fibre surface followed by plasma reaction of a monomer can be used to develop value added textiles, such as water/stain and oil repellent, hydrophilic, antimicrobial, flame retardant and U.V. protective^[1,2,4]. Plasma processing of textile can also be used in improving in dyeing, printing and adhesion strength. Mainly, low pressure plasma has been used for such applications. However, the process technology has not been commercialized in textile due to its inherent limitation in the sample size, treatment time, and maintaining vacuum. Atmospheric pressure plasma is an emerging technology that can overcome the limitations of low pressure plasma technology and can also be easily integrated with the existing textile processes^[3]. In this study, hydrophobic surface modification of cotton textile has been reported.

MATERIAL AND METHODS

100 % cotton woven textile was used for hydrophobic finishing. Plasma reaction was carried out in an indigenously developed atmospheric pressure plasma reactor in the presence of He and fluorocarbon gases. The imparted hydrophobic functionality was measured by measuring the water absorbency time and contact angle as per the AATCC 79-2007 and sessile drop method, respectively. Optical properties of the plasma were measured using optical emission spectrometer (OES). Surface chemical composition of the samples was analyzed using secondary ion mass spectrometry (SIMS) and SEM-EDX.

RESULTS AND DISCUSSION

Plasma generation and textile treatment

Atmospheric pressure plasma reactor was designed and developed indigenously for surface modification of various types of textiles, such as cotton, wool, silk, jute etc. Cold plasma was generated in between the two metal electrode by applying a discharge voltage of ~ 5 kV in the presence of helium (He) and He+ fluorocarbon gases. Depending upon the ionization of gaseous molecules, it produces a distinct colour. For example, helium gas upon ionization produces purple colour and in the presence of fluorocarbon gas produces strong bluish purple colour. Plasma is an ionized gas composed of ions, electrons, neutrals, excited particles, UV light and photon. Therefore, the light emitted by the excited atoms and molecules over the wavelength of 200 to 1100 nm was collected using Optical Emission Spectrometer (OES), Mikropack made Model PlasCalc 2000 in real time to reveal the plasma chemistry. OES spectrum of helium (He), showed the presence of atomic lines at the wavelength of 705 nm, 655 nm, 586 nm, 666 nm & 725 nm. Among these atomic lines, He 705 nm line was the major peak.

Hydrophobic finishing of cotton

Atmospheric pressure cold plasma was generated in the presence of helium and fluorocarbon gases and was utilized for water repellent hydrophobic functionality of cotton textile. It was observed that after the plasma reaction, hydrophilic cotton turned into highly hydrophobic cotton as shown in the below Figure. As a result of this, a water droplet did not get absorbed by the fabric even after 3600s, whereas in the untreated, it fully absorbed by 5s. Water contact angle in the untreated sample was $\sim 0^\circ$, whereas in the plasma treated sample increased to 145° .

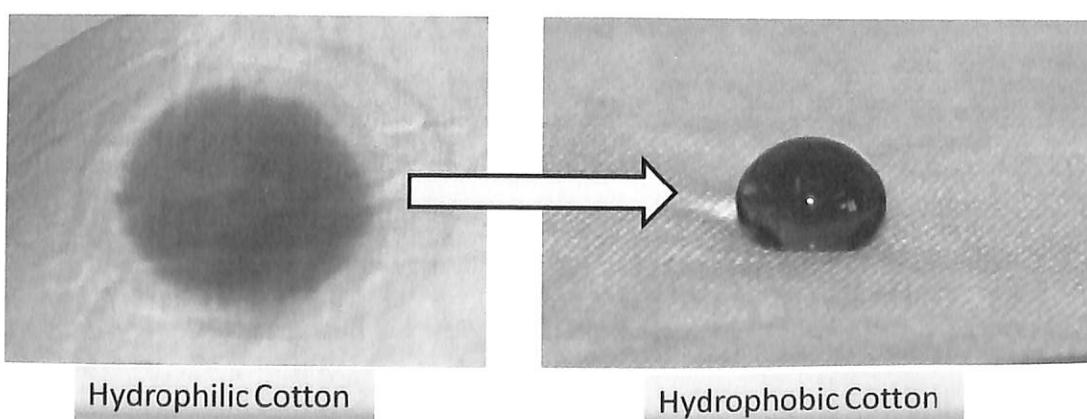


Figure 1: Conversion of hydrophilic cotton to hydrophobic cotton by plasma reaction

SEM-EDX, image showed the presence of 4% atomic fluorine on the surface of the plasma treated sample and as expected, no fluorine signal was detected in the untreated sample. Surface chemical composition of the untreated and fluorocarbon plasma treated samples was also analyzed SIMS. The negative mass spectrum of the untreated sample shows the presence of major species at mass values of 12 amu for C", 13 amu for CH", 16 amu for O", and 17 amu for OH". However, in the fluorocarbon plasma treated cotton sample there was a strong mass peak of F" at 19 amu. It was interesting to note that intensity of F" peak was much more compared to other mass peaks of 12 amu for C", 13 amu for CH", 16 amu for O", and 17 amu for OH". This indicates that the attachment of various fluorocarbon compound in the plasma treated sample helped the sample to be hydrophobic.

CONCLUSION

Atmospheric pressure plasma was successfully generated in presence of He and He/fluorocarbon gases and utilized to impart water repellent hydrophobic functionality in the otherwise hydrophilic cotton textile. After the plasma reaction of He/fluorocarbon, cotton became highly hydrophobic and a water droplet did not get absorbed even after 3600s. Water contact angle also increased significantly. SIMS analysis showed the presence of different hydrophobic molecules on the surface of the plasma treated sample responsible for the hydrophobic functionality. The whole treatment process was carried out in dry state without usage of water. Traditional process for similar textile finishing uses ~10 litres of water, takes 20-30 min time, requires high energy for multiple drying steps and may compromise even fabric comfort quality. Adoption of emerging plasma technology would thus put cotton processing industry at a technological advantage vis a vis its competitors in view of better quality at lower costs.

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A Study of Consumer Awareness and Action Initiated Regarding Environmental Protection With Regard to Clothing

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ABSTRACT

To study the female consumer Awareness and action initiated regarding environmental protection with regard to clothing. To examine the awareness regarding environmental protection, the action regarding environmental protection with regard to clothing, the relationship between awareness and action, the relationship between age and awareness and age and action. A self constructed Questionnaire about awareness and action regarding environmental protection with regard to clothing was given out to 110 working women belonging to age groups, 25-30 and 31-35 years from Nagpur city. The results of a survey administered to a sample of female consumers were well aware about environmental issues with regards to clothing but percentage of action initiated was found to be less. Age plays no considerable role in awareness and action. The most common way of disposing clothes was by donation. The study will have an implication on the minds of children and especially on women regarding the protection of environment by the judicious use and disposal of clothing, encouragement for recycling in female consumers and building awareness among younger generation.

Key Words: Consumer Awareness, Action Initiated, Environmental Protection, Clothing

INTRODUCTION

Processing of manufactured fibers, such as viscose rayon, and natural fibers such as wool may result in water pollution. Cotton processing produces fine dust particles that can cause lung diseases in workers. Chemicals used in dyeing and printing or in special finishing techniques may cause air or water pollution. When textile fabric is ready to be cut and sewn into an item of dress, pre-consumer waste is created. Scraps of new fabric are often left after a garment is cut; but this material can be recycled.

AIMS AND OBJECTIVES

To study the female consumer Awareness and action initiated regarding environmental protection with regard to clothing.

- a) To examine the awareness regarding environmental protection with regard to clothing
- b) To examine the action initiated regarding environmental protection with regard to clothing.
- c) To examine the relationship between awareness and action initiated regarding awareness of environmental protection.
- d) To examine the relationship between age and awareness and age and action initiated.

METHODOLOGY

A self constructed Questionnaire consisting of part A & part B was given out to 110 working women belonging to age groups, 25-30 and 31-35 years. They were also categorized according to their educational qualification i.e. graduates, postgraduates and professionally qualified. Part A: Questionnaire consisted of fifteen questions related to Awareness regarding environmental protection mainly with regard to clothing. Part B: Questionnaire consisted of fifteen questions regarding the action taken to protect the environment with regard to clothing. The responses were tabulated according to the yes, no, and don't know responses. Yes being a positive response was allotted a two score, No being a negative response was allotted a zero score and don't know was allotted a score one. The conclusions thus were drawn on the basis of their scores as given below:

Table 1: Percentage Score of Awareness and Action Initiated

Sl. No.		Percentage Score		
		Age 25-30	Age 31-35	Total %
Statement Part -A				
1	In very near future we are in serious danger of destroying the environment.	97.36	88.88	91.81
2	It is our prime duty to become more radical in safe guarding our environment	94.73	95.83	95.45
3	I am personally aware about the factors that are contributing in polluting the environment.	92.10	83.33	86.36
4	I personally feel helpless in helping to protect the environment.	55.26	69.44	64.54
5	I am very well informed on environmental issues.	73.68	63.88	67.27
6	I am aware about the recycling of plastic.	84.21	70.83	75.45
7	I am aware about the recycling of glass.	89.47	75.00	80.00
8	I am aware about the recycling of paper.	84.21	88.88	87.27
9	I am aware about the recycling of clothes.	65.78	70.83	69.09
10	I feel that recycling is not enough to save the environment.	86.84	86.11	86.36
11	Processing and manufacturing of textiles results in water pollution.	71.05	91.66	84.54
12	Processing of cotton produces fine dust particles that can cause lung diseases.	71.05	87.50	81.81
13	Chemicals used in dyeing and printing process causes air and water pollution.	89.47	95.83	93.63
14	Chemicals used in Special finishing techniques of textiles may cause air and water pollution.	81.55	87.50	85.45
15	Use of eco-friendly clothing can contribute in saving the environment from pollution, to some extent.	86.84	100	95.45
Statement Part -B				
1	In very near future we are in serious danger of destroying the environment.	68.42	41.66	50.90
2	It is our prime duty to become more radical in safe guarding our environment	78.94	86.11	83.63
3	I am personally aware about the factors that are contributing in polluting the environment.	81.55	75.00	77.27
4	I personally feel helpless in helping to protect the environment.	47.36	41.66	43.63
5	I am very well informed on environmental issues.	26.31	40.27	35.45
6	I am aware about the recycling of plastic.	34.21	44.44	40.90
7	I am aware about the recycling of glass.	94.73	77.77	83.63
8	I am aware about the recycling of paper.	31.57	35.50	35.45
9	I am aware about the recycling of clothes.	31.57	23.61	26.36
10	I feel that recycling is not enough to save the environment.	34.21	23.61	27.27
11	Processing and manufacturing of textiles results in water pollution.	68.42	58.33	63.36
12	Processing of cotton produces fine dust particles that can cause lung diseases.	26.31	41.66	50.00
13	Chemicals used in dyeing and printing process causes air and water pollution.	34.21	66.66	70.90
14	Chemicals used in Special finishing techniques of textiles may cause air and water pollution.	31.57	44.44	50.00
15	Use of eco-friendly clothing can contribute in saving the environment from pollution, to some extent.	31.55	48.61	47.27

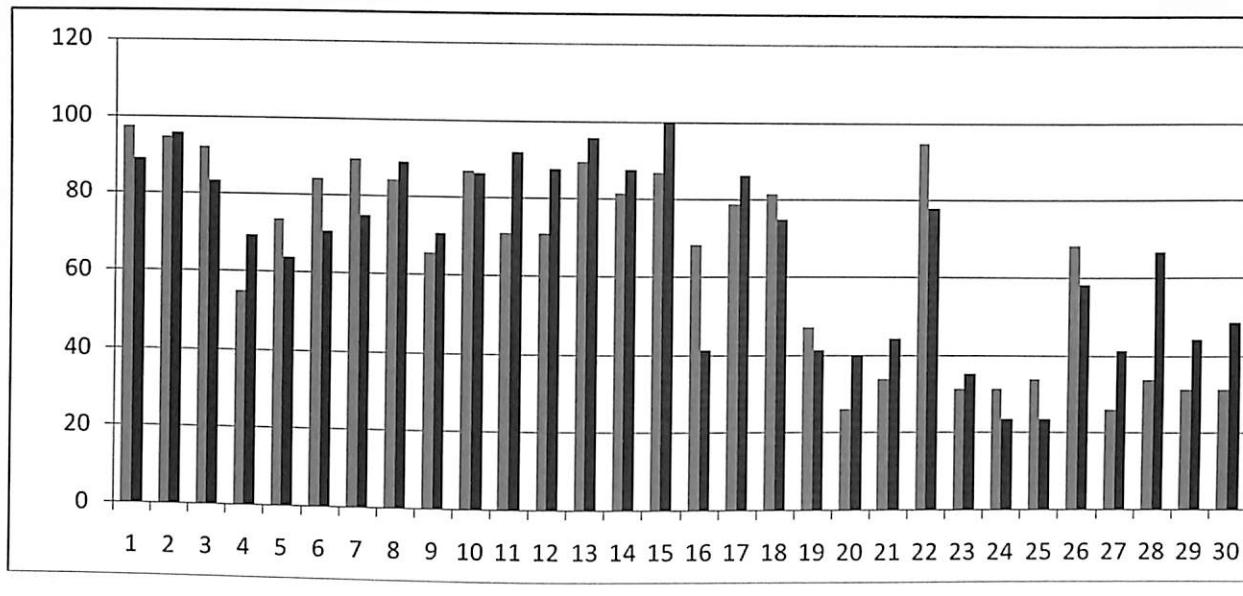


Figure 1: Relationship between Age and Awareness and Action Initiated

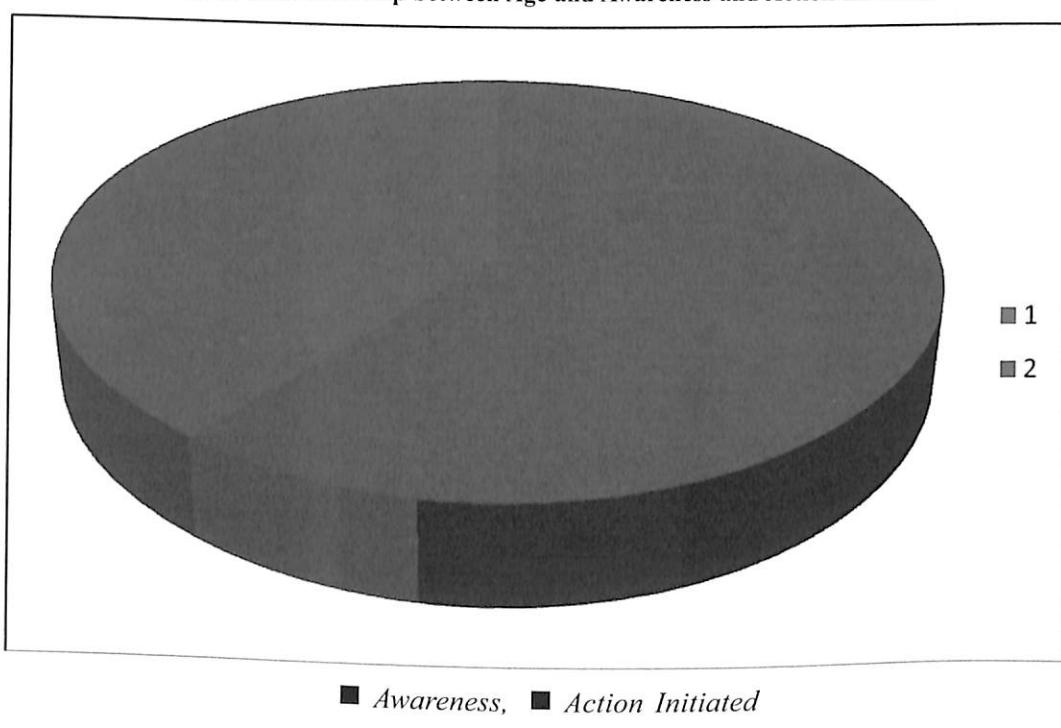


Figure 2: Relationship between Awareness and Action Initiated

RESULTS AND DISCUSSION

- Most of the female consumers (82.96%) are aware about the environmental issues and environmental hazards (88.18 %) with regard to clothing. 69.09 per cent are found to be less aware about recycling of clothes. 95.45 per cent opined that use of eco friendly clothes can contribute to save environmental pollution.
- Action initiated by female consumer regarding protection of environment was found to be 54.81 per cent. This may be due to change in buying behaviour according to changes in fashion and purchasing more clothes than needed. The most common way of disposing of clothes was donation to the hired help, in charity (83.63%). Many of them give good condition clothes to the family members. Only 36.05 per cent women redesign or renovate their clothes.
- Percentage of awareness (82.96%) was found more than the percentage of action initiated (54.81%)

- regarding awareness of environmental protection because of less awareness about recycling of clothes.
4. No significant difference in behavior of female consumer was found due to different age group regarding awareness and action initiated.

CONCLUSION

The female consumers are aware about the environmental issues regarding clothing but lack in action initiated the most common method of disposal used is donation to charity but this should be taken into consideration that clothes from charity do not go to waste and should be used for recycling or can be used to stuffing of the furniture or production of other products.

IMPLICATIONS

The study aims at drawing attention towards the lack of awareness and action initiated regarding the environmental protection due to clothing. It is assumed that the study will have an implication on the minds of children and especially on women regarding the protection of environment by the judicious use and disposal of clothing.

RECOMMENDATIONS

1. Building clothing environmental attribute to the lifestyle of the consumer.
2. Awareness among the younger generations at early age before they reach the stage where their consumption pattern becomes their habit, identity and self value.
3. Environmental pollution due to textile fiber processing and finishing have to be taken into consideration and safer alternatives have to be implemented.
4. Awareness programs regarding health hazards caused by clothing must be held.

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Eco-Green' Batik with Indigo

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ABSTRACT

In olden days vegetable colours especially Indigo were invariably used for batik work, but after the advent of synthetic dyes the use of natural dyes receded and presently naphthol (azoic), solubilised vat and cold brand reactive dye are mainly used in batik. But in the recent past due to growing consciousness about environmental preservations and control of pollution the use of natural dyes are gaining momentum for the colouration of textiles all over the world particularly in the developed countries. Today's consumers understand the value for money and therefore, organic non-toxic products in every field have created a new dimension. So, textiles using of eco-friendly natural dyes on natural fibres is a present trend in its field. Indigo is perhaps the oldest natural dye used by man and considered to be environmentally friendly. Traditional practice of dyeing with natural indigo has always been responsible and sustainable practice on both small and medium scale of operation. Furthermore this natural colour also acts as insect and mosquito repellent. Indigo batik also known as blue batik is one of the latest trends in batik. Classic batik patterns coloured by attractive blue shades offers a different beauty of batik art. Therefore, product diversification through batik work with natural indigo is one of the ways to create fancy effect on handloom cotton textiles for the ever changing fashion market. In the last few decades, batik printed fabric has gained popularity among the young generations who quickly adapted the easy-to-do method for individualizing their shirts, trousers, jeans and casual clothing.

Key Words: Batik, Eco-friendly, Handloom, Indigo, Natural dye

INTRODUCTION

Batik is a method of creating patterns or designs on the fabric surface using wax resist technique. The origin of the word batik is thought to be derived from 'ambatik' i.e. *amba* ('to write') and *titik* ('dot' or 'point'), which also envisages the whole operation. The word 'batik' was first recorded in English in the Encyclopedia Britannica of 1880 where it was spelt as 'battik'. This very old technique originated in Indonesia and the island of Java still produces exquisite batik articles with highest aesthetic merits. During the twentieth century the revival of batik in India began at Santiniketan [6]. On the other hand, Indigo was perhaps the oldest natural dye used by man. It occurs as the glucoside indican in the plant *Indigofera tinctoria* and used for about 4000 years [3] and this natural colour also acts as insect and mosquito repellent [12]. Vegetable dyes viz. Alizarin, Indigo, Harda, Pomegranate rind, Haldi etc. were commonly being used by the traditional dyers and printers of the country. After the synthesis of mauveine by William Henry Perkin [11] and its subsequent commercialization, heralding the advent of coal tar dyes (now synthetic dyes), the use of natural dyes receded [4,5] and the position continued to be much the same until in the recent past growing consciousness about environmental preservation have renewed interest for use of natural dyes for the colouration of textile [1,2, 7-10].

AIMS AND OBJECTIVES

The present work is aimed at to apply *Indigofera tinctoria* (Indigo) on handloom cotton fabric through batik techniques in order to produce diversified value-added handloom products to be used for apparel. Assessment of different colourfastness properties is also reported in this study.

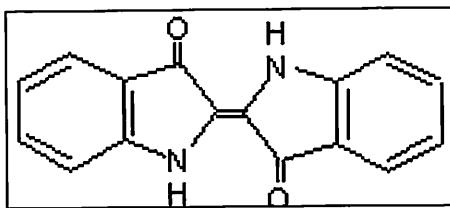


Figure 1: *Indigofera tinctoria* (Indigo)

METHODOLOGY

Materials

Cotton Fabric: Plain weave loom state handloom cotton fabric with yarns of 2/80^s Ne (15 tex) warp and 2/80^s Ne (15 Tex) weft, having 260 ends/dm and 230 picks/dm and weighing 75 g/m² on the average obtained from Shilpa-Sadana Emporium, Visva-Bharati, India were used in the present study.

Chemicals Used: Laboratory reagent (LR) grade sodium hydroxide, sodium meta-silicate, sodium carbonate, hydrogen peroxide, acetic acid, hydrochloric acid, sodium nitrite obtained from M/s Loba Chemie Pvt. Ltd., Mumbai, India, were used in the present study without any further purification. Paraffin wax, bee wax, anionic wetting agent (sulphonated castor oil), non-ionic detergent of commercial grade were also used.

Natural Dye: *Indigofera tinctoria* (Indigo) obtained from M/s ECO-N-VIRON, India, in paste form was used in the study.

Methods

Desizing, Scouring and Bleaching: In order to remove size and other natural as well as added impurities from the loom state (grey) handloom cotton fabric, the latter was desized, scoured and bleached as per the standard procedure [9].

Batik work with Indigofera tinctoria (Indigo): Batik technique involves four steps of drawing, waxing, dyeing and wax removing.

Waxing: At first design was traced out on a piece of cloth and was coated with molten wax. Cracks were then created at places as intended. A mixture of about 1:1 paraffin and bee wax is easiest to work with, but 100% paraffin can also be used. A higher concentration of paraffin will result in more cracks because it is more brittle than bee wax. In this study, for the portions where only cracks were desired paraffin wax was used along with a resinous substance in the ratio of 60:40 and for design portion paraffin wax along with bee wax (60:40) was used. The proportion of paraffin and bee wax may change according to the design requirement and construction of the fabric.

Dyeing: Wax coated fabric was then dipped in to a solution comprising of *Indigofera tinctoria* (Indigo) 100 g/l, sodium nitrite 50 g/l, sodium chloride 30 g/l at a temperature of 45 -50°C for duration of 30 min. The colour was then developed in a bath containing 30 g/l hydrochloric acid and 20 g/l sodium chloride at a temperature of 50°C for 10 min.

Wax removal: After completion of waxing and subsequent dyeing operation wax was removed by boiling with non-ionic detergent along with an emulsifying agent for 5-10 min, followed by hot washed. Almost 90% wax was removed by this process and the rest 10% was removed by placing the fabric in between two news papers, followed by ironing at high temperature.

Assessment of Colourfastness to Washing: Colourfastness to washing was assessed in a launder-o-meter in accordance with a method prescribed in IS: 3361-1984 (ISO-II). A 10 x 4 cm sample was cut and sandwiched between two adjacent fabrics and stitched from all the four sides. One of the two adjacent fabrics was made of the same kind of fibre as that of the dyed sample to be tested; the second piece of adjacent fabrics was made of wool. Washing was done for 45 min at 50 ± 2°C at a fabric-to-liquor ratio of 1:50 employing a non-ionic detergent (5 g/l), washed in cold tap water and finally dried in air. The change in colour of the original dyed

sample and staining on adjacent fabrics were rated between 1–5 using five step grey scales (including half-step) for evaluating change in colour and for evaluating staining respectively, where a rating of 5 indicates excellent and a rating of 1 indicates very poor fastness properties. The grey scale used for assessing change in colour and for assessing staining were having the numbers ISO 105-A03:1993 and ISO 105-A03:1993 respectively.

Assessment of Colourfastness to Light: Colourfastness to light was assessed on a Mercury Bulb Tungsten Filament (MBTF) lightfastness tester following a method prescribed in IS: 2454 -1984. One half portion of each sample measuring 1 x 4.5 cm was appropriately covered with a piece of opaque black paper before placing the same in the lightfastness tester. Eight blue wool standards with numbers (1-8) similarly covered and having progressively lower fading rate with increasing standard numbers were also exposed along with the test specimen. The rate of fading of the test specimen was visually compared with that of the standard samples for determination of colourfastness rating. Blue wool standard fabrics used for such purpose were having number ISO 105: BO1C LFS1 – LFS8.

Assessment of Colourfastness to Rubbing: This was determined employing a Crockmeter following the method prescribed in IS: 766-1984. For such purpose, dyed fabric sample was placed on the instrument and was rubbed with a piece of white fabric. The white piece of fabric having similar construction as that of the dyed sample and was mounted on the tip of a finger of 900 g weight which moved to and fro along a track length of 10 cm. The test piece was subjected to the action of such rubbing for 10 cycles in each case, where one complete to and fro movement of the finger over the track constituted one cycle. The staining on adjacent fabrics was rated between 1–5 using five step grey scale (including half-step) for evaluating staining, where a rating of 5 indicates excellent and a rating of 1 indicates very poor fastness properties. The grey scale used for assessing staining was made in accordance with International Standard Organization (ISO) and was having the number ISO 105-A03:1993.

RESULTS AND DISCUSSION

Data for colourfastness to light, wash and rubbing of cotton fabric dyed with *Indigofera tinctoria* are presented in Table 1. From the table it is observed that Indigo exhibits excellent fastness to washing, light and rubbing. The dye is applied in the soluble leuco form but once it is inside the fibre the dye gets oxidized to the insoluble form and getting firmly held by the fibre resulting excellent wash and light fastness properties whereas excellent rubbing fastness property of this dye when applied on cotton indicates very little deposition of the colourant on the surface of the fabric at the end of the dyeing process.

**Table 1: Colourfastness to light, wash and rubbing for cotton fabric
dyed with *Indigofera tinctoria***

Natural Dye	Mordant	Light fastness	Rubbing fastness	Wash fastness
<i>Indigofera tinctoria</i> (Indigo)	Nil	6	4-5	4-5

CONCLUSION

In recent years the demand for natural dyed eco-friendly hand batik on cotton fabric is gaining momentum all over the world especially in European market due to the fast changing fashion trend. Today's artists and designers constantly developing innovative areas for expression and also stimulating new approaches to textile art. Indigo batik also known as blue batik is one of the latest trends in batik. Classic batik patterns coloured by attractive blue shades offers a different beauty of batik art and is capturing tremendous attention and being explored, updated and combined in highly imaginative ways.

Fashion designers, manufacturers and retailers are busy developing 'green' ranges for people. Eco-friendly natural dyed garments have scorched the ramps as fashion designers have rediscovered the beauty in natural dyes. However, the mass-market clothes are yet to get touched by natural dyes. The retailers are yet to display

and sell natural dyed ranges in their stores. The manufacturers, in spite of seeing the hi-fashion natural dyed garments are restricted to use natural dyes in production due to some limitations.

In view of good overall colourfastness properties of handloom cotton fabric dyed with *Indigofera tinctoria* (Indigo) the application method as described in the present article for creating design through resist techniques (batik) can suitably be used for producing value-added environment friendly apparel and other textile products made from handloom cotton fabric.

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Eco-friendly Printing with Vegetable Colour

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ABSTRACT

Eco-friendly fabric and clothing is the buzz words now-a-days. Designers, manufacturers and retailers are busy to develop 'green' product range for the mass market and the eco-fabric thrust has been identified as an area where consumers are prepared to seek out and pay for fabrics that have a 'green' element. Although the percent of the market place is small, the eco-friendly apparel market is definitely growing and the consumer pressure to make environmentally friendly products has had an impact on the textile and other industries. Today's consumer understands the value for money and therefore organic non-toxic products in every field have created a new horizon. Sustainable fashion can be best realized when people, production process and the environment are interconnected. Presently consumers are demanding for ecologically and social responsible processed textiles and companies are searching for tools to make their supply chains more sustainable. This growing consciousness about environmental preservations and control of pollution had renewed interest for use of natural dyes on textiles and it may provide an important alternative to petrochemical-based dyes in view of growing emphasis and globally nurtured concept of sustainable product and process.

In view of the above this article depicts the process of printing with some selected natural dyestuffs in presence and absence of some innocuous inorganic salts or mordants in a more scientific and technological manner making them higher performing and scope for producing value-added textiles in view. Since it is also the fundamental requirement that coloured textiles should withstand the conditions encountered during processing and subsequent usage and hence assessment of different colourfastness properties viz. washing, light and rubbing are also assessed and reported in this study.

Key Words: Colourfastness, Eco-friendly, Mordants, Natural dyes, Textile

INTRODUCTION

Textile printing is considered to be most versatile and important of the methods used for introducing colour and design to the textile substrates. It is the process of bringing together a design idea, colourants and textile substrate using a technique for applying the colourants with some precision. India has a rich heritage and mastered the art of decorating textile through dyeing and printing using natural colours [6, 10], but with the advent of synthetic dyes in the mid of nineteenth century and its subsequent commercialization the use of natural dyes for colouration of textile receded and the position continued to be the same until in the recent past consumers are demanding for ecologically and social responsible processed textiles and companies are searching for tools to make their supply chains more sustainable. This growing consciousness about environmental preservations and control of pollution had renewed interest for use of natural dyes on textiles and it may provide an important alternative to petrochemical-based dyes in view of growing emphasis and globally nurtured concept of sustainable product and process.

Silpa-Sadana under Visva-Bharati University is a premier institute working in the field of natural dyes on textiles. Studies related to application of some of the natural dyes on cotton, silk and wool fibres are available in

the literatures [25, 14-17], but very little scientific studies on printing with natural dyes have been reported [12-13]. Traditionally textile decoration techniques with natural colour involve (i) printing with natural dyes on the fabric either pre-treated with mordants or (ii) printing with mordants on the dyed fabrics. Those processes have their own limitations viz. time consuming, poor colourfastness to washing, difficult to use print paste containing metal salts in presence of gum after 2-3 hours, etc. Hence in order to overcome these shortcomings the process of printing with some selected natural dyestuffs in presence of some innocuous inorganic salts or mordants is conducted in a more scientific and technological manner making them higher performing and scope for producing value-added textiles in view. Since it is also the fundamental requirement that coloured textiles should withstand the conditions encountered during processing and subsequent usage and hence assessment of different colourfastness properties viz. washing, light and rubbing are also assessed and reported in this article.

METHODOLOGY

Materials

Cotton Fabric: Plain weave loom state handloom cotton fabric with yarns of 2/80^s Ne (15 tex) warp and 2/80^s Ne (15 tex) weft, having 260 ends/dm and 230 picks/dm and weighing 75 g/m² on the average obtained from Silpa-Sadana Emporium, Visva-Bharati, India were used in the present study.

Silk Fabric: Plain weave silk fabric with yarns of 04 tex warp and 12 tex weft, having 430 ends/dm and 210 picks/dm and weighing 50 g/m² on the average were also used in the study.

Chemicals: All the chemicals used in this study were either of laboratory reagent (LR) grade obtained from M/s Loba Chemie Pvt. Ltd., Mumbai, India, or of commercial grade obtained from local market.

Natural Dyes:

- a) *Rubia cordifolia* (Manjistha), *Acacia catechu* (Khayer), *Indigofera tinctoria*, (Indigo), *Punica granatum* (Pomegranate), *Terminalia chebula* (Haritaki), *Curcuma longa* (Turmeric), *Acacia arabica* (Babool), *Allium cepa* (Onion peel) and *Camellia sinensis* (tea) were used as natural dyes for printing purpose.
- b) *Coccus laccae* (Lac), *Curcuma longa* (Turmeric) and *Indigofera tinctoria*, (Indigo) were obtained from M/s ECO-N-VIRON, India, in paste form and were used without any further extraction, whereas *Rubia Cordifolia* (Manjistha), *Acacia catechu* (Khayer), *Terminalia chebula* (Haritaki) *Acacia arabica* (Babool), *Allium cepa* (Onion peel) and *Camellia sinensis* (Tea) either purchased or collected from local market were extracted using water as the solvent, filtered and filtrates were then used as colourant for the dyeing and printing purpose.

Methods

Desizing, Scouring and Bleaching: In order to remove size and other natural and added impurities from the loom state handloom cotton fabric, the latter was desized, scoured and bleached prior to dyeing and/or painting in the manner as described as follows - desizing of grey cotton fabric was performed using hydrochloric acid solution (4ml/l) at a temperature of 40°C for 2 h at a fabric to liquor ratio of 1:20 (w/v). The desized cloth was washed thoroughly using hot water, which was followed by a cold wash prior to the conventional process of combined scouring and bleaching. Combined scouring and bleaching treatment of the desized cotton fabric was performed by conventional tub method. In this method, a solution was made with sodium hydroxide (3%), sodium carbonate (2%), anionic detergent (0.5%), Turkey Red Oil (1%) and sodium meta-silicate (2%) and the liquor was heated up to a temperature of 60°C. At this temperature the desized fabric was immersed into the solution and boiled for 2 h. At the time of boiling hydrogen peroxide solution (2%) was added in two installments and the process was further continued for another 1 h. The scoured and bleached fabric was then washed thoroughly with hot water, followed by cold wash and neutralized with dilute acetic acid, washed again with cold water and finally dried in air.

Degumming of Silk: In order to remove silk gum from the loom state silk fabric, the latter was degummed at

90°C for 1.5 hours in an aqueous solution containing olive oil soap (6g/l) and sodium carbonate (2g/l) at a fabric-to-liquor ratio of 1:20 (w/v) in a thermostatically controlled open bath beaker dyeing machine. Bleaching of the degummed silk samples was performed using a solution containing hydrogen peroxide (0.9%), non-silicate stabilizer (0.15%) and sodium carbonate (0.1%) at a fabric-to-liquor ratio of 1:20 (w/v) in a thermostatically controlled open bath beaker dyeing machine. Degummed and bleached fabric was washed thereafter at 70°C for 10 minutes, cold washed and finally dried.

Extraction of Natural Dyes: Aqueous solution of natural dyes viz. *Rubia cordifolia* (Manjistha), *Acacia catechu* (Khayer), *Terminalia chebula* (Haritaki), *Acacia arabica* (Babool), *Allium cepa* (Onion peel) and *Camellia sinensis* (Tea) were prepared by adding 100 g of dried and crushed vegetable matters to one litre of water. The mixture was stirred, heated and kept at boiling point for 60 min in a thermostat control beaker dyeing machine, allowed to stand for 15 min and finally filtered. Such filtrate was used for dyeing and printing after diluting it to the specified level, if required.

Printing with Natural Colour: Inorganic salts of specified dose level were mixed with the aqueous solution of natural colourants and kept for 15 min in order to form lake or complex. Appropriate amount of gum indulka was then mixed with the help of high speed stirrer to prepare the print paste. Printing on bleached or dyed textile was performed with this paste and the fabric was dried in air, followed by steaming at 102°C for 30 min and washed thoroughly with 2 g/l non-ionic detergent, followed by cold wash and finally dried in air. In case of Indigo, print paste was prepared by mixing Indigo with sodium nitrite and gum Indulka and the colour was developed in a bath containing 30 g/l hydrochloric acid and 20 g/l sodium chloride at a temperature of 60°C for 10 min.

Assessment of Colourfastness to Washing: Colourfastness to washing of cotton fabrics painted with natural dyes was assessed in a launder-o-meter in accordance with a method prescribed in IS: 3361-1984 (ISO-II).

Assessment of Colourfastness to Light: Colourfastness to light was assessed on a Mercury Bulb Tungsten Filament (MBTF) lightfastness tester following a method prescribed in IS: 2454 -1984.

Assessment of Colourfastness to Rubbing: This was determined employing a Crockmeter following the method prescribed in IS: 766-1984.

RESULTS AND DISCUSSION

Assessment of Colourfastness to Light, Washing and Rubbing

Data for colourfastness to light wash and rubbing of cotton and silk fabric printed with natural colourants as specified in presence of aluminium sulphate, ferrous sulphate and copper sulphate are presented in table 1 and table 2 respectively. Use of inorganic salts caused a good lightfastness rating of the printed substrates for all the natural dyes except *Curcuma longa* (turmeric). Turmeric is very much susceptible to light because they emit fluorescence^[9] and also from the structure of curcumin^[8] one can say that this dye is not forming metal-complex with the mordants and hence shows poor lightfastness and the samples are substantially faded within first 3-4 h of exposure time in MBTF fastness tester. The wash fastness of this dye on cotton is also moderate. Moderate wash fastness rating may be attributed due to weak dye fibre interaction and change in hue during washing. In spite of such drawbacks like poor light fastness, moderate wash fastness and pH sensitivity, turmeric remains the most favoured natural colour for obtaining bright yellow shades. On the other hand aluminium, iron and copper with their good complex forming ability^[11] can hold two or more suitable dye molecules together to form insoluble large complex, which enhanced the lightfastness of the dyed substrates^[9,11]. Such complexation of the coloured component within the fibre structure leads to polymerization of the dye molecules which is also responsible for improvement in lightfastness of the dyed substrates^[18-19]. The chromophore in those cases may be protected from photochemical oxidation by forming a complex with the metal. The photons sorbed by the chromophoric groups dissipate their energy by resonating within the ring and hence dye is protected.

Indigo exhibits excellent fastness to washing, light and rubbing. The dye is applied in the soluble leuco form but once it is inside the fibre the dye gets oxidized to the insoluble form and getting firmly held by the fibre.

The rating for colourfastness to washing of printed fabric except *Curcuma longa* (turmeric) in presence of aluminium sulphate, copper sulphate and ferrous sulphate commonly is found to be very good. Improvement in such colourfastness to washing rating may be the consequence of formation of insoluble large complex formed by the colouring component present in the colourants and the metal ions within the fibre.

A common excellent rubbing fastness property of the above natural dyes when applied on cotton and silk fabrics indicates very little deposition of the above colourants on the surface of the fabrics at the end of the printing process.

Table 1: Colourfastness to Light, Wash and Rubbing for Cotton Fabric Printed with Natural Dyes

Natural Dye	Mordant	Light Fastness	Rubbing Fastness	Wash Fastness
<i>Rubia Cordifolia</i> (Manjistha)	$\text{Al}_2(\text{SO}_4)_3$	3-4	4	4
<i>Coccus laccae</i> (Lac)	FeSO_4	5	4	4
<i>Coccus laccae</i> (Lac)	$\text{Al}_2(\text{SO}_4)_3$	4	4	4
<i>Acacia catechu</i> (Khayer)	CuSO_4	5-6	4	4
<i>Indigofera tinctoria</i> (Indigo)	Nil	6	4-5	4-5
<i>Terminalia chebula</i> (Haritaki)	FeSO_4	5-6	3	4
<i>Terminalia chebula</i> (Haritaki)	$\text{Al}_2(\text{SO}_4)_3$	4-5	3-4	4
<i>Curcuma longa</i> (Turmeric)	$\text{Al}_2(\text{SO}_4)_3$	1-2	3-4	3
<i>Camellia sinensis</i> (Tea)	$\text{Al}_2(\text{SO}_4)_3$	4-5	4	4
<i>Camellia sinensis</i> (Tea)	FeSO_4	4-5	4	4
<i>Acacia arabica</i> (Babool)	$\text{Al}_2(\text{SO}_4)_3$	4-5	4	4
<i>Allium cepa</i> (Onion Peel)	$\text{Al}_2(\text{SO}_4)_3$	4-5	4	4

Table 2: Colourfastness to Light, Wash and Rubbing for Silk Fabric Printed with Natural Dyes

Natural Dye	Mordant	Light Fastness	Rubbing Fastness	Wash Fastness
<i>Rubia Cordifolia</i> (Manjistha)	$\text{Al}_2(\text{SO}_4)_3$	4	4	4
<i>Coccus laccae</i> (Lac)	FeSO_4	5	4	4
<i>Coccus laccae</i> (Lac)	$\text{Al}_2(\text{SO}_4)_3$	4-5	4	4
<i>Acacia catechu</i> (Khayer)	CuSO_4	5-6	4	4
<i>Camellia sinensis</i> (Tea)	$\text{Al}_2(\text{SO}_4)_3$	5	4	4
<i>Camellia sinensis</i> (Tea)	FeSO_4	5-6	4	4

CONCLUSION

The eco-fabric thrust has been identified as an area where consumers are prepared to seek out and pay more prices to the fabrics that have a 'green' element. Although the percent of the market place is small, the eco-friendly apparel market is definitely growing and the consumer pressure to make environmentally friendly

products has had an impact on the textile and other industries. In view of good overall colourfastness properties of the colourants extracted from *Rubia cordifolia* (Manjistha), *Coccus laccae* (Lac), *Acacia arabica* (Babool), *Allium cepa* (Onion peel), *Acacia catechu* (Khayer), *Indigofera tinctoria*, (Indigo), *Punica granatum* (Pomegranate), *Terminalia chebula* (Haritaki) and *Camellia sinensis* (tea) one can give a crafty look to produce value-added eco-friendly printed fabrics used for apparel and home furnishing purpose.

Since most of the natural dyes are polygenetic, so there is a tendency to use all types of metal salts for achieving variety of shades without considering their toxicity impact on the environment. Hence before selecting the inorganic salts to be used as mordants it is essential to check their maximum permissible limit in the ultimate products for different Eco-marks. However there is no upper limit on aluminium, iron and tin and the upper limit on copper is also fairly high (50 ppm)^[7]. Hence the salts of these metals could safely be used for mordanting purpose. However, there quantities should be optimized so as to minimize the pollution load.

As compared to traditional process of printing the process as described in the article produces better results in terms of colourfastness properties, storage stability of paste, achieving clear white ground etc. But it is essential to maintain proper proportion of colourants and inorganic salts in the print paste. Excess of dye beyond the limit may cause tinting on the white ground and excess amount of inorganic salts than the desired level will increase in pollution load.

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Comparison of Dye Uptake of Cotton Fabrics using Environment Friendly Single Bath and Traditional Two Bath Wet Preparatory Processes

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ABSTRACT

In the entire world today there has been a growing awareness of the damage caused to the environment. The textile industry is one of the most pollution creating industry in terms of high solid waste, high Biochemical Oxygen demand (BOD)/ Chemical Oxygen Demand (COD) content in waste water, use of hazardous chemicals and dyes etc. Textile wet processing causes maximum damage to the environment, as vast quantity of water and chemicals are used here, and on completion of the process, residual dyes and chemicals together with water are discharged as effluents. In this paper, an attempt has been made by the researcher to use less quantity of water and chemicals by using the single bath wet preparatory process wherein scouring and bleaching process is carried out together in a one bath and as compared to the traditional two bath wet preparatory process on cotton fabrics of different GSM. The dye uptake of each fabric was also evaluated. Cotton fabrics of three different (GSM) are used. Qualitative analysis and physical tests like ends/picks, GSM, tensile strength, whiteness index and K/S value were carried out on untreated light weight, medium weight and heavy weight fabrics. These fabrics were further treated with two traditional methods of scouring and bleaching i.e. open vessel and autoclave method and with three different experimental recipes of single bath wet preparatory process and the treated fabrics were evaluated on the same physical tests. Further all the fabrics were dyed with Reactive High Exhaustion dye-Lemon yellow colour. The dye uptake was evaluated with the help of various fastness tests like wash fastness, contact fastness, perspiration fastness and rub fastness and K/S value. The results concluded that the medium weight fabric proved to be better than the other two fabrics. From the traditional methods of scouring and bleaching, Autoclave method was better and from the single bath wet preparatory process recipes, Recipe 2 gave good results.

INTRODUCTION

Environmental pollution is one of the most serious problems faced by the mankind today. It refers to undesirable change in the physical, chemical or biological characteristics of the environment, which causes harmful effects.

Toxic dyes and chemicals used in wet processing of textile goods come in contact with the skin and may cause damage to the health like skin cancer, allergy etc. Therefore, an important step in the preparation of eco-friendly textile is reduction of waste at source i.e. minimize the use of resources like water and substances that are exhausting. Thus, care has to be taken to eliminate, optimize use of unsafe chemicals, auxiliaries and dyestuffs

A fabric at its grey stage gives an unpleasant, non-appealing look. To get its aesthetic appeal the fabric is treated with series of wet pre preparatory processes. Once it undergoes these treatments it transforms itself from an unattractive look to an attractive look.

Grey cotton fabric needs processing namely desizing, scouring, bleaching and mercerizing. Generally each of these processes are carried out independently in the industry, involving large amount of chemicals, energy and

time ,leading to high amount of environmental pollution.

Desizing, scouring, bleaching and mercerization are the four basic, separate treatments that are conventionally employed for processing grey fabrics. Desizing removes the size used during weaving process. Scouring eliminates organic matters such as wax, pectins, fats etc. Bleaching deals with removal of colouring matter.

As the number of treatments increase, the quantity of chemicals, time and energy also increases directly. Therefore an effort has been made in the study to compare the traditional 2 bath method to the experimental single bath wet preparatory process and also compare its dye uptake.

AIMS AND OBJECTIVES

To evaluate the dye uptake of cotton fabrics, using two bath and single bath wet preparatory processes.

- 1) To compare between the two bath and single bath wet preparatory process.
- 2) To study the dyeability and fastness properties of the cotton fabrics in relation to the Grams per Square Meter (GSM)

METHODOLOGY

Methods

Preparatory Process

1. Two Bath Process

- a) *Open Vessel Method:* In this process scouring and bleaching process was carried out in two different baths.
 - *Scouring:* In a vessel, add water according to the material to liquor ratio. Add 1%, sodium hydroxide and 0.1% nonyl phenol ethylene oxide condensate (non-ionic wetting agent). Put fabric into the vessel and cook it for 4 hours. After treatment take off the fabric from the vessel, wash the fabric with hot water for 5 times and then with cold water for 5 times. Neutralize the fabric with 0.1% Acetic Acid. Further, wash the fabric with cold water and dry.
 - *Bleaching:* Fabric, sodium silicate, Caustic soda, Hydrogen Peroxide, Na_2SiO_3 (Sodium Silicate) - 2-4 %, Caustic soda- 0.7-2.0 %, H_2O_2 - 2-3 %. Keep the fabric in the above solution for 30 minutes at 60°C. Raise the temperature to 70°C and keep the fabric for 1 hour, than raise the temperature to 90-95°C and keep the fabric in it for another 2 hours. Continue bleaching for more 30 minutes. Remove the fabric from the vessel wash with cold water thoroughly and dry.
 - *Autoclave Method (Two-bath Wet Process):* In this process scouring and bleaching process was carried out in two different baths.
 - *Scouring:* In an Autoclave, add water according to the Material to liquor ratio. Add 1%, Sodium Hydroxide and 0.1% Auxipon (Non- ionic Wetting Agent). Maintain the pressure at 15 lbs for 4 hours. After treatment take off the fabric from the Autoclave, wash the fabric with hot water for 5 times and then with cold water for 5 times. Neutralize the fabric with 0.1% Acetic Acid. Further, wash the fabric with cold water and dry.
 - *Bleaching:* Fabric, Na_2SiO_3 (Sodium Silicate) - 2-4 %, Caustic soda- 0.7-2.0 %, H_2O_2 - 2-3 %.Keep the fabric in the above solution for 30 minutes at 60°C. Raise the temperature to 70°C and keep the fabric for 1 hour, than raise the temperature to 90-95°C and keep the fabric in it for another 2 hours. Continue bleaching for more 30 minutes. Remove the fabric from the vessel wash with cold water thoroughly and dry.

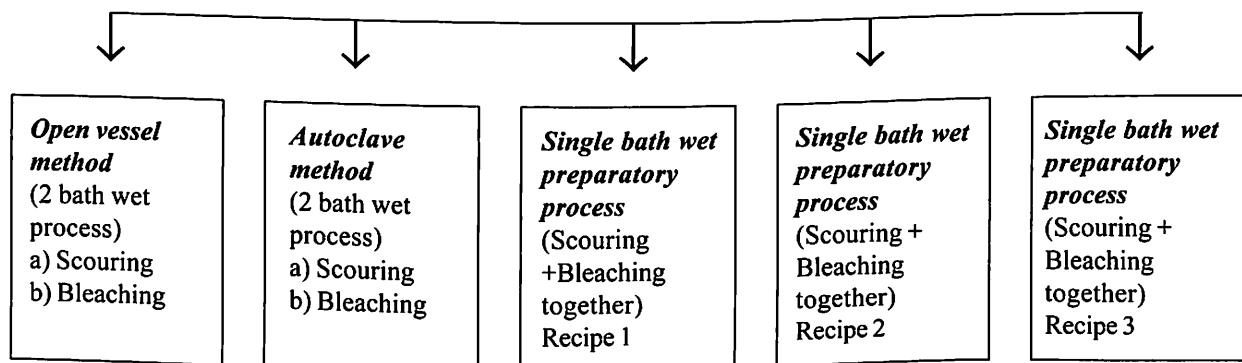
2. Single-bath Process of Scouring and Bleaching Together

- *Recipe I:* Material to liquor ratio - 1: 30, Sodium Hydroxide - 0.5 %, Sodium Silicate - 1 %, nonyl

phenol ethylene oxide condensate (wetting agent) - 0.5 %, Hydrogen Peroxide - 1 %. Take a vessel, add water according to the material to liquor ratio. Solution of Sodium Hydroxide, Sodium Silicate and Nonyl phenol ethylene oxide condensate (Non ionic wetting agent) was prepared and added into the vessel. Fabric was then put into the vessel and boiled for 40 minutes. Hydrogen peroxide was added and boiling was continued for another 10-20 minutes. The fabric sample was taken out from the solution bath and washed thoroughly with hot water followed by cold water. Then it was neutralized by keeping the fabric in 0.1 % of Acetic Acid for 5 minutes. Finally washed the fabric with water and dried.

- *Recipe 2:* Material to liquor ratio - 1: 30, Kleanox PSF (Scouring agent) - 1 %, Caustic Flakes - 3 %, Hydrogen Peroxide - 2.5 %, Sodium Meta Silicate - 0.3 %, H_2O_2 Stabilizers Zystab C - 1/4th of H_2O_2 . Take water in a vessel according to the material to liquor ratio, add the above chemicals to the vessel and raise the temperature to 90-98°C and put the fabric in it. Cook the fabric in it for 45-60 minutes. Remove the fabric from the vessel. Wash thoroughly with cold water and dry.
- *Recipe 3:* Material to liquor ratio - 1: 30, Kleanox PSF (Scouring agent) - 2 %, Caustic Flakes - 5 %, Hydrogen Peroxide - 2.5 %, Sodium Meta Silicate - 0.3 %, H_2O_2 Stabilizers Zystab C - 1/4th of H_2O_2 . Take water in a vessel according to the material to liquor ratio, add the above chemicals to the vessel and raise the temperature to 90-98°C and put the fabric in it. Cook the fabric in it for 45-60 minutes. Take off the fabric from the vessel. Wash with water and dry. Dyeing is the next step after the wet preparatory process is carried out on the three fabrics. Exhaust method of dyeing is used and Reactive High exhaustion dye - Lemon yellow colour was used. After Dyeing, evaluation of the dye uptake by the fastness tests like Wash fatness, Rub fastness, Perspiration fastness, Contact fastness and the physical properties were evaluated.

Dyeing of the Treated Fabrics



RESULTS AND DISCUSSION

In this research, cotton fabrics of 3 different GSM are used. The fabric undergoes different methods of wet processes and further dyeing takes place. The fastness of these fabrics is also being evaluated.

Identification of Fibers

Identification of fibers was done by qualitative test methods like burning test, microscopic test and solubility test on all the three cotton fabrics. The inference confirms the presence of cotton in all the three different GSM of cotton fabrics.

Fabric Count (Ends/ Picks)

With the help of a pick glass, the number of warp per inch and number of weft per inch in light weight fabric, medium weight fabric, and heavy weight fabric were counted. This test was carried out at the untreated stage and after the treatment of different methods of scouring and bleaching, and after dyeing. It was observed that the fabric count of the treated light weight fabric increased for all method of scouring and bleaching whereas

the count of treated medium and heavy weight fabric showed a slight change as compared to the untreated fabrics. The count of all the three fabrics after dyeing showed a minor difference.

Table 1: Physical Characteristics of Untreated and Treated Cotton Fabric

Fabric (Cotton)	Untreated	Ends / Picks				
		After Treatment				
		Open vessel	Autoclave Method	Single Bath (Recipe-1)	Single Bath (Recipe-2)	Single Bath (Recipe-3)
Light Weight	34 x 37	44 x 39	42 x 39	41 x 35	41 x 36	41 x 36
Medium Weight	33 x 31	33 x 32	31 x 32	32 x 32	33 x 32	33 x 32
Heavy Weight	31 x 32	33 x 32	30 x 30	32 x 32	31 x 31	33 x 32

Grams per Square Meter (GSM)

GSM cutter is used to evaluate the weight of the fabric. The evaluation was carried out at the untreated stage and after undergoing the different methods of scouring and bleaching. The light weight fabrics showed increase in GSM in all the five methods of scouring and bleaching. The increased in GSM is due to the fact that the warp and weft yarns may have come close to each other. Single bath wet preparatory process (Recipe 2) proved to be better.

Table 2: GSM of Untreated and Treated Cotton Fabric

Fabric (Cotton)	Untreated	GSM				
		After Treatment				
		Open vessel	Autoclave Method	Single Bath (Recipe-1)	Single Bath (Recipe-2)	Single Bath (Recipe-3)
Light Weight	0.637	0.810	0.753	0.796	0.818	0.908
Medium Weight	1.007	0.960	0.990	0.996	1.020	0.985
Heavy Weight	1.504	1.469	1.390	1.452	1.602	1.573

Tensile Strength

Using the ASTM method of breaking force evaluation, the strength parameter was evaluated at the untreated stage and after undergoing the different wet methods of scouring and bleaching. Strength values are calculated in Newton. Among the traditional wet process, the Autoclave method show good results. Medium weight fabrics show the highest values in most of the different wet processes used. The single bath wet preparatory process (recipe 2) gave good results amongst all the other.

Whiteness Index

Whiteness index is carried out using a spectrophotometer. The evaluation was carried out at the untreated stage and after undergoing the different methods of scouring and bleaching. The autoclave method was the best amongst all the other wet processes. Among the traditional wet process, the Autoclave method show great results. Medium weight fabric gave better reflective values than the other two fabrics.

K/S Value

Like whiteness index, K/S value is also carried out using a spectrophotometer. The evaluation was carried out at the untreated stage and after undergoing the different methods of scouring and bleaching. The Single bath

wet preparatory process (Recipe 2) method was the best amongst all the other wet preparatory processes. Among the traditional wet process, the Autoclave method show great results. Light weight fabric gave better reflective values than the other two fabrics.

Table 3: Whiteness Index of Untreated and Treated Cotton Fabric

Fabric (Cotton)	Untreated	Whiteness Index				
		After Treatment				
		Open vessel	Autoclave Method	Single Bath (Recipe-1)	Single Bath (Recipe-2)	Single Bath (Recipe-3)
Light Weight	-15.944	63.875	63.948	56.439	36.652	45.150
Medium Weight	2.342	69.703	74.875	69.060	49.381	51.953
Heavy Weight	0.240	70.899	72.117	67.241	38.696	47.986

Table 4: K/S of Untreated and Treated Cotton Fabric

Fabric (Cotton)	Untreated	K/S Value				
		After Treatment				
		Open vessel	Autoclave Method	Single Bath (Recipe-1)	Single Bath (Recipe-2)	Single Bath (Recipe-3)
Light Weight	0.5247	0.0538	0.0363	0.0665	0.1217	0.0975
Medium Weight	0.2994	0.0220	0.0210	0.0322	0.0717	0.0649
Heavy Weight	0.3307	0.0197	0.0230	0.0286	0.0889	0.0706

Dyeing

Cotton fabrics were dyed with exhaust dye method of dyeing. The fabrics were dyed with reactive High Exhaustion dye- Lemon yellow color. The samples were tested for its various fastness properties like wash fastness, contact fastness, perspiration fastness and rub fastness. A pilot study was conducted in which all the fabrics of all different methods used showed excellent fastness properties.

Table 5: K/S of Untreated and Dyed Cotton Fabric

Fabric (Cotton)	Untreated	K/S Value				
		After Dyeing				
		Open vessel	Autoclave Method	Single Bath (Recipe-1)	Single Bath (Recipe-2)	Single Bath (Recipe-3)
Light Weight	0.0538	2.5706	3.3113	3.1521	3.8991	3.8379
Medium Weight	0.0220	1.9137	2.5960	2.7004	3.7989	3.2988
Heavy Weight	0.0197	1.9036	2.5527	2.3295	3.6427	3.6515

CONCLUSION

Cotton fabrics were then undergone 5 different methods of scouring and bleaching. Two traditional methods were used Open vessel method and Autoclave method. The single bath wet preparatory process included 3

different recipes. On the basis of ends/ picks, GSM, tensile strength, whiteness index, K/S value results the following results were observed. The cotton fabrics were further dyed and the fastness properties were evaluated. It can be concluded that, from the traditional method of scouring and bleaching, the autoclave method proved to be better than open vessel method because it saves time and energy as well as it shows better results in terms of physical tests and fastness properties compared to the open vessel method. From the single bath wet preparatory process, Recipe 2, shows better results on physical tests and fastness properties, followed by Recipe 3 and lastly, Recipe 1. The traditional method of scouring and bleaching leads to high effluent waste and use of water, chemicals, energy, etc. hence, it can be concluded that single bath wet preparatory process is a better option.

Amongst the three different fabrics of cotton, the medium weight gave the best result, followed by heavy weight and then light weight. The medium weight fabric gave good results after undergoing different wet preparatory processes on the parameters like ends/picks, GSM, tensile strength, whiteness and K/S values.

For the industrial use, for single bath wet preparatory process (recipe 2) is advantageous for light weight fabrics.

For the medium weight fabrics, single bath wet preparatory process (recipe 2) can be used from the three recipes and for heavy weight fabrics (recipe 1) can be used. Autoclave method can be used for all the three fabrics from the traditional method for industrial purpose

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Eco Finished Under Arm Pads

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ABSTRACT

Technology need to support the sustainability of ecology but the use of non biodegradable chemicals and materials is adversely affecting the ecosystem. With the busy life style and urbanization, the generation of sweat and bacteria's is causing rashes and health problems to common man. The use of deodorants and perfumes and their disposals were environmental threatening; also microbes are getting resistance to conventional antimicrobial agents. As more medicinal plants were blessed with phytochemical's, which are biodegradable and eco-friendly they can be extracted for imparting eco-finishes to the fabrics, which is a safe alternative than harmful chemicals. Keeping this in view the present study is on the invention of a novel article of manufacturing an armpit perspiration absorbent pad using bamboo spun laced fabric treated with cassia auriculata flower extract. The cassia auriculata treated fabric was evaluated for its phytochemical analysis and antibacterial activity. After observing the zone of inhibition the parameters such as time, temperature and concentration for finishing was optimized and developed into an underarm pad. Then the developed underarm pad was evaluated for wear study and its microbial count was recorded. One of the principal objects of the invention is to provide an efficient inexpensive eco friendly antibacterial treated disposable and comfortable under arm perspiration absorbent pads.

Key Words: Eco-finishing, Antibacterial activity, Cassia auriculata, under arm pads.

INTRODUCTION

The empowerment of women from housewife to a complete professional has naturally increased the "active" working hours in a day. Being a tropical country, Indian women are more prone to perspiration and odour. The upper garments like jackets, blouses and coats are usually close to underarms. The release of sweat from their body to textiles will create an ambient condition for micro-organisms to grow and cause rashes and health problems to them. This can be controlled by using antimicrobial treated, deodorized underarm absorbent pad. As synthetic antimicrobial agents are non-biodegradable and cause health hazards. The invention of eco-friendly antimicrobial agents is need of the hour. Medicinal plants, which are blessed with lot of phytochemical's can act as best eco-friendly antimicrobial agents against pathogenic bacteria's.

Thus the objective of this study was to determine the antibacterial activity and phytochemical profile of flower extracts of *Cassia auriculata*, optimization for finishing on the fabric and to develop into an antibacterial treated underarm absorbent pad. Studies on the antibacterial activity of ethanol extract of dry flower of *Cassia auriculata* was conducted using agar diffusion method. The microorganisms used include *Staphylococcus aureus* and *Escherichia coli*. The maximum activity was observed against both organisms. Presence of phytochemicals such as tannins, phlobatannins, glycosides, saponins, flavonoids, anthraquinones, quinones and phenols were observed. The growth of micro organisms was found to be reduced when compared to the untreated underarm pads.

METHODOLOGY

Materials

Collection of Source for Extraction: The flower was collected from the nearby *Cassia auriculata* plant and washed thoroughly in soft water to remove the extraneous matters and dried in shade for 2-3 days and then powdered.

Selection of Solvent: Usually herbal extraction was carried out with aqueous, acidic, alkaline and with alcoholic solvents. To find maximum effectiveness of the antibacterial activity, the flowers were extracted with water and ethanol solvents. The solvent which shows the maximum activity was selected to extract the bioactive compounds from the flower.

Extraction of the Bioactive Compound: In hot continuous Soxhlet extraction method, the finely ground crude sample was placed in a porous “thimble” made of strong filter paper, which was placed in the chamber of the Soxhlet apparatus. The extracting solvent in flask was heated and its vapors condense in condenser. The condensed extractant drips into the thimble containing the crude sample and extracts it by contact. When the level of liquid in chamber rises to the top of siphon tube, the liquid contents of chamber siphon into the flask. This process is continuous and was carried out until a drop of solvent from the siphon tube does not leave residue when evaporated. The advantage of this method is that large amounts of drug can be extracted with a much smaller quantity of solvent^[3-4]. Hence following the above mentioned method *Cassia auriculata* flower extract was extracted.

Phytochemical Screening: The extract was subjected to tests for secondary metabolites such as tannins, phlobatannins, glycosides, saponins, flavonoids, anthraquinone, quinone and phenols. The tests were carried out using standard methods and analysis^[1, 2, 6 & 9]. These test proved the presence of tannins and phenols which has antimicrobial property. Therefore the *Cassia auriculata* flower extract was applied on the fabric.

Selection of Micro-Organisms: Sweat is broken down into fatty acids that have unpleasant, pungent odors which give rise to smelly armpits and feet. The moist areas of the skin are home to the largest number of bacteria. *Staphylococcus* and *E.coli* is the most common and numerous species of bacteria found on human skin. Hence for the study the *Staphylococcus* and *E.coli* bacteria were selected.

Selection of Material: Bamboo a cellulose fiber is considered as a true sense of natural and environmental fiber. It has properties such as well-breathable, water absorbing, long-wearing and easy-dying, as well as the efficacies of germproof, bacteriostasis, killing mites and deodorization. Spunlaced fabrics show high drape, softness and comfortable handle because more fiber entanglement leads to increased strength. Considering this bamboo spun laced fabric were selected for the study.

Methods

Optimization of the Finish Process Conditions: Time, temperature and concentration are the three major factors influencing the antimicrobial activity against bacteria and fungi organisms. Thus to optimize the finishing process conditions the fabric was treated at different time intervals of 1, 3 and 5hrs, at different temperatures of 40°C and 50°C and at concentrations of 0.5g, 1.0g and 1.5g respectively. After finishing the antibacterial activity was noted for each sample and the maximum zone of inhibition formed was selected for the further study.

Table 1: Optimized Parameters for Finishing of Bamboo Spun Laced Fabric

Parameters	Coded levels
Time	1, 3 and 5 hrs
Temperature	40°C and 50°C
Concentration	0.5, 1.0 and 1.5 g of the extract

Application of Extract on the Fabric: Time, temperature and concentration of the extract were optimized and the maximum zone of inhibition was appeared in 1.0g of concentration kept at 50°C for 5 hrs. Hence these parameters were considered as the best parameter for the study. The treated fabric sample was evaluated for its antibacterial activity.

Developing an Antibacterial Treated Underarm Absorbency Pad: After finishing the bamboo spun laced fabric with *Cassia auriculata* flower extract it was then constructed into an underarm absorbent pad and its antibacterial count was determined after wear study.

Evaluation of the Treated Sample

The objective evaluation such as tensile strength, elongation, thickness, stiffness, fabric weight and absorbency of the finished fabric was observed. The microbial count of the underarm pad was also evaluated after wear study.

Antimicrobial Assessment Test Methods: The antibacterial activity of finished and unfinished samples was evaluated by qualitative methods (AATCC 147,AATCC 30)^[5] of agar diffusion test for bacteria was done and the zone of inhibition formed was recorded.

RESULT AND DISCUSSION

Agar Diffusion Test

The antimicrobial activity of *cassia auriculata* flower extract was carried out in all optimized conditions. The following table shows the zone of inhibition formed for *S.aureus* and *E.coli* test bacteria.

Table 2: Zone of Inhibition for *S.aureus* and *E.coli* at Different Concentration, Temperature and Time

Concentration (g)	Temperature (°C)	Time (hrs)	Zone of inhibition (mm)	
			<i>S.aureus</i>	<i>S.aureus</i>
0.5	40	1	4	5
		3	4	6
		5	5	6
	50	1	3	6
		3	5	12
		5	12	3
1.0	40	1	4	8
		3	4	6
		5	3	10
	50	1	WF	3
		3	15	7
		5	16	15
1.5	40	1	5	4
		3	5	5
		5	6	7
	50	1	WF	4
		3	3	3
		5	17	18

WF- Weekly Formed

Table 2, shows zone of inhibition formed in various optimized conditions. The fabric treated with 0.5 g of the flower extract kept at 50 °C for 5 hrs shows the maximum zone of inhibition of about 12mm for *S.aureus* and for *E.Coli* in 3 hrs. Similarly the greatest inhibitory effect was observed in 1.0g of concentration against *Staphylococcus aureus* with a zone of inhibition of 16 mm diameter followed by *Escherichia coli* with a zone of inhibition of 15 mm diameter. Also it was clear from the table that the increases in the concentration of the flower extracts and increase in time and temperature shows an increase in the diameter of the zone of inhibition of about 17 and 18mm respectively.

Phytochemical Screening Test

The phytochemical analysis (Table 3) shows the presence of tannins, phlobatannins, glycosides, saponins, flavonoids, anthraquinons, quinons and phenols. These compounds are found to be biologically active and therefore, aid in the antimicrobial activities. The secondary metabolites exert antimicrobial activity by different mechanisms. Flavonoids have also exhibit wide range of biological activity such as anti microbial, antioxidant, anti inflammatory and anti- allergic [7-8].

Table 3: Phytochemical Screening Test

Phytochemical Components	Cassia auriculata Flower Extract
Tannin	+
Phlobatannins	+
Glycosides	+
Saponins	+
Flavonoids	+
Anthraquinones	+
Quinone	+
Phenols	+

Objective Evaluation of the Treated and Untreated Fabric

The tensile strength, elongation, thickness and stiffness of the treated fabric show only slight increase when compared with the untreated fabric. The absorbency of the treated fabric was found to have decreased mean value of 39.6 when compared to the original which has 44.6 respectively. The decrease in the value illustrates that the treated fabric has very good absorbency. Also the weight of the treated fabric show increase in mean value of about 2.53 than the original fabric which has 1.47 respectively. Thus the increase in weight of the fabric reveals that the flower extract of *Cassia auriculata* was very well absorbed by the finished fabric.

Table 4: Objective Evaluation of the Treated and Untreated Fabric

Samples	Tensile strength (lbs)	Elongation (inch)	Thickness (mm)	Stiffness (inch)	Fabric Weight (gm)	Absorbency (Sec)
Original	42.2	2.54	0.516	2.56	1.47	44.6
Treated	43.0	2.73	0.661	2.292	2.53	39.6

Evaluation of Underarm Absorbent Pads

The constructed armpit pads were distributed to ten women's working in different areas. They were asked to use the pads for a period of 8 to 10 hours. Later they were asked to remove it and put into a zip lock bags which were tested for bacterial count. The developed underarm absorbent pad was evaluated quantitatively using turbid meter test method. The test result reveals that the treated underarm pad shows decrease in turbidity of

2.4 NTU than compared to the original fabric which shows 4.4 NTU. Thus it is clear that the growth of micro organisms in the treated fabric was reduced after treated with the flower extract.

CONCLUSION

The *cassia auriculata* flower extract finished fabric was proved to be effective. The agar diffusion method and phytochemical analysis tests also reveals the same. Thus modern technologies have opened new doors to use the herbs in a more effective manner. It can also boost Indian export market by showcasing the new avenues in medical textiles.

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Conversion of Jute Stick into Biomass Energy: A New Approach for Agricultural Waste Management

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ABSTRACT

Energy, essential for development, is often in short supply in countries with the greatest biomass resources. Jute, the "Golden fibre" has been an important cash crop for the cultivators of the eastern zone of India, and is also a valuable exchange earner for the country. Jute stick, the agro-waste constitutes about 40 percent of the green plant with an annual production of 4.0 million tones. Traditionally, it is used as a fuel for cooking in rural community which leads to enormous air pollution and burning with poor thermal efficiency due to low bulk density. An attempt has been made to densify jute sticks for improving its thermal efficiency through charring and pelletization processes. The pellets developed were characterized for their energy values and other fuel parameters. The effect of binders at different concentrations on density of pellets was also evaluated.

In TGA analysis, the jute stick pellets recorded exothermic peaks at 455.5°C and 547.2°C and endothermic peak at 1404°C. Corresponding mass loss is 77.70%. Specific surface area is measured through Multi-Point BET plot and was found to be 1.428 m²/g. The calorific value and carbon content of jute stick pellet was found to be 4448 Kcal/Kg and 58.80% respectively.

INTRODUCTION

Energy is the key input for technological, industrial and socio-economic development of a Nation. Major energy sources of the country can be grouped in two main classes; conventional and non-conventional [1]. Conventional energy sources are petroleum, natural gas, coal and electricity. The non-conventional energy sources are fire wood, agricultural crop residues, cattle dung and others. The others include solar energy, wind energy and hydro power generation. However, among the non-conventional energy sources, agricultural biomass is the most dominant and promising one. Jute stick is one such agricultural waste having enormous potential as non-conventional energy source.

Availability and Constituents Analysis

Jute stick is a pale coloured, highly porous hence very light and voluminous, woody structure of the jute plant around which the fibres form skin or the bark [2]. The estimated amount of jute stick available in India per annum is about 4 million tones. Most of it is used for domestic purposes as fuel; temporary fencing, etc., whereas, a small fraction of it is used industrially [3]. Chemically jute stick is a lingo-cellulosic raw material, the analysis of which is given in Table 1.

Table 1: Chemical Composition of Jute Stick

Component	Percentage Fraction (%)
Holo-cellulose	72.70
Alpha-Cellulose	40.80
Pentosans	22.10
Lignin	23.50
Extractives	1.90
Ash	1.00

Energetic of Jute Stick

Considering the calorific value of jute stick as 4000 Kcal/Kg and that of coal as 4600 Kcal/Kg; mineral oil 10,000 Kcal/Kg; 1 Kg. of coal is equivalent to 1.15 Kg. of jute stick and 1 Kg of mineral oil is equivalent to 2.5 kg of jute stick. Hence, 4 million tones of jute stick can produce 3.47 million tones of coal & 1.60 million tones of mineral oil equivalent.

MATERIALS & METHODS

A Charring drum of size 110 mm x 800 mm was fabricated for charring purposes that is having an out let door with cloth/felt gasket. For collection of charcoal, A tray was placed beneath the outlet. A pellet making machine with the specifications viz. feed capacity 50 Kg/hr, screw diameter – 160 mm, screw length – 600 mm, orifice diameter – 30 mm, cutting length – 120 mm, power supply – 440 Volts was procured to prepare pellets after mixing with suitable binders. The Accessories of the Pellet machine includes the Mixer with 25 Kg/hr capacity running with 440 Volt three phase AC motor. Thermal analysis (TGA and DTA) of samples have been performed from 40°C to 1500°C @ 10°C/ min. Measuring instrument used was NETZSCH make STA 449C. Surface area of samples has been measured by BET method. Measuring instrument used was Quanta chrome make NOVA 4000e. For measuring carbon content the instrument used was LECO C 600 Carbon analyzer. Pore volume vs. pore size data was obtained. To study the effect of binders, four different types of binders viz. molasses, boiled rice water (rice starch), soil and cow-dung were used at 4 different concentrations (5%, 10%, 15% and 20%). The density was measured by Micromeritics Accupyc II 1340 GAS.

RESULTS AND DISCUSSIONS

The proximate composition of jute stick was evaluated before subjecting to charring and the values recorded are given below (Table 2.) along with the comparison with agro-residues.

Table 2: Proximate Analysis Values of Agro-residues

Agro-residues	Moisture Content (%)	Proximate Composition (Percentage)			Potential tar Forming Volatiles (%)
		Volatile Matter	Fixed Carbon	Ash Content	
Jute Stick	13.00	72.41	25.30	2.29	82.54
Wood Chips	12.50	74.85	23.44	1.71	83.57
Palm Seed	11.50	69.49	28.82	1.69	78.40
Rice Husk	12.50	60.00	23.43	16.57	81.37
Dhaincha Stick	13.00	68.96	27.02	4.02	83.58
Jute Caddies	13.00	68.96	16.68	14.36	81.13

Low PTFV: less than 25 %, Medium PTFV : 25 – 50%, High PTFV : above than 50%PTFV: Potential Tar Forming Volatiles

Jute stick was made into charcoal in the charring drum. The time of carbonization and yield were 1.5hr and 40.0% respectively (Figure 1). The char obtained was ground manually and mixed with binders at different concentrations and fed into the pellet machine^[4]. Four different types of binders based on their easy availability and use were selected for pellet making (Figure 2 & Figure 3)^[5]. The binders so used are molasses, boiled rice water (rice starch), soil and cow-dung at 4 different concentrations (5%, 10%, 15% and 20%).



Figure 1: Charcoal Making in Charring Drum



Figure 2: Feeding into the Pellet Machine



Figure 3: Preparation of Pellets

The FTIR spectra of jute stick and jute stick charcoal were studied and the spectral signature of different functional groups has been evaluated (Table 3 and Table 4).

Table 3: FTIR Spectra of Jute Stick

Peak No.	Position of Bands (cm^{-1})	Functional Groups	Intensity
1	3355	O-H stretching (H-bonded)	S
2	2900	C-H stretching in methyl and methylene	S
3	1736	C-O stretching in carboxyl and un conjugated beta ketone	Sh
4	1630-1635	H_2O molecules in non-crystalline cellulose	W
5	1593	Aromatic skeleton ring vibration	S
6	1455	C-H deformation and CH_2 bending	S
7	1190-1200	Phenolic H-O deformation	Sh
8	1030	Aromatic C-H plane of deformation	W

Table 4: FTIR Spectra of Jute Stick Charcoal

Peak No.	Position of Bands (cm ⁻¹)	Functional Groups	Intensity
1	3577	O-H stretching (H-bonded)	S
2	3308	O-H stretching (H-bonded)	S
3	2093	Alkyne mono-substituted Hydrogen bonded O-H stretching	Sh
4	852	Aromatic C-H out of plane deformation	Sh
5	652	O-H out of plane bending	S
6	600	O-H out of plane bending	S

The difference observed between jute stick and jute stick charcoal has been enumerated below

- a) The characteristic IR peak of jute stick at 1593, 1455, 1190 and 1030 cm⁻¹ is absent in jute stick charcoal
- b) The shoulder peak on 1736 cm⁻¹ C-O stretching in carboxyl and un-conjugated beta ketone is present in jute stick, whereas, shoulder peak for charcoal at 2093 due to Alkyne mono-substituted
- c) In jute stick charcoal three prominent peaks at 852, 652 and 600 are prevalent which are due to presence of aromatic C-H out of plane deformation, O-H out of plane bending and O-H out of plane bending at the charcoal component.

The variation of density of pellets with concentration for jute-stick pellets are shown in Figure 4 to Figure 7. The process parameters for making pellet were found optimum at 10-15% moisture content of charcoal mixture and binder concentration of 15%. Beyond 15% binder concentration, the density decreases [6]. The highest value of density was found in the case of soil as binder at 15% moisture content.

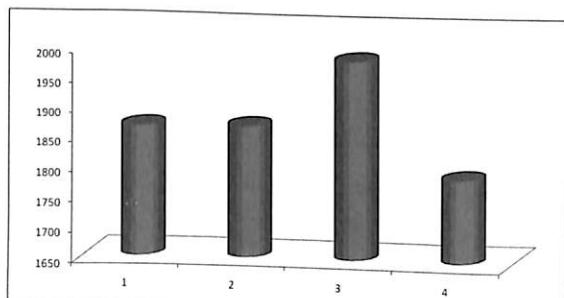


Figure 4: Variation of density of jute stick pellets with binder (cow dung) concentration
(Density varies from 1866- 1983 Kg/m³),
Values on X axis 1=5%, 2=10%, 3=15%
and 4=20%

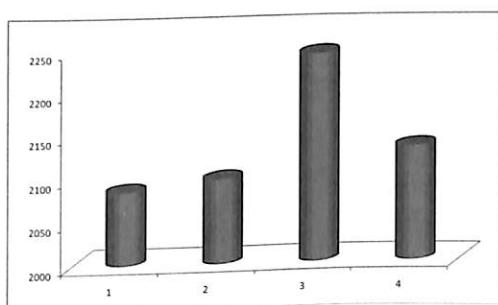


Figure 5: Variation of density of jute stick pellets with binder (soil) concentration
(Density varies from 2084 - 2241Kg/m³),
Values on X axis 1=5%, 2=10%, 3=15%
and 4=20%

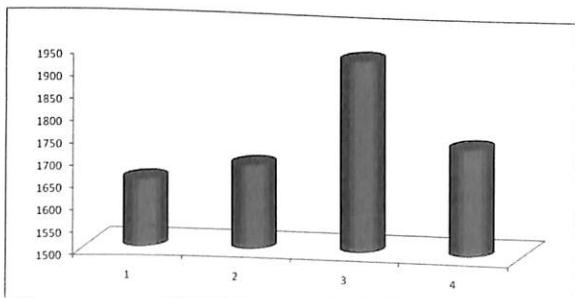


Figure 6: Variation of density of jute stick pellets with binder (molasses) concentration
(Density varies from 1652- 1933 Kg/m³),
Values on X axis 1=5%, 2=10%, 3=15%
and 4=20%

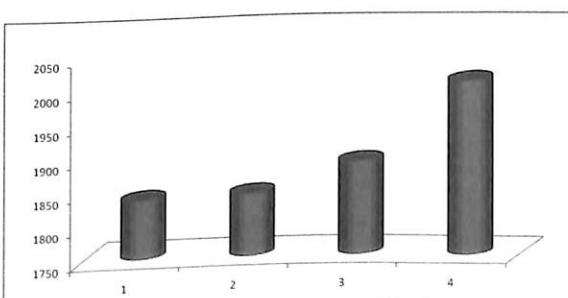


Figure 7: Variation of density of jute stick pellets with binder (rice gruel) concentration
(Density varies from 1842- 2004 Kg/m³),
Values on X axis 1=5%, 2=10%, 3=15%
and 4=20%

In TGA analysis, the jute stick briquettes recorded exothermic peaks at 455.5°C and 547.2°C and endothermic peak at 1404°C. Corresponding mass loss is 77.70%. Specific surface area is measured through Multi-Point BET plot and was found to be 1.428m²/g. The pore size distribution was also studied. The carbon content of jute stick pellet was found to be 58.80%. The results are shown in the graphs (Figure 8 to Figure 11) below:

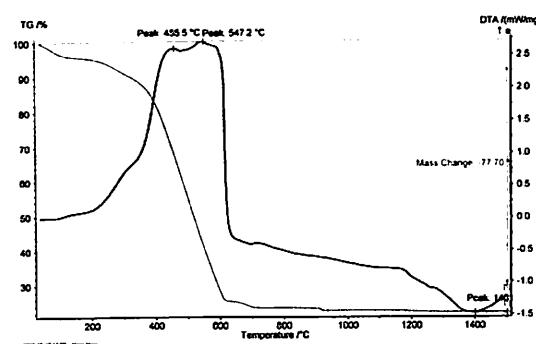


Figure 8: TGA and DTA Curves of Jute-stick Pellets

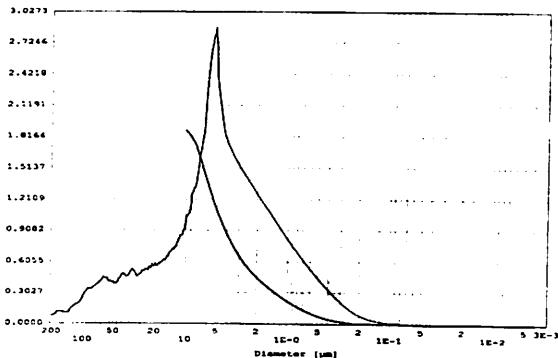


Figure 9: Pore Size Distribution of Jute-stick Pellets

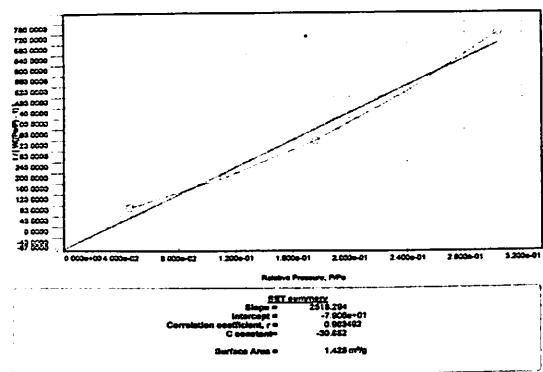


Figure 10: Multi Point BET Plot for Jute-stick Pellets

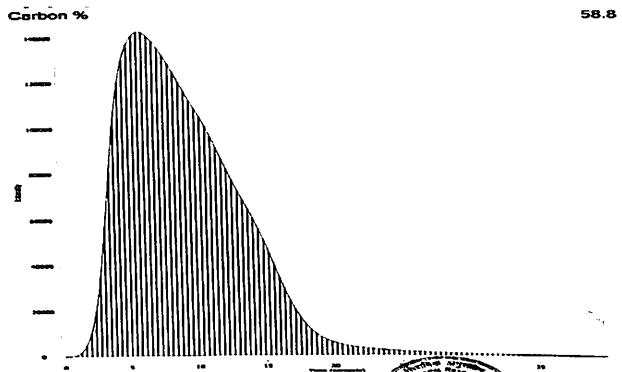


Figure 11: Carbon Content Plot for Jute-stick Pellets

The calorific value of jute stick pellets was found to be 4448 Kcal/Kg and the Energy benefit after subtracting the energy consumed was found to be 462.01 Kcal/Kg for jute stick.

CONCLUSION

Every year thousand tons of jute stick is burnt inefficiently in loose form causing air pollution. Handling and transportation of this agro-waste is difficult due to its low bulk density. This waste can provide a renewable source of energy by converting it into high density fuel pellets through charring and pelletization.

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Indian Almond Leaves as a Dye Source

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ABSTRACT

The non eco-friendliness behavior of the synthetic dyes has diverted the researches towards natural dyes. Much have been explored and concluded with positive results. Extraction of dye from vegetation which is otherwise waste is one of the upcoming areas of the research. In the present work, Indian almond leaves were used to extract dye for obtaining a color palette on cotton, jute and tussar silk. The fabrics were pre-mordanted and post mordanted with three metallic mordants i.e. alum, copper sulphate and ferrous sulphate at self pH for the development of color palette. The aqueous extractions of dye from the leaves were done in following condition: time of extraction (30 to 45 mins.), temperature (60° to 90°C), and amount of dye powder (3%). Dyed samples were tested for color yield using spectrophotometer to measure the K/S and CIE l*a*b* values and fastness (wash, light and rub) properties were tested using standard test methods. The color obtained from Indian almond leaves were on green-yellow quadrant of the color system and fastness ranged from moderate to excellent.

Key Words: Indian almond leaves, aqueous extraction, exhaust dyeing, Spectrophotometer analysis

INTRODUCTION

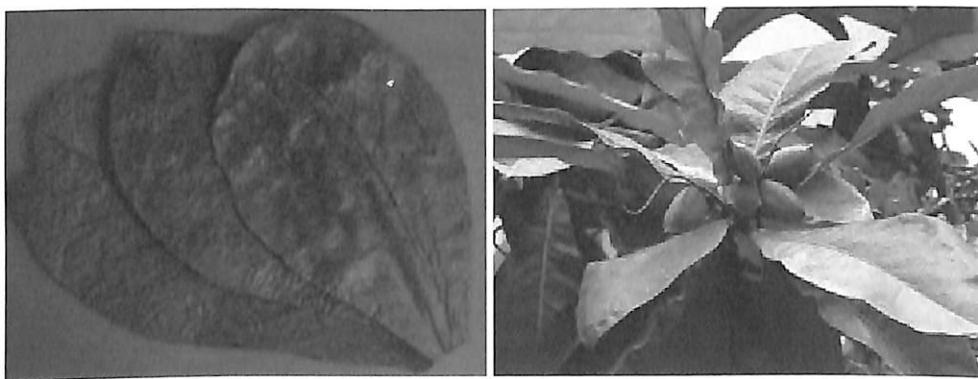
Natural dyes are the color obtained from renewable resources of nature such as plants and animal, although natural dyes from minerals of the earth are known. Use of natural dyes for coloration of textiles is practiced since 1000BC. After the synthesis of mauveine by William Henry Perkin in 1856 and its subsequent commercialization, the use of natural dyes receded and the position continued to be much the same till the recent past [3-4]. The growing consciousness about environmental preservation, control of pollution and conventional wisdom and belief regarding environment friendliness of natural dyes have renewed interest for the use of natural dyes for the coloration of textiles. In recent years, there is a trend to revive the art of natural dyeing owing to the following merits [7-9].

- a) Shades produced by natural dyes/colorants are usually soft, lustrous and soothing to the human eye.
- b) Natural dyestuff can produce a wide range of colors by mix and match system. A small variation in the dyeing technique or the use of different mordants with the same dye can shift colors to a wide range or create totally new colors.
- c) Natural dyestuffs produce rare color ideas and are automatically harmonizing.
- d) Unlike non-renewable basic raw materials for synthetic dyes, the natural dyes are usually renewable, being agro-renewable/ vegetable based and at the same time biodegradable.
- e) In some cases like Harda, Indigo, etc. the waste in the process becomes an ideal fertilizer for use in agricultural fields. Therefore, no disposal problem of the natural waste.

- f) Many plants thrive on wastelands. Thus wasteland utilization is an added merit of the natural dyes. Dyes like madder grow as host in the tea gardens. So there is no additional cost or effort required to grow it.
- g) This is a labour intensive industry, thereby providing job opportunities for all those engaged in cultivation, extraction and application of these dyes. Application of natural dyes has potential to earn carbon credit by reducing consumption of fossil fuel (petroleum) based synthetic dyes.
- h) Some of its constituents are anti-allergens, hence prove safe for skin contact and are mostly non-hazardous to human health.
- i) Some of the natural dyes are enhanced with age, while synthetic dyes fade with time.
- j) Natural dyes bleed but do not stain other fabrics, turmeric being an exception.
- k) Natural dyes are usually moth proof and can replace synthetic dyes in kids garments and food-stuffs for safety.
- l) Natural dyes are mostly non-substantive and must be applied on textiles by the help of mordants, usually a metallic salt, having an affinity for both the coloring matter and the fibre.

The binomial name of Indian Almond is *Terminalia catappa*. It is a large tropical tree in the leadwood tree family, Combretaceae that is native to the tropical regions of Asia, Africa, and Australia. The leaves contain several flavonoids (such as kaempferol or quercetin), several tannins (such as punicalin, punicalagin or tercatin), saponines and phytosterols. Due to this chemical richness, the leaves (and the bark) are used in different herbal medicines for various purposes. For instance in Taiwan, fallen leaves are used as an herb to treat liver diseases. The leaves may contain agents for prevention of cancers (although they have no demonstrated anticarcinogenic properties) and antioxidants, as well as anti clastogenic characteristics.

In the present study an attempt has been made to dye tussar silk, jute and cotton fabric with Indian almond leaves at self pH varying application of metallic mordants, and analyzing these samples in UV spectrophotometer to measure the K/S and CIE $l^*a^*b^*$ values and fastness (wash, light and rub) properties using standard test methods.



Materials and Methods

Locally available cotton (muslin), tussar silk and jute fabric were selected for the study. The selected fabric for the study was tested for their primary information of content, weave, count, weight per unit area and fabric thickness and given in Table 1.

All the fabrics were scoured using 2g/l of soda ash and 2g/l of detergent (non-ionic detergent in case of tussar silk) in a material to liquor ratio of 1:40. The fabrics were boiled in this solution for 30 minutes then cooled and rinsed in water to remove the traces of soap and dried in shade. The selected fabrics were subjected to hydrogen peroxide bleaching. Then the fabrics were mordanted with three metallic mordants namely alum, copper sulphate and ferrous sulphate. Pre- mordanting (mordanting before dyeing) and post mordanting (mordanting after dyeing) was done. Samples were dyed using open bath dyeing process.

Table 1: Preliminary Data of the Fabrics

Fabric	Fiber Content	Weave	Fabric Count (yards/sq.cm)		Weight per Unit Area (gms/sq.mt)
			Ends	Picks	
Cotton	100% cotton	Plain	37	35	930.8
Jute	100% jute	Plain	25	27	875.5
Tussar Silk	100% silk	Plain	42	44	33.24

Hydrogen Peroxide Bleaching: 1% (v/v) of hydrogen peroxide was mixed with 2gp/l of sodium silicate with the material liquor ratio 1:40. The cotton samples were dipped into this solution for 30 minutes at 50°C and then neutralized with 1% acetic acid for 5 minutes.

Dye and Chemicals: As a natural dye source, Indian Almond leaves was used. Leaves were dried in the shade and then powdered. In order to extract the dye, the dye was taken with the 3% concentration and was boiled for 30 minutes. The dye extract thus obtained was directly used for dyeing of the bleached samples. Alum (10% concentration), copper sulphate and ferrous sulphate (4% concentration) were taken as mordant. Both pre and post mordanting was carried out. For both the mordanting methods, calculated amounts of mordants were taken, mixed with water keeping the material to liquor ratio 1:40. The samples were kept in the mordanted solution for 30 minutes and then dyed in the dye bath.

Dyeing: The exhaust dyeing method was used. The dye baths were prepared with the requisite amount of dye, which was calculated on the basis of material to liquor ratio of 1:40. The pre mordanted samples and samples without mordanting were kept into the dye bath at room temperature. The temperature of the dye bath was increased to boil gradually and the dyeing continued for 1 hour. After dyeing, the pre mordanted samples were thoroughly rinsed and dried. For the post mordanting, samples were kept for mordanting immediately after dyeing, then rinsed and dried.

Measurement of K/S and CIE Lab Value: The dyed samples were assessed to find out K/S and CIE lab values using UV Spectrophotometer. For the analysis of fastness properties, the dyed samples were assessed for wash, rub and light fastness using laudero-meter, crockmeter and fade-o-meter respectively.

RESULTS AND DISCUSSIONS

Color strength, change in hue and shade of the dyed samples were compared with unmordanted and dyed (control) samples. The L*, a*and b* of the dyed samples were studied with the help of Computer Colour Matching Software. Color strength values (K/s) of the dyed samples were calculated using spectrophotometer as per standard procedure. L*value indicates Lightness- Darkness index of the sample. The L* value of pure white fabric is 100. The a* indicates Redness-Greenness index while b* indicates Yellowness-Blueness index.

Note for all the given tables below

Control C: Control sample

Sc & B: Scoured and bleached samples

Sc & B Pr: Scoured, bleached and pre-mordanted

Sc & B Po: Scoured, bleached and post-mordanted

Table 2: Shades of Indian Almond Leaves on Cotton fabric

S.N.	Samples	L*	a*	b*	c*	DL*	Da*	Db*	Dc*	K/s
1	Control C	50.68	6.55	31.55	32.23	-	-	-	-	29.34
2	Sc & B	56.49	4.09	26.99	27.30	5.80	-2.46	-4.55	-4.92	17.74
3	Alum									
	Sc & B, Pr	49.53	7.19	36.47	37.18	-1.52	0.36	4.95	4.92	26.97
	Sc & B, Po	60.29	1.22	28.32	28.35	9.61	-5.33	-3.87	-3.23	11.27
4	CuSO ₄									
	Sc & B, Pr	46.41	7.04	37.23	37.79	-4.26	0.48	5.56	5.57	38.65
	Sc & B, Po	53.76	4.58	27.21	27.59	3.07	-1.97	-4.34	-4.64	14.84
5	FeSO ₄									
	Sc & B, Pr	27.84	2.01	8.95	9.18	-22.84	-4.53	-22.84	-23.05	29.03
	Sc & B, Po	29.94	-0.22	4.69	4.69	-20.74	-6.77	-26.86	-27.53	34.14

On analyzing the results given in Table 2, it was observed that higher L* value was obtained with post mordanting method of alum (60.29) while lower L* value was obtained with ferrous sulphate pre-mordanting (27.84). Positive a* value showed that it contained red content with an exception of post mordanted sample of ferrous sulphate (-0.22). Positive b* value obtained with all the samples show the presence of yellow. It was observed from the table that the highest value for K/s was obtained on pre mordanted sample of copper sulphate (38.65) while post mordanted sample of copper sulphate showed the least K/s value (14.84).

From the results given in Table 3, it was observed that higher L* value was obtained with pre mordanted sample of alum (45.14), indicating that the sample was lighter than the control sample while lower L* value was obtained with ferrous sulphate pre-mordanting (16.64) indicating the sample was darker compared to control sample. The colors obtained have red and yellow content in their shade and it was concluded by the positive a* and b* values. Both the ferrous samples i.e. pre mordanted (89.76) and post mordanted (71.15) showed higher color depth.

Table 3: Shades of Indian Almond Leaves on Jute

S.N.	Samples	L*	a*	b*	c*	DL*	Da*	Db*	Dc*	K/s
1	Control C	36.63	8.33	22.94	24.42	-	-	-	-	24.48
2	Sc & B	38.04	8.10	25.31	26.57	1.41	-0.27	2.63	2.14	37.74
3	Alum									
	Sc & B, Pr	45.14	6.55	38.57	39.13	8.51	-1.82	15.63	14.70	25.63
	Sc & B, Po	42.98	6.38	26.54	27.08	6.35	-2.20	3.60	2.87	26.66
4	CuSO ₄									
	Sc & B, Pr	34.70	7.27	28.09	29.02	-1.92	-1.10	5.15	4.59	43.80
	Sc & B, Po	39.06	5.23	24.59	24.03	2.42	-3.12	1.02	0.17	31.70
5	FeSO ₄									
	Sc & B, Pr	16.64	1.26	5.45	5.30	-19.9	-7.11	-17.6	-18.9	89.76
	Sc & B, Po	23.94	0.31	6.52	6.51	-12.6	-8.06	-16.4	-17.9	71.15

From the table 4, it was observed that the highest value of K/s was obtained from the post mordanted sample of ferrous sulphate (33.34) while the least value was obtained in case of pre mordanted sample of alum (18.67). It was concluded that darkest shade was obtained with post mordanted ferrous sulphate sample as it exhibits least L* value (29.13) and the lightest color ($L^* = 59.81$) was achieved in case of pre mordanted alum sample. Positive a* indicate the presence of red with only exception of post mordanted ferrous sulphate sample (-1.52) while positive b* indicates the presence of yellow color in the shades.

Table 4: Shades of Indian Almond Leaves on Tussar Silk

S.N.	Samples	L^*	a^*	b^*	c^*	DL^*	Da^*	Db^*	Dc^*	K/s
1	Control C	49.68	3.84	23.73	24.03	-	-	-	-	20.87
2	Sc & B	53.37	3.53	24.86	25.11	3.69	-0.32	1.12	0.49	21.25
3	Alum									
	Sc & B, Pr	59.81	0.59	31.72	31.72	10.13	-3.25	7.98	7.68	18.67
	Sc & B, Po	55.61	0.71	32.75	32.92	5.93	-3.11	8.86	8.87	23.50
4	$CuSO_4$									
	Sc & B, Pr	44.22	3.19	26.31	26.51	-2.27	-0.65	2.46	2.46	27.14
	Sc & B, Po	47.40	4.23	26.85	27.18	-5.45	0.38	3.13	3.13	22.58
5	$FeSO_4$									
	Sc & B, Pr	30.93	1.08	4.67	4.71	-18.75	-2.76	-19.25	-19.25	30.65
	Sc & B, Po	29.13	-1.52	3.92	4.20	-20.54	-5.37	-19.82	-19.84	33.34

Table 5, 6, 7 showed the wash, rub and light fastness of the dyed samples rated on the grey scale. Rub fastness was rated 4-3 on grey scale i.e. sample showed excellent to good fastness against rubbing in both conditions. Light fastness of dyed samples was rated from 6-5 on grey scale indicating very good light fastness properties. Wash fastness was rated on the basis of change in color observed and staining on white fabric using the rating grey scale (1-4) i.e. 1 being poor to 4 being excellent. All the samples showed good to excellent wash fastness in case of color change as well as in staining on white.

Table 5: Fastness properties of Indian Almond Leaves Dyed Cotton Samples

S.N.	Samples	Wash Fastness		Rub Fastness		Light Fastness		
		Change in color	Staining on White	Dry	Wet	Rating at 5 hrs.	Rating at 10 hrs.	Rating at 15 hrs.
1	Control C	2	4	4	3	6	6	6
2	Sc & B	2.5	4	4	4	6	6	6
3	Alum							
	Sc & B, Pr	3	3	4	4	6	6	6
	Sc & B, Po	3	3	4	4	5	5	5
4	$CuSO_4$							
	Sc & B, Pr	3	3	3	4	6	6	6
	Sc & B, Po	3	2	4	4	6	6	6
5	$FeSO_4$							
	Sc & B, Pr	2	2	4	4	6	6	6
	Sc & B, Po	2	2	4	4	5	5	6

Table 6: Fastness properties of Indian Almond leaves dyed Jute Samples

S.N.	Samples	Wash Fastness		Rub Fastness		Light Fastness		
		Change in color	Staining on White	Dry	Wet	Rating at 5 hrs.	Rating at 10 hrs.	Rating at 15 hrs.
1	Control C	2	4	4	3	6	6	6
2	Sc & B	2.5	4	4	4	6	6	6
3	Alum							
	Sc & B, Pr	3	4	4	4	6	6	6
	Sc & B, Po	2.5	3.5	4	4	5	5	5
4	CuSO ₄							
	Sc & B, Pr	2	3	3	4	6	6	6
	Sc & B, Po	2	2.5	4	4	6	6	6
5	FeSO ₄							
	Sc & B, Pr	1.5	1.5	4	4	6	6	6
	Sc & B, Po	2	2	4	4	5	5	6

Table 7: Fastness properties of Indian Almond leaves dyed Tussar Silk Samples

S.N.	Samples	Wash Fastness		Rub Fastness		Light Fastness		
		Change in color	Staining on White	Dry	Wet	Rating at 5 hrs.	Rating at 10 hrs.	Rating at 15 hrs.
1	Control C	3	4	4	3	6	6	6
2	Sc & B	3	4	4	4	6	6	6
3	Alum							
	Sc & B, Pr	3	4	4	4	6	6	6
	Sc & B, Po	2	4	4	4	5	5	5
4	CuSO ₄							
	Sc & B, Pr	2.5	3	3	4	6	6	6
	Sc & B, Po	2	3	4	4	6	6	6
5	FeSO ₄							
	Sc & B, Pr	2.5	2	4	4	6	6	6
	Sc & B, Po	2	2	4	4	5	5	6

CONCLUSION

It can be concluded from the study that the natural dye Indian almond leaves could be successfully used as a dye source for cellulosic and protein fabrics. The colour strength (in terms of K/S value) of control sample (i.e. without bleaching) when compared to the bleached samples increased. Among the three fabrics used for the study, tussar silk showed the highest colour strength, followed by jute and cotton for the dye source. The fastness properties showed varied from good to excellent for all three fabrics. Hence, Indian almond leaves could be an effective natural dye source for both cellulosic and protein fabrics.

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Designing Eco-friendly Paper from Water Hyacinth (Eichorina Crassipes)

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ABSTRACT

Water hyacinth (Eichhornia crassipes) is a fast growing perennial aquatic plant. The tropical plant spreaded throughout the world in the late 19th and early 20th century [5]. Today it is considered as a serious and one of the most noxious aquatic pests. Mechanical and manual harvesting has proven expensive. Although its complete eradication may not be visible, the control of its spread is possible with achievable utilization advantages. With the development of innovative utilization methods of water hyacinth, not only the water bodies will become cleaner, but also help in generation of sustainable livelihood, thus creating a “New sense in Nuisance”. Considering the concept of utilization of available waste bio resource a study was planned to extract pulp from water hyacinth (Eichhornia crassipes) for preparation of sheets and to evaluate the physical properties. The results laid a strong foundation for the preparation of handmade papers with different properties which in turn could be used for various end uses.

Key Words: Water hyacinth (*Eichhornia crassipes*), handmade papers

INTRODUCTION

Environmental pollution is one of the most serious problems facing humanity and other life forms on our planet today [3]. India is among the world's worst performers when it comes to the overall environment. Beyond developing technologies for the benefit of man, it is also essential to study simultaneously their impact on the environment so that the cyclic processes which the nature has devised for conservation of resources is not affected Environment Protection and Biodiversity Conservation Act, 1999, 2011. Good environmental management involves activities that enhance the utilization, recycling and reuse of waste materials [1].

Water hyacinth (Eichhornia crassipes) is a fast growing perennial aquatic plant. Today it is considered as a serious and one of the most noxious aquatic pests. With the development of innovative utilization methods of water hyacinth, not only the water bodies will become cleaner, but also help in generation of sustainable livelihood, thus creating a “New sense in Nuisance”. Water hyacinth has good absorption capability and therefore there is a greater potential in developing utility products from the plant. Considering the concept of utilization of available waste bio resource, a study entitled “Designing Eco friendly Paper from Water Hyacinth (Eichorina Crassipes)” has been planned.

METHODOLOGY

Collection of Raw Materials: Fresh water hyacinth were collected from the river side and brought to the research centre, Wet Processing Laboratory, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore.

Processing of Raw Material: From the collected water hyacinth plants, the roots and leaves were removed

off by the help of sickle. The remaining stalks were washed and cleaned properly using fresh water. The stalks were then tied into bundles.

Preparation of Water Hyacinth Pulp and Paper: The clean stems of water hyacinth, were used for the preparation of pulp and later this pulp was used for the preparation of water hyacinth papers. The development of pulp and handmade papers were carried out in Indian Jute Industries Research Association (IJIRA), Kolkata.

The fresh stalks of water hyacinth after the removal of leaves and roots were splitted and dried in the sun until nearly crispy. The dried stalks were then chopped to a size of one inch using scissors. The chopped water hyacinth stalks were mixed with water and beaten in a Hollander beater. Hollander beater is a U-shaped trough with a drum. On the outer sides, iron blades are attached which cut the raw material and convert them into pulp. Excess water was drained out by squeezing the pulp over a strainer so that the required consistency could be obtained. The pulp was then poured in the handmade paper making machine. This mixture was filtered through a wire mesh where a wet sheet of paper was produced.

Table 1: Parameters for Preparation of Various Handmade Sheets

Beating Time (min)	Amount of Pulp (ml)	Softening Agent
30	350	-
30	350	-
20	350	-
30	350	-
45	500	-
30	200	-
45	350	-
30	500	-
45	600	-
20	500	2 Gm

In the preparation of sheet S₁, dried stalks of water hyacinth were chopped, mixed with water and five gms of guar gum. This mixture was placed in Hollander beater and the mixture was pulped for 30 min., 350 ml of such pulp was taken, mixed with four liters of water and the liquid mixture was poured in handmade paper making machine. The mixture was stirred thoroughly so that a homogenous mixture could be obtained. The excess water was drained through the wire mesh and wet sheet of paper was obtained. By the help of blotting paper and rolling cylinder, excess water was removed from the sheet and a smooth texture was obtained. This paper was further dried in hot air oven, and when semi dried it was sun dried till all the moisture present in the paper was removed. The dried papers were finally passed through the calendaring machine which smoothened the paper and gave it a glossy look.

In the preparation of sheet S₂ to S₉ the same procedure was followed, the only difference being that no binding agent was added and the crushing level and amount of pulp used varied as shown in Table 1.

The procedure followed in the preparation of sheet S₁₀ was similar to the other papers described earlier, the only difference was that two gms of softening agent "silicone" was added, without the use of guar gum, the pulp was beaten for twenty minutes and 500 ml of pulp was used for the preparation of sheets.

Evaluation of Prepared Water Hyacinth Handmade Papers: All the different varieties of sheets produced from water hyacinth were evaluated for different properties.

Subjective Evaluation: Hundred students Mastering Textiles and Clothing of Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, were given the prepared handmade sheets for subjective

evaluation in terms of appearance, softness and luster. The consolidated feedback of the Performa is presented in the : Results and Discussion

Objective Evaluation: The prepared sheets were further subjected to a series of objective evaluation, which included drop test, vertical wicking, horizontal wicking and wet strength test.

RESULTS AND DISCUSSION

Evaluation of the Prepared Water Hyacinth Handmade Sheets

Subjective Evaluation of Prepared Water Hyacinth Sheets: The prepared handmade sheets of water hyacinth were subjected to evaluation for the properties of appearance, softness and luster. The consolidated feedback of subjective evaluation of sheets is presented in Table 2.

Table 2: Subjective Evaluation of the Prepared Water Hyacinth Handmade Sheets

Sl. No.	Sheet No.	Appearance (%)		Softness (%)			Luster (%)	
		Good	Bad	Soft	Medium	Rough	High	Medium
1.	S ₁	35	75	5	15	80	5	22
2.	S ₂	20	80	25	50	25	10	65
3.	S ₃	15	85	4	32	64	12	15
4.	S ₄	63	37	35	42	23	27	60
5.	S ₅	45	55	11	42	47	16	38
6.	S ₆	76	24	48	40	12	42	38
7.	S ₇	59	42	22	48	30	14	49
8.	S ₈	52	48	18	63	19	29	45
9.	S ₉	31	69	20	42	67	12	63
10.	S ₁₀	31	69	21	36	43	23	62
								15

The analysis of the feedback reveals that sheet S₆, S₄, S₇ and S₈ had a better appearance with positive feedback of 76 per cent, 63 per cent, 59 per cent and 52 per cent respectively, whereas sheet S₃, S₂, S₉, S₁₀ and S₁ got poor feedback from the subject in relation to the appearance and the data obtained for these sheets were 15 per cent, 20 per cent, 31 per cent, 31 per cent and 35 per cent respectively for good appearance.

The results of softness indicated that sheet S₆ was the softest sheet with 48 per cent agreement of the judges. Sheet S₈, S₂ and S₇ were of medium softness with 63 per cent, 50 per cent and 48 per cent feedback, whereas sheet S₁, S₉ and S₃ proved to be the roughest sheet with percentage feedback obtained being 80 per cent, 67 per cent and 64 per cent in rough category. The analysis of luster property of prepared sheets revealed that sheet S₆ was most lustrous (42%) whereas the sheet S₁ and S₃ had minimum luster obtaining percentage feedback of 73 per cent for both the papers.

Objective Evaluation of Prepared Water Hyacinth Sheets

- a) *Vertical Wicking Property of the Sheets:* The vertical wicking property of the prepared paper is presented in Table 3.

Table 3: Vertical Wicking of the Prepared Water Hyacinth Handmade Sheets

Parameters	Handmade Papers									
	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇	S ₈	S ₉	S ₁₀
Mean (cm)	2.32	2.54	3.48	2.68	2.20	3.24	2.08	3.34	2.60	2.84
Rank	8	7	1	5	9	3	10	2	6	4

From the Table 3, it is evident that sheet S₃, S₈ and S₆ show high vertical wicking as 3.48 cm, 3.34 cm and 3.24 cm respectively proving to have good capillary action, whereas samples S₇, S₅ and S₁ exhibited less vertical wicking as 2.08 cm, 2.20 cm and 2.32 cm which proves lesser capillary activity. The rest of the samples showed moderate performance. The statistical analysis showed that there was no significant difference between the readings of each sample, but a comparison between samples proves a significant difference at one per cent level. Hence it can be concluded that samples S₃, S₈ and S₆ project best capillary action.

- b) *Horizontal Wicking Property of the Sheets:* The horizontal wicking property of the prepared paper is presented in Table 4.

Table 4: Horizontal Wicking of the Prepared Water Hyacinth Handmade Sheets

Parameters	Handmade Papers									
	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇	S ₈	S ₉	S ₁₀
Mean (cm)	1.160	0.960	0.840	0.960	0.960	0.960	1.080	1.060	1.040	1.040
Rank	1	7	8	7	6	7	2	3	4	5

From the Table 4, it is revealed that sheet S₁, S₇ and S₈ shows high horizontal wicking as 1.16 cm, 1.08 and 1.06 cm respectively, whereas sheet S₃ exhibited minimum horizontal wicking as 0.84 cm. The remaining samples showed average performance. The statistical analysis of the data revealed that there was no significant difference between the readings of each sample but a comparison between samples proves a significant difference at five per cent level. Hence, it can be concluded that samples S₁, S₇ and S₈ were the handmade water hyacinth sheets which dispersed drop of water transversely maximum.

Wet Strength of Handmade Sheets: The wet strength of the prepared handmade sheets is presented in Table 5.

Table-5: Wet Strength of Prepared Water Hyacinth Sheets

Parameters	Handmade Papers									
	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇	S ₈	S ₉	S ₁₀
Mean (cm)	73.92	69.12	59.52	59.52	79.68	59.52	66.24	82.56	118.08	102.72
Rank	5	6	8	8	4	8	7	3	1	2

From the Table 5, it is clear that sheet S₉, S₁₀ and S₈ has good wet strength as it can withstand a weight of 118.08 gms, 102.72 gms and 82.56 gms respectively, whereas sheet S₃, S₄ and S₆ were weak sheets and could not withstand a load of more than 59.52 gms. The statistical analysis of the data proved that there was no significant difference between the readings of each sample, but a comparison between samples revealed a significant difference at one per cent level.

Hence, it can be concluded that among all sheets, sheets S₉, S₁₀ and S₈ were the strongest and showed high wet strength.

Along with these tests, tests carried out in a similar study by Srivastava and Rawat has proved that papers produced from pure Water Hyacinth have good porosity and opacity. Their study also proved that Water Hyacinth sheets gave satisfactory performance in terms of uniformity of colour of the printed area when experimented with ball pen, ink pen, gel pen, marker and typing ink. In the project “New Sense in Nuisance” carried out by Chalmers University of Technology and Oslo’s School of Architecture and Design^[6], the Oeko-Tex test done, on Water Hyacinth papers, which is a simulation of wearing a material against the skin gave satisfying results as none of the heavy metals crossed their limiting values, thus indicating to be safe to be used on the skin.

CONCLUSIONS

To address the problems related to the environment protection, a greener attempt was tried out. Realizing the potentiality of water hyacinth with respect to absorbency, porosity, opacity, printability, strength and non allergenic, the study was conducted to utilize the so what assumed bio waste into wealth. The study had proved hand made sheets from water hyacinth to be an effective product which can be utilized in multiple ways. In a nutshell, this research work has emphasized a new look to water hyacinth and proved the Golden Rule “Use Bio waste / resource for value addition” and “economical development”.

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Developing Hand Bags using Non Woven Fabric

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ABSTRACT

Bags are an important component of every woman's wardrobe. In addition to being functional, bags also serve as a style statement. Non-woven fabrics are produced from fibres, natural or man-made, generally waste derived from the conventional yarn / fabric manufacturing process. Non-woven fabrics are economical, environment – friendly and also recyclable. The objective of the study was to develop hand bags based on consumer preferences and current market trends, which were cost effective and yet environment friendly. The tools were employed on 180 participants using multi-method, namely interview schedule, questionnaire and product development. Various designs of bags were sketched along with different motifs for embellishment. The most preferred styles of bags were developed and their acceptability was assessed. The most preferred colours for hand bags were black, white and brown. The preferred motifs for embellishment were games (tic tac toe, ludo and chess) and geometric forms, with painting, embroidery as a relevant technique for embellishment. The developed products were very well accepted and appreciated by the participants for its use in the market.

INTRODUCTION

Bags are one of the most important components of everyone's life. The driving potential of consumers towards bags' is not just its functionality but also its aesthetic appeal. People of all age groups use bags in various forms, styles and colors depending on their need. For women, bags constitute an important and integral part of their wardrobe. In addition to being functional, bags also serve as a style statement.

A bag is a container made up of fabric or plastic that is open at mouth and can be fastened using zips and buttons etc. They can range from a small coin pouch to a huge luggage carrier depending on their end use or the purpose for which they are been used. The type of materials used in the manufacture of bags varies, based on their purpose.

According to European Disposals and Non-Woven Association (EDANA), nonwovens are manufactured sheets, web or bat of directionally or randomly oriented fibers bonded by friction and / or cohesion and /or adhesion, excluding paper or products which are woven, knitted, tufted, stitch bonded incorporating binding yarns or the filaments or felted by wet milling whether or not traditionally needle, the fiber may be natural or manmade, they may be staple or continuous or may be formed in situ.

The basic unit to produce a nonwoven fabric is the fiber (staple length or the long filament) that is capable of forming a web which can be made use of in order to make a nonwoven fabric. Various techniques are used for making a non-woven fabric like needle punching, spun bonding, stitch bonding, thermal bonding, hydro-entanglement and chemical bonding. The technique of manufacture varies depending on the fiber type and its specified end use.

Some of the properties of non-woven fabrics that make them suitable for various end-uses are good resiliency,

economical, relatively high tensile strength, good absorbency, good porosity, light weight and eco-friendly. Non-woven fabrics can be easily adapted as per the end use either mechanically or chemically. They can be applied various finishes to increase its softness, wash-ability, they can also be flame proof, U.V resistant, biological resistant, washable, etc.

AIMS AND OBJECTIVES

Bags in different colours and styles with different accessories / embellishments are used for different purposes and occasions. Bags are commonly available in leather, rexin, plastic, woven canvas fabric, etc. Non-woven fabrics are eco-friendly, made from short length fibers which otherwise cannot be used for making woven or knitted fabrics. Additionally non-woven fabrics can be recycled and reused unlike most of the other fabric constructions and they are also cost effective.

1. To develop hand bags based on the consumer preferences and current market trends using non-woven fabric.
2. To assess the acceptability of bags made using non-woven fabric.

METHODOLOGY

The methodology used is multi-method (questionnaire and interview) and multi-agent (shopkeeper, teenage girls, housewives and working women). The sampling technique used was that of 'purposive sampling'. All those who fulfilled the inclusion criteria and agreed to participate in the study were selected for the study. The inclusion criteria for collecting information were:

- (a) frequent users of different types of bags;
- (b) frequent purchasers of different types of bags and
- (c) shopkeepers who sell and manufacture bags.

The researcher contacted and briefed the participants in various settings like college (teenage girls), offices (working women), residential complexes (house wives), and shops (shopkeeper).

The study was conducted in three parts, viz, selecting styles and motifs for hand bags, developing hand bags and assessing the acceptability of the developed products.

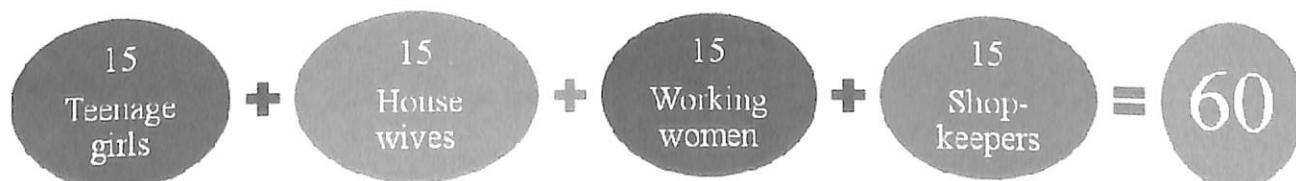
In the first part of the study, analysis of market trends was done to understand the current trends in hand bags. Based on the analysis of the market trends, styles of bags were sketched and finalized on the basis of the responses received. Similarly, motifs for embellishing the bags and the embellishing techniques for the same were developed. The developed motifs were also selected based on the consumer preferences.

The second part of the study involved selection of fabrics and other materials to be used for the making of the hand bags. The hand bags were developed as per the preferences given by the consumers.

In the third part of the study, the acceptability of the developed products was assessed. Questionnaire method was used to assess the acceptability of the developed products.

RESULTS AND DISCUSSION

In the first part of the study, styles of bags were sketched, motifs for embellishment, and techniques for embellishment were included in the survey administered to the participants of the study. The survey was administered to 60 participants.



The results of the same are presented as follows:

Colors: Of the ten different colors listed, maximum participants preferred black, white and brown colored hand bags. The color preferences of participants for hand bags were as follows:

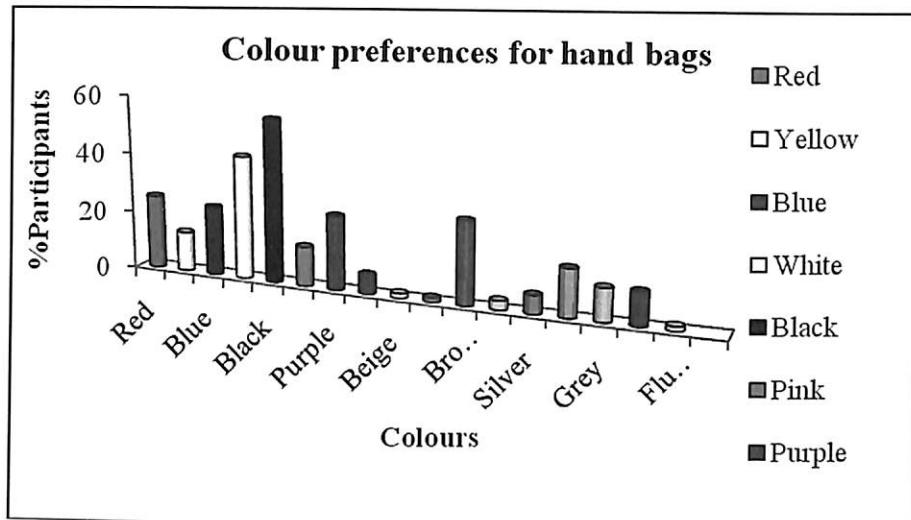


Figure 1: Colour Preferences for Hand Bags

Styles of Bags: Of the twelve styles of hand bags, the following styles were preferred by the participants.

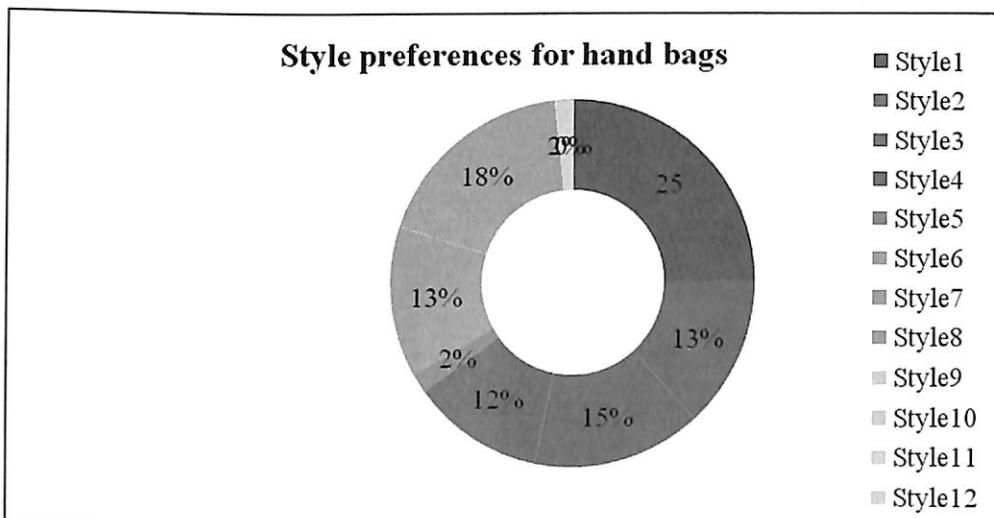
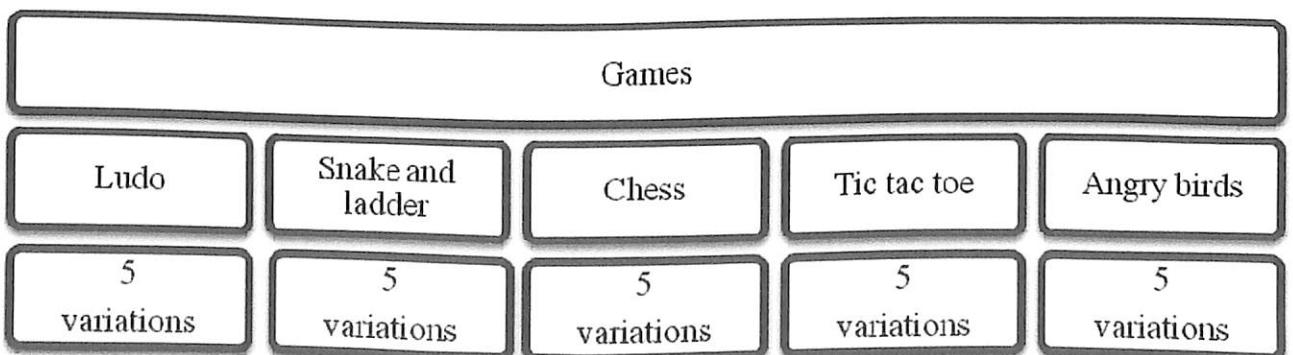


Figure 2: Style Preferences for Hand Bags

Motifs: Geometric motifs and motifs of some of the games were selected for embellishing the hand bags. In all, thirty motifs were sketched and were surveyed for the purpose of shortlisting.



Geometric

Design1

Design2

Design3

Design4

Design5

According to data collected, the six highly rated motifs by the participants from the category Games and Geometric were:

- Chess style 1 (45%)
- Geometric design1(41.7%)
- Geometric design 4 (31.7%)
- Ludo style1 (31.7%)
- Tick tac toe style 3(31.7%)
- Snake and ladder style 1 (31.7%)

Embellishing Techniques: The embellishing techniques preferred by the participants were painting and embroidery.

Developed bags: On the basis of the responses received from the participants, twelve hand bags were developed, using the shortlisted styles of bags, preferred motifs and embellishing techniques (Refer to Annexure II). After the bags were developed, a questionnaire was administered to assess the acceptability of the developed products. The questionnaire was administered to 80 participants.

Acceptability of developed bags: Figure No.3 shows the preferences of participants of the developed hand bags. It can be noted that 31.25 % of the participants rated style 2A the most preferred, Style 2B and 3B was rated by around 21.25 % of the participants, while 18.75% of the participants preferred style 1A. However all the participants felt that the developed hand bags can be introduced in the market for sale.

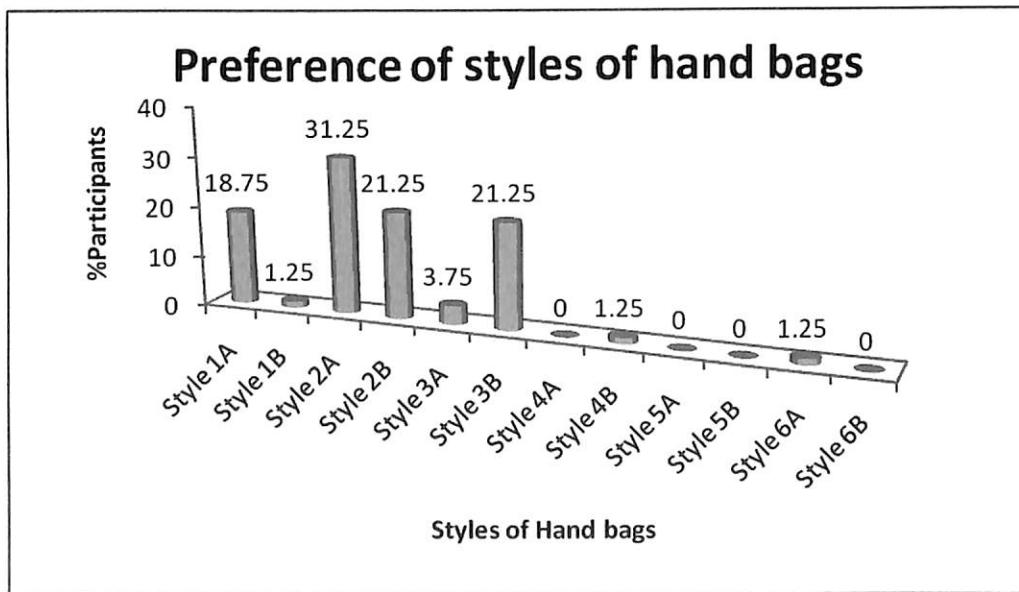


Figure No 3: Acceptance of the Hand bags

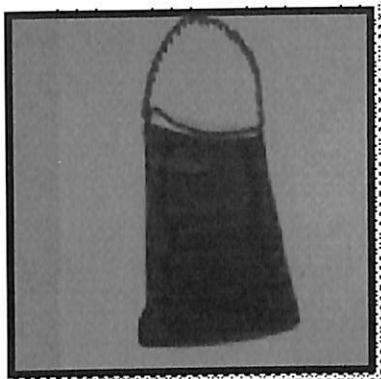
Factors affecting acceptability of bags: The participants listed various factors affecting the acceptability of the hand bags developed using non-woven fabrics. The factors were motifs used, color combinations used, easy care, utility value and most importantly environment-friendly.

CONCLUSION

Most of the consumers today, are aware of the environmental concerns with regards to the use of products which are not bio-degradable. The study highlights the awareness of the consumers as well as their willingness to buy products which are eco-friendly. The consumers as well as the shop-keepers have accepted the hand bags developed using non-woven fabrics.

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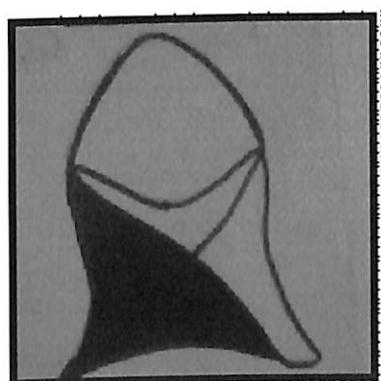
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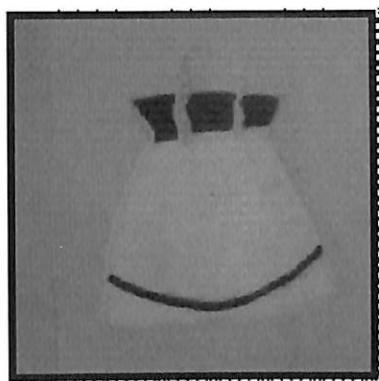
Style 1



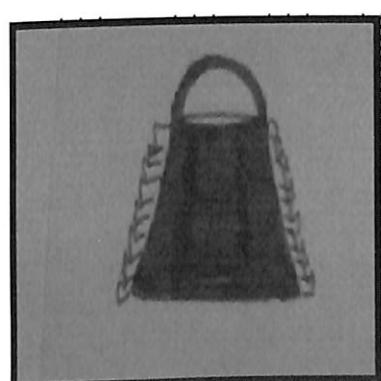
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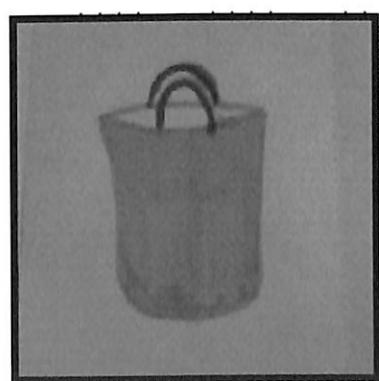
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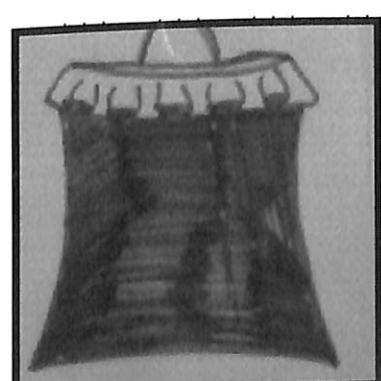
Style 4



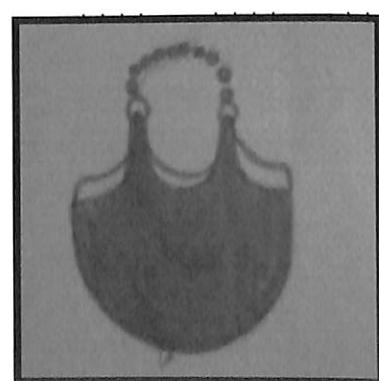
Style 5



Style 6



Style 7



Style 8

Hand Bags - Style No I A



Hand Bags - Style No I B



Motif – Geometric; Technique used – Embroidery

Hand Bags - Style No II A



Hand Bags - Style No II B



Motif – Games, Tic Tac Toe; Technique used – Painting

Hand Bags - Style No III A

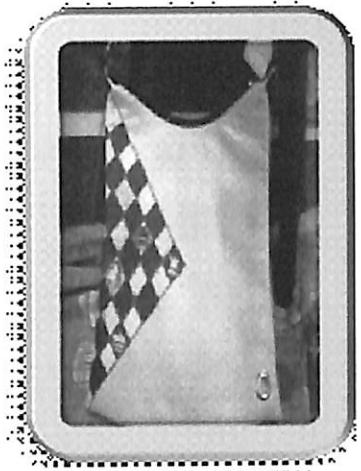


Hand Bags - Style No III B

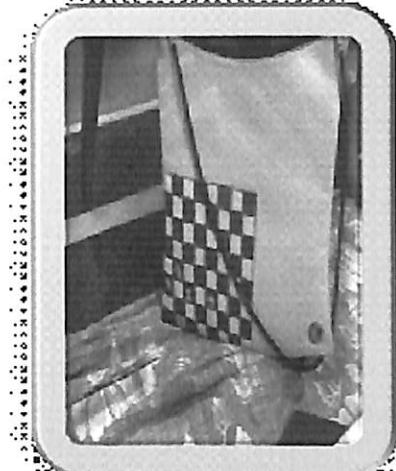


Motif – Geometric; Technique used – Embroidery

Hand Bags - Style No IV A

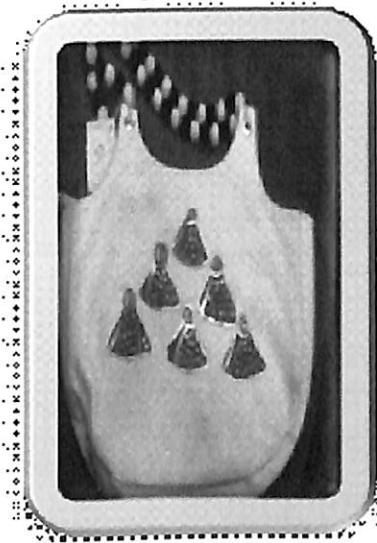


Hand Bags - Style No IV B

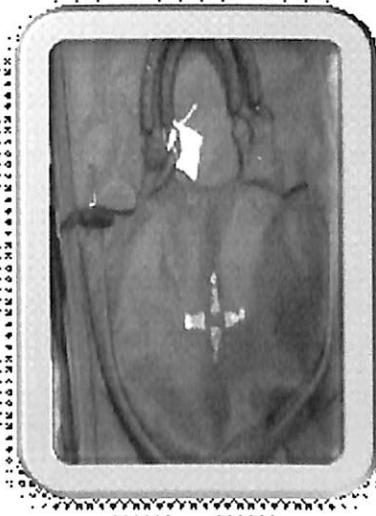


Motif – Games, Chess; Technique used – Painting

Hand Bags - Style No V A

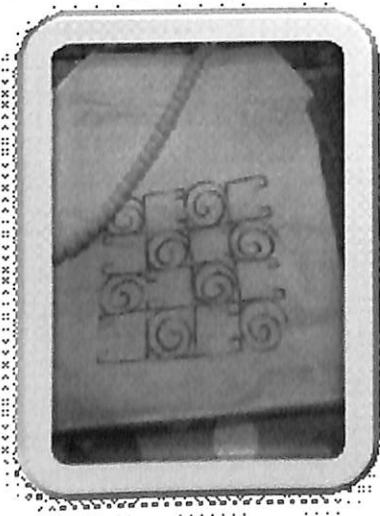


Hand Bags - Style No V B

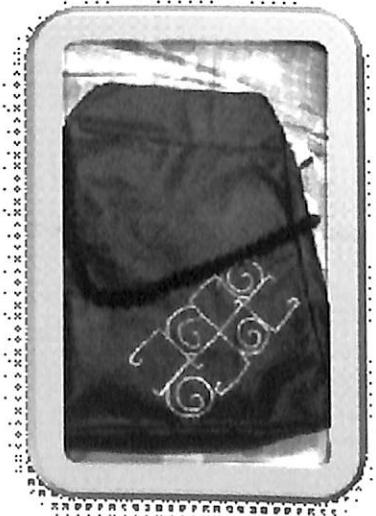


Motif – Ludo; Technique used – Painting

Hand Bags - Style No VI A



Hand Bags - Style No VI B



Motif – Geometric; Technique used – Embroidery

Development of Hygienic Jute Textiles by a Novel Method

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ABSTRACT

*Hygienic property on natural fibre products is an important value addition process and its eco-friendliness has attained more attention than ever before. Silver nanoparticles have potential to impart hygienic property on natural fibers, since it is effective in terms of minimum inhibitory concentration. The synthesis of silver nanoparticle needs reducing and stabilizing chemicals, which increases the pollution load. A novel method has been proposed to impart antibacterial finishing on jute textiles by in-situ synthesis of nano silver, since jute fibre has acidic-reducing nature. Jute fibre was applied with different concentration of silver nitrate solution (1mM to 100mM) by exhaustion method and their antibacterial properties were evaluated using AATCC 147:2004 method. The formation of nanosilver on the surface of the jute fibre was confirmed by SEM-EDX and colour change. Results inferred that zone of inhibition of jute fabric against gram positive bacteria (*Bacillus subtilis*) and gram negative (*Escherichia coli*) is increased with increasing in concentration of nano silver present on the surface of the jute fibre, in which zone of inhibition against *E.Coli* is higher than *B.Subtilis*. This study concludes that nano silver application by this novel in-situ method with 25mM AgNO_3 on jute fibre leads to development of hygienic textiles.*

INTRODUCTION

Surface functionalization of natural fibre with nano metal / metal oxides still is an interesting approach, because it has high activity. Metal nanoparticles are synthesised from its precursors by reduction followed by stabilization using a polymer. Similarly, metal salts are reduced by an alkali followed by stabilization with a polymer for synthesis of metal oxide nanoparticles. These nanoparticles are used in textile products for imparting wide range of functional properties like ZnO for UV-blocking, Ag for antimicrobial and natural colouration, sodium montmorillonite clay for flame retardant, Silica and polysiloxane for water repellency, TiO₂ for self-cleaning and copper for conductivity. The application of nanoparticle involves the following steps synthesis, stabilisation, application either by exhaustion method or by pad→ dry→ cure method and post treatment to improve the stabilisation of nanoparticle inside the fibre.). Thiry (2010) inferred that most of the nanoparticles held on the surface of the fibre by weak chemical bonding, so they can be migrated from the products to the environment. Research work on improvement of fixation of metal oxide particle by enhancing the pore size of the fibre is still scanty. Surface modification of natural fibres play an important role, because they can improve surface functional groups, surface energy and void content [4,38,16] in which the modified fibre can improve the diffusion and fixation of finishing chemical applied subsequently [1,10,23,35].

To reduce the application steps as well as to improve the entrapment of nanoparticles, some novel approaches like in-situ synthesis of metal nanoparticle [8], sol-gel application of nanoparticle and application of nanoparticle using of spacers [19] have been developed. Silver nitrate is mixed with aqueous NH₃ to form Ag₂O, while it is reduced to Ag nanoparticle using reducing and stabilizing features of cellulose. A novel method is introduced by

using a reducing agent (sodium dithionite) to reduce the fineness of coarse wool as well as synthesis of nano silver to impart antibacterial properties on wool^[12]. Silver nanoparticle were synthesized inside the wool fibers by using their functional groups as polyfunctional ligands and by using lecithin, a biological lipid for improving the diffusion of silver ions inside wool fibre^[2]. Polymers which have hydroxyl groups on its backbone such as polyvinyl alcohol, PVA/dextran and PVA/methyl cellulose were showed the ability to reduce silver nitrate (AgNO_3) in to Ag-nanoparticles^[22,25] it is inferred that natural cellulose fiber represents as a high oxygen (ether and hydroxyl) density and could be considered as a aggregated nano-reactor and stabilizer for the nucleation and growth of silver nanoparticles^[41]. Nano silver on cotton fabrics was deposited through in situ method by the reduction of AgNO_3 without any reductant and dispersant at 90°C for 30 minutes^[14]. Jute fibre was selectively oxidised with TEMPO (2,2,6,6-tetramethylpiperidine-1-oxyl radical) for in situ deposition of silver nanoparticles in the range of 50.0 ± 2.0 nm^[3]. Literature information on application of silver nanoparticle on jute fibre for antimicrobial functionality still scanty. On this background, this work was carried to study the effect of in-situ formation of silver nanoparticle on jute fibre and their performance properties.

EXPERIMENTAL PROCEDURE

Materials

Jute fabric of the following specification was used for this study. Plain woven hessian with ends/cm=6.15 (252 Tex); picks/cm =5.4(230 Tex); area density = 275 gm⁻²and thickness = 0.95 mm. All other chemicals used elsewhere were LR grade and purchased from Kolkata.

Methods

Scouring: Jute fabric was treated with scouring solution of the following recipe for 60 minutes with constant stirring. After scouring, the sample was taken out, washed with warm water, neutralized with hydrochloric acid solution, washed with cold water and dried at ambient condition

Jute fabric	:	x gm
NaOH	:	1% (owf)
Non-ionic detergent	:	4% (owf)
EDTA	:	1% (owf)

In-situ synthesis of silver nanoparticle: The jute fabric was entered in a bath containing 0mM to 100nM of silver nitrate solution with 1: 20 MLR at pH 5.0 (adjusted with acetic acid solution). The sample was kept at 40°C for 15 minutes and then the bath temperature was raised to 90°C @ 2°C/minute. The sample was kept at 90°C for 60 minutes for conversion of Ag^+ to Ag nanoparticle with constant stirring. Then bath temperature was gradually reduced to 40°C, sample was taken out, washed with distilled water and dried at ambient condition.

Characterization

Fourier Transform Infrared Spectrometry (FTIR): FTIR spectra of fiber samples were taken with a Bruker FTIR analyzer using an attenuated total reflectance (ATR) mode. The data were recorded in the range of 4000-500 cm⁻¹ wave numbers. Each of the samples from various treatment conditions was pressed into the sample chamber for FTIR measurements. For each condition, three replicated measurements were made.

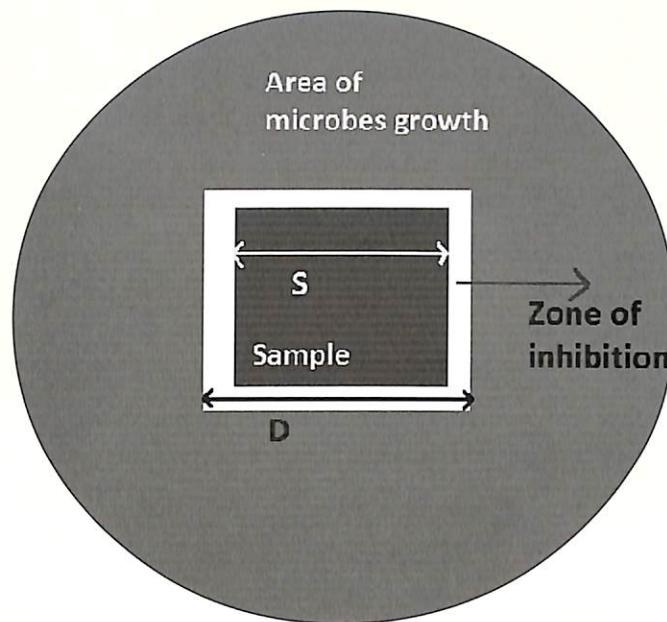
p-X-ray diffraction (pXRD) measurement: The crystallinity of untreated jute, scoured jute, and scoured jute with silver nanoparticles were analyzed at ambient temperature by step scanning on a X-ray diffractometer using a monochromatic Cu K_α radiation ($\lambda = 1.5406\text{\AA}$) in the range of $2\theta = 6\text{--}60^\circ$ with a step size of 0.04°/min. and a scanning rate of 5.0°/min.

Evaluation of antibacterial activity: The width and length of the sample as well as the inhibition zone were measured in three different places respectively in mm. After measuring the dimensions, the average value has taken for calculation of zone of inhibition (AATCC 147-2004).

$$\text{Zone of inhibition (mm)} = (D-S)/2$$

Where, D = Length of inhibition zone

S = Length of sample



RESULTS

We have applied nano silver on jute fabric by in-situ synthesis method and presence of nanosilver on jute fibre was assessed by SEM-EDX, pXRD, FTIR, their antibacterial activity were assessed by the AATCC standards in terms of zone of inhibition.

pXRD Analysis

The phases and crystallinity of the scoured jute fiber and the scoured jute fibers deposited with silver nanoparticles were characterized by XRD and shown in the figure 1 a & b.

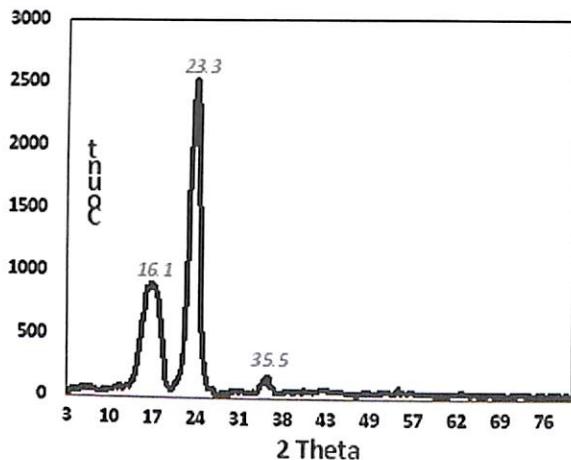


Figure 1 (a): pXRD graph of the scoured jute fibre

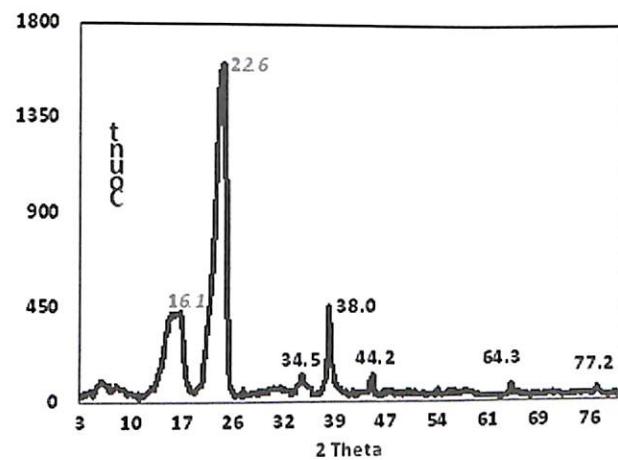


Figure 1 (b): pXRD graph of the nano silver applied on scoured jute fibre

It could be seen that the XRD pattern of the scoured jute fibers exhibits a sharp high peak at $2\theta = 23.2\text{æ}%$, and one weaker diffraction peak at $2\theta = 16.1\text{æ}%$, which are assigned to cellulose I. (Liu & Hu, 2008). Fig. 1b showed the XRD patterns of scoured-jute fibers treated with 100mM AgNO_3 . In this figure we noted that additional diffraction peaks at $2\theta = 31.3\text{æ}%, 38.0\text{æ}%, \text{ and } 44.2\text{æ}%$ are attributed to the (111), (200) and (220) planes of the crystallized silver with a cubic structure, respectively, which confirmed the reduction of silver by scoured cellulose^[8] on the surface of the jute fibre. Since there are not peaks related to silver oxide (Ag_2O) in the respective peaks like at $2=32.5^\circ$ and 54.5° , which also confirmed that silver cation is effectively reduced with aldehyde group on jute fibre into nano silver.

FTIR

The ATR- FTIR graph of the untreated jute fibre, scoured jute fibre and nano silver applied on scoured jute fibre were shown in two different ranges i.e. 4000 to 500 cm⁻¹ and 1200 to 520cm⁻¹ were shown in figure 2a and 2b respectively

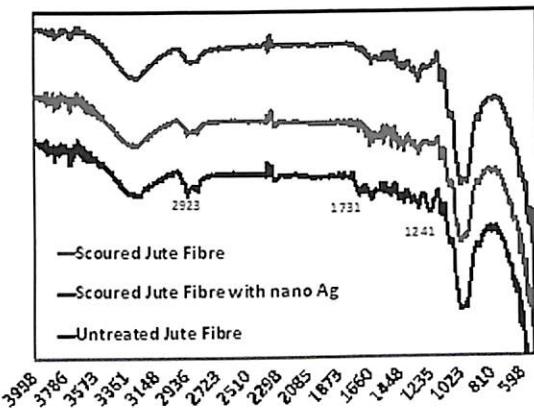


Figure 2 (a): FTIR graph of the scoured jute fibre

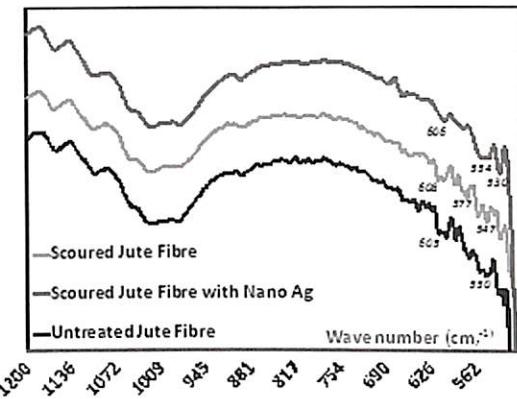


Figure 2 (b): FTIR graph of the nano silver applied on scoured jute fibre

The disappearance of the small peak at 1287 cm⁻¹ was replaced by the appearance of medium peak at 1346 cm⁻¹ in the spectrum, which was due to the complexation between Ag⁺ and -OH group of the cellulose polymer to form metallocopolymer. There is a shortening of the peaks around 3540–3120 cm⁻¹ due to loading of nano silver on the surface of the jute fibre. The asymmetric and symmetric stretching vibrations in all these three cases are found at 2925 and 2853 cm⁻¹ respectively. The presence of nano silver in the fibre is also led to the disappearance of several bands in the range from 840 to 570 cm⁻¹. Bands at 570, 650, and 711 cm⁻¹ are assigned to out-of-plane vibration of the -O-H group. It is important to point out that the disappearance of these bands suggests that interaction between Ag nanoparticles and the matrix takes place over the -O-H groups. Further no appreciable change has been observed for other peaks marked.

Antibacterial Activity

The zone of inhibition (mm) of Ag deposited jute fabric with respect to different concentration of AgNO₃ against gram positive (*B. Subtilis*) and gram negative bacteria (*E. coli*) were shown in Table 1 & 2 respectively. Table 1 inferred that in-situ generated nano silver has very good resistance to gram positive bacteria on the jute fabric. The zone of inhibition is increased with increasing in the concentration of the precursor.

Table 1: Zone of inhibition (mm) of gram positive bacteria *Bacillus Subtilis* on nano silver applied jute fabric by in-situ synthesis method

Concentration of silver nitrate	Zone of inhibition (Mean±SEM)	Growth of organism observed on & underneath the fabric
1 mM	1.0±3.9	No
25 mM	2.8±1.1	No
50 mM	2.8±4.6	No
75 mM	4.1±3.7	No
100 mM	4.5±3.4	No
Control jute fabric	No zone of inhibition	Yes

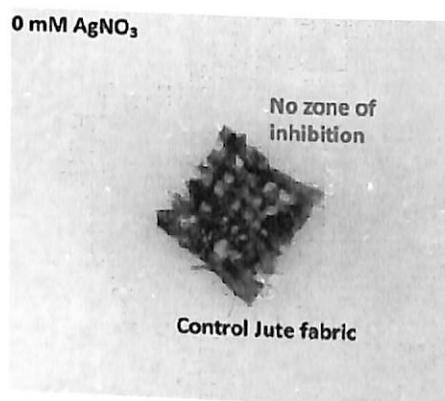
Table 2 inferred that in-situ generated nano silver has very good resistance to gram negative bacteria *E Coli* on the jute fabric in comparison to nano-silver colloidal application. The zone of inhibition is increased with increasing

in the concentration of the precursor, and it also inferred that nano silver has more resistance than gram positive bacteria.

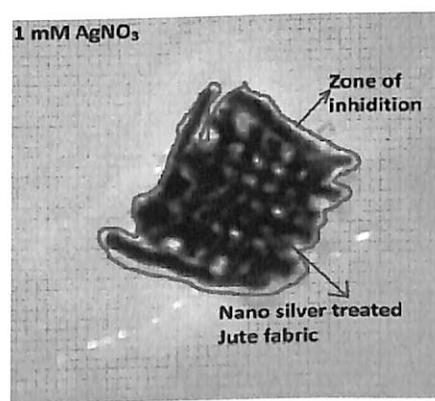
Table 2: Zone of inhibition (mm) of gram negative bacteria *E.Coli* on nano silver applied jute fabric by in-situ synthesis method

<i>Concentration of silver nitrate</i>	<i>Zone of inhibition (Mean±SEM)</i>	<i>Growth of organism observed on & underneath the fabric</i>
1 mM	2.5±1.3	No
25 mM	3.5±3.4	No
50 mM	4.0±1.3	No
75 mM	4.2±2.8	No
100 mM	5.1±2.8	No
Control jute fabric	No zone of inhibition	Yes

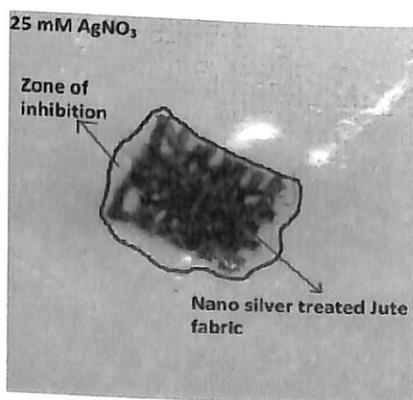
Photograph of zone of inhibition of *Bacillus Subtilis* on in-situ synthesized silver nano-particle in different concentration of AgNO_3 (Precursor) applied jute fabric is shown in Figure 3. The Petri dish, supplemented with control fabric, showed a dense population of bacterial colonies. However, a clear inhibition zone could be distinctly seen in Petri dish supplemented with the Ag deposited fabrics. There was no significant difference on the size of inhibition zone when the test was carried out with different Ag deposited fabrics against certain bacterial strain. However, the inhibition zones against *E. coli* (ca. 2.5 mm) were larger than those against *B. Subtilis* (ca. 1.0 mm), suggesting that the Ag nanoparticles have more effective contact biocidal property against *E. coli*, probably due to the different cell membrane structure between *E. coli* and *B. Subtilis*.



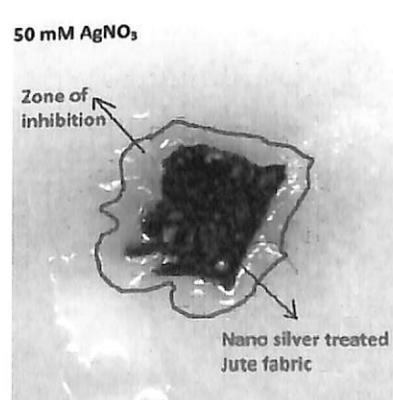
a. Control Jute Fabric



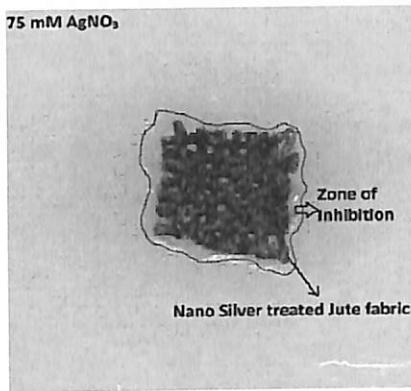
b. 1mM AgNO_3



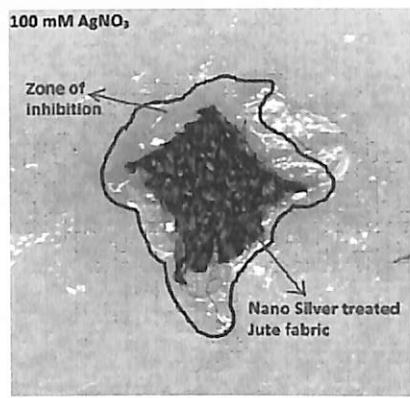
c. 25mM AgNO_3



d. 50mM AgNO_3



e. 75mM AgNO_3



f. 100 mM AgNO_3

Figure 3 : Photograph depicting the of zone of inhibition of *Bacillus Subtilis* on in-situ synthesized silver nano-particle in different concentration of AgNO_3 (Precursor) applied jute fabric

Attack on Gram-positive vs. Gram-negative bacteria by nano silver

Nano silver has less resistance to gram-positive bacteria than gram-negative bacteria due to the charge of peptidoglycan molecules in the bacterial cell wall. Gram-positive bacteria have more peptidoglycan than gram-negative bacteria because of their thicker cell walls. Also peptidoglycan in the bacteria is negatively charged and silver ions are positively charged, so silver may get trapped by peptidoglycan in gram-negative bacteria than in gram-positive bacteria.

SEM with EDX

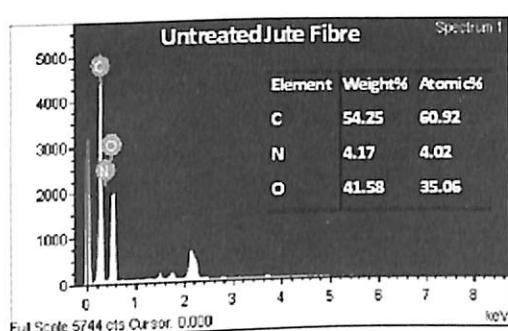


Figure 4 (a): EDX photographs (10000 X) of Untreated Jute Fibre

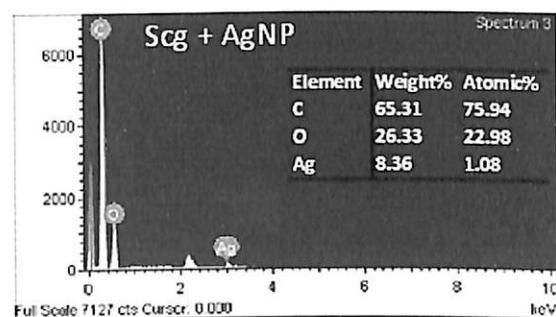


Figure 4 (b): EDX photographs (10000 X) of Scoured Jute Fibre with Nano Silver by in-situ method

Figure 4 (a) & (b) shown the standard EDX spectrum recorded on the examined jute samples. In the middle part of the presented spectrum one can clearly see five peaks located between 2 kV and 4 kV. Those maxima are directly related to the silver characteristic lines K and L. The maximum located on the left part of the spectrum at 0.2 kV clearly comes from carbon. The hardly visible maximum located at 0.5 keV is connected with the oxygen characteristic line. The spectra obtained during EDX studies were used for carrying out the quantitative analysis. Quantitative analysis proved high silver contents (1.08%) in the examined samples.

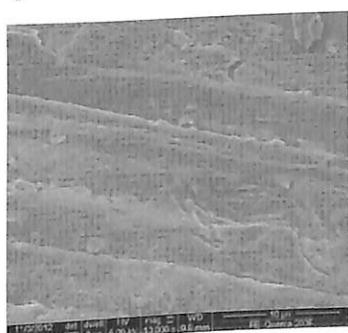


Figure 5 (a): SEM photographs (10000 X) of Untreated Jute Fibre

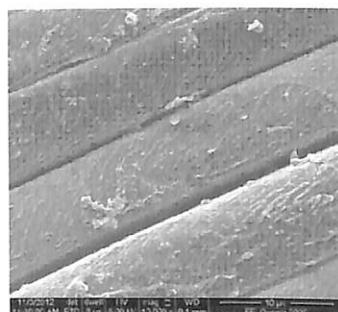


Figure 5 (b): SEM photographs (10000 X) of Scoured Jute Fibre with Nano Silver by in-situ method

Figure 5 (a) & (b) inferred that, SEM photographs are clearly shown the presence of the nano silver present on the surface of the jute fibre at different sizes.

CONCLUSION

From this work, the following conclusions have been drawn

1. Nano silver can be applied to jute fabric to impart anti-bacterial finishing
2. The antimicrobial activity of the nano silver mainly depends on the concentration of nano silver present on the surface of the jute fibre, since the zone of inhibition (efficiency of antimicrobial activity) is increased with increasing in concentration nano silver applied
3. Nano silver resists gram negative bacteria better than gram positive bacteria

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Studies on Fire Retardant and Rot Resistant Protective Chemical Finishing of Jute Based Textiles

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ABSTRACT

Jute has certain inherent properties e, g. susceptible to catching fire, microbial attack, and high moisture absorption which have restricted its growth of use towards protective textiles. A new formulations for achieving fire retardancy has been discussed which achieved high fire retardancy as indicated by LOI value. A newer method of rot resistance finish have been developed where jute based product can be made rot resistance using safer chemicals and the fabric retained 90% tensile strength after soil burial test. In this study, citric acid(CA) is used as a crosslinking agent and mixed with poly ethylene glycol(PEG 400) and the effect of CA and PEG400 combination in presence of Sodium hypophosphite monohydrate (SHP)catalyst on jute fabrics is investigated by pad-dry- cure method to study its rot resistance, crease resistance as well as related physical properties. Curing was done at 150°C for 5 minutes. Citric acid possibly reacts with hydroxyl groups in cellulose or Poly ethylene glycol to form ester. The performance of the finished fabric e.g. dry crease recovery, rot resistance (expressed as % retention of tensile strength of the fabric after a standard soil burial test), tensile property due to treatment, whiteness index and bending length(for stiffness) were also evaluated and analysed. The additives PEG in the presence of citric acid significantly affected the performance of treated jute fabric. Jute fabric crosslinked with CA alone also showed good crease and rot resistance properties, but, CA/PEG400 combined treatment imparted somewhat increased functional properties considering enhancement in rot and crease resistance property as well as tenacity and whiteness retention. Thermal studies showed that final residue left at 500°C was much higher for CA/PEG400 treated fabric than untreated jute fabric. FTIR spectroscopy suggested the formation of ester crosslinkage between the jute fibre, citric acid and PEG and it is proposed that rot resistance is achieved by this mechanism.

Key Words: Ammonium Sulphamate, Urea, Citric acid, Poly ethylene glycol, Fire resistance, Crease resistance, Rot resistance, Jute fabric, Thermal Behavior, Thermo-gravimetric Analysis.

INTRODUCTION

Jute and jute based fabrics are gaining popularity in domestic and international field due to eco-friendliness and biodegradability characteristics. Golden fibre Jute has certain inherent properties e, g. flammability, high moisture absorption, and susceptibility to rotting which have restricted its growth of use towards protective textiles. To find use as value added technical textiles, jute fabric have to undergo improved chemical finishing process especially fire retardancy, water repellency, rot resistance etc. depending on end use application^[1,2]. For the development of various types of functional finishing of jute, proper choice of chemicals along with process parameters are important. Some important finishing processes are discussed here.

Fire-retardancy

Now-a-days, fire-retardant textiles are being produced in large quantities due to prevailing legislations for fire safety and public awareness. Demand for fire-retardancy of jute material is also increasing in area like upholstery, automotive fabrics, floor coverings, Tentings etc.

Some chemical formulations for making jute fabric fire retardant for different end uses have also been discussed in this paper.

Rot-resistance

Textile materials jute,cotton etc. are susceptible to microbiological attack when kept in contact or close proximity to soiling conditions, storage etc. under humid or warm conditions Different jute products like sand bags, Geotextiles, Tentage materials, Wagon covers etc. are ordinarily subjected to prolonged exposure to soil, rain, dew, sunlight etc.

Rot-proofing or resistance treatments are usually applied on textile materials with the object of prolonging the life of material when under the actual condition of usage. It is evident that the rot resistance treatment so far tried on jute are limited and have been mostly confined to compounds of Copper, Zinc or Cadmium e.g. Sulphate, Naphthenate, Cupramonium etc. Cutch and Tannin have been incorporated to improve resistance to light^{2,3,4}. Sometimes, Penta-chloro phenol, bitumen are also used to make jute rot resistant. All these chemicals are not safe for the environment and also impair some colour to the fabric. Now-a-days, efforts are going on rot resistance finishing using ecofriendly chemicals. Citric acid can also be used to improve some soil resistance to jute fabric ^[6].

In this paper, we also report some new semi durable rot-proofing process for jute fabrics using safe chemicals.

METHODOLOGY

Materials

Jute Fabric: Conventional H₂O₂ bleached plain weave jute fabrics having 63 ends/dm(count 195 tex), 59 picks/dm(count 214 tex), 220 g/m² (area density) were used for the present study.

Chemicals : Urea and Ammonium Sulphamate is used as fire retarding chemicals. For rot resistance finish, Citric acid as crosslinking agent, Sodium hypophosphite monohydrate (NaH₂PO₂.H₂O) as used as catalyst and Poly ethylene glycol 400 as additive are used. All the chemicals are of analytical grade.

Methods

Fire-retardancy:

- a) Fire-retardancy using Ammonium Sulphamate and Urea: The fabric was padded in a solution containing urea and ammonium sulphamate. The padded fabric was dried at 100°C and cured at 140°C for 5 minutes.
- b) Rot resistance finish: Bleached jute fabrics were padded (100% wet pick-up) in a solution containing Citric Acid (6% to 12%), Sodium hypophosphite monohydrate (6%) and wetting agent (0. 1%) followed by drying at 100°C for 10 min and curing at 150°C for 5 min. The cured fabric is washed and dried.

In another experiment, bleached jute fabrics were also padded (100% wet pick-up) with 10% Citric acid, Poly ethylene Glycol of molecular weight 400 (2% to 12%), Sodium hypophosphite monohydrate (6%) and wetting agent (0. 1%) followed by drying at 100 °C for 10 min and curing at 150°C for 5 min. The cured fabric is washed and dried.

Testing Method

Fire-retardancy

The evaluation of fire retardancy was assessed by Limiting Oxygen Index (LOI)-test and 45° Inclined Flammability Test

- a) *45° Inclined Flammability Test:* Selected untreated and treated jute fabric samples of specified length (15cm length and 5cm wide) were exposed to a standard flame for a specified time (for cotton it is 1 sec, for jute it is 10 sec, standardized in this laboratory) and was allowed to burn in an inclined

plane (45° inclined) Standard flammability tester(Make: Paramount, India,) following ASTM-D-1230-94 standard method^{3,4}. The fabric samples was mounted at 45° angle in a specimen holder and was then exposed to a standard flame of specified height exposed at 90° with the specimen for 10 second and is left for burning, to note flame spread time, afterglow time, and char length (in cm) after the burning.

b) *Determination of Limiting Oxygen Index:* Limiting Oxygen Index (LOI) is critical oxygen index values indicate the relative measure of flammability of any materials or textiles. LOI values of selected untreated and treated fabric samples were determined in an standard LOI tester (Make: S C Dey & Co., Kolkata) as per ASTM-D-2863-77 method.

Rot Resistance

Rot resistance i.e. resistance to microbial attack of the fabric samples was assessed by determining the % retention of tensile strength after subjecting the fabric to a standard soil burial test for 21-days as per IS:1623:1960 [3,9].

Measurement of Crease recovery Performances

Dry Crease recovery angle (warp +weft) of selected fabric samples were measured by the SASMIRA crease recovery tester in accordance with ASTM-D-1295-67.

Measurement of Tensile Properties

Tensile strength of selected fabric samples were measured by the raveled strip method as per IS-1969-1985 method using an Instron (Model-1445) CRT-Universal tensile tester with a traverse speed of 100 mm/min and a pretension of 0.5 N. The final gauge length(sample size) of the fabric sample was 50 mm. x 20 mm. under the jaws.

Measurement of Whiteness Indices

Whiteness index as per Hunter Lab-Scale formula^[11] of the selected jute fabric samples were directly evaluated using a computer aided Macbeth 2020 plus reflectance spectrophotometer (with D₆₅ standard illuminant and 10° standard observer setting) and associated colour measurement software.

Determination of Fabric Stiffness (bending Length)

Fabric stiffness as expressed in terms of bending length of the selected fabric samples were measured as per IS-6490-1971 method using Cantilever type SASMIRA fabric stiffness tester.

Thermal Behaviour by TGA

TGA thermograms of untreated and treated jute fibre samples (finely crushed) after being taken out from the corresponding untreated and treated jute fabrics were obtained from a Shimadzu Thermo-Gravimetric Analyser (Model-TGA-50) under atmospheric air for TGA at heating rate of $10^{\circ}\text{C}/\text{min}$, using a pre-fixed sample weight of exactly 2 mg over a temperature range from 30°C (ambient) to 500°C , following usual procedure.^[7,18]

Fourier Transform Infrared Spectroscopy (FTIR)

Selected jute fibre (finely crushed)samples (3mg)taken out from untreated and treated fabrics were examined in a double beam FTIR spectrophotometer (BOMEM,MB 104)using KBr disc technique^[7,18].

RESULTS & DISCUSSIONS

Fire Protective Finish

The changes in flammability properties(LOI values), physical properties of jute fabrics after being treated with urea(15% to 25%) and ammonium sulphamate in varying amount viz.,15%,20%,and 25% have been assessed and shown in Table – 1a. The flame retardancy performance of a textile material can generally be assessed by determining the ignition time, burning time, char length, flame spread time, after glow and Limiting Oxygen Index(LOI) value etc.Test results in Table1 show that with the increase of sulphamate concentration, the fire

retardant performance is found to be improved steadily as reflected by flame spread time in 45° inclined flammability tester and LOI value. Ammonium sulphamate as well as urea in combination are reported to be reasonably good fire retardant agents for cellulosic material.

Table 1a indicates the fire retardancy characteristics of treated jute fabrics. The results show that the formulations impart good fire retardancy. The chemicals are water soluble and indigenously available. Among the fire retardant formulations studied in the present work, Formulation based on 20% urea and 20% Ammonium Sulphamate gives the highest fire retardant performance with some loss of tenacity of jute fabric showing LOI value upto 38

Table 1a: Fire-retardant Treatment for Jute Fabrics and Their Properties

Treatments (Applied on % Weight of Fabric)	Physical Properties			Flammability Properties				L.O.I%	
	Tensile Properties	Bending Properties	Surface Appearance	45° Inclined Flammability Test Properties					
	% Loss in Tenacity	Bending Length (cm)	Whiteness Index (Hunter)	Flame Spread (Sec)	After Glow Time	Char Length (cm)	Limiting Oxygen Index %		
Untreated	—	3.8	75.20	49.0 (BEL*)	55.0'	*BEL (12.5)	20.5		
Urea-20%+Ammonium Sulfamate 15%	20.5	3.7	73.64	18	12	2.5	35.2		
Urea-0%+Ammonium Sulfamate 20%	22.7	3.9	72.08	nil	Nil	1.0	38.0		
Urea-20%+Ammonium Sulfamate 25%	25.6	4.2	71.95	nil	Nil	1.1	37.5		
Urea-25%+Ammonium Sulfamate 20%	24.3	4.4	72.08	Nil	Nil	1.1	37.2		
Urea-15%+Ammonium Sulfamate 20%	25.3	4.1	73.25	Nil	Nil	1.5	36.4		
Urea-20%+DAP 10%									
Urea-0%+Ammonium Sulfamate 20%	33.7	4.8	72.56	Nil	Nil	2.0	35.0		
Urea-20% + DAP 10% + Ammonium Sulfamate 20%	35.6	4.6	72.84	Nil	Nil	2.2	36.5		

Table 1b: Effect of Citric Acid Treatment on Physical Properties of Jute Fabric

Expt. No.	Treatment	% Loss in Strength due to treatment	% Retention of Tensile Strength after soil burial for 21 days	Dry Crease Recovery Angle, degree(w+f)	Whiteness Index	Bending Length (cm)
	Untreated Jute Fabric	—	8	150	75.2	3.8
1	6% Citric Acid	24	30	210	74.3	3.9
2.	8%Citric Acid	30	39	230	73.4	3.9
3	10%Citric Acid	35	50	240	73.2	3.9
4	12%Citric Acid	40	50.5	242	73.0	4.0

Rot Protective Finish

Effect of Citric Acid on Functional Properties of Jute Fabric

The changes in rot resistance, crease recovery of jute fabrics after being treated with citric acid in varying amount viz., 6%, 8%, 10% and 12% have been assessed and shown in Table – 1b.

a) **Crease Recovery:** Crease recovery property sharply increases with increase in CA concentration since the increasing CA concentration will increase the availability of cross linking molecules and consequently increase its accessibility to crosslink jute hydroxyls. DCRA (W+F) value reached to 240° with 10% CA where as untreated fabric DCRA (W+F) value is 150°. Further increase in citric acid concentration (12%) have only marginal improvement on crease recovery property (242) but fabric suffered higher loss in strength. Citric acid treatment causes loss in tensile strength and an increase in wrinkle recovery of treated fabric, which is a presumptive evidence of cross linking with cellulose. The degree of crease recovery is moderate, and it is thought that moderate level of cross linking is achieved with jute fabric and citric acid forming ester. Citric Acid being an α-hydroxy tricarboxylic acid, it is less effective for cross linking cellulose than are tri and tetra carboxylic acids that do not possess hydroxyl groups in their molecular structure [6,16].

b) **Tensile Property:** It is established that cross linking treatment of cellulosic materials causes damages to its several physical properties e.g. tensile strength, whiteness and stiffness. The fabric suffered 35% loss in strength with 10% CA treatment due to cross linking. This may be due to the acidic degradation of CA during curing.

Whiteness: For the surface appearance properties, it is noticed that whiteness indices are found to be decreased with increase in concentration of CA. This may be explained that during curing condition some unsaturated poly carboxylic acid are also generated which cause yellowing [13,16].

Stiffness: The bending length of citric acid treated jute fabrics are found to be increased with the increase in concentration of citric acid causing the fabric handle stiffer. Fabric handle is slightly deteriorated on CA treatment at 6% and above as indicated by increased bending length. The stiffness so imparted is due to the effect of cross linking reaction.

Rot Resistance: Rot resistance of treated jute fabric was measured by soil burial test where the extent of fabric damage by micro organism is indicated by loss in strength. The fabric performed well in soil burial test with increase in citric acid. The strength retention% after 3 weeks soil burial test is 50% with 10% Citric Acid, where as untreated fabric is almost completely deteriorated in the soil burial test and retained only 8% tensile strength. Further increase in citric acid concentration, rot resistance property remains to be unchanged. Rot Resistance property imparted is attributed to chemical modification which makes the cellulose polymer detrimental to micro-organism. Cross linking protect from microbial degradation by making jute inaccessible to cellulose and hemicelluloses degradable enzyme.

Table 2: Physical Properties of Bleached Jute Fabrics Treated by Citric Acid and PEG 400

Expt. Treatment No.	% Loss in Strength due to treatment	% Retention of Tensile Strength after soil burial for 21 days	Dry Crease Recovery	Whiteness Index	Bending Length (cm)
Untreated jute fabric	-		150	75.2	3.8
10% CA	35	50	240	73.9	3.9
1. 10% CA and 2%PEG 400	32	54	242	74.0	3.9
2. 10% CA and 4%PEG 400	30	63	248	74.2	3.9
3. 10% CA and 6%PEG 400	27	74	252	74.6	3.9
4. 10% CA and 8%PEG 400	25	80	256	74.7	3.9
5. 10% CA and 10%PEG 400	23	84	260	74.9	3.8
6. 10% CA and 12%PEG 400	22	84	256	75.0	3.8

Effect of Treatment with Combination of Citric Acid and Poly Ethylene Glycol 400

The changes in rot resistance, crease resistance and related textile properties of jute fabrics after being treated with poly ethylene glycol 400 in varying amount viz.(4% to 12%) in combination with CA10% have been assessed and shown in Table – 2.

Rot resistance: Relevant data from Table-2 indicates that with the application of 4-10% PEG with 10% Citric Acid, rot resistance performance is significantly increased with increase in PEG concentration up to 10% as indicated by tensile strength% after soil burial test and at 12% PEG 400 concentration, only marginal improvement in % strength retention is achieved. From Table 2, it is evident that the strength retention % after soil burial test is 84% with 10% CA and 10% PEG400 which is much higher than CA cross linked fabric (50% strength retention). Although CA is the main cross linking agent but PEG played an important role in reducing microbial activities. Different theories have been put forward to explain PEG's antimicrobial mode of action. The thermal adaptability of the modified fabric is unique because of the latent heat provided by the bound polyols, and hence many other properties are also improved^[21]. Highly hydrophilic properties inherent in PEG desiccate microbes by depriving them of moisture. PEG treated fabric also impart a surfactant effect preventing the bacteria or fungi from becoming permanently attached. Their ability to buffer temperature changes and retard changes in surface temperature occurs in the range where most of the microbes have optimum growth. The modified fabric never reaches the temperature conductive to optimum microbial growth and the microbial growth in fabric surface is inhibited^[21].

Dry Crease Recovery: Dry Crease Recovery Angle (DCRA) value (W+F) is found to be slowly increased with increase in PEG 400 concentration up to 10% keeping CA% constant at 10% and with further increase of PEGm(12%) DCRA value is slightly decreased. Maximum crease recovery value of 260 is obtained with 10% CA and 10% PEG. The glycol react with the cross linking agent CA during curing treatment and become bound to the fabric as part of the finishing agent /fabric matrix. PEG provided more reactive site, increased degree of cross linking having more flexible three dimensional network than the network produced by CA. Some of the PEG may also react with oxy cellulose (-CHO,-COOH) formed due to bleaching of jute.

Tensile strength and stiffness: From Table-2, it is found that incorporation of PEG 400 in citric acid bath, also enhanced tensile strength and whiteness retention property of jute fabric improved than without it. Stiffness is decreased as indicated by decreased bending length and the treated fabric reached the original bending length. PEG is a good plasticizer which improved the flexibility, reduced brittleness and made a film forming property on jute fabric and hence strength and stiffness improved^[14].

Whiteness: Addition of PEG in the CA treatment improved whiteness retention property and at 10% PEG concentration, satisfactory whiteness of 74.9 was achieved which was nearer to whiteness index value of untreated jute fabric (75.2). PEG, being a good humectant, increase the rate and extent of moisture absorption, reduces the formation of unsaturated acids, improved the whiteness property ^[13].

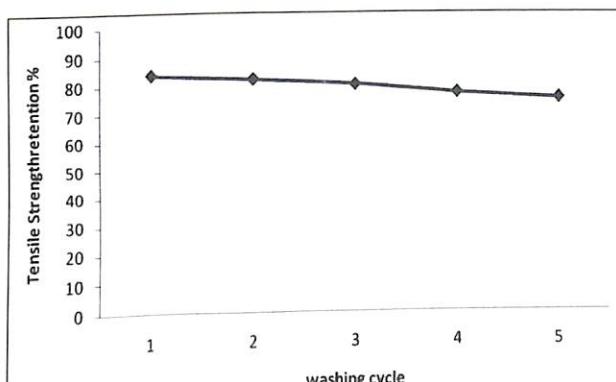


Figure1 a: T. Streghth Retention %of Jute Fabric Treated with CA & PEG after Soil Burial for 5-Washing Cycle

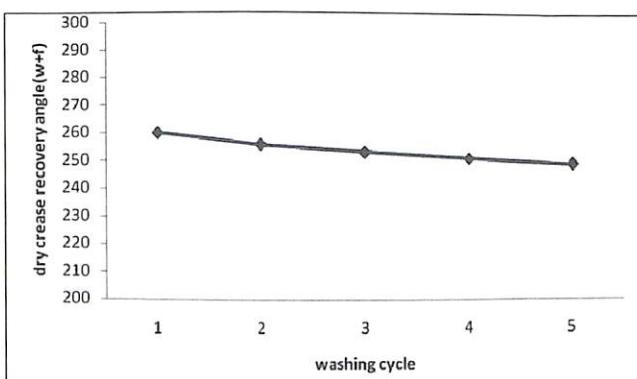


Figure 1 b: Crease Recovery Angle of Jute Fabric Treated With CA & PEG after 5-Washing Cycle

Wash Stability of CA and PEG Treated Jute Fabrics

While rot resistance of jute fabric treated with 10% CA and 10% PEG 400 treatment is good, performance is found to be slightly decreased after several washings (Fig-1a). After 5 consecutive washings, rot resistance performance(expressed as % tensile strength retention after soil burial) is found to be slightly decreased. Crease recovery property (DCRA) also found to be marginally decreased after 5 consecutive washing (1b).

Thermal Analysis of Treated and Untreated Jute Fabric

Thermo-Gravimetric Analysis (TGA) in air of jute and chemically treated jute samples are shown in Fig.2 respectively. TGA analysis of treated jute fabric showed that residue left at 500°C is more than that of untreated jute. Among the different treated fabric, it can be shown CA(10%) and PEG(10%) treatment leaves highest residue(20.5%) or weight loss is minimum where as untreated jute leaves a residue of only 10%. Therefore, this combination is expected to give higher thermal stability property^[7,18]. The crease recovery and soil burial value also confirm this observation. CA (10%) treatment also leaves a residue of 18% at 500°C due to cross linking ester formation which is also gave thermal stability.

FTIR-Spectroscopic Study

FTIR-spectra of bleached jute and fire retardant treated jute are shown Fig. 3.

The spectra of bleached jute (Fig.3a) showed characteristics broad peaks at 3610 cm⁻¹ (-OH-stretching), 1736 cm⁻¹ (-CO-stretching), 2893 cm⁻¹ (-CH-stretching)^[18].

CA treated jute fabric (Fig.3b) showed esterification of jute led to increased peak area 1736 cm⁻¹ (-CO-stretching). This can be explained by the formation of ester linkage as a result of reaction between cell-OH group and citric acid^[19,20]. In case of CA and PEG 400 treatment, addition of PEG with CA (Fig.3c) has not generated any new functional group but it is seen that area of carbonyl group peak (1736 cm⁻¹) has increased. These suggest that PEG has an effect in increasing the degree of esterification reaction with jute and CA.

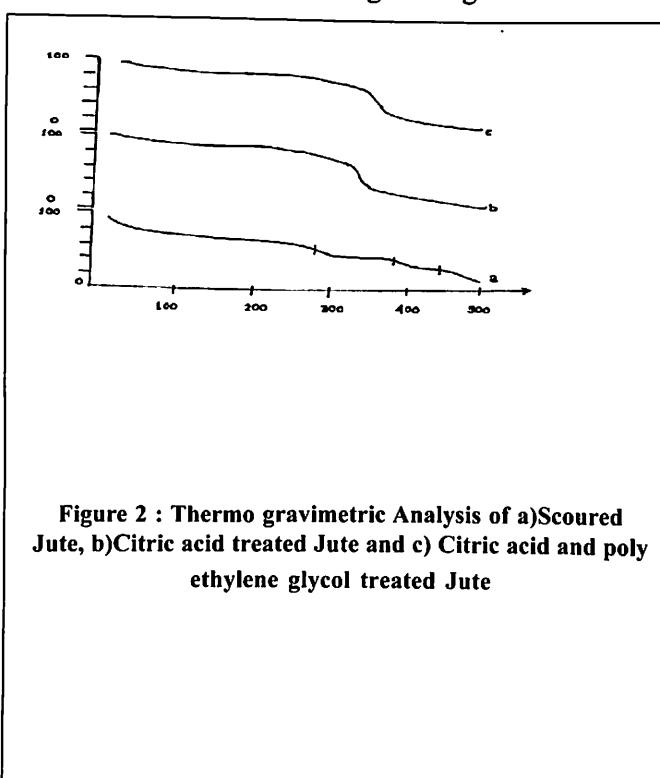


Figure 2 : Thermo gravimetric Analysis of a)Scoured Jute, b)Citric acid treated Jute and c) Citric acid and poly ethylene glycol treated Jute

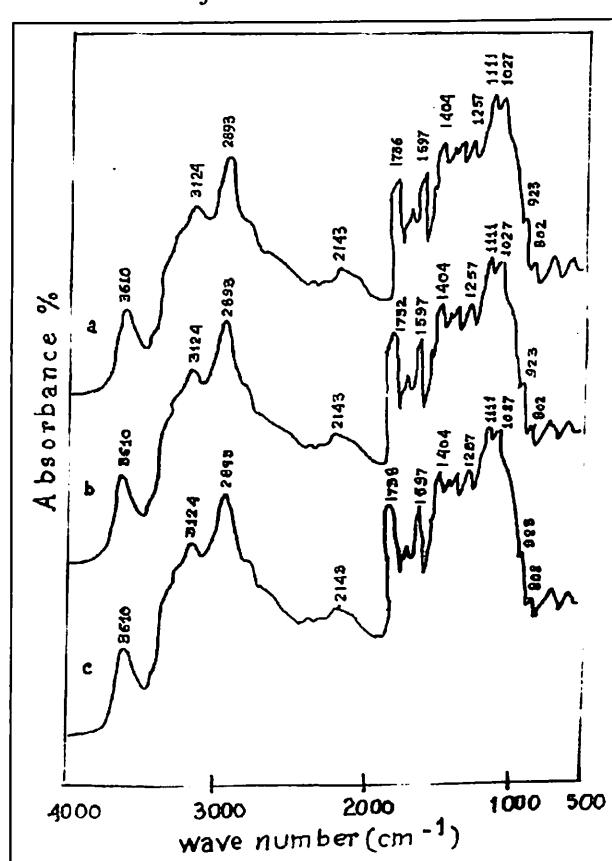


Figure 3: FTIR Spectra of a) Scoured Jute, b) Citric Acid Treated Jute and c) Citric Acid and Poly Ethylene Glycol Treated Jute

CONCLUSIONS

Combination of CA and PEG treatment showed satisfactory results with regard to crease resistance and rot resistance finishing for jute fabrics. The results show that concentration of CA and PEG are the most influential factors in determining the wrinkle resistance, tensile strength retention of the treated fabric. The optimum performance were obtained when jute were treated with 10% CA, 10% PEG 400 with 6% Sodium hypo phosphate monohydrate(catalyst) at 150°C for 5 min. The CA and PEG finished fabric shows adequate wrinkle resistance, sufficient whiteness retention property and high tensile strength retention property of jute fabric as compared to untreated fabric. The CA & PEG treatment also rendered high rot resistance property as indicated by soil burial test even after five washings.

Data on rot resistance or resistance to microbial attack are given in Table 3. Untreated bleached jute fabric showed very poor rot resistance property and maintained only 8% strength retention after soil burial test. A considerable degree of rot resistance is imparted to jute fabric treated with urea, di-ammonium phosphate and poly vinyl acetate. The fabric treated by the above process are chemically modified (phosphorylated) and impart rot resistance to jute fabric..Poly vinyl acetate also acts as a binder to jute. The strength retention after 3 weeks soil burial id 91%. The treatment is eco friendly also durable to plain water leaching or washing. Besides, the process has little effect on colour. But, during treatment the fabric suffers loss of strength of around 25%.

Rot resistance data of some crosslinking resin treatment of bleached jute fabric (e.g. AMF-resin, DMDHEU-resin, Citric acid) after soil burial test are also shown in Table 3 for comparison.

Jute fabric can be made fire retardant with urea and ammonium sulphamate based formulations. Rot resistance of jute fabric can be achieved with eco friendly chemicals. Combination of CA and PEG treatment showed satisfactory results with regard to crease resistance and rot resistance finishing for jute fabrics. The results show that concentration of CA and PEG are the most influential factors in determining the wrinkle resistance, tensile strength retention of the treated fabric. The optimum performance were obtained when jute were treated with 10% CA, 10% PEG 400 with 6% Sodium hypo phosphate monohydrate(catalyst) at 150°C for 5 min. The CA and PEG finished fabric shows adequate wrinkle resistance, sufficient whiteness retention property and high tensile strength retention property of jute fabric as compared to untreated fabric. The CA & PEG treatment also rendered high rot resistance property as indicated by soil burial test even after five washings

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Value Addition of Traditional Handloom Cotton Fabrics

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ABSTRACT

Handloom, the traditional device of manufacturing simple and decorative fabrics meant mostly for apparel in our country, has been playing a major role for the economic development of rural areas by the way of generating employment potential. It provides largest employment next to agriculture and is a low capital investment sector and occupies prime place in Indian economy. Despite of its several advantages the dispersed and unorganized nature of the industry in our country has been facing constraints on its sustenance. Textile decorations with printing, hand painting, embroidery, batik & bandhani, stitching etc. are the various approaches of product diversification on traditional handloom fabrics. To increase the penetration of handloom products in the domestic market there is a strong need to develop system of better integration of both product availability and awareness creation. The various methods tried in this journey will definitely show a constructive path for creation of value added handloom textiles with aesthetic appeal for the domestic as well as for the export market without involving costly infrastructure.

Key Words: Diversification, Embroidery, Handloom, Printing

INTRODUCTION

Handloom is the oldest weaving machine for producing elegant textile products till date and constitutes a timeless facet of the rich cultural heritage of India. This sector occupies a place second only to agriculture in providing livelihood to the people. As per handloom census 2009-2010, it is estimated that handloom industry provides employment to 43.31 lakh workforces directly and there are about 23.77 lakh handlooms spread all over India, which constitutes almost 80% of world handloom^[2]. The production of handloom fabrics contributes almost 16% of total textile production in India. The sector has an edge over the power loom sectors in its ability to commercially produce the goods in small volumes, openness to innovations, switch over to new designs, adaptability to suit suppliers' requirement and creation of exquisite design. However, in the present context of globalization and rapid technological changes, this sector is beset with manifold challenges and handloom products are being increasingly replicated on power looms at much lower price. Hence product diversification is very much essential for the survival of this rich cultural heritage of the country.

Silpa-Sadana, a department under Palli Samgathana Vibhaga of Visva-Bharati University is well acquainted for its technical and vocational training imparted in cottage industries and craft sectors since its inception. It had once taken a leading role in revitalizing the decadent rural industries and craft sector in India and also a premier institute working in the field of handloom textiles. In this context the present work is aimed at to create or develop a new product line for handloom textiles through different surface ornamentation techniques which will create a new domain for the upper and middle segment of the society in domestic and export market as well. These value additions also enrich the aesthetic appeal of the end product without compromising the product quality.

METHODOLOGY

Materials

Cotton Fabric: Plain weave handloom cotton fabric with various constructions purchased from the Silpa-Sadana Emporium, Visva-Bharati, India were used in the present study.

Chemicals Used: Diammonium phosphate, Emulsifier – N, Urea, Binder SLN, Texcron Pigment Emulsion, Fixer CCL, Kerosene Oil and Bee wax was used in this study.

Methods

Printing with kerosene oil-water emulsion thickener: Conventional methods of printing on handloom cotton fabric with pigment colour involves: (i) preparation of kerosene oil-water emulsion thickener, (ii) preparation of printing paste, (iii) printing and (iv) curing.

Preparation of thickener: A stock paste of kerosene oil-water emulsion thickener was prepared with kerosene oil, water, emulsifier N and urea according to the recipe as mentioned in table - 1 with the help of a high speed stirrer machine.

Preparation of printing paste: Diammonium-phosphate, Binder SLN and Pigment emulsion were mixed with the kerosene oil-water emulsion thickener with the help of a high speed stirrer machine as per the recipe.

Printing process: The bleached and/or dyed cotton fabrics were printed and painted with the above printing paste by the help of wooden blocks, screens, stencil, hand nozzle, rollers sponge, brush etc as per the design. Finally, after printing or painting the fabrics were dried in air and cured at 1400C temperature for 5- 10 min.

Table 1: Print Paste Recipe

Kerosene oil-water thickener		
Kerosene oil	:	80 parts
Emulsifier-N	:	01 part
Urea	:	05 parts
Water	:	Balance
Total	:	100

Preparation of printing paste

Pigment colour	:	X parts
Diammonium phosphate	:	02 parts
Binder SLN	:	10 parts
Emulsion Thickener	:	86 parts
Total	:	100

Wax resists and pigment painting: Batik and bandhani is a method of creating patterns or designs on the fabric surface using resist technique i.e. some portions of the fabric are prepared to ‘resist’ colour during the application of dyes. In batik work, the resist material traditionally used is molten wax, whereas in bandhani fold, knot, ties etc resist the colourants.

In this method design was created on a piece of cloth and the waxing process was done with the help of molten bee wax. Pigment solution was then prepared according to the recipe as mentioned in the Table – 1 followed by painting with the help of different types of brush. After completion of waxing and subsequent painting process,

wax was finally removed by placing the fabric in between two news papers, followed by steaming at 102°C for duration of 60 min in a cottage steamer.

RESULTS

Table 2 shows various methods adopted for producing value added handloom cotton textiles to be used for apparel without involving costly infrastructure along with cost comparison.

Table 2: Techniques adopted to create different value added handloom textile to be used as dress materials

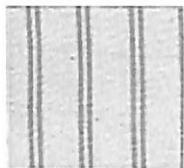
Sample No.	Ends/inch	Picks/inch	Techniques adopted	Cost. per meter (Rs.)		End use
				Before value-addition	After value-addition	
1	76	52	Resist and painting	45	85	Dress Material
2	68	72	Sponge and hand nozzle	65	100	Dress Material
3	68	60	Block	60	95	Dress Materials
4	36	26	Block	65	100	Dress Material
5	72	52	Block and Kantha Stitch	60	130	Dress Material
6	65	50	Transfer and block printing along with stitching	45	85	Dress Material
7	38	28	Hand painting	65	100	Dress Material
8	80	50	Stitching	45	105	Dress Materials
9	72	52	Hand painting and stitching	60	105	Dress Material

CONCLUSION

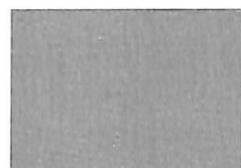
Studies presented in the article relate to surface ornamentation of handloom cotton fabric with the objectives of achieving value added traditional handloom textiles for domestic and export market, making them higher performing and enhancing the scope for their use in different applications. This report also reveals the various innovative methods adopted by the designer to create fancy effect on the handloom textile for the ever changing fashion market, but there is ample scope to create new design through different surface ornamentation techniques without involving much more infrastructure. This will help to retain the long cultural heritage of the country. But the environmental problems associated with the use of kerosene oil - water based emulsion thickening agent in pigment printing may be replaced by aqueous based thickening agent [1].

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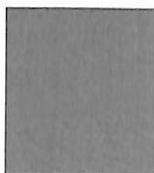
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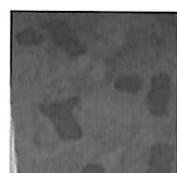
Sample 1: Value Addition through Wax Resist Techniques



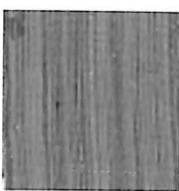
Sample 2: Value Addition through Painting using Hand Nozzle



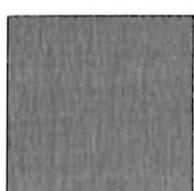
Sample 3: Value Addition through Block Printing



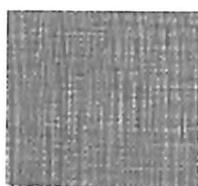
Sample 4: Value Addition through Block Printing



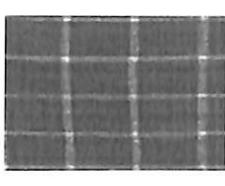
Sample 5: Value Addition through Block Printing & Stitching



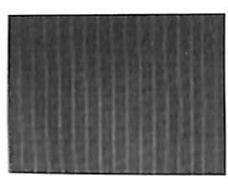
Sample 6: Value Addition through Transfer & Block Printing along with Stitching



Sample 7: Value Addition through Hand Painting



Sample 8: Value Addition through Stitching



Sample 9: Value Addition through Hand Painting & Stitching

Studies on Jute Geotextile and its Geo-Technical Applications with respect to Eco-Concern

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ABSTRACT

Natural fibres are gradually emerging as essential ingredients of various types of textiles in view of increasing global concerns about environmental degradation. Reduction of carbon foot print in constructions is currently attracting global attention warranting innovations in construction technology with stress on eco-congruity. In this context increasing use of eco-concordant materials made of natural fibres to the extent feasible in constructions has assumed significance. Textile Technology is at the same time poised to take innovative turns by manufacturing products that could meet the technical requirements on the one hand and could help maintain eco-congruity on the other. Till date man-made (artificial polymer-based) fibres have a dominant role for its many advantages excepting the aspect of eco-congruity. Jute, besides its unique features, excels other natural fibres in availability and spinnability. There has been substantial research on technological innovations of Jute in the recent past mostly related to non-technical applications. With newer avenues in technical applications opening up of late, the need for continuing R & D has become a necessity. Development of Jute Geotextiles (JGT) in Geotech category of Technical Textiles is a pointer in this direction. Besides its effectiveness in carbon sequestration and eco-compatibility from cradle-to-grave, diverse applications of JGT are being conceptualized with thrust on R & D as unique technical attributes of Jute can meet most of the technical requirements needed for the major geo-technical applications. This paper brings out the physical characteristics of Jute fibre and some of the innovative R & D exercises executed so far.

Key Words: carbon foot print, eco-congruity, Jutegeotextiles, geo-technical applications.

INTRODUCTION

Use of geotextiles (now termed geosynthetics encompassing both natural & man-made geotextiles) to address a variety of soil-related problems in civil engineering is now an accepted and proven technology^[1]. Extensive R & D on man-made (synthetic) geotextiles has led to development of new varieties for specific applications according to the nature and severity of problems. Interestingly, the concept of making geosynthetics from man-made fibres such as nylon, polyester, polyamide and similar petro-chemical derivatives which originated in the first half of 1950s owes its origin to natural contrivances made ages ahead for soil erosion control^[2]. Making of geosynthetics from natural fibres such as Jute & coir is thus something like switching back to the original roots of a concept.

This paper aims at introducing natural geotextiles with special reference to Jute Geotextiles (JGT) and presents an overview of the emerging technology.

Suitability of Natural Fibres as Geotextiles

Geosynthetics in general call for adequate tensile strength, good spinnability and weavability in machines (for large scale production), drapability (loosely, flexibility) and retention of tensile strength for at least two years^[3]. Natural geosynthetics generally cannot match their man-made counterpart in the upper range of tensile strength. Usually tensile strength of 25 kN/m is sufficient to address the majority of the requirements. Most of the natural fibres can meet this requirement.

Precise porometric features in woven geosynthetics depend on spinnability and weavability of the yarn. Coir for instance is a strong and rigid fibre but low in spinnability and weavability. As woven geotextiles are designed in keeping with average grain size diameter of soil on which it is to be laid and may need to have pore size as low as 100 μ in some cases, only fine fibres such as Jute can address the requirement which is only second to cotton in this respect [4].

The foremost concern in respect of all natural geotextiles is about availability of fibres in sufficient quantities for commercial production of geosynthetics. Only Jute and coir are available in abundance. Other natural fibres at the existing rate of production are not in a position to meet the demand of geotextiles.

Table 1: Chemical Composition of Some Natural Fibres

Constituents Fibre	Flax	Jute	Mesta (Kenaf)	Sunn Hemp	Ramie	Cotton
Holo Cellulose	80.8	82-85	83.5	85.1	81.7	94.3
α -cellulose	64.1	58-63	60.0	78.3	68.6	94.0
Hemi Cellulose	16.7	21-24	23.5	6.8	13.1	0.3
Lignin	2.0	12014	10.1	4.0	0.6	—
Pectin	1.8	0.2-0.5	—	—	1.9	0.9
Fax and Wax	1.5	0.4-0.8	0.6	0.5	0.3	0.6
Water Soluble Extract	3.9	—	—	—	5.5	—
Ash	1.1	0.5-0.8	0.7	0.3	1.1	1.2
Organic Acid						0.8

Jute Geotextiles (JGT) vis-à-vis Man-made Geotextiles

Man-made (synthetic) fibres are basically thermoplastics such as polyamide, polyester, polyethylene, polypropylene, PVC and the like. Fabrics made of such synthetic polymers were initially used as apparels and fabrics basically for internal use. Long durability of synthetic fibres as well as their very high tensile strength, ease of production and technical flexibility led to development of geotextiles first in the Netherlands in 1953 for geotechnical applications and till date is accepted as the most technically effective engineering fabric for addressing geotechnical problems.

Interestingly, long before the concept of making fabrics with man-made ingredients took shape, a section of engineers in Scotland and India thought of laying Jute Hessian on roads for strengthening. The first such experiment was carried out at Dundee, Scotland in 1920 and later, on Strand Road, Kolkata, India in 1934 by Bengal PWD [5]. Jute Hessian was also reportedly used in World War II in Myanmar with satisfactory results. The trials unfortunately were not monitored and followed up in right earnest and potential of Jute in road construction remained unrealized for long. The trials deserve to be treated as the first use of Jute fabrics as geotextile. The U.S.A. started using open weave Jute Geotextiles (JGT) under brand names of “Soil Saver”, “Anti-wash” principally for slope erosion control which, till date, remains a major exportable product of India. Concerted efforts to manufacture, use and promote JGT started in early 1990s [6]. Environmentally man-made geotextiles have disadvantages which is why natural geotextiles are gradually being preferred in less critical areas globally.

Specialities of Jute

Jute fibres possess good pliancy and render a high degree of flexibility and fineness to fabric construction. High initial modulus, consistency in tenacity (depends on thickness of the filament), high torsional rigidity and low percentage of elongation-at-break make Jute a suitable fibre for geosynthetics [7]. The other remarkable property

of Jute is its capacity to absorb water because of its high cellulosic content. Jute fibres/yarns can absorb water up to about 500% of their dry weight. Hygroscopic property of Jute is the highest among all fibres—natural & ofcourse man-made. Jute Geotextiles can be manufactured conforming to customized specifications in regard to porometry, tensile strength, permittivity (passage of water across the fabric) & transmissivity (transmission of water along the fabric) which are comparable to man-made geotextiles. Puncture strength and burst strength of Jute Geotextiles are also close to man-made geosynthetics. Besides, JGT has a distinct environmental edge.

Table 2: Properties of Jute Fibre in Contrast with Man-made Fibre

Sl.No.	Properties	Jute	Polyester	Polypropylene
01.	Specific gravity	1.48	1.38	0.91
02.	Tenacity, g/d	3 to 5	2 to 9.2	2.5 to 5.5
03.	Breaking Elongation, %	0.8 to 2	7 to 37	17
04.	Elastic recovery, %	75 to 85	57 to 99	75 to 95
05.	Moisture regain, At 65% R.H. and 27°C.	12.5 to 13.8	0.4	0.01
06.	Effect of heat	It does not melt. Up to 180°C there is no major wt. loss and tenacity loss. However hemi cellulose degrades around 293°C and other constituents at higher temperature.	Sticks at 180°C and Melts at 230° – 240°C	Softens at 143° – 154°C, melts at 160°C & decomposes at 288°C
07.	Effect of acid /alkalis	Good resistant to dilute organic and mineral acids at room temperature but degrades in conc. mineral acids. Affected by hot alkali.	Good resistance at room temperature but disintegrates in conc. hot alkali. Excellent resistance to acids.	Excellent resistance to conc. acid and alkalis.
08.	Effect of bleaches & solvents	Resistant to H ₂ O ₂ bleaching conditions. Excellent resistant to organic solvents. However, affected by strong oxidizing agents.	Excellent resistance to bleaches & oxidizing agents.	Resistance to bleaches & solvents. Chlorinated Hydrocarbon cause swelling & dissolves at 160°C and higher.

Applications of Jute Geotextiles (JGT)

Jute Geotextiles (JGT) have been tried successfully in slope management, erosion control and soil conservation, stabilization of earthen embankment, protection of river and canal bank, strengthening of sub-grade of road pavement and railway track, consolidation of soft soil etc.. Understandably design approach has to be application-specific. Natural geotextiles may be used in conjunction with vegetation in case of erosion control of exposed soil. Bio-engineering measure to control erosion is a much preferred option all over the world for environmental reasons at present. JGT fits in with this trend. Elaborate studies have been done in the developed countries with man-made geotextiles compared to studies on JGT. Standardization of applications along with finalization of specifications of the suitable JGT types is the next step for which necessary initiatives have been taken. What is critical is to evolve design methodologies for different applications with JGT. This is an empirical exercise based on data generated from fields and their corroboration in laboratory. An international project on JGT covering India and Bangladesh sponsored by the Common Fund for Commodities (CFC), Amsterdam, a financial

institution of the United Nations, with support from the Governments of the two countries is on way. The project aims at identifying potentially important JGT for erosion control and construction of low volume roads is in progress. Notably more than 150 field applications conducted so far in India with JGT for addressing soil-related problems encountered in road construction, railway track settlement control, control of river bank erosion, stabilization of slope, including hill slope, have proved effective establishing the efficacy of the product. Quite a few field applications have been done in some of the European countries & the USA as well. Bangladesh has obviously been using JGT for soil erosion control and stabilization.

Durability of Natural Geotextiles

Durability of natural geosynthetics depends on a number of factors. The type and strength of fibres, soil composition and its physical characteristics, duration and extent of their contact with water are principal determinants in respect of their durability. Environmental factors like atmospheric relative humidity, temperature and the nature and duration of atmospheric exposure also influence durability and strength of geosynthetics^[8]. In fact, mechanism of degradation of natural geosynthetics is complex. JGT is seen to degrade faster in an acidic ambience with pH value less than 5.2. With pH value higher than 7, degradation of JGT is seen to be rather slow and depends on the linear density of yarns (higher linear density is more susceptible to quicker degradation). On top of it, microbial decomposition of natural geosynthetics is an area of concern. It has been observed that bacteria and fungi with the abetment of favourable ranges in moisture content and temperature hasten degradation of JGT.

The situation therefore warrants treatment with a coating of rot-resistant natural additive. Bio-degradability of natural geotextiles however is not a technical disadvantage as is commonly perceived. Long durability of geotextiles has proved to be an over-rated requirement as corroborated by a good number of field trials. Soil consolidation is optimized by gradual riddance of pore water from the soil due to filtration function of the geotextiles leading to development of effective stress within it. All types of geotextiles, natural and man-made, need to retain tensile strength and their dimensional features for two to three years usually to optimize soil consolidation. Long durability of geotextiles is thus not a technical necessity as all geotextiles act as change-agents to the soil in or on which they are applied.

There have been significant findings also in this regard which can be summarized as loss of strength of JGT after a year which is not a technical disadvantage as by that time JGT provides a self-sustaining sub-grade for most of the soils (Ramaswamy & Aziz-1989), the gain in strength of sub-grade compensates the loss of strength of JGT within the same time-frame (*ibid* & report of Jadavpur University 2005) and dependence of soil on JGT for stability decreases with the passage of time^[9].

Eco-compatibility of Jute Geotextiles

Natural fibres are supposed to be eco-compatible by nature from cradle-to-grave. Eco-concordance of retting methods is sometimes questioned. To avoid retting in water as is done in case of Jute, mechanical de-cortification manually or by simple mechanical appliances without water is being tried by some countries such as China. To establish eco-compatibility of natural fibres, Life Cycle Assessment (LCA) study on Jute and important Jute products entrusted to Price Waterhouse Coopers Ltd by national Jute Board reveals that the most significant impact on the Jute life cycle is carbon sequestration by green Jute plants in the agricultural stage. Approximately 4.88 tons of carbon dioxide get sequestered per ton of raw Jute fibre production^[10]. Jute plantation acts as a sink for carbon. The carbon dioxide emission from Jute is carbon-neutral in nature since the product is from plant-source and can be considered as a bio-mass.

Green House Gas (GHG) emissions from Jute are negative on account of large carbon sequestration in Phase I. All man-made geosynthetics exhibit positive GHG emissions. Air-acidification of Jute & JGT is also far lower when compared to other man-made alternatives^[11].

During the 100 days of Jute growing period, 1 Hectare of Jute plant can absorb about 15 metric ton of carbon dioxide from atmosphere and liberate about 11 metric ton of oxygen, the life supporting agent. Studies reveal that carbon dioxide assimilation rate of Jute is several times higher than that of trees (Inagaki, 2000; IJSG 2003).

The main use of Jute sticks (a retting output) is as fuel apart from other household uses. Yield of Jute sticks is 2.5 times the fibre by weight [12].

Taking overall production of raw Jute / Mesta fibre at 2.7 million tons (in India and Bangladesh), the total output of Jute sticks comes to 6.75 million tons. Considering the other household use at 25 % level, Jute sticks annually saves 5.06 million tons of forest wood and bamboo in these two countries and help in preserving ecological balance. Leaves which are left in the field are good manures and increase the fertility of land. Apart from this, Jute cultivation creates a large direct employment to the farmers, industrial workers and indirect employment to workers associated with ancillary industries.

In view of the ‘carbon foot print reduction’ concept in construction to ensure marketing eco-friendly products, JGT should attract greater global acceptability.

Overlooked Environmental Applications with Jute and other Natural Geotextiles

There could be more environmental applications with JGT & coir geotextiles. The overlooked areas are - watershed management, stabilization of mine spoils and overburden dumps, especially in open cast mines, management of pulverized fly ash (PFA) heaps and municipal solid waste (MSW). Only about 11% of the fly ash produced is effectively utilized and the rest are heaped in open lands within the stations. Fly-ash

dusts, conveyed by winds, are menace to health. The same may be said about disposal of MSW. Jute hessian has been in use in the overseas for covering up the waste dumps daily (e.g. Brazil). Low cost non-woven JGT can curb spread of pollution caused by accumulated foul gases, liquid pollutants and light waste matter of the refuse heaps. Efficacy of JGT in fostering vegetation in arid and semi-arid zones is well established. Watershed management though critical is still a neglected sector in India where JGT can play a significant role.

CONCLUSION

With increasing emphasis on using natural ingredients in engineering and other sectors for reduction of carbon foot-print and thrust on adopting bio-engineering measures to tackle soil-related problems in engineering, there is need for continuing research on improvement of fibre-quality It is also felt expedient to organize awareness courses for civil engineers (who are the main end-users of geosynthetics) on Jute Geotextiles (JGT). Regular courses on Geosynthetics—both natural and man-made—should be introduced in Engineering Institutes.

Standardization is critical to promote any innovative engineering material. One BI Standard on application of JGT in slopes has already been published (IS: 14986:2007). Two other BI Standards are under print (rural road construction & river bank erosion control). Indian Roads Congress has recently released a document on JGT (*State-of-the-art Report on use of Jute Geotextiles in road construction & prevention of soil erosion/landslides*).

Railway Ministry has started using JGT on unstable formations after successful trials in some distressed sections Burdwan-Howrah Chord Line (based on a design concept of the *first author* presented in Indian Geotechnical Conference at IIT Mumbai in 2000). All these are pointers that JGT is fast catching up both within and outside India. Survival of Jute industry, perhaps the oldest surviving agro-industry in the world, largely depends on acceptance of the product as Jute is fast losing its monopoly in the sack-market.

LCA study of all available & potent natural fibres from ‘cradle to grave’ should be taken up and a comparative evaluation made including different man-made fibres. Carbon foot print reduction is being advocated globally for all types of construction materials. Continuing R & D on natural fibre-based geotextiles should be carried out and their technical limitations obviated by improving fibre- & fabric- quality. There is a huge need for evolving JGT-specific design methodology & global accreditation of the products with their applications. Besides, JGT deserves special encouragement from the central & state governments and decision-makers for its ensured use especially in the public sector in the greater interest of national economy and for environmental reasons.

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Green Processing of Jute and Other Textiles for Fulfilment of Eco-Criteria and Pollution Control Norms

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ABSTRACT

Eco-friendly textiles are to be ecologically safe and should not harm the natural ecological balance of the environment, either directly or indirectly, although the term of eco-friendliness is partly standardized by eco-mark and other such standards but yet to be standardized in different context. This paper deals with the requirement of eco-criteria for such standards of textile, eco-friendly chemical processing covering preparatory processes, dyeing, printing, finishing etc. This paper provides information about the use of alternative chemicals having low COD/BOD values for eco-friendliness of textile chemical processes as well as eco-friendly textile products. Some of the relevant studies by this department of Calcutta University towards establishing newer recipe for eco-friendly processes and products including natural dyeing of jute and cotton textiles are reported here for green processing of textiles towards an endeavour to achieve eco-friendly textile product at optimized and minimized cost. This paper thus gives comprehensive scientific information on some important R&D work related to application of eco-friendly chemicals and dyes on jute and other textile substrate, which and may be useful for future researchers/ industrial dyers/processers.

Key Words: Cotton, Dyeing, Eco-friendly Process and Products, Finishing, Green Processing, Jute, Natural Dyes, Printing

INTRODUCTION

Progress of civilization has obliged mankind to stoop down to understand the eco-values of textile, right from its origin to end-use and therefore, customer sets the benchmark, uttering what would be in and what wouldn't. Chain-stores and mass retailers then adapt the ideas for the ultimate consumers in the street. Though, demand-trend ranks textile and clothing industry as the world's second-biggest economic activity, the eco-concept, more often than not in developing countries, are far from the standard. The environment pays a heavy price too. However, manufacturers and distributors are launching the initiatives built around sustainable development, who knows, ecology and green concept may be the next new trend! The present paper is a current technical review of such scientific studies which appears to be useful for all concerned.

World's preference towards clean fabric i.e. eco-friendly textiles, and consequent regulations and restrictions including certain ban and standardisation of certain eco-criteria have pushed the textile manufacturer to remain cautious about the cleanliness and eco-friendliness of their process and products. Textile industry or any textile manufacturer including jute industry therefore can't be an exception.

The standard eco-mark scheme of different organisations of German, based on six/seven major eco-parameters (free formaldehyde, pesticides, pentachlorophenol, heavy metals, azoic dyes containing carcinogenic/toxic amines, halogen carrier, chlorine bleaching, pH of aqueous extract etc.) along with relevant eco-mark scheme of India is reported in this paper.

However, this is to mention that only satisfying the above eco-criteria within the maximum allowable limits, does

not satisfy a product to be marked as eco-friendly textiles. Along with the satisfying all eco-criteria as per relevant standard, the other general considerations/requirements in most of the cases include the followings :-

- a) All the textile products manufactured should comply with the relevant standards of Bureau of Indian Standards as well as there shall not be any contamination of toxic substance during packaging/shipment handling.
- b) To mark a product eco-friendly, besides the product including its packaging need to satisfy specified limits of eco-criteria, the processes for its manufacture, are also to be eco-friendly maintaining the water, air and noise pollution limits in discharges/emissions and processes including all relevant environmental issues. Hence the manufacturer of textile products must produce clearance consent provisions regarding (i) Water (Prevention and Control of Pollution) acts, 1974, 1977, (ii) Air (Prevention and Control of Pollution) Act, 1981 (iii) Environment (Protection) Act, 1986 & (iv) Documentary evidence of compliance with noise level and occupational health issue under the Factories Act, 1948 to the BIS while applying for the ECO MARK
- c) The product packaging may briefly display the criteria on which the product has been labelled environment-friendly. Material used in apparels, non-apparel functional textiles including packaging textiles should also be eco-friendly and bio-degradable, if possible.
- d) In some countries, they are considering some product behaviour under eco-criteria, to protect consumers' interest i.e. Fastness of Coloured Textiles, pH of the aqueous extract of the product etc.

So, one has to look to the problem as a whole from growing (cultivation) stage of raw fibre to all production stages upto finishing including packaging and handling etc.

Importance of Eco-label

Eco-label i.e. certification as environmental friendly or eco-friendly product, has recently gained much importance in the world-wide business of consumer goods including textile and jute products. Primarily, eco-criteria for textiles have become so important after German Govt. ordinance dated. 15.07.94, banning the use of 20 amines (identified by MAK Commission of Germany as carcinogen/toxic) barring the use of relevant azo-dyes or other products which during use may yield/release such banned amines as well as subsequent adoption of the similar eco-criteria related norms by European Community Country and others. This German ban was to be effective from 31.12.94, postponed to 30.06.95 and further extended and became effective ultimately from 01.04.96. Govt. of India has also adopted this eco-criteria in the same spirit banning the use of relevant azo-dyes (Govt. of India has banned 40 benzidine based dyes and 72 other azo dyes based on 22 toxic amines identified by relevant Indian Committee) and forming eco-mark scheme, having some fine differences in the nature of Indian ban and the German ban on relevant issue^[1-4].

Considering the above-said eco-ban for certain direct, acid, basic dyes and azoic colour components, the alternative remains to the dyers are to use reactive, vat, sulphur or certain natural dyes for eco-friendly dyeing of textiles. In the present paper, the total aspects of eco-friendly processing of textiles as a whole is discussed.

Major Factors for Eco-friendliness

With respect to textile industry, the phrase 'ecology' is classified into three groups:

- 1) **Production Ecology:** Which includes Cultivation and harvesting of natural fibres, Production of semi-synthetic /regenerated fibres and also Production of yarns, twisted threads and fabrics and its Dyeing, Printing & Finishing.
- 2) **User Ecology:** Which is related to the uses of textile products and the accessories having additives that give them required property criteria, beauty and serviceability and performance characteristics during application.
- 3) **Disposal Ecology:** Which refers to the disposal of textiles after application i.e., to-recycling, composting, dumping or incinerating in a manner that ascertains the least probable environmental impact or polluting effect.

There are 2 types of criteria for eco labels:

- **Product Based:** This pertains to the limits of harmful chemicals which vary with the intended use of textiles.
 - a) **Group-I** Baby wear: The limits (stringent) are the lowest for the clothes and textiles for babies below age 3.
 - b) **Group-II:** Material in direct skin contact, worn next to skin, e.g., underwear, bed sheets and night dresses.
 - c) **Group-III:** Materials not in direct skin contact-textiles worn as second layer dresses, coats, article with linings.
 - d) **Group-IV:** Furnishing articles and accessories as decoratives. e.g., Table wear, upholstery, curtains, textile flooring and mattresses.
- **Process Based:** Recommendations for processes to be avoided /Controlled
 - a) Bleaching with Hypochlorites
 - b) Use of chlorinated organic compounds as carriers in polyester dyeing.
 - c) Optimum use of water and energy
 - d) Use of Eco Friendly Dyes and additives : Dyestuffs when exhausted on fiber are fixed to the extent of 50 to 90%; the unfixed exhausted dye along with additive chemical impurities contaminate the effluent, hence there is a need to ensure that the dyestuff and dye additives that are used in the dyeing process are eco friendly.
 - e) Use of finishing chemicals that release formaldehyde from finished textile product on usage.
 - f) Use of Fixer-CCL or its derivative for printing of textiles
 - g) Use of Jute batch oil (JBO) for production of jute products

Considering all these, the factors for establishing eco-standards may be Pesticide residue, Toxic materials or additives like Formaldehyde, PCP/LPCP or carcinogenic azo dyestuff, heavy metal content, skin neutrality, pH & Colour fastness.

Table 1: Eco-Criteria for Textile Products

Parameters	Maximum Limit in mg/kg (ppm)	
	Home Textile and Clothing	Packaging Textiles like Hessian and Sackings Jute Bags
Free & Releasable Formaldehyde		
Close to Skin	75	NA
Outer Fabrics	300	—
Heavy Metals (Sum Parameters)	10	—
Mercury	0.1	NA
Chromium-III	0.1	NA
Chromium-VI	NIL	NA
Lead		NA
Non-halogenated Hydrocarbons	3%	3%
Fatty Esters Based Oils	200	1
Volatile Halogenated Organics	-	—
Pesticides	1	1
Banned Pesticides	NIL	
pH of Aqueous Extract	6.0 - 7.0	6.0 - 7.0
Coupled Amines Released from Azo Dyes	50 (Detectable using GCMS)	50

Table 2: Eco Standards on Textile Production Maximum Permissible Limits

	M.S.T.	OTN 100	Clean Fashion	Steilmann	ECO-Mark Scheme(India)
Free Formaldehyde					
Close to skin	0.0075%	75 ppm	0.0075%	300 ppm	75 ppm
Baby clothing	0.002%	20 ppm	0.002%	50 ppm	20 ppm
Outer fabric/ furnishing fabric	300 ppm	300 ppm	300 ppm	500 ppm	300 ppm
Pesticides					
DDT	1.0 mg/kg	—	—	—	—
HCH	0.5 mg/kg	—	—	—	—
Llndan	1.0 mg/kg	—	—	—	—
Alfrin	0.2 mg/kg	—	—	—	—
Dieldrin	0.2 mg/kg	—	—	—	—
2, 4-D	0.1 mg/kg	—	—	—	—
2,4,5-T	0.05 mg/kg	—	—	—	—
Toxaphen	0.1 mg/kg	—	—	—	—
Sum parameter of pesticides	1.0 mg/kg	5 ppm	1.0 mg/kg	1 ppm	1.0 mg/kg
PCP	0.5 mg/kg	—	0.5 mg/kg	ban	0.5 ppm
Heavy metals	—		ban in	10 mg/kg	
(Sum Parameters)	0.01mg/kg	—			silk products (sum para-meters)
Pb	0.04 mg/kg	—		—	
Cd	0.005 mg/kg	—		—	
Hg	0.001 mg/kg	0.01 ppm	0.1 mg/kg		
Baby Clothing	0.001mg/kg	0.02 ppm	0.02 mg/kg		
Ni	0.2 mg/kg	10 ppm	10 mg/kg	spec.(*)	
Baby Clothing	—	—	1 mg/kg		
Cu	3.0 mg/kg	1 00 ppm	50 mg/kg		
Baby Clothing	3.0 mg/kg	30 ppm	10 mg/kg		
Cr III	0.1 mg/kg	20 ppm	20 mg/kg		
Baby Clothing	0.1 mg/kg	1 ppm	1 mg/kg		
Co	0.2 mg/kg	20 ppm			
Baby Clothing	0.2 mg/kg	1 ppm	—		
Zn	5.0 mg/kg				
Azoic DyesContaining					
carcinogenic aromatic amines	—	—	ban	ban	50 mg/kg
Halogenic Carrier	—	—	—	Ban	200 mg/kg
					Organic Halogen
Chlorine bleaching	—	—	—	To avoid	No Consideration
pH of aqueous extract	4.5-7.5	—	—	—	4.0-7.5

Table 3A: List of 20 Forbidden Amines Banned in Germany

MAK Group III AI	MAK Group III A2	Others
Benzidine diphenyle	O-aminoazotoluene	4-4 diamino methane
4-chloro-o-toluidine	2-amino-4-nitrotoluene	3-3 dimethyl-4-4diamino-diphenyl methane
2-naphthylamine	3,3 -dichlorobenzidine	P-chloroaniline
4-aminodiphenyl	3,3 -dimethoxybenzidine (o-dianisidine) diamine	4-4methylene-bis-(2-chloroamiline)
	3,3 -dimethylbenzidine methyl (o-tolidine)	4-methoxy-ma phenyline
	5-nitro-0-toluidine	2-methoxy -5 methyl (o-tolidine) aniline
	4,4 -thiodianiline	4-4 oxydianiline
	O-toluidine	
	2,4-toluylendiamine (2+4+5 Trimethylaniline)	

Table 3 B: List of 22 amines identified as Carcinogen/toxic, based on which handling of 112 AZO-dyes banned in India.

Coupled Amines Rereased from Azo Dyes	
1	4-aminodiphenyl
2	2-amino -1 -nitrotoluene
3	Benzidine
4	4 -chloro -0- toluidine
5	2 -naphthylamine
6	O -aminoazotoluene
7	p -chloroaniline
8	2, 4 -diaminoanisidne
9	4, 4- diaminodiphenylemethane
10	3, 3 -dichlorobenzidine
11	3, 3 -dimethoxybenzidine
12	3, 3 -diamethylbenzidine
13	p -kresidin (20 methoxy -5- methylaniline)
14	4, 4 -methylene -bis -(2- chloroaniline)
15	4, 4 -Oxdianiline
16	4, 4- thiodianiline
17	O-toluidine
18	2, 4 -toluyIndiamlne
19	2, 4, 5 -trimethylaniline
20	3, 3 -dimethyl 4, 4 -diaminodiphenylmethane
21	p -aminoazobenzene
22	2 -methoxyaniline

Eco-friendly Processing of Jute based Textiles

Use of non-toxic (hydrocarbon free) batching oil for Jute

Conventional Jute Batching Oil (JBO), a mineral oil fraction (gas oil fraction having IBP - 230 – 285° C and FBP - 350 – 370°C) usually contain certain polynuclear hydrocarbons (pyrene, chrysene, benzopyrene etc.) responds showing uv absorbance beyond a limit in UV-VIS Spectrophotometer at 280 - 400 nm., which are considered to be toxic hydrocarbon present in JBO. Sometimes JBO also contains varying amount of sulphur (0.12 - 3%). If some halogenated volatile organics are present as contamination in JBO, it is also objectionable. Also Nonyl phenol based emulsifier/surfactant, used in preparing JBO emulsion are reported to be toxic. So, it is recommended to use a safe batching oil, i.e. toxic hydrocarbon free batching oil for jute. Such oils may be some vegetable oils. But all vegetable oils do not serve this purpose considering cost economy and giving standard process performance. Initially, a few mills in Bangladesh, tried a solution containing industrial glycerine and $MgSO_4/Na_2SO_4$ type of water bearing salts/Humactants etc. Use of high quantity of salt is objectionable for increased water pollution load on washing. Indian Jute Industry also tried to use self emulsified castor oil with suitable preservatives since-1992 and has got limited success. Later a combination of 2% castor oil with 0.5 to 1% glycerin in the form of oil in water emulsion is found to be another good alternative. Use of Antifriction agent like amino silicone softener from 0.5 to 1% also found to be good performer. IJIRA initially developed technology for use of sulphonated castor oil (surfactant-cum-softener-cum-lubricant) and licensed the same to a commercial company for use of this with suitable additive as an alternative of JBO^[5]. However, due to cost, performance as well as its behaviour as anionic surfactant, this was not well accepted in industry. Silicone oil (Dimethyl polysiloxane) with suitable additives usually gives better performance than sulphonated castor oil and hence can be used. However, IJIRA has recently developed a better substitute recommending the technology for use of a particular grade of rice - bran oil (a vegetable oil) instead of conventional JBO^[6].

Alkaline Treatment or Enzymatic Softening of Textile instead of using Chemical Softener

Among chemical softeners, most popularly used softener for jute-based textile is cationic softener. But most of the cationic softener are not eco-friendly either for less bio-degradability or for generating high COD in effluent. So, softening of jute based textiles are to be done using 5-10% NaOH pre-treatment. But high alkali increases pH of effluent water and is not desirable. Also acetic acid used for neutralisation of textile fabric is a high COD compound, which should be replaced by formic acid or oxalic acid having lower COD value. Another safe alternative should be enzymatic softening of textiles. Different report in literature includes technology for biological softening and upgradation of raw jute for manufacture of soft and fine jute yarn. Mixture of Cellulase and Xylanase or mixture of Cellulase, Xylanase and pectinase are found more fruitful for jute instead of only cellulase enzyme. Such commercial mixtures may be Biocellulase ZK having Hemicellulase-cellulase ratio 14:3, and Bioxylanase having Hemicellulase-cellulase ratio 14:2.5, both obtainable from M/s Biocon, Bangalore. According to one report^[7], the optimum condition recommended is enzyme concentration in terms of enzyme activity is 0.0005 ml./gm of jute fibre at a temperature of 45°C for 2 hour. Another report^[8] suggested to use such enzyme 0.4 gm/kg. of jute, at a temperature of 45-50°C for one hour, as a pre-treatment before usual hydrogen peroxide bleaching, resulting enhanced brightness and softness of jute fibres after bleaching.

Alkali treatment like caustic soda on cotton yarn and fabric is generally termed as mercerization which may be carried out at hot (60°C) or cold (18°C) condition with or without tension. This caustic treatment (18-22%, o/wm) alters the softness and hand of cotton textiles along with improving other property parameters including dyeability. On the other hand, enzymatic softening of cotton and other textiles is always advantageous than using synthetic softener including cationic softener that increases chemical oxygen demand (COD). Moreover, enzymes on textiles perform many roles like desizing, scouring, bio-polishing, softening, stone washing of textiles and each of the operations is carried out for specific purpose. Enzymes are also used for effluent treatment. Advent of high temperature stable enzymes made the revolution in textile processing. Nowadays, high temperature stable enzymes are used at continuous process range of cotton serving various purposes.

Eco-friendly Sizing and Desizing of Jute Based Textiles

Sizing of warp yarn is an important step before weaving and it improves weaving performance which, however, needs to be removed during chemical processing of textile weaven fabrics. Generally, starch based sizing agents are used for cotton yarn sizing. Tamarind Kernel Powder (TKP) is the usual size for jute yarns. Moreover, different size additives are also required including antiseptic/antimildew agents such as penta-chloro phenol or copper sulphate, both of which are not eco-safe. Therefore, Sodium silico fluoride can be used as ecosafe antiseptic agent. Also high starch content increases suspended solids in effluent after desizing. Therefore, alternative size may be hot water soluble grade polyvinyl alcohol type synthetic size, desizing of which is also easier and eco-safe. Acid based desizing process is prone to corrosion of metallic chamber and therefore, enzyme desizing is an eco-safe alternative process.

Scouring of Jute and other Textiles

Scouring of textiles is done wherever required to remove oils, fats and waxes and to make it absorbent. Usually scouring of cotton is done with caustic soda (alkali) and high caustic concentration on discharge liquor increases pH of the effluent. 3-5% (owm) caustic is used for cotton scouring. Enzymatic scouring may be an alternative towards eco-friendly scouring process. Scouring of jute is normally avoided, as it darkens the brown colour of jute and also absorbency of raw jute fibre is considerably high, which do not require scouring. But considering the dirt, dust and acquired impurities including jute batching oil added in spinning of jute yarn, it needs scouring, if better whiteness is expected after bleaching, a step towards light shade dyeing of jute. It is already mentioned that jute batching oil used should be free from toxic hydrocarbon i.e. safe vegetable oil like rice bran oil etc. may be used.

Ordinarily, scouring of jute yarn or fabric can be done by treating the material with 1-4 g/L sodium carbonate (approx. 2% owg effectively) and 1 g/L non-ionic detergent (Lissapol-N) at 50-60°C for 30 minutes followed by normal wash. This scouring process is a clean process and need no modification to make it eco-friendly.

However, jute yarns or fabric may be safely cleaned (by removing Calcium and Magnesium Salts/ Cations) and deoiled by treating jute with 0.5-1% HCL at room temperature for 5-15 minutes at a material : liquor ratio 1:20. Thus, brighter jute can be obtained by HCl pre-treatment avoiding alkali scouring before bleaching. However, complete de-oiling is difficult by this method.

Bleaching of Jute and other Textiles

Textile material can be bleached with any one of the bleaching agents like potassium permanganate, sodium hypochlorite, bleaching powder, sodium chlorite, hydrogen peroxide, hypochlorite followed by peroxide, peracetic acid etc.

Cotton fabric should be bleached with eco-friendly hydrogen peroxide or peracetic acid avoiding chlorine based chemicals. Hydrogen peroxide is readily available but needs a little bit care and the hardness of water should be less than 10 ppm to avoid any detrimental effect on textiles. Use of organic stabilizers for peroxide instead of silicate or meta-silicate may be another step towards green processing of textiles. Cold bleaching (cold-Pad-Batch) or room temperature bleaching of jute is energy saving process and needs to be adapted in industry.

In case of jute, sodium chlorite bleaching removes some lignin and reduces maximum strength. Hypochlorite bleaching does not give appreciable whiteness. Moreover, considering eco-friendliness, chlorine containing bleaching agents should be avoided, even hypochlorite followed by peroxide bleaching of jute is not safe. Therefore, a safe alternative is usual hydrogen peroxide bleaching of all textile material with some care.

The following is the usual recipe and condition of hydrogen peroxide bleaching of jute in exhaust method:

Chemicals	Amount	Conditions
a) Hydrogen Peroxide (50%)	4-6% (owf)	pH - 10.8-11.0
b) Sodium Silicate and Sodium Carbonate plus	8-10% (owf) 2.5% (owf)	Temperature - 80-85°C Time - 2 hrs
Caustic Soda	0.5% (owf)	<ul style="list-style-type: none"> • MLR - 1:6 for Fabric in Jig • MLR - 1:20 for Yarn
OR		
b) Sodium Metasilicate and Tri-sodium Phosphate	4-6% (owf) 2.5% (owf)	
c) Wetting Agent	0.5% (owf)	
d) Sequestering Agent (Optional)	0.5% (owf)	

Though this bleaching process is more or less safe considering specified limits of eco-criteria in products, but this process is not completely eco-friendly considering the eco-problems related to effluent load etc. to satisfy water pollution prevention act. Use of sodium silicate or sodium metasilicate causes the higher (alkaline) pH of effluent, and during neutralisation (equalisation) of effluent treatment, silicate precipitates and cause scale formation in effluent treatment plant damaging it and the drainage system. Therefore, alternative safe bleaching of jute can be done by using Stabiliser - AWNI or Stabiliser - SIFA made by M/s Clariant (formerly Sandoz) or any other organic stabiliser like sodium salt of diethylene triamine penta acetic acid etc. may be used. One reference^[9] suggested to bleach jute using 1% of 50% hydrogen peroxide along with 10 g/L Stabiliser AWNI and 1 g/L sodium carbonate at 85°C for 1 hour at material : liquor ratio 1:30.

Another alternative may be peracetic acid bleaching of jute using 4-5 g/L peracetic acid, tetrasodium pyrophosphate - 1g/L, wetting agent 1 g/L at pH 5.5-6.5 at temperature 65-70°C. But peracetic acid bleaching being costlier, Sharma & Chattopadhyay et al^[10] have suggested bleaching employing peracetic acid in first stage followed by usual hydrogen peroxide bleaching using following recipe.

1st treatment with peracetic acid (10%) - 10 ml./L, Tetra sodium pyrophosphate - 1 g/L (pH 6.5) at temperature 70°C for one hour followed by 2nd treatment with hydrogen peroxide (50%) - 3% owf in presence of polycarboxylic acid-based stabiliser SIFA - 0.5-1 g/L , other conditions of hydrogen peroxide bleaching remaining same.

Dyeing of Jute and other Textiles

Different fibres take different types of dyes depending upon their chemical composition and functionality pattern. Also, dyeing of any textile for developing a particular colour needs judicious selection of dyes that are free from harmful amines. A list of banned amines is shown in Table 3B. Inspite of ban of certain azo-based synthetic dyes containing objectionable amines, there are many azo-free eco-friendly synthetic dyes that can be safely applied on textile fibres for production of eco-friendly textiles. Synthetic dyes are cheaper and can produce deep/ bright shades and hence, still in textile industry, most of the fibres are being coloured with synthetic dyes.

Among different classes of dyes, cellulosic and ligno-cellulosic fibres are mostly dyed with direct, reactive, azoic, sulphur and vat dyes. However, unlike cotton, jute being ligno cellulosic, it additionally takes acid, pre-metallised and basic dyes also. For the sake of understanding the dyeing of different textiles, it is considered worthwhile to make a comparison of chemical nature / resistance and dyeing characteristics of jute, cotton and wool as depicted in Table-4 & 5. Table 6A & 6B shows the Azo based banned dyes of different classes.

Table 4: Chemical Nature, Dyeability and Chemical Resistance of Jute, Cotton and Wool Fibres

Fibre Properties	Jute	Cotton	Wool
Chemical Constituent	Ligno-cellulose	Cellulose	Protein (Keratin)
Hygroscopicity	Good (12-13%)	Fair (6-8%)	Very Good (14-16%)
Strength on Wetting	Dry > Wet	Wet > Dry	Dry > Wet
Effect of Acids	Little	Reduction in Strength	Little (resistant to weak acid)
Effect of Alkalies	Adverse (woolenization occur)	Nil (Mercerization occur)	Adverse (dissolving in 5% KOH/NaOH)
Resistance to Mildew Growth	Fair (mildew is formed on jute goods when stored in moist condition)	Low (susceptible to mildew attack)	Fair (mildew is formed on wool when stored in soiled condition)
Effect of Sunlight	Colour rapidly changes to yellow or brown	Slight discolouration on prolonged exposure	Colour changes to yellowish white
Dyeability	Very Good (all classes of dyestuff as used for cotton, in addition to basic and acid dyes)	Good (selected classes of dyestuffs like direct, sulphur, naphthol, reactive &vat)	Medium to Good (selected classes of dyestuff like acid, pre-metallised & reactive)

Table 5: General Dyeing Characteristics of Jute, Cotton & Wool

Class of Dyestuff	Jute	Cotton	Wool
Acid	✓	x	✓/✓
Basic	✓	x	✓
Pre-metallised	✓	x	✓/✓
Direct	✓/✓	✓/✓	✓
Sulphur	✓	✓	x
Reactive	✓/✓	✓/✓	✓
Vat	✓	✓/✓	x
Naphthol(Azoic)	✓	✓/✓	x
Pigment	✓	✓	✓
✓/✓ Most Applicable		✓ Applicable	x Not Applicable

Table 6A: List of Benzidine Based Azodyes* Banned in India

Sl. No.	CI Generic Name	CI Constn Number	Sl. No.	CI Generic Name	CI Constn Number
1	Acid Orange 45	22195	22	Direct Green 1	30280
2	Acid Red 85	22245	23	Direct Green 6	30295
3	Acid Black 29	—	24	Direct Green 8	30315
4	Acid Black 94	30336	25	Direct Green 8:1	—
5	Azoic Diazo Compound 112	37225	26	Direct Brown 1	30045
6	Direct Yellow 1	22250	27	Direct Brown 1:2	30110
7	Direct Yellow 24	22010	28	Direct Brown 2	22311
8	Direct Orange 1	22370	29	Direct Brown 6	39140
9	Direct Orange 8	22130	30	Direct Brown 25	36030
10	Direct Red 1	22310	31	Direct Brown 27	31725
11	Direct Red 10	22145	32	Direct Brown 31	35660
12	Direct Red 13	22153	33	Direct Brown 33	35520
13	Direct Red 17	22150	34	Direct Brown 51	31710
14	Direct Red 28	22120	35	Direct Brown 59	22345
15	Direct Red 37	22240	36	Direct Brown 79	30056
16	Direct Red 44	22500	37	Direct Brown 95	30145
17	Direct Violet 1	22570	38	Direct Brown 101	31740
18	Direct Violet 12	22550	39	Direct Brown 154	30120
19	Direct Violet 22	22480	40	Direct Black 4	30245
20	Direct Blue 2	22590	41	Direct Black 29	22580
21	Direct Blue 6	22610	42	Direct Black 38	30235

Source -Textile Dyer & Printer, July 16, 1997

Table 6B: List of Azodyes (Non-Benzidine) Banned in India

Sl. No.	Colour Index Generic Name	Colour Index Number	Sl. No.	Colour Index Generic Name	Colour Index Number
1	Acid Red 4	14710	36	Direct Red 26	29190
2	Acid Red 5	14905	37	Direct Red 39	3630
3	Acid Red 24	16140	38	Direct Red 46	23050
4	Acid Red 26	16150	39	Direct Red 62	29175
5	Acid Red 73	27290	40	Direct Red 67	23505
6	Acid Red 114	23635	41	Direct Red 72	29200
7	Acid Red 115	27200	42	Direct Violet 21	23520
8	Acid Red 116	26660	43	Direct Blue 1	24410

Table 6B: List of Azodyes (Non-Benzidine) Banned in India (*contd.*)

Sl. No.	Colour Index Generic Name	Colour Index Number	Sl. No.	Colour Index Generic Name	Colour Index Number
9	Acid Red 128	24125	44	Direct Blue 3	23705
10	Acid Red 148	26665	45	Direct Blue 8	24140
11	Acid Red 150	27190	46	Direct Blue 9	24155
12	Acid Red 158	20530	47	Direct Blue 10	24340
13	Acid Red 167	—	48	Direct Blue 14	23850
14	Acid Red 264	18133	49	Direct Blue 15	24400
15	Acid Red 265	18129	50	Direct Blue 22	24280
16	Acid Red 420	—	51	Direct Blue 25	23790
17	Acid Violet 12	18075	52	Direct Blue 35	24145
18	Acid Brown 415	—	53	Direct Blue 53	23860
19	Acid Black 131	—	54	Direct Blue 76	24411
20	Acid Black 132	—	55	Direct Blue 151	24175
21	Acid Black 09	—	56	Direct Blue 160	—
22	Basic Red 111	—	57	Direct Blue 173	—
23	Basic Red 42	—	58	Direct Blue 192	—
24	Basic Brown 4	21010	59	Direct Blue 201	—
25	Developer 14+ Oxidation Base 20	76035	60	Direct Blue 215	24115
26	Direct Yellow 48	23660	61	Direct Blue 295	23820
27	Direct Orange 6	23375	62	Direct Green 85	30387
28	Direct Orange 7	23380	63	Direct Blue 222	30368
29	Direct Orange 10	23370	64	Direct Black 91	30400
30	Direct Orange 108	29173	65	Direct Black 154	—
31	Direct Red 2	23500	66	Disperse Yellow 7	26090
32	Direct Red 7	24100	67	Disperse Yellow 23	26070
33	Direct Red 21	23560	68	Disperse Yellow 56	—
34	Direct Red 22	23565	69	Disperse Orange 149	—
35	Direct Red 24	29185	70	Disperse Red 15	26130

(*The Gazette of India: Extraordinary*) [(No. -193, Part II, Sec. 3 (ii)])

S. O 243(E) dt. 26.3.1997.

Source -Mantra Bulletin, July, 1997

Unlike cotton (purely cellulosic), the major constituents of jute being cellulose, hemicellulose and lignin, it can be dyed with any one of the direct, acid, basic, azoic, reactive, sulphur, vat and natural dyes. Direct and acid dyes on jute show poor wash fastness and basic dyes on jute show poor light fastness, besides their problem related to possibility of release of carcinogenic amines. However, all direct dyes and acid dyes are not banned and all do not contain objectionable toxic amines. 112 (40 benzidine based and 72 more dyes based on 22 listed amines)

azo-dyes are banned in India and Bayers of Germany offered a list of 118 similar dyes dropping from their production list based on 20 listed carcinogen amines banned in Germany. These lists are available in literature, Table – 3A & 3B^[1,4]. Dyestuff Manufacturers Association of India (DMAI) has also published a Directory in November, 1996 entitled “Directory of Safe Dyes”.

However, the eco-ban towards certain direct, acid, basic dyes and azoic colour components (objectionable coupling amines) as well as their overall poor dye fastness on textiles, excludes them for further use particularly in export goods, as product behaviour (colour fastness) is also considered as one of the eco-parameters in certain country (Denmark, Sweden & EEC countries). So, alternative safe dyes one can think are reactive, sulphur and vat dyes as well as natural dyes applicable for cellulosic and lingo-cellulosic textiles, therefore can be safely dyed with these dyes with some modifications in their application procedure. For sulphur dyeing, one has to avoid sodium sulphide to make the application process eco-friendly. For reducing total dissolved solids in effluent of dye houses, one has to use less salts and one has to achieve more fixation of dyestuff (achieving less unfixed dye and colour in effluent) following short liquor ratio particularly for reactive and vat dyeing. For vat dyeing, less alkali is to be preferred. For natural dyes, if mordanting is necessary, one has to avoid copper salts. The necessary care / modifications in procedure for each class of the eco-friendly dyes are given below

Dyeing with Sulphur Dyes and Ecofriendliness Therein

Though sulphur dyes are safe dyes considering eco-criteria for textiles, sulphur dye effluent from traditional dyeing system contains unfixed dyestuff, sulphides, inorganic and organic residuals etc. which increases effluent load and thus sulphur dye application using sodium sulphide is not eco-friendly. Effluent discharge of sulphides is not usually permissible for the danger of liberation of hydrogen sulphide during effluent equalisation treatment and also after the discharge. It can corrode the sewerage system, damage treatment work and often offer high pH of the effluent. Residual organic / inorganic material coming from impurities in sodium sulphide causes higher COD of the effluents.

So, to obtain clean process of sulphur dyeing, use of sodium sulphide as reducing agent is to be avoided. Use of non-sulphide reducing agent (such as Redugen-A etc.) was attempted earlier and received a limited success. From our experience, full replacement of sodium sulphide by glucose do not give uniform dyeing (often patchy dyeing results), though use of full glucose-caustic soda system as reducing environment for sulphur dyeing is suggested in a recent report for eco-friendly processing of textiles with sulphur dye^[11].

The traditional recipe and conditions of sulphur dyeing for jute may be similar to that of application of sulphur dye to cotton, as given below :-

Reduction and solubilisation of sulphur dye	Recipe for dye-bath preparation	Recipe for oxidation after dyeing
Nonionic Wetting Agent - 0.5 g/L	Nonionic wetting agent - 2.5 g/l	1-2 g/l Hydrogen Peroxide(30%)
Sulphur Dye - x%	Soda ash - 2.5 g/l	and Soda Ash as required
Sodium Sulphide Flakes - x%	Glucose - 2.5 g/l	OR
		1-4 g/l Sodium Dichromate and
Soda Ash - x/2%	Sodium Sulphide Flakes- 5 g/L	1-4 g/l acetic acid (80%)
Heating if required to keep at 70°C for 20 minutes	Glauber Salt - 7.5 g/l (to be added later at 60°C) Solubilised Dye Solution - as required MLR - 1:20	At 60-80°C for 15 minutes

The traditional dyeing procedure and condition using above recipe for sulphur dyeing of textiles is to keep an initial temperature of dye-bath at 50-60°C and then to add the solubilised sulphur dyes and required quantity of glauber salt to be added in two installments simultaneously raising the temperature to 90°C and to continue dyeing at this temperature for one hour. After dyeing is over the dyed goods are to be oxidised using above

recipe followed by 1-2 g/L nonionic soap wash at boil for 15 minutes followed by normal wash.

To make or modify the application of sulphur dye to be eco-friendly, the reduction of sulphur dye is to be done by using glucose -NaOH system at 70°C for 20 minutes or subjecting it to the treatment with 2.5 times (with respect to weight of the dye) liquid jaggery (prepared from Commercial Jaggery which contains water, sugar and non-sugar, by treatment with 0.04% citric acid for 24 hours (for formation of higher reducing sugar proportion). In the dye-bath, also replacement of sodium sulphide is to be done by the use of glucose- NaOH system or liquid jaggery reported in recent literature [9,11]. But use of both glucose- NaOH system and liquid jaggery need higher salt application (upto 40-50 g/L) in sulphur dyeing for equivalent shade, which may cause an increase in TDS.

Dyeing with Vat Dyes and Eco-Friendliness Therein

Vat dyes and its application method is eco-safe and need no modification except to take care of not using excess of alkali which may raise the pH of the effluent and presence of unfixed dyes in the effluent may increase the effluent load including colour of the effluent. The normal vat dyeing recipe applicable for cotton and jute, as given below :

a) Normal Vatting Recipe for Reduction and Solubilisation of Vat Dyes

- Dye (to be pasted with wetting agent) - 1 g
- Non-ionic Wetting Agent or TRO (10%) - 0.5 to 1.0 ml
- Caustic Soda (Solid) - 1.5-3 g (preferably 2 g)
- Sodium Hydrosulphite (Hydrose) – 2 to 3 g (preferably 2 g)
- Water - 50 to 100 cc (preferably 80 cc)
- Temperature - 60°C
- Time - 15-20 minutes

b) Dye-bath Recipe

- Solubilised Dye Solution - as per shade %
- Caustic Soda - 2-15 g/l (depending on the type of vat dyeing methods i.e. IN, IK, IW & IN special)
- Hydrose - 2-9 g/l
- Glauber salt (for IK & IW process only) - 5-30 g/l
- Water - as required to maintain MLR
- Dyeing Temperature - 50-60 °C for IN process, 45-50°C for IW process, 20-25°C for IK process and 70-80°C for IN special process.
- Time - 1 hour

c) Recipe for Oxidation

- 1-2 g/l sodium dichromate and 2.5-10ml/L acetic acid at 40°C for 10-15 minutes
OR
- 3 ml/l H₂O₂ (50%) at 50-60°C for 20-30 minutes

Thus, vat dye application to cellulosic textiles is eco-friendly process if proper control on alkali concentration and unfixed dye has to be maintained to reduce effluent load.

In general, this is to mention that, to reduce water pollution load in terms of total dissolved solids, it is required to avoid or reduce salt application level in the direct, reactive, vat and sulphur dyeing applications.

Dyeing with Reactive Dyes and Eco-Friendliness Therein

The recipe and conditions of exhaust process of dyeing of cellulosic textiles with HE brand reactive dye is to start the dyeing at 50°C, using required amount of common salt (30-70 g/L upto 0.5-4% shade) in three installments covering 30 minutes simultaneously raising a temperature upto 80-85°C (dyeing temperature) and the dyeing should continue at this temperature for 1.5 hour adding required quantity of soda ash (10 - 20 g/L) in two equal instalments at 15 minutes interval in the first 30 minutes of 1.5 hour. After the dyeing is over, the dyed material is to be soap washed using 2 g/L soap solution at boil for 15 minutes followed by normal wash.

It is observed that though cellulosic textiles can be dyed with any of the M, H and HE brand of reactive dyes, some dichlorotriazine dyes show relatively poor light fastness on ligno-cellulosics, while better overall fastness properties of bi-functional HE brand reactive dyes on jute is also observed. Hence, HE brand dyes should be preferred for obtaining an eco-acceptable colour fast shade on textiles. Moreover, from our experience we feel that jute can be dyed with HE brand reactive dyes following almost similar conditions applicable for cotton dyeing, but an increase in soda/soda ash to a limited extent favours deep shade dyeing of jute with HE brand reactive dyes. In case of fabric dyeing using silicate pad-batch process, either one has to reduce amount of silicate or has to avoid this process for eco-friendliness. For reducing unfixed dye in effluent, concentration of salt and urea are to be re-optimised, Low salt dyeing process for jute is to be developed also.

Among vat, sulphur, reactive and natural dyes, jute can be easily dyed with reactive dyes without any difficulty in economical way, as an eco-friendly dyeing. Details of reactive dyeing procedure using M & H brand of reactive dyes^[16].

Dyeing With Natural Dyes and Eco-Friendliness Therein

Textile goods can also be dyed with some natural dyes though it is to be remembered that all natural dyes derived from natural sources are not always safe (e.g. flora and fauna are not eco-safe) due to their source of origin and methods of application associated with use of heavy metal salts containing copper etc. for mordanting.⁽¹²⁾ . Also majority natural dyes are very costly and give poor fastness towards wash and other agencies which goes against its wide application. In the country where poor dye fastness is considered as one of the criteria to be Eco-friendly for protecting consumers in the environment, lower colour fast natural dyes can not be used. Still its popularity lies in its eco-friendliness (besides the unsafe natural dyes), biodegradability, natural source, novel and soothing shade etc. Some data on application of natural dyes (from Ratan Jot, Katha, Red Sandal Wood, Harda alum, Jack wood etc.) on different textiles are available in a recent report^[13] of BTRA

Most of the natural dyes need pre-treatments or post-treatment with some agents besides actual dyeing procedure following boiling of the material in solution of natural dyes with or without suitable pre-treatment of the textile material. The use of mordant for various natural dyes needs to be optimised and care should be taken that they are eco-safe. For example, pre-treatment using 10 g/L Aluminium sulphate at 70°C for 30 minutes at MLR 1:30, was essential to dye jute with Manjistha^[14]. Again, Katha, another natural dye need post-dyeing treatment with potassium dichromate (0.1%) at 50°C for 5 minutes for improving dye fastness. After natural colour dyeing with or without pre or post-treatments, the dyed material is to be soaped (lightly) using 1-2g/L soap solution at 50°C for 10-25 minutes. If high light fastness property is not essential and if additional cost is affordable for particular product, most of the natural dyes can be a safe alternative as eco-friendly dyes.

This department has studied^[15] the effect of different mordanting system on colouration of jute and cotton fabric for application of natural dyes. Conventionally bleached jute and cotton fabrics have been subjected to pre-mordanting with selective single and double mordants using myrobalan (harda) and other mordants (metallic salts) followed by dyeing with aqueous extract of jackfruit wood and then studied for their mechanical and dyeing properties. It is observed that the application of 10-20% myrobalan followed by 10-20% of $\text{Al}_2(\text{SO}_4)_3$ or FeSO_4 in sequence have been identified as two most prospective mordanting systems. The study on the effect of dyeing process variables on surface colour strength indicates that the 90 min dyeing time, 70-90°C dyeing temperature, 11.0 pH, 1:30 material-to-liquor ratio, 20-30% mordants concentration, 30-40% dye concentration, and 15 gpl common salt are the optimum values with minor differences among the fibre-mordanting systems.

Colour fastness to washing, rubbing and exposure to sunlight, in general, and dyeing-pH sensitivity, in particular, for selective fibre-mordants-dye systems have also been assessed and compared. Dyeing at pH 11.0 for both the double pre-mordanting systems offers overall good colour fastness properties.

Printing of Jute and Eco-Friendliness Therein

Pigment printing is very popular for textiles. Some methylolated resin compounds (such as melamine formaldehyde in the trade name of Fixer CCL or fixing agent - 2F etc), are used as pigment fixing agent to improve rub-fastness properties. These agents releases formaldehyde during use of the pigment printed fabrics. Moreover, objectionable absorbable organic halogens (AOX) and heavy metals are present as impurities in pigments from the production process. One can use formaldehyde scavenger i.e. urea as additive when methylolated type of fixing agent are used. Otherwise one has to avoid completely the use of such formaldehyde containing compounds. According to a report of MANTRA, Surat, that only for contamination in pigments and binder during their production, the pigment printed fabric can show upto 30 ppm formaldehyde content, tested in japanese method. Kerosene used for preparation of emulsion thickener is to be avoided for avoiding air pollution and health hazards. Alternative thickener is polyacrylic acid or its esters based synthetic emulsions, but they give duller shade.

Printing of jute with sulphur dyes using glucose - NaOH system as reducing agent (optimised concentration being 3 times of the amount of dye) with other condition remaining same is reported in recent literature as an eco-safe process. Also liquid - jaggery treated with 0.4% citric acid, producing sufficient amount of reducing glucose, may be used in sulphur dye printing [9]

Chemical Finishing and Eco-friendliness Therein

A general review of chemical finishing of textiles is available in literature^[16-17]. Textile fabrics are normally treated with salts of metals such as copper, chromium, iron, antimony, cobalt used separately or in selected combination for improving its rot resistance/weather resistance etc. Very common rot resisting agents are copper napthanate, copper penta-chlorophenate and lauryl pentachlorophenate, etc. which are not eco-safe. So, safe rot resisting chemicals may be hydroxy quinolate type of compound.

For softening of textiles, among chemical softener, use of cationic chemicals softeners become popular. This is not completely eco-safe and not easily biodegradable.

Application of silicone emulsion or polyethylene emulsion on ligno-cellulosic fabric produce adverse effect on fibre shedding property and brittle nature of ligno-cellulosics is not reduced to the desired level, while application of polyurethane or high abrasive nature of polymer reduces fibre shedding. So, polyurethane modified polysiloxane type of compound may be useful for reducing fibre shading as well as for softening.

But silicones or modified silicones are not easily biodegradable and increases COD in effluents.

For flame retardancy of textiles brattice cloth used in coal mines, a treatment of 6.75% potassium sodium tartarate(Rochelle salt) results in self extinguishing properties . Also use of salts of Diammonium phosphates (DAP) or combination of DAP and Ammonium sulphate /sulphamates have been reported to render different textiles fire-retardant. These are eco-safe though they need high % application and not wash-fast as well as DAP may cause damage to the fabric. Other semi- wash-fast and complete wash - fast fire-retarding agents like antimony oxychloride, THPC (Tetrakis hydroxy-methylol phosphonium chloride) or THPOH etc are not eco-safe. THPC and THPOH, both have formaldehyde release problem. THPC and antimony oxy-chloride are also halogenated FR agent, and are not eco-safe. So, durable eco-safe FR agent may be (Tris) Aziridinyl phosphonium oxide (APO) and similar compounds.

Use of Stearato chromic chloride with or without suitable resin (Urea-Formaldehyde or Melamine Formaldehyde) is to be avoided for rendering water repellancy of textile cloth to fulfill the eco-criteria. Dimethyl silicone may be an alternative, but it is costlier and not fully biodegradable. So use of aluminium soap with some other eco-safe compound may be the only safe alternative.

Use of DMDHEU and similar methylolated resin is to be avoided for rendering crease resistant finish on cellulose based fabrics having formaldehyde release problem beyond the stipulated limit. One alternative is to use N-N-Dimethylol acrylamide resin as a low formaldehyde releasing agent for cross linking Jute and Cotton textiles. But higher % application (more than 8%) is to be avoided. As a more safe alternative, citric acid may be used as a formaldehyde - free cross linking agent on jute fabric (application method, doses, catalyst system and conditions are available in literature)^[14].

Use of Alternative Chemicals Having Low COD / BOD Values for Eco-Friendliness of Processes.

The followings are the partial lists of some common chemicals used in chemical processing of jute which are either eco-unsafe or have high COD/BOD values. Some of the suggested alternative chemicals having eco-safe properties or at least having lower COD/BOD values, can be used for eco-safe processes or to reduce water pollution load in the effluent, increasing the eco-friendliness of the processes or product of jute.

To understand the eco-friendliness of process and product as a whole, the better idea is to assess the carbon foot print of the product in its life cycle by cradle to grave approach, encompassing all the aspect of eco-friendliness in terms of energy equivalent with respect to amount of carbon di-oxide emission in all the processes and its application stages, for example, this department has started an interesting work^[18] assessing the carbon foot print in the life cycle of jute product, starting from its agricultural stage to disposal stage. Some of the results of the partial work done so far are available in the M. Tech thesis of this department. More studies are being conducted under Ph.D. programme and will be available with few years. Such studies for all textile products are very much essentially required for understanding the eco-balancing criteria and reduction of carbon emission to save the world.

Routine Chemicals Being Eco-unsafe or having High COD/BOD	Suggested Alternative Eco-safe Chemicals or Chemicals having Low COD/BOD.
Jute batching oil	Vegetable oil based lubricant
Acetic acid (Neutralising agent or dyeing assistant)	Formic acid or Oxalic acid
Pentachlorophenol or copper sulphate (as a preservative of size)	Sodium silicofluoride
Chlorine containing bleaching agent	Hydrogen peroxide bleaching with stabilizer AWNI or per acetic acid bleaching
Sodium dichromate (for oxidation in vat dyeing)	Hydrogen peroxide.
Sodium Sulphide (reducing agent for sulphur dyeing)	Glucose based reducing agent
Kerosene(in pigment printing)	Polycarboxilic acid esters (synthetic thickener)
DMDHEU	Citric acid
THPC or THPOH	APO.

CONCLUDING REMARKS

Thus, one has to take atleast following care for achieving eco-friendliness in textile processes and products

- a) One has to avoid unsafe azo-dyes and has to find alternative safe dyes for obtaining desired shades choosing from reactive, sulphur, vat and natural dyes with above care and modification in the process suggested.
- b) One has to take care that the water, air and noise pollution prevention act is maintained during application of dyes and other chemicals during scouring, bleaching, dyeing and allied process for improving its asthetic and customer's appeal. For that, one has to use chemicals of low COD and BOD substituting the chemicals of higher COD & BOD, e.g in many cases, acetic acid may be replaced by formic acid or citric acid (if process performance is not hampered) as the later acids have lower COD & BOD values than that of acetic acid.

- c) One has to avoid high salt, high alkali or toxic dyes and chemicals in the process, product and effluents / emissions.
- d) One has to modify process recipe and process conditions so as it become completely eco-friendly.

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HUMAN DEVELOPMENT, FAMILY & SOCIETY
(Research Papers)

Factors of Fear and Fantasy in Environment and its Impact on Children

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ABSTRACT

Immediate environment of growing children continuously impacts them. A child possesses different types of fears and fantasies, some of which are completely imaginary, others may be acquired/ learned from the environment, while some others may be experiential in nature. Sometimes the fears are just a passing phase, but at others they can grow to be larger than life. Most of us who suffer from different kinds of fears are those who have not really learnt to let go of their childhood fears. Parents of 80 children aged 6 to 8 years selected on incidental purposive basis were interviewed regarding their children's favourite and fearful objects/figures from their child's world of stories and television. A detailed interview schedule both in Hindi and English was developed for this purpose. Most of the figures of fantasy and favourite objects were found to be acquired through TV and are animated characters like Tom and Jerry, Chota Bheem, Doraemon, Ninja Hattori, Chin-Chan and Barbie. The most common fears in children as reported by mothers were fear of darkness, loud noises, animals, ghost, being left alone and burglars as well as that of being harmed by super human creatures.

Key Words Fear, Fantasy

INTRODUCTION

Human development always occurs in a context and these contexts often influence the course of that development^[1]. In his ecological model emphasizes the interrelationships of the individual with layers of environmental context. The theory suggests that the environment and the child continually influence one another in a transactional manner. The first layer of environment ie the microsystem consists of the family, the school and the peer group along with the relationships child forms within these settings. The physical characteristics such as the play ground, the play equipments, books, TV programmes also impact tremendously on the developing child.

In this context, the type of TV programmes, story books, stories told to the child, would have lasting influence on her budding mind including her fantasies and fear.

Fear and fantasy has negative Connotation but everyone needs to understand that fantasy/fear are natural emotions completely normal and present from very young age. Some develop fear at an early age or some little later in life, like adolescents' social fears, but they are always triggered by events or encounters in one's environment. Sometimes the fears are just a passing phase, but at others they can grow to be larger than life. Most of us who suffer from different kinds of fears are those who have not really learnt to let go of their childhood fears. High level of fear is often categorized as childhood trauma and can be caused by extremely disturbing events in his or her childhood years.

Fears are natural, necessary and of different types. They are developmental in nature. As children grow, the objects of their fear, its stimulation and reactions to fear keep changing. The types of fears a child has provide a clue to his surroundings, care and cognitive abilities.

For years, fantasy or imagination was thought of as a way for children to escape from reality, and once they reached a certain age, it was believed they would push fantasy aside and deal with the real world. Children were very often pushed away from imaginative play considering them a waste of time. But, increasingly, child development experts are recognizing the importance of imagination for young children and the role it plays for them in understanding reality. Imagination is necessary for learning about people and events we don't directly experience, such as history or events on the other side of the world. For young kids, it allows them to ponder the future, such as what they want to do when they grow up.

Fantasies allow the actor to consider and speculate about central and sometimes painfully realistic themes in a way that is more palatable than in reality. The fantastic nature of the character and the setting provides with emotional distance that gives room to consider sensitive and important ideas more objectively. An irony about fantasy is that despite the fanciful characters, strange imaginary worlds, and bizarre situations encountered, it has the power to help us better understand reality^[4].

One author revealed that, preschool children are more responsive than older children and adults to salient visual images; that is, something that looks frightening will be more likely to frighten young children than something with a more benign exterior that is actually harmful. Young children are also more likely than their older counterparts to respond with fear to blatantly fantastic happenings, and less likely to respond to threats communicated in a more abstract manner^[2].

Another author stated that fantasy is an important part of human inheritance but children's fantasy world is specifically created by the multitude of stories, comics, films etc. to which they are exposed. Fantasy is a primary process activity which operates, and generates its peculiar images, according to the rules of substitution, displacement etc. Fantasy allows children to create an imaginary world in which they can rehearse and begin to deal with many of the most fundamental psychological challenges and problems that come with the territory of being human. Most of the mothers (95%) admitted in Table 10 that their children did not get fearful of any objects in the stories. According to them children know that these are only stories and there is no reality in them. As few as 2.50 percent were scared of ghosts, krishna movie (1.25%) and ants (1.25%).

AIMS AND OBJECTIVES

Aim of the present study was to find the objects of fear and fantasy imbibed from the environment of children between 6 to 8 years of age.

METHODOLOGY

Mothers of 80 children aged 6 to 8 years selected on incidental purposive basis were interviewed regarding their children's favorite and fearful objects/figures from their child's world of stories and television. A detailed interview schedule both in Hindi and English was developed for this purpose.

RESULTS AND DISCUSSION

Respondents' Profile

The overall result depicts that the highest number (22%) of the mothers were uneducated followed by graduates (20%) and secondary level (18.75%) in Table-1. Only 10 percent were post graduate while 5 percent had doctorates and very few (2.5%) had completed B.Ed.

Table 1: Education of the Mothers

Education	Percent
Primary	5%
Middle	10%
Secondary	18.75%
Senior secondary	7.50%
Graduate	20%
Post graduate	10%
B.Ed	2.50%
PhD	5%
Not Educated	22.50%

Overall analyzing the result in Table-2, lead to the conclusion that majority of the mothers (86.25%) were fulltime house wives 6.25 percent were teachers, 5 percent were guest faculty in the college and 2.50 percent of the mothers were working as maids.

Table 2: Occupation of the Mothers

Occupation	Percent
House wives	86.25%
Teacher	6.25%
Lecturers (University Level)	5%
Maids	2.50%

Table-3 reveals that the favourite object/cartoon character of the majority as reported by the mothers were Tom and Jerry (25%), Chota Bheem (22%), Doraemon (20%), Barbie (16.25%), and Ninja Hattori (12.50%).

Table 3: Favorite Object /Cartoon Characters

Character	Percent
Tom and Jerry	25%
Doraemon	20%
Chota Bheem	22.50%
Barbie	16.25%
Ninja Hattori	12.50%

Mothers reported that of the children fear ghosts. Very few (5%) reportedly had fear of Chota Bheem and Ugly Face. However, in Table 4 half of the mothers reported that their children do not fear the cartoons they watch.

Table 4: Cartoon character children fears

Cartoon	Percentage
Ghost	18.75%
Chota bheem	5%
Ugly face	5%
No fear	50%

As can be seen in Table-5 that the most common fears of children concerned animals (71.25%), darkness (47.50%), ghosts / shadows (10%). Very few (2.50%) children have fear of robbers / kidnappers.

Table 5: Children Objects of Fear

Objects	Percentage
Animals	71.25%
Dark	47%
Ghost / Shadow	10%
Robbers / Kidnappers	2.5%
No fear	36.25%

When mothers were asked about their children expression of fear in Table 6, maximum numbers of the mothers (62.50%) reported that their children express fear verbally, through their facial expression like closing their eyes (12.50%) and some (6.25%) children express their fear by bodily reactions.

Table 6: Ways of Expressing Fear

Expression	Percentage
Verbal expression(switch on/off the lights, shouts)	62.50%
Facial expression(closed eyes)	12.50%
Bodily reaction(running away)	6.25%
No fear	40%

Table-7, a query was made to know the ways of reassurance used by mothers when the child is fearful. The result revealed that most of the mothers 26.25 percent give logical explanation by making them aware about the reality. While 12.50 percent of the assurance came in the form of verbal assurance. 11.25 percent mothers exposed their children to fearful situations in a gradual manner. Surprisingly only 7.50 percent of the mothers reported giving bodily support to alleviate their child's fears by making them sleep/sit nearby, and by kissing, patting and hugging their children, 6.25 percent of the mothers were not particular about reassuring their children. A large number of the mothers (22.50%) reported that their children have absolutely no fears.

Table 7: Ways of Reassurance Used by Mothers

Ways	Percent
Logical explanation	26.25%
Verbal assurance	12.25%
Exposing the child to fearful situation gradually	11.25%
Bodily support	7.50%
Religious support	1.25%
Nothing particular	6.25%
No fear	22.50%

Table-8 reveals that 7.50 percent children liked to read Balhans, Balbhaskar (6.25%), Chotu Motu (3.75%). A very high number of the mothers (62.50%) reported that they do not buy story books for their children.

Table 8: Choice of Story Books

Story Books	Percent
Balhans	7.50%
Balbhaskar	6.25%
Chotu Motu	3.75%
No Response	62.50%

It is important to analyze about the favourite stories of children. As revealed in Table-9, majority (83.75%) of the mothers reported that their children demanded to listen animals stories, fairy tales (16.25%) and religious stories (15%). As high as 35 percent of mothers however, did not give any response to this query.

Table 9: Favourite Stories of Children

Stories	Percent
Animal Stories (Lion and the mouse, rabbit and tortoise, lion and the rabbit, the foolish turtle, etc.)	83.75%
Fairy Tales (Snow white, Cinderella, Barbie, Tinker bell etc.)	16.25%
Religious (Krishna, Surya bhagwan)	15%
No Response	35%



Most of the mothers (95%) admitted in Table 10 that their children did not get fearful of any objects in the stories. According to them children know that these are only stories and there is no reality in them. As few as 2.50 percent were scared of ghosts, krishna movie (1.25%) and ants (1.25%).

Table 10: Fear Factor in Stories

Object	Percent
Ghost	2.50%
Ant	1.25%
Krishna movie	1.25%
No fear	95%

CONCLUSION

The findings lead to the conclusion that most common fears in all children are ghosts and darkness. However, they disappear or diminish with time and experience. Most of the children are influenced by the television; cartoons are more attractive to the children. The stories children like to listen are Lion and the Mouse, Rabbit and Tortoise, Lion and the Rabbit, the Foolish Turtle, Snow White, Cinderella, Barbie, Tinker bell etc. They watch cartoons like Tom and Jerry, Doraemon, Chin-Chan, Chota Bheem, and Ninja Hattori the most. Children do have fear of darkness, animals and scolding by parents as well as social acceptances. Fear is an innate emotion having a developmental curve i.e. it increases with age and experiences and gradually gets limited with further age and experiences. Also the sources or stimuli for fear keep getting varied and wider. Experts insist that if a child continues to harbor a fear long after others have outgrown it or if it's severe, the fear may have developed into a phobia. If a child regularly goes to great lengths to avoid a feared object or situation, it may be time to seek professional counseling or treatment. However, one must not forget that fears and fantasies are a natural part of child's being, most of which are imbibed from the environment. Psychologists like Jacqueline Woolley, a professor at the university of Texas at Austin, are studying the process of "magical thinking", or children's fantasy lives, and how kids learn to distinguish between what is real and what isn't and that it is important for children's cognitive development^[5].

Therefore, it can be concluded that to a certain level all growing up children have fears and fantasies and that these are essential for their normal development.

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A Study on Environmental Awareness of Students and Teaching Learning Strategies in Different Schools in Kolkata

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ABSTRACT

Environmental awareness means knowledge and understanding of facts and concepts related to environment and consequences of various environmental problems like pollution, population explosion, deforestation, ecological disruption, energy crises etc. In the recent years rapid changes have occurred in the environment throughout the globe resulting into global warming. This study tries to explore about the attitude and intention of environmental awareness among 100 students (Std. V, VI & VII) and teaching learning strategies in different schools in Kolkata with the Environment Awareness Scale and a self made questionnaire for assessing the teaching –learning strategies. Gender wise there is no significant difference in the mean values of attitude & intention. There is a significant difference in the attitude of English and Bengali medium students towards environmental awareness. Educational qualification and training of the teachers are said to have a significant effect on the environmental awareness (attitude and intention level) of the students.

Keywords Environmental Education, Environmental Awarness.

INTRODUCTION

The term environment comes from the Latin word ‘environ’ which is the combination of two words i.e. “En” (in) “Viron” (circle) which means to encircle or to surround. According to International Encyclopedia of Social Sciences, “Environment is the aggregate of all external conditions and influences affecting the life and development of an organism”. Environment constitutes a very important part of our life.

“Environmental awareness is defined as the sum total of responses that people make to various thematic aspects of the construct environmental education”^[10]. In simple terms it means knowledge and understanding of facts and concepts related to environment and consequences of various environmental problems like pollution, population explosion, deforestation, ecological disruption, energy crises, etc. Environmental awareness is to understand the fragility of our environment and the importance of its protection. Promoting environmental awareness is an easy way to become an environmental steward and participate in creating a brighter future for our children.

Environmental education is the study of the relationships and interactions between dynamic natural and human systems. Environmental education includes learning in the field as well as the classroom and incorporates the teaching methods of outdoor education, experiential education, and place-based education.

The objectives of environmental education are:

- Explain the concept of environmental degradation ;
- Identify various factors causing environmental degradation ;
- Recognize the growing awareness about Environmental degradation ;
- Explain the concept of sustainable development ;

- Recognize the national and international commitment to the protection of Environment.

Status of Environmental Education in School Education

The education system in India had incorporated certain aspects of environment in school curricula as early as 1930. The Kothari commission (1964-66) also suggested that basic education had to offer Environmental Education and relate it to the life needs and aspirations of the people and the nation. At the primary stage, the report recommended that “the aims of teaching science in the primary schools should be to develop proper understanding of the main facts, concepts, principles and processes in physical and biological environment.” Environmental education is an essential part of every pupil’s learning and it was treated in a different way at primary, secondary, higher secondary levels to encourage awareness of the environment, leading to informed concern for active participation in resolving environmental problems.

Nurturing Environmental Awareness in Children

Children of today will inherit a planet that isn’t very healthy. Hence they must be educated and made aware of our impact on its atmosphere, fresh water, soils, forests, and oceans. The most important findings related to the present study are discussed as follows-

- Primary Stages – Environmental Education was introduced without any delay from class –1 as EVS, as a subject so that right from their childhood, the right attitudes towards environment will be nurtured in the young minds. Therefore, we need the school children to share and develop the motivation from school about various environmental issues, which are the challenges of today and prepare them for the future. The researchers carried out a study for measuring the level of environmental knowledge among preparatory school students determining their attitudes towards some environmental concepts, and assessing the effect of environmental education on these knowledge and attitudes. Results of the study revealed that majority of them had poor level of environmental knowledge and have negative attitude toward the environment.^[8]
- Secondary Stages – In the secondary stage some of the major concepts which are being taught are – adaptation of living beings in environment, natural resources, water cycle, food chain, role of plants and animals in environmental balance and soil conservation, ecosystems, necessity of clean air for healthy living, greenhouse effect, wildlife protection, impact of industrialization on environment, effects of environmental pollution, etc.

Two authors surveyed on 600 secondary and senior secondary school students in the city and villages found that rural students and students studying in government schools were still not aware of the various threats of environment and natural calamities and most of the Government rural schools did not possess basic literature related to Environment (in regional language)^[6]. Researchers investigated on secondary school student’s environmental awareness in North Gujarat (Std 8, 9 & 10) and found that female girls were more conscious than boys and also found significant between standard wise differences^[16]. Investigated Secondary School student’s environmental awareness, concern to protect environment for future generation and the source of information about the environment and found that they have better environmental awareness compared with CBSE and State Board students of Std 8, 9 & 10^[3].

Another researcher studied on the extent of environmental awareness among ninth standard students and to compare the environmental awareness among them in relation to gender, educational qualification and occupation of their parents, revealed that there is no environmental awareness among ninth standard students at higher level and there is no significant gender difference in environmental awareness^[3]. The aim of one study was to evaluate the environmental awareness among students in middle and high schools in an industrial city. Results indicated girls to be more knowledgeable than boys^[5]. The researcher attempted to study the level of environmental awareness among the senior secondary school students. Male science students exhibited higher degree of environmental awareness than female science students but overall no significant difference was found between male and female students^[14].

- Higher Secondary Stages – The main purpose of a study by some researchers were to understand the effect of Stream (Arts, Science and Commerce) and Gender on Twelfth Grade Students' Environmental Awareness and Environment Related Behaviour in Kolkata^[12]. Another researcher studied on environmental awareness among higher secondary students and some educational factors affecting it. It was found that science stream students had more environmental awareness in comparison to arts stream students^[1]. The present investigation was undertaken to study the environmental awareness among the high school students, related to their Sex (Boys/Girls), Locality (Rural/Urban) and types of schools (Govt, /Private). The results of the study revealed that, Gender and locality have interaction effect on Environmental Awareness of the secondary school students^[13].

Role of School

The teacher's role in creating environmental awareness is to model awareness, respect, and wonder. Teachers must show delight with each new discovery and teach respectful observation of the life around us. It is not required that the teacher have a broad base of knowledge in environmental education, but only a shift in perspective coupled with a big dose of enthusiasm and sincerity. The more things they notice, the more children will begin to understand that they are part of a global community, such as using globes and maps, observing nature, project on trees and animals, etc.

The researcher studied on environmental awareness and attitudes of teachers. The relationship between the teachers' attitudes and their gender, academic major, grade level, geographical region and socioeconomic status was evaluated^[9]. She studied the environmental awareness of higher primary school teachers of Mysore City in India. Results revealed that on the whole, majority of the teachers had moderate levels of environmental awareness. Both of them showed that female teachers had significantly higher levels of environmental awareness as compared to their male counterparts^[7]. He studied on secondary school teachers to study their environmental awareness with respect to their residential background, subject specialization and teaching experience. Results revealed that there are significant differences between them in environmental awareness across and within two groups with regard to their subject specialization (science and arts)^[11].

Need for the study

In the present age, the entire globe is facing severe environmental problems. The loss of forests, loss of soil productivity, and global warming are some of the problems of great concern for scientists and intellectuals all over the world. Some other problems are the direct outcome of human greed and lack of concern towards environment. Young students as future citizens must know their environment, its uses and how to preserve and conserve it. This study tries to explore about the awareness and concern of environment among secondary school students who are the pillars of future generation and teaching learning strategies in different schools in Kolkata.

AIMS AND OBJECTIVES

In the present age, the entire globe is facing severe environmental problems. The loss of forests, loss of soil productivity, and global warming are some of the problems of great concern for scientists and intellectuals all over the world. Some other problems are the direct outcome of human greed and lack of concern towards environment. Young students as future citizens must know their environment, its uses and how to preserve and conserve it. This study tries to explore about the awareness and concern of environment among secondary school students who are the pillars of future generation and teaching learning strategies in different schools in Kolkata.

The main objectives of the present study are:

1. To study the extent of environmental awareness (attitude & intention) of secondary school students.
2. To compare the environmental awareness (attitude & intention) among secondary school students on the basis of gender.
3. To compare the environmental awareness (attitude & intention) among secondary school students on the basis of medium of instruction.
4. To find out the teaching learning strategies in different schools.

Hypotheses

The research hypotheses are as follow:

1. There is no significant difference in the environmental awareness (attitude & intention) among secondary school students on the basis of gender.
2. There is no significant difference in the environmental awareness (attitude & intention) among secondary school students on the basis of medium of instruction.
3. There is no significant relationship between teaching learning strategies and environmental awareness (attitude & intention) among secondary school students in different schools.

METHODOLOGY

Population and Sample

In the present study, students of class V, VI & VII of different schools of Kolkata city were selected for the study. For this purpose, 2 Bengali Medium and 2 English Medium schools were selected through random sampling technique. Sample size is hundred (100).

Tool Used

1. The National Institute for Educational Measurement has developed a scale to measure environmental awareness (The Environment Awareness Scale). The Environment Awareness Scale consists of two parts, the titles of which are: "What is your opinion on environmental issues?" and "What are you prepared to do about the environment?" In the first part there are eighteen statements, in the second part there are twenty. The students have to indicate on a three point scale to what extent a statement applies to them. The statements in the first part involve the attitude of the student toward the environment. The second part involves their intentions, that is, to what extent they are prepared to go to behave in an environment-friendly way.
2. A self made questionnaire has been developed to manipulate the teaching –learning strategies of the different schools. The questionnaire comprises of three parts- general information schedule, curriculum and teaching instructions.

Statistical Analysis

Frequencies and descriptive statistics were used to explore information about the distribution of variables. The collected data was interpreted by using mean, standard deviation, t-value and chi-square.

RESULTS AND DISCUSSION

Table-1: School-wise Distribution of Samples

	Mean		S.D	
	Attitude	Intention	Attitude	Intention
School-1 (Female Bengali Medium)	12.08	11.60	1.579	2.198
School-2 (Female English Medium)	9.80	11	2.566	2.198
School-3 (Male Bengali Medium)	10.36	11.04	2.644	2.010
School-4 (Male English Medium)	11.16	10.72	1.573	1.860

Table-1 shows the school wise distribution of the samples. There is significant difference in the mean scores of attitude of school 1 and school 2 but not in the scores of intention. But in case of school 3 and 4 the difference exists in both the mean scores of attitude and intention.

Table-2: Gender Difference Related to the Environmental Awareness

Gender	N	Attitude			Intention			df	t-value
		Mean	S.D	df	t-value	Mean	S.D		
Female	50	10.94	2.402			11.30	2.197	98	1.01
Male	50	10.76	2.191	98	0.39	10.88	1.923		

Table-2 shows the gender difference related to the environmental awareness of the samples. Gender wise there is no significant difference in the mean values of attitude & intention. The calculated 't' value of attitude (0.39) is smaller than table value (1.64) at 0.05 level of significance. The calculated 't' value of intention (1.01) is smaller than table value (1.64) at 0.05 level of significance. Hence, there is no significant difference between the environmental awareness of the male and female students. Therefore, null hypothesis is accepted. The probable reason may be that both groups are taught and facilitated equally. They also get knowledge about environment through media, newspaper, etc., which also play an effective role in exceeding awareness towards environment.

Table 3: Environmental Awareness among Students of English & Bengali Medium

Gender	N	Attitude			Intention			df	t-value
		Mean	S.D	df	t-value	Mean	S.D		
English									
Medium	50	10.48	2.215			10.86	2.020		
Bengali									
Medium	50	11.22	2.324	98	1.62	11.32	2.104	98	1.11

Table-3 shows the environmental awareness of the samples on the basis of medium of instruction. The obtained value of 't' of attitude (1.62) is smaller than the value of 't' (1.64), which is non-significant (at 0.05 level). But it is significant at 0.10 level (1.28) and hence it can be concluded that there is a significant difference in the attitude of English and Bengali medium students towards environmental awareness. Probable reason may be that the Bengali medium schools are providing more opportunities and resources for students to explore the environment.

The calculated 't' value of intention (1.11) is smaller than table value (1.64) which is non-significant at 0.05 level of significance. Hence, the null hypothesis is partly accepted and hence it can be said that the medium of instruction does produce a significant effect in the attitude of the secondary school students towards environmental awareness.

Table 4: Chi- Square Values of Dimensions of Teaching Learning Strategies

Dimensions	Pearson Chi- Square	df	
Educational qualification*Attitude	13.161	2	Significant*
Educational qualification* Intention	6.494	2	
Training*Attitude	13.161	2	
Training* Intention	6.494	2	
No. of years*Attitude	25.279	6	
Class Allotment*Attitude	13.749	4	
Syllabus followed*Attitude	5.357	2	Significant***
Project assigned*Attitude	5.357	2	
Nature observation* Attitude	25.279	6	Significant*
Audio-visual aids* Attitude	7.573	2	
Mode of instruction* Attitude	7.573	2	
Marks allotment* Attitude	23.608	4	
Result* Attitude	8.782	4	Significant***
*At .05 level	***At .10 level		

Table-4 shows the Chi-square value of dimensions of teaching learning strategies and environmental awareness level. The teacher oriented dimensions include educational qualification, training, no. of years of teaching. The calculated values of educational qualification & training are significant at .05 level with respect to attitude and intention level but the value of training*attitude level is significant at .05 level only.

The curriculum oriented dimensions include class allotment, syllabus followed, project assigned and nature observation. The values of class allotment (13.749) and nature observation (25.279) is significant at .05 level but the chi-square values of syllabus followed and project assignment (5.357) is significant at .10 level with respect to attitude level.

The teaching instructions include the use of audio visual aids, mode of instruction, marks allotment and the result of the students. The obtained chi-square values of the audio visual aids, mode of instruction (7.573) and marks allotment (23.608) is significant at .05 level with respect to attitude level. The result given to the students (8.782) is also significant at .10 level with respect to attitude level. Thus only educational qualification and training of the teachers are said to have a significant effect on the environmental awareness (with respect to both attitude and intention) of the students.

CONCLUSION

The main findings are:

1. There is no significant difference between the environmental awareness of male and female students at 0.05 level (similar to Thakur K, 2012).
2. There is no significant difference between the environmental awareness of English and Bengali medium students at 0.05 level, but there is a significant difference at .10 level in the attitude of English and Bengali medium students towards environmental awareness.
3. There is significant relationship between the environmental awareness and teaching- learning strategies (educational qualification and training of the teachers with respect to attitude and intention level) (similar to the findings of Prahallada NN, 2011).

The above findings show that all the students included in the sample manifest some environmental awareness. Gender wise there is no significant difference in the mean values of attitude & intention. There is a significant difference in the attitude of English and Bengali medium students towards environmental awareness because Bengali medium schools are providing more opportunities and resources for students to explore the environment. Educational qualification and training of the teachers are said to have a significant effect on the environmental awareness (attitude and intention) of the students. Thus, overall, medium of study and teaching- learning strategies does affect the environmental awareness of an individual.

Implications of the Study

On the basis of the findings of the study, a few educational implications of the study may be indicated as follow-

1. The findings of the present study will be helpful for the educationists, teachers, and students to increase their level of environmental awareness [14].
2. Formal systems of education should also incorporate in its curriculum, some elements of environmental awareness programmes to be a compulsory part of the curriculum.
3. With the help of various mass media and modern means of communication, the concept of environment and its protection should be published and popularized viz. news paper, radio, TV, film, etc.[11]
4. Environmental awareness should be inculcated at an early stage and in a manner which includes more practical and less text book instruction.



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A Comparative Study on Environmental Knowledge and Environmental Awareness of Secondary School Students Between Different Socioeconomic Statuses

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ABSTRACT

The present investigation attempted to study the effectiveness of Environmental Education by assessing the level of environmental knowledge and environmental awareness among secondary school students of Kolkata. It also attempted to find out if there is any difference in these variables between the students of upper and lower socioeconomic status. Two reputed schools consisting of upper and upper-middle class students and two other schools comprising of lower and lower-middle class students were selected for this purpose. Students of classes IX and X were chosen as sample for the study and the sample size was 220. A structured questionnaire developed by the investigators on environmental knowledge and a standardized test on environmental awareness were used. Statistical analysis of the collected data was done by computing means, standard deviations and t-tests. The findings indicate that the level of knowledge on environmental issues ranged from 45% to 60%, whereas the awareness level ranged from 73% to 78%. The t-tests indicated that there was a significant difference at .01 level in environmental knowledge between the students of upper and lower socioeconomic statuses, in favour of the upper class students. However, the difference between the means of environmental awareness was not statistically significant. Thus it can be inferred that the level of information and understanding of the sample regarding environmental problems is not very good, though they are well aware about the environmental issues.

Key Words Environmental Education, Environmental Knowledge, Environmental Awareness.

INTRODUCTION

Environment plays a key role for making life, i.e., life is solely and wholly dependent on environment. There are several components of environment, natural plus man made environment, the latter including crop fields, cities, industrial space etc. These environment components are to a great extent changeable by the action of man and natural hazards. Under such circumstances man, plant and animal face many acute problems and the balance of nature is disturbed to a great extent

The unprecedented economic progress of 19th and 20th centuries have pushed the environmental and ecological awareness into the background. However, today there is a growing concern towards global environmental problems. The environmental problem is three-dimensional a) environmental pollution, b) ecological decay or destruction c) resource depletion. Many of these are irreversible and so it is our foremost duty to conserve our environment resources.

The goals of environmental concern are to develop a world population that is aware about the environment, its associated problem, so that the population will have the knowledge, skill, attitudes, motivation and commitment to work individually and collectively towards the solution of current problems and presentation of new ones. Global concern regarding the steadily deteriorating state of the environment has emphasized the need for environment education. Environment education is a powerful vehicle bringing about change, a panacea of all

evils and a potent weapon for prevention of the environment. Environment education can make people sensitive towards nature. Environment education is an attempt to reorient education so that environmental competence is restored as one of its basic aims along with personal and social competence. It is not just a subject of education but an expansion of its whole philosophy recognizing our environment as continuous with ourselves and in need of the same care and understanding as we give to our personal and social well being. World educators and environment specialists have repeatedly pointed out that a solution to environmental crisis will require an environmental awareness and its proper understanding which should be deeply rooted in the system at all levels of school education. The goals are meant to develop a world problem that is aware of and concerned about total environment and its associated problems and solutions and prevention of new ones.

In India the implementation of environmental education at all stages of formal education is the mandate of the Ministry of Human Resource Development (MHRD). The Ministry of Environment and Forests has been interacting with the MHRD, NCERT, State Departments of Education etc to ensure that environmental components are adequately covered at the school levels by infusion into the school curriculum at various levels. Thus Environmental Education is an effective process to develop the understanding of Environmental Awareness. Environmental Awareness is the most important aspect of Environmental Education but not the whole. Environmental Education has more productive function, it helps in planning and generating conducive environment and it provides opportunities and situations for performing certain tasks and activities for solving environmental problems.

In a developing country like India, the most severe problem is the depletion of natural resources. Spectacular advances in technology and science have resulted in dramatic improvement in living standards. This has resulted in explosive growth in population on one hand, and high consumption of natural resources on the other hand. This is ultimately exerting pressure on the environment dangerously. So, there is a close relation between economic development and natural resources. With economic development more and more resources are consumed. Since resources are scarce, they are to be exploited efficiently. Unless technology continues to reduce dependence on raw materials, it is possible for a country to run out of needed resources. Moreover, if population continues to grow by increasing its per capita income, then it must invest more to protect the natural environment as also to continuously increase the supply of renewable resources and conserve renewable ones. Then only the society can achieve sustainable development. Two major threats to such sustainable development are a) growing population in the low income developing countries, b) rising consumption standards, specially of the expanding middle class. Therefore, it is the task of policymakers in countries like India to strike a balance between these two opposite tendencies.

A study revealed that total family monthly income and environmental knowledge and perception are positively correlated with solid waste management practices^[3]. In another study it was found that the best discriminator between environmentally concerned and indifferent young people was self-reported level of knowledge about specific environmental issues^[7]. Level of scientific knowledge and exposure to television science programs were also powerful discriminators after the social class effect was considered. In addition, attitudes toward scientific changes were a good discriminating factor, after the effects of social class and knowledge were taken into account^[5].

Given these perspectives the present study was carried out to find out the effectiveness of Environment Education in the secondary stage in the schools of Kolkata under the West Bengal Board of Secondary Education. In order to determine the effectiveness, Environment Knowledge and Awareness of secondary school students were assessed. Further an attempt was made to determine if there is any association between socioeconomic status and Environment Knowledge and Awareness of these students.

AIMS AND OBJECTIVES

- a) To find out the status of environment education in the secondary schools of Kolkata.
- b) To assess the knowledge of environment of the secondary school students belonging to different socio-economic status.

- c) To assess the awareness of environment of the same students.
- d) To find out if there is any difference in the knowledge of environment between the students of lower socioeconomic and upper socioeconomic status.
- e) To determine if there is any difference in environmental awareness between the students of lower socioeconomic and upper socioeconomic status.

METHODOLOGY

Sample

Subjects were drawn from classes IX and X of four secondary schools of Kolkata. The size of sample was 220. Among them 110 were from two reputed schools where children from upper and upper-middle classes study and rest 110 were from schools where children from lower and lower-middle classes study. 95 of them were male and 125 were female.

Description of the Tools

A questionnaire was developed by the present investigators by consulting related literature and the prescribed books on Environmental studies for class IX and X. The questionnaire had 3 parts. The first part consisted of questions related to personal information and school related information. In the second part there were 35 questions on environment. There were 25 multiple choice items and 5 completion items based on information regarding environment, 5 open end items based on understanding and comprehension of the different conditions and problems of environment.

Another questionnaire on environmental awareness dealing with different environmental issues constructed by Dr. Madhumala Sengupta of Dept. of Education, Calcutta University (2005) was used^[11]. This was a standardized questionnaire with two parts. The first part consisted of 20 items and there were 5 categories of responses ranging from ‘Yes-always’ to “Never”. In second part there were 20 items, each including 4 statements on a particular problem of environmental pollution.

Data Collection

Data were collected from the students of classes IX and X. In each school the students were made to sit in a classroom and were requested to fill up the questionnaires after reading the instructions carefully. The same procedure of data collection was followed for all the schools.

Scoring

The data gathered in the first part of the questionnaire related to personal information and school information were coded. In environmental knowledge ‘1’ mark was assigned for each correct answer for questions 1 to 30 and ‘2’ marks for remaining 5 questions. So the maximum score could be 40. The total score of each individual was then converted to percentage to determine the level of environmental knowledge. In case of Environmental Awareness test responses were scored according to the scoring key. Then the scores of each individual were summed and this total score was also converted to percentage in order to determine the level of awareness. Thus two separate scores in percentage were obtained for each student on environmental knowledge and environmental awareness.

Statistical Analysis

In order to verify the objectives of the study the data were statistically analysed by computing means of the percentage scores of the two variables, standard deviation and t-test.

RESULTS AND DISCUSSION

Analysis of the data obtained in the first part of the questionnaire suggests that all the schools have a separate teacher on Environmental studies who is responsible for taking at least one class per week generally taken in late school hours. To make the subject interesting and to increase the awareness level different activities are



carried out besides regular classes. These are celebration of world environmental day, plantation, cultural functions and lectures on importance of the day etc. However, the schools do not arrange any educational tour, field trips to learn about the different environmental issues. Only the schools in high socioeconomic status carry out some projects on different environmental topics. Educational techniques such as problem solving, case study, group discussion, simulated technique are not practiced.

To find out the level of Environmental knowledge and awareness among the students the means and standard deviations of the percentage values have been computed. These values are shown in the following table according to the schools, where school 1 and 2 comprised of students belonging to upper and upper-middle socioeconomic group, and schools 3 and 4 consisted of children belonging to lower and lower-middle socioeconomic group.

Table 1: Distribution of the Means and Standard Deviations on Environmental Knowledge and Environmental Awareness According to Different Schools.

School	Mean Environmental Knowledge (EK)	Mean Environmental Awareness (EA)	Standard Deviation (EK)	Standard Deviation (EW)
1	60.59	78.62	6.81	6.43
2	53.62	73.90	8.90	4.03
3	49.50	73.22	6.52	11.9
4	45.31	75.73	9.87	6.44

Table-1 indicates that the EK in the upper status seems to be more than that of the lower status. However EA appears to be more or less same in all the schools. As the mean values are found to be less than 60% in three schools and just 60% in one school, it can be interpreted that the students of all schools have moderate level of knowledge of environment and are not attaining mastery learning. This may be due to the fact that the schools are having an environmental studies class only once a week. Besides this there is dearth of experiential learning through different projects on environmental problems, field visits, etc. Similar findings have been reported by a group of researchers. Analysis of the environmental knowledge of the 10th and 12th grade students revealed low levels of environmental knowledge. A majority of students were able to recognize basic facts concerning environmental problems; however, most students could not apply their knowledge in order to comprehend the consequences or potential solutions related to the problems. Students also demonstrated extremely little growth in environmental knowledge from 10th grade to 12th grade. Parental level of education, quantity of high school science courses, and gender (in favor of males) all were found to be significantly related to the students level of environmental knowledge^[6].

It has found that Lebanese secondary school students have favourable attitude toward the environment but lacked in their environmental knowledge. Moreover environmental knowledge is significantly related to parental education level^[10]. In a recent study it has been found that average level of environmental knowledge is 34.71% right answers. The environmental knowledge of the secondary students in Macedonia is usually on the level of recognition^[12].

In order to find out whether there is any significant difference in mean scores in environmental knowledge and awareness between the students of upper and lower socioeconomic schools t- tests have been done. The result is presented in Tables-2 and 3. The Table-2 In order shows that the critical ratio is significant at .01 level which means that there is an association between socioeconomic status and environmental knowledge. The knowledge of the students in the upper status is significantly higher than that of the lower class students. Table-3 reveals that environmental awareness does not depend upon socioeconomic status because the critical ratio is not significant. All types of school have been able to create awareness among the students.

Table 2: Representation of 't'-value of Mean Difference between Environmental Knowledge of Students Belonging to Lower and Upper Socioeconomic Statuses

't' calculated	Degree of Freedom	Level of Significance	Table Value	Decision
4.18	218	0.05	1.98	Significant
		0.01	2.63	Significant

Table 3: Representation of t'-value of Mean Difference between the Environmental Awareness of Students of Lower and Upper Socioeconomic Statuses

't' calculated	Degree of Freedom	Level of Significance	Table Value	Decision
0.88	218	0.05	1.98	Not significant
		0.01	2.63	Not Significant

Earlier researches have also demonstrated positive relationships between environmental knowledge and economic background. For instance, a researcher examined the environmental attitudes of Turkish secondary students. In two-way multivariate analysis of variance (MANOVA) conducted to determine the effect of school type and gender on four dimensions of the environmental attitude questionnaire it has been found that school type and gender have a significant effect on the collective dependent variables^[2].

Thus the overall findings suggest that socioeconomic status has more effect on knowledge than on awareness. Further the knowledge level of the students is lower than their awareness level in both the groups. This may be probably due to poor performance of the students on comprehension and problem-solving type of items. This finding corroborates with the previous studies. Some authors have assessed level of environmental knowledge, environmental awareness and environmental concern of 11th grade students. Independent variables included type of school, region of school and the level and sex of students. They found that, although students scored rather low on knowledge questions, they displayed higher score on awareness and concern^[8]. Similarly, another author has also reported that minimum level learning in environmental studies was far below the minimum desired level of 80% in the primary level students^[9].

CONCLUSION

The present investigation attempted to study the level of environmental knowledge among secondary school students intending to find out if there is any difference in the environmental knowledge and awareness between the secondary school students of upper and lower socioeconomic statuses. Statistical analysis of the data indicates that students are aware of the environmental issues as the mean values are found to be more than 70%. However their level of environmental knowledge is not very satisfactory as it ranged from 45% to 60.59%. When the mean scores are compared between the students of lower and upper status by t-test, the results indicate that there is no significant difference in awareness, but the difference in knowledge level is significant at .01 level in favour of upper socioeconomic status. It can be inferred from the findings that the different activities arranged by the schools have been effective in creating awareness regarding environment but there is need to increase the environmental knowledge at the secondary stage of school education through adequate measures.

IMPLICATIONS

Different activities such as celebration of Environment Day, plantation, cultural functions and valuable lectures on the importance of knowing and saving the environment should be practiced as they have been found to be effective in creating awareness regarding environment.



There is need to decrease the quantum of awareness and increase the knowledge of real life situation, conservation and sustainable development at the secondary stage of education. To disseminate environmental knowledge important techniques such as problem solving, case study, group discussion, simulated technique should be used. Action oriented work and field visits should be included in the curriculum.

The schools imparting education to lower socioeconomic group often face problems of resource materials, funds and trained instructors etc. Special efforts should be made to overcome such problems.

These measures can only ensure protection of the future world from environmental hazards.

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From Environmental Sustainability to Promoting Sustainable Environments: An Initiative by Delhi Schools

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ABSTRACT

Over recent decades, global problems relating to degradation of natural resources and pollution have increased dramatically. Natural resources are depleted by excessive use. Air and water pollution have reached such levels that have already resulted in serious health problems, as well as negative impact on the environment, and inevitably influencing prospects for long-term economic growth. In such a scenario, the need for environmentally sensitive and aware people is of utmost importance. In providing comprehensive environmental information, it is important to target the right population. The role of younger generation is crucial in achieving these objectives. Their knowledge and awareness about the environment would yield positive results to counter these problems. In this regard, the role played by school becomes extremely important. The present paper on is an attempt to explore the initiatives taken by school towards environmental concerns and the environmental awareness possessed by the students.

Key Words Sustainable Environments, Environmental Awareness, Younger Generation, School.

INTRODUCTION

Sustainable Development stands for meeting the needs of present generations without jeopardizing the ability of future generations to meet their own needs – in other words, a better quality of life for everyone, now and for generations to come. It offers a vision of progress that integrates immediate and long-term objectives, local and global action, and regards social, economic and environmental issues as inseparable and interdependent components of human progress^[2].

The concept of sustainability has been establishing a strong foothold in recent times, with efforts ranging from reducing air emissions from our industrial processes to lowering our energy consumption and much more. Reappraising economic sectors (green building, sustainable agriculture), or work practices (sustainable architecture), using science to develop new technologies (green technologies, renewable energy), to adjustments in individual lifestyle. The need of sustainable development is picking up pace and one of the drivers behind this thrust is the realization of increasing occupational morbidity and unprecedented energy consumption patterns of buildings^[3].

Environment is one of the key areas of current human concern. Ironically and probably unknowingly, it is human beings themselves who are responsible for degrading, destroying and polluting it. The future generations shall have to reap the harvest of unplanned and insensitive approach that has irreparably damaged the relationship and harmony of human beings with the nature^[4].

The climate change issue is part of the larger challenge of sustainable development. Climate change is one of the most important global environmental challenges, with implications for food production, water supply, health, energy, etc. The most effective way to address climate change is to adopt a sustainable development pathway by shifting to environmentally sustainable technologies and promotion of energy efficiency, renewable energy, forest conservation, reforestation, water conservation etc^[5]. Full attention to climate change issues requires public awareness and knowledge of societal and personal strategies for addressing climate change. Three

challenges of climate awareness are the lack of global consensus on the topic, public confusion about the issue, and incomplete education of teachers and students. Each of these challenges is interconnected, requiring combined effort and communication between key stakeholders^[3].

One of the best strategy for addressing this problem is initiatives taken by school and adoption of the green concept in not only the design of the school buildings but also the operations and practices followed like use of renewable energy, waste management, water conservation etc. By doing so, schools not only get an opportunity to contribute to the global problem of climate change but also instill the sense of environment preservation among the future citizens of the country.

Lately, schools have emerged as an important agency for promoting sustainability. Through the curriculum and through their practices, schools can set an example to today's children and young people. By engaging children in action to reduce emissions and thus contributing to environmental sustainability, schools can enhance children's learning and build their understanding of how they can respond to issues of national and International importance like climate change^[1].

Thus, various measures undertaken by the school to sensitize students on environmental issues will further encourage students to live a "greener" lifestyle, at home and at school. By teaching children at a young age to be environmentally aware, school are in turn building lifelong habits that could potentially make a dramatic difference in the future of the earth.

The environment in which the children live and play has an important role in the acquisition of environmental concepts and development of environmental attitude in children. With schools adopting the green concept, the youth of the country will learn sustainability by living it every day at school, so that when they leave school these ideas will have become a part of the way they think and approach life. Thus, the exposure to green concepts gained at school becomes a part of their lifestyle.

AIMS AND OBJECTIVES

The study was planned to identify:

- a) The green initiatives taken by selected private schools in Delhi and
- b) To assess the environmental awareness possessed by the students

METHODOLOGY

The study was conducted in selected schools of Delhi. For the purpose of study, four schools actively taking green initiatives were selected and the sample comprised of twenty students from each school making it a total of 80. The students studying in class VII were selected reason being, they are still in their formative years and it is the right age for habit formation.

A questionnaire was prepared to study the initiatives taken by the school. An observation checklist was also prepared by the researcher which was administered by the researcher during visit to the schools. A close ended questionnaire was prepared to assess the environmental awareness and green practices followed by students. The data was analyzed and interpreted quantitatively and qualitatively keeping in mind the objectives of the study.

RESULTS AND DISCUSSION

Green Initiatives Taken by Schools

In order to study the environment friendly practices followed by schools, case studies for all schools were developed and were further analyzed on the basis of green initiatives taken by schools in categories of land, air, water, energy and waste. Table 1 highlights the green initiatives taken by selected schools in respective categories. The case studies of all schools revealed that the schools were taking similar kind of initiatives in each area namely land, water, air, energy and waste. All the schools were found to undertake activities, campaigns and projects centered around the students to enhance their understanding on environmental issues. Most of the



activities undertaken were part of the eco-club. Also, one of the common factor observed among all schools were associations with other institutions such as non-government organizations working in the area of environment, government agencies like Department of Environment, Government of NCT of Delhi etc. in order to sensitize the students on issues of environmental significance. The schools are also encouraging students to extend these environmental initiatives from the school to the communities to meet the overall goal of sustainable development.

Table 1: Highlights of Green Initiatives Taken by the Selected Schools

Land

- Regular plantation drives undertaken to increase green cover
- Use of organic means (manure, compost, vermicomposting) to improve soil fertility
- Environment friendly pest control employed (bio pesticides)
- Maintenance of herbal garden
- Footrest of open air amphitheatre covered with grass instead of being cemented
- Celebration of special days with environmental significance like Earth day, Vanmahotsav, Environment day
- Organization of field visits, nature walks for students

Air

- Provision of public transport
- Provisions of natural ventilation in all areas of school
- Presence of plants along corridors
- Use of dust free chalks
- Interaction with parents during parent teacher meetings to encourage Walking, Cycling and Car-pooling to school
- Special assemblies conducted on the issue
- Priority given to students within 5 kms. of school range during admissions
- Experts from industry invited to make students aware about air pollution
- Students encouraged to participate in various activities like anti cracker campaigns, street plays etc to create awareness among the masses in nearby localities

Water

- Water Efficient Irrigation system
- Irrigation procedure employed early morning/ late evening when rate of evaporation is minimal
- Water efficient / conserving fixtures installed like automatic on-off fixtures, low flow toilets, waterless urinals etc.
- Rain water harvesting performed
- Waste water treatment & recycling
- Selection of drought resistant & native plants which require very less water
- Celebration of special days like world water day etc. to create awareness among students on the issue of water conservation
- Students assigned duties to check for water leakages
- Students encouraged to participate in various activities like campaigns, street plays etc to create awareness among the masses in nearby localities

Energy

- Provision of adequate natural day light in all areas of the school
- Use of energy efficient lighting like tubelights and compact fluorescent lamps
- Measures implemented to maximize daylight
- Use of energy star certified fixture & installations

Application of solar energy

Energy managers appointed in each class who ensure fans and lights are switched off when not in use

Students are involved in activities related to energy conservation , visits organized for to nearby areas and talking to people about energy conservation etc.

Waste

Measures such as printing notices on half sheets and use of emails instead of faxes to reduce waste generation

Waste segregation by use of separate dustbins

Waste composting facility

Colony compost pit maintained by students of the school

On campus paper recycling facility

Outsourcing waste paper for recycling

Banning use of polythene bags in school

Proper disposal & management of e-waste

Proper disposal & management of biomedical waste

Students encouraged to participate in various activities like cleanliness drives, best out of waste competitions etc

Environmental Awareness Possessed by Students

Environmental awareness among respondents was assessed based on the responses to certain questions on different dimensions of environment. Table 2 depicts mean scores and standard deviation obtained for students of selected schools. Overall, the mean environmental awareness score of the respondents were 31.7, 32.1, 32 and 31.6 for school 1, school 2, school 3 and school 4 respectively out of a maximum score of 40 indicating that majority of the students scored well in the environmental awareness test which shows that students were well aware about the environmental concepts.

Table 2: Mean Environmental Scores and Standard Deviations of Students from the Selected Schools

School	N = 80	Mean	S.D.
1	20	31.7	3.39
2	20	32.1	3.58
3	20	32	3.11
4	20	31.6	4.19

The respondent's environmental awareness was categorized according to the composite score of responses to twenty questions with a maximum score of 40. Respondents who score 0 to 13 have low awareness, 14 to 26 moderate awareness, and 27 to 40 have a high environmental awareness.

Table 3: Percentages Depicting Level of Environmental Awareness of Students from Selected Schools

Schools	Low	Moderate	High
School - 1	0	15	85
School - 2	0	15	85
School - 3	0	15	85
School - 4	0	20	80



The results from Table-3 demonstrated that the majority of students in each school had a high level of environmental awareness. Whereas, overall only 16% students indicated moderate level of environmental awareness. While none of them displayed a low level of environmental awareness.

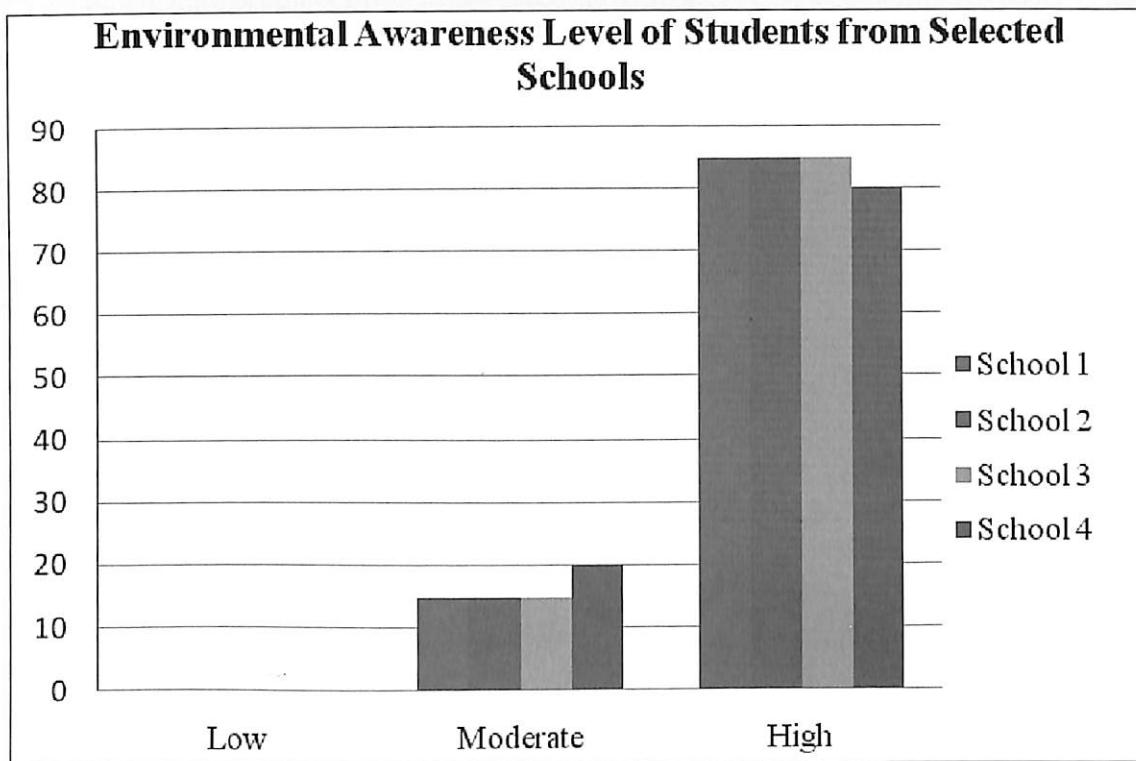


Figure 1: Environmental Awareness Level of Students from Selected Schools

The performance of the students on the environmental awareness test was further analyzed on the basis of correct responses obtained in specific environmental dimensions in order to gain insight into student's awareness on specific issues. Table-4 demonstrates the percentage of marks obtained in different dimensions for students of each school.

Table 4: Dimension-wise Performance in Percentage of Students on the Environmental Awareness Test

Dimension	School - 1	School - 2	School - 3	School - 4
Land	65	72	62	65
Waste	80	90	92	86
Energy	69	73	75	70
Global Warming	91	93	95	91
Renewable Resources	65	70	65	80
Water	92	98	96	90
Air Pollution	78	75	72	68

As can be seen from Table-4, the students from all schools performed well in the environmental awareness test but the performance in different dimensions of environment being tested varied.

Overall, the respondents seem to have displayed high level of awareness on the overall environment awareness test, but as we go from general to specific we get to know that out of the few chosen dimensions, respondents have deepest knowledge about waste management and water pollution. Majority of the students were aware about identification of organic waste, segregation and collection of waste in separate coloured dustbins and

vermicomposting. This may be because all the schools are not only taking proper measures for waste management by indulging in waste segregation and composting the bio-degradable waste but are also encouraging students to follow the practice. Though, the students clearly lacked an understanding of hazardous waste as most of them could not identify waste considered as hazardous and waste that cannot be recycled by virtue of it being hazardous. The schools are mostly involving students in waste segregation of biodegradable and non-biodegradable waste but are not creating awareness of this aspect of waste.

Then on coming to land and air pollution respondents had shown low scores due to the fact that respondents didn't have knowledge relating to the sources and effects of these pollutions and if one doesn't know the sources of these pollutions then it becomes difficult to prevent it. Students were aware about the importance of plants which can be directly attributable to the involvement of students in the plantation drives in school but lacked awareness regarding the causes of land degradation. Though, all the selected schools are using only organic means of improving soil fertility and even the form of pest control employed is biopesticide but the students also need to be told the relevance of taking these measures. Similarly, students were aware about the concept of carpooling which is highly being encouraged in all schools to curb air pollution but were not aware about the impact of air pollution on the environment.

Awareness on renewable energy sources was found to be even less known. Majority of the students could not identify the different renewable resources. Most of the schools are not taking advantage of renewable energy in the schools and they are not even taking any initiatives for promotion of these resources among students.

Trying to find out on the knowledge of environmental problems that can be considered to be in a two-way relationship with environmental awareness (both as prerequisite and as consequence of awareness of environmental problems) the results showed that there is still a lot of work to be done in creating awareness among students on the major ecological problems.

CONCLUSION

The schools were found to be actively taking environmental initiatives and involving students in this endeavor. Moreover, the results of environmental awareness test revealed that the respondents were good at general environmental concepts but lack knowledge about specific pollutions and their causes. But this is what is needed if we want to enhance student's participation in improving the environmental condition then their knowledge has to be enhanced first and that too in every environmental aspect. Detailed knowledge will guide their lives and living both. Thus, the different environmental concepts should be integrated in the curriculum as part of different subjects and schools should teach the subject of Environment with a practical approach and use the green initiatives implemented as tools for teaching the students.

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- Category: HUMAN DEVELOPMENT, FAMILY AND SOCIETY • Code: (HDFS6)

A Study to Find Out the Level of Environmental Awareness among Secondary School Students in West Bengal

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ABSTRACT

The study is concerned with finding out the achievement level of secondary students in West Bengal in Environmental Education to understand the level of environmental awareness among students. The objective of the study was to critically analyze the disabilities of the students in Environmental Education. Learning disabilities were found out in terms of Environmental Education. At present it had become a burning problems to the students, the parents and the teachers as well as the entire society. This paper tries to find out the disability of students in Environmental Education; to investigate the level of disability of the students in Environmental Education and to find out the remedial measures of these disabilities. Also this study highlights a comparison between the achievement level of boys and girls students and urban and rural students in Environmental Education at secondary level in West Bengal. In this study t-test were done for finding out significance of difference of mean scores in Environmental Education of the students. This paper tries to highlight that more research works should be carried out in this area by the future researchers in order to develop interest of the students as well as the improvement of the education system of the country especially in schools subjects like Environmental Education.

Key Words Environmental Education, Environmental Awareness, Learning Disabilities, Education System.

INTRODUCTION

The ultimate goal of any educational program is the formation is to preserve and protect our natural environment. Ideally, it would be desirable to have pervasive Environmental Education efforts both longitudinally as well as laterally; that is, Environmental Education that reaches to the younger generation of the society and that is possible by imparting proper training to school students and spans every cultural, ethnic, and socio-economic level. To achieve this Environmental Education program must be as innovative as they are as comprehensive and as easily understandable as they are profound in their treatment of environmental issues. To be sure, teachers and trainers of Environmental Education must be willing to abandon traditional methods and use more innovative techniques. Moreover, urban communities must be made to realize the connection between the local environmental concerns and global environmental issues. Environmental Education and training program must, however, meet the specific needs of the particular community^[6]. It has been seen that Government still seems to operate from an ivory tower and community concerns dissolve before they reach policymakers. The environmental crisis plaguing our urban communities requires not only prioritized attention, but demands clarity and consistency in this linkage process. No longer can the environmental movement confine itself to certain ethnic and economic constituencies while claiming to chart a global campaign to save the planet. This research work will try to assess successful strategies in Environmental Education and training.

A study on sustainable development in Primary schools also put forwarded that Environmental Education should be brought at the Pre – school age and continue through adulthood^[1].

Another remarkable study on environmental knowledge level of primary students in Turkey throw lights. It

stated to give awareness , introduction of environmental laws and proper education is very essential among students of each level from primary to higher level, among general public and special emphasis should given on slum areas with an integrated, inter- disciplinary and holistic manner [2].

One eminent Professor has studied curriculum to enhance environmental literacy in the year 2002. The study explains environmental literacy is an important part of undergraduate education. The author finds that such literacy is optimally gained with an approach that weaves together the necessary disciplinary knowledge within a problem-based context[5].

In another study on Environmental Education at the High School Level, it was found that through the medium of education awareness of the environment and its problems related to pollution should be taught as a compulsory subject[3].

So the above mentioned research works definitely have thrown light while dealing with the specific problem of this particular study.

AIMS AND OBJECTIVES

The aims and objectives of the study are as follows-

- i) To find out the disability of students in Environmental Education;
- ii) To investigate the level of disability of the students in Environmental Education;
- iii) To find out the remedial measures of these disabilities;
- iv) To encourage the teachers and the future researchers to work in this field;

METHODOLOGY

Sample

The students (N=230) of four schools from different areas of Kolkata and district of Purba Medinipur were selected Out of two hundred thirty students 49% were boys and 51% were girls. They were all studying in class IX. The schools were selected from rural and urban areas.

Tools used

To measure the dimensions of Achievement in Environmental Education, a self prepared questionnaire was used.

Collection of data

Selection of the sample

For the final selection and standardization of the test, try-out of the test-items was made .The sample for try-out of the test-items was smaller than of the final sample. In this case, a sample of nineteen boys and twenty one girls was chosen. They were selected as to represent a population of the class IX students. Finally, the students of four schools in different areas in the districts of Kolkata and Purba Medinipur were selected. The tool was administered on two hundred thirty students.

Administrations of the test for a try-out purpose

The time taken by each pupil to complete the test items was recorded by a stop watch. They were asked to all the items out. It should be mentioned that in the try out purpose a considerable period of time was allotted to complete the answer. The underlying idea behind this was that as the test not a speed test and the pupils should not consider time as a factor influencing their scores. There was no time limit for the test. The time taken by individual student was recorded, and it was found that the average time taken by the students was two hours. The difficulty faced by each pupil was carefully taken into consideration to modify the items in the final test. Any difficulty in language or in the direction of instruction was judiciously improved for the final purpose.

Administrations of the Achievement- test

A blue print of the final test was prepared after the try-out test. It contained the objectives of the Achievement Test of Environmental Education. The language of each item of the test were not made too much complex. Several questions aiming at different objectives were framed. The questions were framed to evaluate different dimensions. Each and every question measured a definite and specific dimension.

Evaluation of the Answer - Scripts

After completion of the final administration of the test, the answer - scripts were examined with the help of a scoring key previously prepared by the researcher. Each correct answer credited with full marks one, the items that was either incorrectly answered or was not attempted was given zero or no credit.

Re-Administration of the Test Items and Evaluation of the Answer Scripts

The same test was re-administered on twenty percent randomly selected students out of original sample fifteen days after the date of the original administration of the test. The test was re-administration in the same period as in original administration of the test. This was done to determine the reliability index of the text.

RESULTS AND DISCUSSION

Table 1: Mean, Standard Deviation and t – test values obtained by Boys and Girls in Achievement Test of Environmental Education

	Boys	Girls
Number of Students Involved	112	118
Mean of Score	52.54	52.44
Standard Deviation	4.15	3.76
t- test	0.192*	

* - Not Significant at .05 level.

Table 2: Mean, Standard Deviation and t – test values obtained by Urban and Rural students in Achievement Test of Environmental Education

	Urban	Rural
Number of Students Involved	120	110
Mean of Scores	52.05	52.97
Standard Deviation	3.31	4.55
t- test	1.74*	

* - Not Significant at .05 level

Achievement test development by the researcher was administration in four schools. Out of four schools, one was exclusively boys' school, one was exclusively girls' school and two were co-education schools. Two of them were in urban areas and other two were in rural areas. The test was administration on two hundred and thirty students, out of which 112 were boys and 118 were girls. Out of total sample chosen for administration , 120 students were taken from urban schools and the rest from the rural schools. The test was administered on the student of class IX only. Further, the t-test were done for finding out significance of difference of mean scores in Environmental Education of the students. Hence, comparative study of mean scores in Environmental Education of boys and girls and urban and rural students were computed. The values of t in all cases were found to be 1.74 which was not significant at the .05 level. Again, the value for boys and girls was found to be. 192 which was not significant at .05 level.

The objective of the study was to critically analyze the disabilities of the students in Environmental Education. Learning disabilities were found out in terms of Environmental Education. At present it had become a burning problems to the students, the parents and the teachers as well as the entire society.

The test was administered particularly in four schools and thereby both good, average and slow learners were included. The means and standard deviations of the scores obtained by the students boys and girls (Sex wise) and urban and rural (Strata wise) were found out separately. The difference in mean scores in achievement test of the urban and rural students and that for boys and girls were found to be 1.74 and .192 respectively, both of which were not significant at the .05 level. Hence, it might to be concluded that the rural students possessed better ability in Environmental Education on the average than urban students.

CONCLUSIONS

The achievement of the child should be judged in relation to the child's learning capacity. A main cause of learning disability is due to poor teaching learning situations. Hence the researcher attempted to diagnose critically the disabilities of the students of class IX in Environmental Education. Environmental Education involves learning about the natural systems that sustain life and how those systems are affected by human activity. Environmental Education raises public awareness of the environmental consequences of our actions. Hence, schools should assume responsibility for educating about environmental protection, and Environmental Education (EE) can be effective as a part of a school curriculum. Several educators and environmentalists have produced a rich variety of education models, instructional packages and materials, and theoretical guidelines that have constituted EE. All these efforts have underlined the importance of education in promoting environmental awareness and protection.

RECOMMENDATIONS

Some suggestions were stated below to remove the disabilities of the students in Environmental Education:

- i) A favorable and pleasant environment should be established in class room situation and also out side the classroom such at home particularly in urban areas so that the student might acquire better skill in Environmental Education.
- ii) Also classroom environment will be created in such a way so that both boys and girls should be well acquainted with the current events of environmental issues. This will further increase their interest in Environmental Education^[6].
- iii) The child should be surrounded with abundance of attractive materials of Environmental Education in and around their class room.
- iv) A well- equipped and well managed classroom, laboratory and library are essential for increasing awareness regarding Environmental Education among the learners.
- v) Every student should be given opportunities to place their opinion regarding the subject in the classroom.
- vi) The students should be asked important questions to develop their skills in Environmental Education.
- vii) The teachers should develop innovative methods of teaching Environmental Education in the classroom, so that the learners might be interested in the subject.
- viii) Finally, more research works should be carried out in the area by the future researchers in order to bring interest of the students as well as the improvement of the education system of the country especially in schools subjects like Environmental Education.

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- Category: HUMAN DEVELOPMENT, FAMILY AND SOCIETY • Code: (HDFS7)

Social Environment and its Psychological Impact on Children and Early Adolescents Belonging to Two Age Groups and Two Different Socio - Economic Conditions: A Comparative Study

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ABSTRACT

The study aims to find the importance of social environment on the cognitive ability of children by comparing the relations shared by drawing performance and self esteem in two age groups, belonging to two different socio - economic conditions. Random samples of two hundred 10 and 11 year olds and two hundred 14 and 15 year olds were selected. The correlations were found to be positive and significant. The result of the t – test showed that there was no significant difference between the human – figure drawing scores and self esteem scores of 10 - 11 year and 14 - 15 year olds. Result of the Z – test revealed that there was significant difference between the correlation coefficients of the human figure drawing and self esteem scores of 10 and 11 year olds belonging to middle socio - economic and low socio-economic group; whereas there was no significant difference for the early adolescents. In case of the entire sample results indicated that there was significant difference between the correlation coefficients of the human figure drawing and self esteem scores of both the age groups belonging to middle and low socio - economic groups.

Key Words Cognitive Ability, Human Figure Drawing, Self Esteem, Socio – Economic Conditions.

INTRODUCTION

Socioeconomic status has significant impact on self-esteem and human figure drawings of children and adolescents. Individuals, belonging to higher socioeconomic status show higher self esteem and human figure drawing scores than those belonging to lower socioeconomic status.

Drawings by children and adolescents express their creativity^[23]. Investigations have indicated that children's drawings of human figure reflect their intellect^[1]. Therefore children's and adolescents' drawings may be considered as effective tools for assessing neurocognitive development^[9].

An author found that expression of self-esteem were greatly associated with figure drawings of 97 fifth and sixth grade boys^[8]. Another researcher worked with 253 four to eleven year olds and concluded that the children increased the sizes of and used most preferred colours for drawing positively characterized figures, did not decrease the sizes of the negative figures but used least preferred colours to draw them^[5].

Several studies have reported significant findings regarding the effects of socio-economic status (SES) on self-esteem. Generally, research suggested that individuals with a higher socio - economic status have higher levels of self-esteem than individuals who have a lower socio - economic status^[3, 12, 19]. Some studies have focused on the impact of socio - economic status for all age groups^[19]. One researcher found that parental unemployment contributes to the depletion of children's self-esteem^[7]. Some researchers suggested that low socio - economic status has an indirect effect on the self-esteem of adolescents because it causes a decrease in the support and involvement of the parents. They do not think that it is necessarily the family's economic condition in and of itself that affects a child's self-esteem, but that it is how the economic status affects the parental-child relationship that makes the difference^[24].

Similarly, a study on the relationship between mothers and their 6- to 8-year-old children found that mothers who had higher levels of education and higher levels of family income provided higher quality home environments for their children. Furthermore, these higher quality environments were found to be related to their children's levels of achievement^[3]. In addition, two researchers found that as long as children with a low socio - economic status feel that they have competence in one major area, either home or school, they are able to maintain a high sense of global self-worth. It is when the low socio - economic status children have low levels of competence in both major areas that they have significantly lower ratings of global self-worth. Whether direct or indirect, socio - economic status does appear to have some impact upon self-esteem^[15].

Researchers found out in their study that the relationship between children's reflection-impulsivity styles and their human figure drawings. The study was done on a sample of Mexican children of middle ($n = 97$) and low ($n = 110$) socio - economic status. Drawings were scored for Developmental, Emotional, and Impulsivity indicators^[21].

In studies by various investigators it was revealed that socio - economic status influenced parenting style^[2, 11, 14]. Schooling also was influenced by socioeconomic status^[16, 17]. Previous investigations indicate that socio - economic status may exert influences on the variables of human – figure drawing^[4, 22] and self esteem^[6, 18, 20].

Therefore in today's world of social change and technological advancement, drawings prove to be effective tools of therapy^[10]. Art therapy helps children and adolescents overcome emotional and behavioral problems, as emotional problems which can not be expressed verbally find expression in drawings. The present investigation may help to find the impact of social environment on the psychological wellbeing of children and early adolescents. Thus art therapy can be useful in managing different issues emerging due to socioeconomic status, schooling as well as parenting style.

AIMS AND OBJECTIVES

- To find out whether Human – Figure Drawing scores of both the age groups and socio – economic groups are positively and significantly related to their Self Esteem.
- To find out whether there is positive and significant difference between human figure drawing scores of children and adolescents belonging to the middle income group and low income group.
- To find out whether there is positive and significant difference between self esteem scores of children and adolescents belonging to the middle income group and low income group.
- To find out whether there is positive and significant difference in correlation (human – figure drawing and self esteem) of the two age groups belonging to the middle and low income group.
- To find out whether there is positive and significant difference in correlation (human – figure drawing and self esteem) between middle and low income groups of the 10 and 11 year olds.
- To find out whether there is positive and significant difference in correlation (human – figure drawing and self esteem) between middle and low income groups of the 14and 15 year olds.

METHODOLOGY

Hypothesis

- Human – Figure drawing scores of both the age groups and socio – economic groups are positively and significantly related to their Self Esteem.
- There is positive and significant difference between human figure drawing scores of children and adolescents belonging to the middle income group and low income group.
- There is positive and significant difference between self esteem scores of children and adolescents belonging to the middle income group and low income group.
- There is positive and significant difference in correlation (human – figure drawing and self esteem) of the two age groups belonging to the middle and low income group.

- e) There is positive and significant difference in correlation (human – figure drawing and self esteem) between middle and low income groups of the 10 and 11 year olds.
- f) There is positive and significant difference in correlation (human – figure drawing and self esteem) between middle and low income groups of the 14 and 15 year olds.

Sample

Two samples, one of two hundred 10 - 11 year olds and 14 - 15 year olds belonging to middle income group and another of two hundred 10 - 11 year olds and 14 - 15 year olds belonging to low income group were randomly selected. Each sample comprised equal number of girls and boys residing in Kolkata. The subjects belonging to the middle income group attended English-medium schools and the subjects belonging to the low income group studied in their regional languages but were to understand English.

Instruments

The following standardized instruments were used for data collection:

- a) The Goodenough - Harris Human - Figure Drawing Test:
- b) The Coopersmith Self-Esteem Inventory, School Form:

For inferring middle and low socio-economic status from the occupations of the parents of the subjects, the manual of the Socio-Economic Status Scale (Urban) developed by Kuppuswamy (1962; 1984) was consulted.

RESULTS AND DISCUSSIONS

The basic descriptive statistics (viz., the means and standard deviations) of the two age groups and two income levels are presented in Table 1.

Table 1: Mean and S.D. values with respect to the human-figure drawing and self esteem scores of subjects belonging to two age groups and two socio- economic groups.

	Variables	Age Groups	Mean	Standard Diviation
Middle Socio-Economic Status	Human - Figure Drawing	10 and 11 years (N = 100)	38.55	11.75
		14 and 15 years (N = 100)	63.5	6.56
		Total (N = 200)	33.6	15.71
	Self Esteem	10 and 11 years (N = 100)	47.12	9.81
		14 and 15 years (N = 100)	75.47	12.19
		Total (N = 200)	61.29	17.99
Low Socio-Economic Status	Human - Figure Drawing	10 and 11 years (N = 100)	42.42	11.61
		14 and 15 years (N = 100)	61.91	6.98
		Total (N = 200)	34.33	13.67
	Self Esteem	10 and 11 years (N = 100)	52.16	9.97
		14 and 15 years (N = 100)	74.95	10.75
		Total (N = 200)	63.55	15.40

From observation of Table-1, it is clear that all the scores have on the average increased with the increase in age - level of the subjects as well as in two socioeconomic groups. The standard deviation values reported in Table-1 are moderate indicating that the human – figure drawing scores of the entire sample (N = 400) and the two age – groups are more or less homogeneous.

Consequently, Table-2 represents the product-moment correlation coefficients between pair of the pertinent

variables which were computed and tested for significance separately for the two age groups and the two income groups.

Table 2: Correlations among human-figure drawing and self esteem scores of children (10 - 11 years) and early adolescents (14 - 15years) belonging to middle and low socio- economic group.

Socio - Economic Status	Age Group	Correlation Coefficients
Middle Socio-Economic Status	10 - 11 years (N = 200)	0.63 **
	14 - 15 years (N = 200)	0.52 **
	10 - 11 and 14 - 15 years (N = 400)	0.83 **
Low Socio-Economic Status	10 - 11 years (N = 200)	0.109 **
	14 - 15 years (N = 200)	0.343 **
	10 - 11 and 14 - 15 years (N = 400)	0.620 **

** p < .01

Table-2 reveals the positive and close relation between human – figure drawings and self esteem of the ten and eleven years old girls and boys belonging to middle economic group status. Similar results was also seen incase of early adolescents. Positive and significant relationship was revealed for girls and boys of both the age groups belonging to middle and low socio – economic status. Therefore the first hypothesis is accepted. Similar results were corroborated by results of previous investigations^[8]. Table-3 represent the t-test between the relevant variables.

Table 3: Result of the t-test of human - figure drawing and self esteem scores of children (10 - 11years) and early adolescents (14 - 15years) belonging to middle and low socio-economic status families

Age Group	Variable	t calc	df	t crit .05	t crit .01	Inference
10-11 years (N=200)	Human - Figure Drawing	0.015	198	± 1.97	± 2.6	difference between middle and low income groups human – figure drawing scores of children non significant
	Self Esteem	0.00018	198	± 1.97	± 2.6	difference between middle and low income groups self esteem scores of children non significant
14 - 15 years (N=200)	Human - Figure Drawing	0.052	198	± 1.97	± 2.6	difference between middle and low income groups human – figure drawing scores of early adolescents non significant

Age Group	Variable	t calc	df	t crit .05	t crit .01	Inference
10 - 11 years and 14 - 15 years (N=400)	Self Esteem	0.37	198	± 1.97	± 2.6	difference between middle and low income groups self esteem scores of early adolescents non significant
	Human - Figure Drawing	0.141	398	± 1.97	± 2.59	difference between middle and low income groups human figure drawing scores of children and early adolescents non significant
	Self Esteem	0.0172	398	± 1.97	± 2.59	difference between middle and low income groups self esteem scores of children and early adolescents non significant

Results reveal that there was no significant difference between the human – figure drawing and self esteem scores of the 10 and 11 year olds and 14 and 15 year olds belonging to the middle and low socio - economic status. Therefore the second and third hypothesis is rejected. Majority of the previous studies has shown the impact of socio-economic status on the human figure drawing and self esteem on children and adolescents. Some researchers suggested that low socioeconomic status has an indirect effect on self esteem due to lack of parental involvement^[24]. Others found that as long as children with a low socio - economic status feel that they have competence either in home or school, they are able to maintain a high sense of global self-worth^[15]. It is the low level of competence that has significant effect on global self-worth. Researchers suggested that socio-economic status influence parenting style^[11]. Schooling also was also influenced by socio-economic status^{[16], [17]}. Therefore it has significant impact on human – figure drawing too. Table-4 reveals the z - test scores of the relevant variables.

Table 4: z-Test between the correlation coefficients of middle and low socio – economic status children and early adolescents human – figure drawing and self esteem scores

Age Group	z - calc	z crit .05	z crit .01	Inference
10 – 11 years (N = 200)	4.5	± 1.96	± 2.58	difference between the correlation coefficients (human figure drawing and self esteem) of middle and low income group children is significant
14 – 15 years (N = 200)	1.64	± 1.96	± 2.58	difference between the correlation coefficients (human figure drawing and self esteem) of middle and low income group early adolescents is not significant
10 – 11 years and 14 – 15 years (N = 400)	4.6	± 1.96	± 2.58	difference between the correlation coefficients (human figure drawing and self esteem) of middle and low income group children and early adolescents is significant



Table-4 reveals that there is significant difference between the correlation coefficients of human figure drawing and self esteem scores of middle and low income group children and early adolescent girls and boys. Therefore the fourth and fifth hypothesis is accepted and the sixth hypothesis is rejected.

CONCLUSIONS

The result from the following table shows that there is significant correlation between the human figure drawing and self esteem scores of children and early adolescents belonging to middle income group. This finding was congruent with scores of children and adolescent belonging to low income group too. Findings revealed that there was no significant difference between the human figure drawing and self esteem scores of children and early adolescents due to there difference in socio - economic status. The z – test however revealed that there was significant difference between the correlation coefficients of human figure drawing and self esteem scores of children belonging to middle and low income group. This was true for the entire sample also. Therefore it may be stated that though socio - economic status has significant impact on the nature of relationship shared between human figure drawing and self esteem, the relationship may be influenced by the parenting style and schooling of children and early adolescents. The present study revealed that socio – economic status did not influence the human figure drawing and the self esteem scores of both the age groups but the difference in there correlations was prominent.

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Stigma of Leprosy: A Social Challenge towards Sustainability

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ABSTRACT

Recorded for thousands of years Leprosy is a chronic infectious disease caused by the bacteria *Mycobacterium Leprae*. This bacteria thrives only in tropical environment. The incidence of leprosy is highest in the poverty stricken belt of the globe. It is from the environment that the disease is transmitted. Therefore, environmental factors such as unhygienic living conditions, overpopulation, and malnutrition may also be contributing factors favoring the infection. This communicable disease cause permanent deformity and physical disability despite evidence that suggest more than 95% of the world's population has natural immunity to development of the disease. In addition to the disease's physical effects, patients historically have suffered severe social stigma and ostracism from their families, communities and even health professionals to such an overwhelming extent that leprosy has been known as "the death before death". Many countries of the world have been successful in eradicating the disease but it is defying efforts to eradication across India. The main reasons range from lack of awareness, understanding and education to fear of ostracism. The present study aimed to find the level of self stigma of the leprosy patients along with their mental health. Further the study surveyed people from various walks of life to know their knowledge and attitude regarding the disorder. The results revealed that the leprosy patients feel stigmatized and suffer from depression, anxiety, insomnia and somatic symptoms. At present leprosy can be totally cured by multi drug therapy. The survey found common people know that the disease is curable although a handful of them are aware of present day treatment and rehabilitation. These people also maintains a social distance showing a tendency to avoid them. Thus creating an adverse social environment that affects social well being of the leprosy patients.

Key Words Leprosy, Stigma, Mental Health

INTRODUCTION

Recorded for thousands of years Leprosy is a chronic infectious highly communicable disease caused by the *Mycobacterium Leprae* that thrives in tropical environment. According to World Health Organization Leprosy is one of the seventeen neglected tropical diseases^[18]. The incidence of leprosy is highest in the poverty stricken belt of the globe. It is from the environment that the disease is transmitted. Therefore, environmental factors such as unhygienic living conditions, overpopulation, and malnutrition may also be contributing factors favoring the infection^[10]. At highest risk for developing leprosy are those living in endemic areas with poor environmental conditions such as inadequate bedding, contaminated water and insufficient diet or disease that compromise immune function^[20]. Leprosy remains one of the leading cause of deformity and physical disability from a communicable disease, affecting millions of individuals worldwide, despite evidence that suggest more than 95% of the world's population has natural immunity to development of the disease^[1].

Sustainability is the capacity to endure. Healthy ecosystems and environment are necessary to the survival and flourishing of humans and other organisms^[17]. It has been found over years that leprosy patients do not get a healthy environment to live. As Social and environmental problems are deeply intertwined^[16]. The environment

and the society has great impact on leprosy patients. Throughout history, their communities and families have often ostracized the afflicted [2]. Leprosy patients in India suffer under some worst conditions and stereotypes about this disease.

Twenty first century social psychologists consider stigmatizing and stereotyping to be a normal consequence of peoples' cognitive abilities and limitations, and of the social information and experiences to which they are exposed. On the other hand, those who perceive themselves to be members of a stigmatized group, whether it is obvious to those around them or not, often experience psychological distress & many view themselves contemptuously^[6]. Thus the social stigma can result from the perception (rightly or wrongly) of mental illness, physical disabilities and diseases such as leprosy^[7]. This social stigma of leprosy is a challenge to the maintenance of positive mental health. Mental health is defined by WHO as "a state of wellbeing in which the individual realizes his own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community"^[12].

A community is composed of people as well as the places where they live; it is as much a social environment as a physical environment. Thus, communities must not only be environmentally sustainable, they must also be socially sustainable^[15]. If people in the community suffer from poor mental health they are deprived of certain rights and are stigmatized, their existence in the community becomes a social challenge. In this context it can be mentioned that till date people affected with leprosy are deprived of many rights as amendments are not made in the existing acts even when present Multi Drug Therapy (MDT) can cure the disease completely.

AIMS AND OBJECTIVES

The present study aims to investigate the self-stigma or the internalized stigma of leprosy patients i.e. how do they perceive themselves as well as perceived by others. It also aims to find their mental health status.

However, the knowledge regarding leprosy remains incomplete without knowing how common people in the society think and feel about the disease leprosy and the leprosy patients. Keeping this in mind the knowledge and attitude of general population regarding leprosy formed another part of the present study. Thus another objective of the present study was to find out their basic knowledge about leprosy (like its causes, transmission, cure, prevention and so on) and social distance they maintain from these patients.

METHODOLOGY

Sample characteristics

Table 1: Some details of the leprosy patients studied

Sex	N	Age range (in years)	Mean age (in years)	Marital status	Monthly income of the family	Average duration of treatment
Male	42	20-55	43	Married	Rs. 2500-5000	2 years 5 months

The educational qualifications of male respondents were varied from- studied till class X to graduation. Similarly the occupations of male respondents were varied from being rickshaw puller to van and bus driver. Some were labors in construction sites and jute mills. Two reported to be salesmen selling mobile coupons and jewelry tools respectively. Two were security guards, four having business being small tea stall owner and one having a small sweet shop. One also reported to be a volunteer in an ashram.

The present investigation also surveyed people from various walks of life to know how aware are they about the disease and whether they have a tendency to keep a social distance from them or not, In other words, their knowledge and their social stigma regarding the disease and the people suffering from it. For this 503 people were selected at random from different age groups, gender (male and female) religion (Hindu, Muslim and Christian), educational qualification and professions.



Tools used

The tools used for this research were 4 questionnaires, 3 standardized and 1 self-prepared. The details of these are as follows:

a) For the respondents suffering from leprosy

1. Internalized Stigma of Mental Illness Scale (ISMI), adjusted for leprosy affected person by Ritsher, B.J.^[13]
2. General Mental Health Questionnaire (GHQ-28) by Goldberg, D.P and Hillier, V.F adapted into Bengali by Basu, S. and Dasgupta, S.K. (1996) Department of Applied Psychology Calcutta University, Calcutta^[5].

b) The respondents from general population were administered:

3. A self-prepared 12 items structured questionnaire regarding knowledge about leprosy and attitude towards leprosy patients.
4. Social distance scale by International Leprosy Eradication Program (ILEP). In this the names in the vignette were changed accordingly to avoid any bias and prejudice towards any religion or sex.^[14]

Collection of data

The study was conducted at the Outpatient Department of Leprology of the School of Tropical Medicine, Kolkata during the period of 4 weeks on every Tuesdays and Fridays. Data were collected from 42 leprosy patients undergoing treatment on one to one basis giving them ample time to reply.

To know the attitude of the general population regarding the disease and the patients, data were collected from 503 people who were willing to volunteer for the study and have heard about leprosy. They were asked few questions regarding the disease and were administered the social distance scale (ILEP).

RESULTS AND DISCUSSION

The present study aiming to find the self-stigma i.e. internalized stigma of the leprosy patients explored that majority of the leprosy patients feel highly stigmatized (mean value 72).

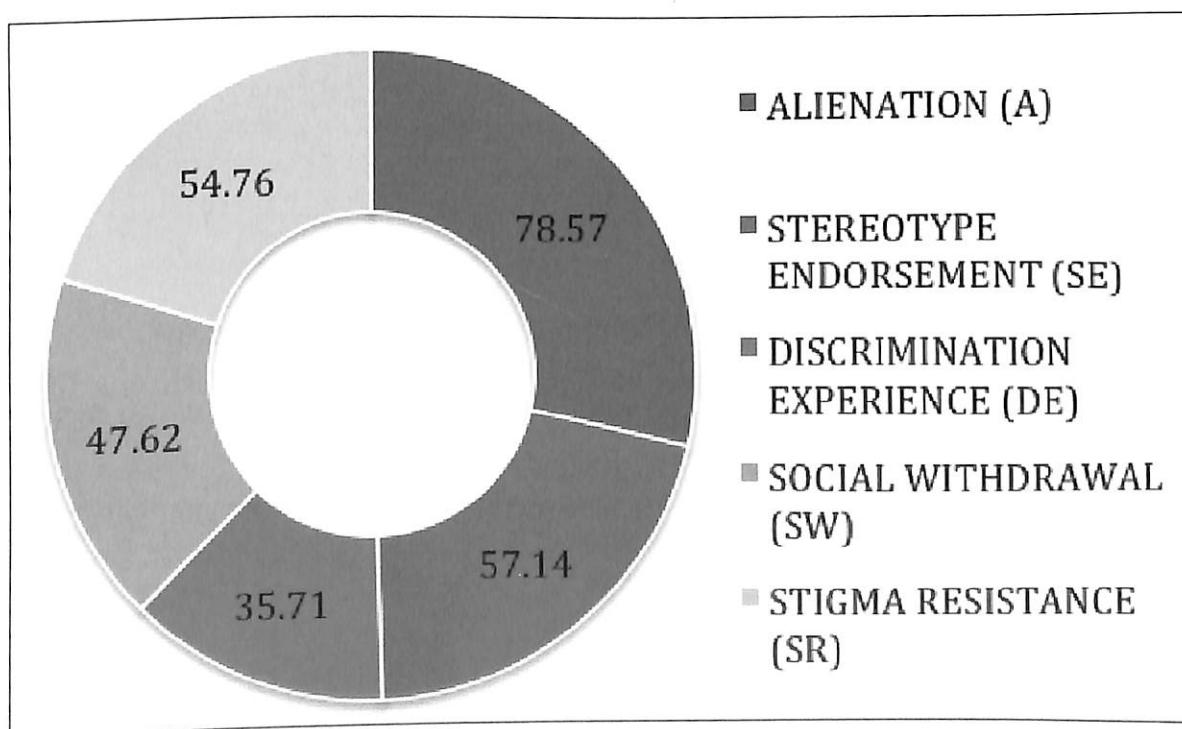


Figure 1: Showing the percentages of high responses in the subscales of ISMI scale among 42 male leprosy patients.

Taking into account the various dimensions of the ISMI scale it may be further said that 78.57% of the respondents experienced alienation i.e the subjective experience of being less than a full member of society, or having a ‘spoiled identity’ [4]. They felt out of place because of the disease and thought that the disease has in a way spoiled their life. They felt an overriding sense of disappointment and sadness about the disease and that they are suffering from it and hence tried to alienate themselves from the social environment for the fear of isolation and rejection.

The second dimension, stereotype endorsement (SE) measures the degree to which respondents agree with common stereotypes existing about people with leprosy. In the present study 57.14% respondents said that stereotypes about leprosy applied to them also. According to them, people with leprosy cannot live a rewarding life and their contribution to society is less as compared to normal healthy people.

Discrimination experience (DE), being the third dimension intends to capture respondent’s perception of the way that they currently tend to be treated by others. The majority of the leprosy patients of the study reported that people did not discriminate them.

Almost 48% of the respondents reported to stay away from social situations and avoid people, when asked questions on the dimension Social Withdrawal (SW).

The last subscale of ISMI is Stigma Resistance (SR), which intends to portray the experience of being affected by internalized stigma. The result obtained from the present study found that the stigma resistance is high among 55% of the leprosy patients studied. They reported that leprosy had made them weak and vulnerable and was not able to live the way they wanted to.

The results of the present study are to some extent similar to the findings of a longitudinal study of 344 leprosy patients attending a clinic in Gwalior, India. The study revealed that social stigma was present in a variety of forms, and was more prevalent among persons who were illiterate and from low socio-economic groups [9].

Overall high-internalized stigma is a challenge to mental health of the leprosy patients.

A study pointed out that stigma may be a major reason for psychiatric morbidity among leprosy patients [8]. Even if others do not stigmatize the leprosy patients, still they experience self-stigma. They are not only ashamed of their illness but also of the attitude of others towards the disease.

The leprosy patients studied in the present research all belonged to low income group and were not much educated also, studying the mental health, it was found that, most of them were suffering from insomnia and somatic symptoms (61.92%), anxiety (64.29%), depression (59.52%), and some of the patients reported social and cognitive dysfunction (47.62%) also.

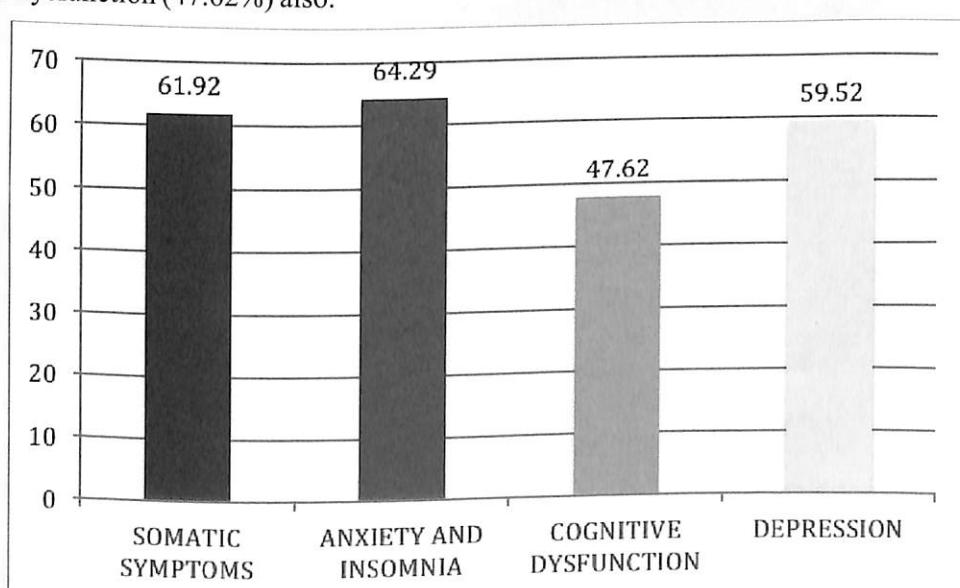


Figure 2: Percentages of high responses considered as cases in the four areas of Mental Health.

The results of the present study are in line with a study conducted in Dhaka district of Bangladesh, which concluded that mental health scores of the leprosy patients were worse than the general population. The author suggested that the possible cause of the deteriorated Quality of life (QOL) of these patients was the presence of stigma, fewer years of education, presence of deformities and lower annual income^[19]. Thus people with mental health conditions meet the major criteria for vulnerability. They are subjected to stigma and discrimination on a daily basis ^[3].

The present study surveying 503 people from various walks of life found that more than 50% of people will avoid people suffering from leprosy and 70% reported that they would not buy food from leprosy patients. In this context it may be further mentioned that majority of the literate people know the exact cause of leprosy (bacteria), although the illiterate people attributed it to ill luck. Regardless of their educational qualification, most people studied know that the disease spreads through physical contact. May be the infectious nature of the disease are keeping the common people away from leprosy affected people and restricting them from buying food from them. Thus indicating a major role of environmental factors specially the social environment in which the people interact and communicate with each other.

Administering the social distance scale on the same sample it was found that more or less common people in general keep a social distance from the leprosy patients revealing a tendency to avoid them. Thus making the total picture of leprosy grim.

CONCLUSION

Treatment and cure are not the last words for a disease like leprosy. As found from the results of the present study the pain and woe of being stigmatized remain even when the disease is being treated and the person is taken care of. Psychological suffering that affects the mental health stays back challenging the day-to-day living of these people.

Still today the common people hardly know that leprosy can be totally cured by Multi Drug Therapy (MDT) and with the progress of the treatment, the disease does not remain contagious. They rather prefer to cling to the stigma of the leprosy and keep a social distance from the people suffering from the disease.

RECOMMENDATIONS

The image of leprosy has to be changed at the local as well as national levels. A new environment, in which patients will not hesitate to come forward for diagnosis and treatment at any health facility, must be created. Sustained and committed efforts by the government, NGOs, family members and society members are needed to decline the burden of leprosy.

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ARCHITECTURE & INTERIOR DESIGN
(Research Papers)

Role of Environmentalism towards Sustainable Development - A Retrospective Study on Anti Tehri Dam Movement

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ABSTRACT

Environmentalism provides an ethic which will necessarily guide environmental movement (activism) for the benefit of man and his society. This ethic is completely compatible with the goal of sustainable development. Development is really a comprehensive term and from the holistic point of view, it means the fulfillment of the material, moral and aesthetic aspirations of man and his society. The modern Environmental movement most likely started during 1960s with concern about environmental issues. Observance of the Earth Day motivated the leadership of the nation towards the environmental movement. The 1970s may be considered as the decade of environmentalism in India when anti-big dam movement and forest related environmental movement became popular. This decade is generally seen as one of the growing period of environmental consciousness and protests against environmental plundering. Simultaneously, the environmental politics also came into existence with Anti-Tehri Dam Movement. The Tehri multipurpose river valley project in Garhwal district of Uttarakhand has been the subject of much controversy since it is located in a seismological active zone. Thus, the Anti Tehri Dam Movement as a great weapon played a vital role in safeguarding the environment on the Himalayas. Role of activism is investigated through a perception study where local people, environmental activist and leaders of the movement were participated.

Key Words: Environmentalism, Sustainability, Environmental plundering, Environmental politics, Seismological active zone

INTRODUCTION

Environmental movements are generally considered as the struggle of the people on the issues relating to maintenance of clean and congenial environment for the man and biosphere. All such movements which create public awareness about the vulnerability of environment are collectively termed environmentalism.

The modern environmental concerns have been slowly mounting ever since the second half of the twentieth century. Thomas edited a book entitled ‘Man’s role in changing the face of the Earth’ which is the outcome of the International symposium held at Chicago that spotlights the various aspects of environmental deterioration^[7]. Rachel Carson in her “history making best seller” *Silent Spring* sounded the warning bell of such concern in 1962^[4]. The observation of *Earth Day* in 1970 on 22nd April in USA is also a milestone in the saga of global environmentalism.

Deployment of the developmental strategies and the pursuing of avenues of social uplift, however, very often disturb the life supporting systems adversely. Ecological problems caused by mankind usually lead to political and social instability resulting global environmental crisis. In many instances the common people become the victims of those crises. Most of the environmental movements started initially with the agitation for some local issues which finally turned into an environmental crusade thus giving the movements a national as well as international dimension.

Development is really a comprehensive term and from the holistic point of view, it means the fulfillment of the material, moral and aesthetic aspirations of man and his society. One very important aspect of development is the construction of huge dams, big barrages and other irrigation networks. High dams alter the landscape greatly and many unforeseen problems may crop up as a result of habitat modification.

Since development is a must for the developing countries, so as to improve the quality of life of the people it is imperative that it should not disrupt the ecological harmony. In many cases projects are implemented without verifying the ecological consequences.

The concept of sustainable development, as visualized by the World Commission on Environment and Development (WCED), thus aims to provide efficient and rational management of natural resources without endangering the threshold limit of resilience of the ecosystem for a longer period of time.

A retrospective study on the status of Anti Tehri Dam movement is carried out. Perception of the local people as well as that of environmental activists and leaders of the movement has been recorded through field survey in different districts of Garhwal Himalayan Region. Secondary data also have been collected from different official sources.

The majority of the people of old Tehri were rehabilitated to New Tehri District for the construction of Dam. A total of 80 common people were interrogated who were rehabilitated at New Tehri Town, Baurari and Bhagirathipuram.

The respondents included people belonging to varied professions viz. the dam personnel, persons of engineering profession, school teachers, political leaders, staff of Panchayat office, general volunteers of the association of Anti Tehri Dam Movement, as well as activists and the leaders of the movement, common shop-owners, staff of the transport department, even simple taxi-driver with a view to ascertain a representative perception in general against the Dam Project.

AIMS AND OBJECTIVES

The Anti-Tehri Dam movement that took place in Garhwal Himalayan region during last four decades has assumed great significance so far the environmental consciousness is concerned. The great Chipko Movement lit the lamp of environmentalism in the Garhwal Himalayan region. Later on, people belonging to the grass-root level launched a united revolt being inspired by the agitation against the construction of Tehri Dam. These two movements played important role in the question of environmental stability of the Himalayas. Though the movement against Tehri Dam Project could not prevent construction of Dam; however, the movement could build up a spontaneous human resistance against the construction of dam. These two movements of Garhwal Himalayas significantly influenced the environmental movement all over the world to a great extent.

The present study aims to throw light on the efficacy of the movement upon the society of that region. It also aims to feel the pulse of the present generation about the movement.

RESULT AND DISCUSSION

Role of Environmentalism

The vulnerability of environment caused by human being has initiated the global ecological movement as a value-driven social movement. Basically *environmentalism* provides an ethic which will necessarily guide environmental movements for the benefit of man and his society^[5]. This ethic is completely compatible with the goal of sustainability.

The modern Environmental movement most likely started during 1960s with concern about environmental issues like air pollution, water pollution, solid waste disposal, dwindling energy resources, radiation, pesticide poisoning, noise pollution, and other environmental hazards. Of course, the Silent Spring by *Rachel Carson* provided significant momentum to the movement.

April 22, 1970, also left a permanent impact on the environmental consciousness of America. It forcibly thrusts

the issue of environmental quality and resource conservation into the political dialogue of the nation. The consequences of the event emerged the first environmental legislation - the Clean Air and Clean Water Acts in US. Thus, observance of the Earth Day motivated the leadership of the nation towards environmental movement.

The Bishnoi Movement of India was perhaps the first ecological movement in the context of not only India, but also world at large. Besides Bishnoi movement the noteworthy movements are: Chipko Movement, Silent Valley Movement, Anti Tehri Dam Movement, Narmada Bachao Andolan and Appiko movement. The incident of Bhopal Gas Tragedy is also important as it prompted to pass new laws in safety regulations and framing policies to all industrial sectors throughout the country.

The 1970s may be considered as the decade of environmentalism in India when anti-big dam movement and forest related environmental movement became popular. This decade is generally seen as one of the growing period of environmental consciousness and protests against environmental plundering. Simultaneously, the environmental politics also came into existence with Anti-Tehri Dam Movement. The Tehri multipurpose river valley project in Garhwal district of Uttarakhand has been the subject of much controversy since it is located in a seismologically active zone. Non-violence resistance in different forms against construction of dam was waged where Bahuguna participated to undertake fast unto death. Virendra Dutt Saklani was the pioneer to confer legal dimension on the movement waged by the 'Tehri Bandh Virodh Sangharsh Samiti' (TBVSS).

Among the activists, the direct victims, who opposed the Dam Project whole-heartedly, gave stress on their safe rehabilitation. But, the activists belonging to environmentalist group led the movement with the objects of saving Himalayan ecology, sustainable environment and the longevity of the dam. They cited examples of natural disasters like massive landslide and dam burst which took place in 1978 at Kanodiagad in upper catchment of Bhagirathi⁽¹⁾.

However, Dam was constructed as per instruction of the highest court of the country but with shedding tears of thousands of Garhwali.

Big dam controversy

The activists of Anti-Tehri Dam Movement had opined against construction of dam on Garhwal-Himalayan region. According to them the region is seismologically sensitive and the construction of dam will eventually destabilize geological characteristics of the locality inviting occasional earthquake. 80 percent of the respondents have opined their position against big dam in the Himalayan region.

Bandyopadhyay mentioned that the high seismicity of the Himalayan region is rooted in its orogenic evolution, as a result of which the Himalaya is still rising^[1]. He also referred the report of the World Commission on Dams^[8], and argued that the WCD has successfully drawn global attention to the broader aspects which are not limited merely to the structural design and physical construction of dam^[3]. According to him there are many other important aspects associated with dams. He also identified some environmental constraints on natural resource use^[1]. In order to identify the potentials and constraints of natural resource use for sustainable development in the Himalaya, a closer understanding regarding the Himalayan characteristics has to be conceived. He also asserted that the further transformation of mountain is to be immediately stopped; otherwise mountainous sustainability cannot be assured.

Inaccessibility of Mountain

Bandyopadhyay argued that human civilization has a trend to explore inaccessible parts on the earth where economic activities can be extended^[2]. Thus such exploration, gradually tells upon the natural inaccessible characteristic of the mountains which ultimately threatens sustainability. Hence, mountain development should be done depending on its structural characteristic. According to researchers, mountain characteristic should be given priority in order to establish sustainable development in the mountains. In the present study, the respondents also expressed their views towards stabilization of Himalayan ecology which is now facing a challenge. According to them any short sighted and unplanned scheme for development may eventually harm Himalayan stability.

Alternative sources of power

Kumar has examined the potential of micro-hydropower in Uttarakhand^[6]. Power generation by constructing big dam on mountains may cause frequent earthquake. But Uttarakhand has enormous potential for small, mini and micro hydro power generation. Therefore, the wide accepted policy is construction of small scale dams and power generation projects which will reduce the chances of earthquake. It will also provide electricity at a cheaper price in an eco-friendly manner. But it is revealed from the present study that the local people including the activists and leaders of the movements opined against the construction of any dam in the region. They opined to search alternative sources of power like solar power.

Environmentalism and Politics

It comes out from the field survey that the majority of the respondents confirm the Anti Tehri Dam Movement as a great weapon in safeguarding the environment on the Himalayas.

But some of the respondents considered that the Anti Tehri Dam Movement in no way can be identified as environmental movement; rather it can be well recognized as a political movement as the matter of rehabilitation crept in its usual course of action. The involvement of political parties, gave the movement an anti-government dimension. It is observed in field survey that the most ordinary people, who did not suffer the hardship for Tehri Dam Project, did not participate in the Anti Tehri Dam Movement. Environmental aspects due to dam construction also were not much popular.

The other resentment was observed in the policy of governmental fund allotment in the matters of rehabilitation. Initially those who came forward spontaneously with their own pieces of land for dam construction keeping in view of speedy development of the locality, were the worst sufferer ultimately. They did not get adequate help from the government for the rehabilitation; only a token money was offered to them for transfer of land. On the contrary, those, who were conservative from the very beginning and hesitating in transferring land, were fortunate to get coveted compensation. Hence, the question of fairness and justice as perceived by the residents in fund allotment cannot be ignored.

The common people referred to governmental policy of creating confusion and depredation among them to nullify the movement. A section of people were cleverly used to weaken the force of agitation. Few people had been kept abashed by sanctioning fabulous compensation. As it would have been, the movement lost its vitality; common people had no faith upon a section of leaders. They strongly believed that such leaders enjoyed lion's share of the fruit of rehabilitation scheme.

Ecological Refugee

Some of the respondents treated themselves as ecological refugee and they face some serious problems, in terms of water availability, extreme climate, lack of employment opportunity and inadequate medical facilities.

The discussion with the respondents of New Tehri where they have been rehabilitated expresses their discomfort at the new place for the reasons manifold. According to them, the extreme climate of new Tehri is chiefly responsible for their discomfort. They think the climate of old Tehri was much better than New Tehri. The residents of old Tehri where people were habituated with a temperate climate have now been forced to shift to New Tehri where extreme cold climatic condition persists. To them, the Old Tehri with treasures of congenial topography, plenty of water and soothing atmosphere are still indispensable; while shifting to new habitation can hardly be a substitute for having heart to heart relation with the old place. The affluent river of Old Tehri where life was exuberant now seems to be a pool of stagnant water to them in New Tehri. Here, the river fails to cause any pleasure to the people. Consequently, the air has become moisture laden and the sky remains foggy in the most of the period of the year. The captivated charm of the Himalayan peaks glittering in the sun beam is no more visible due to foggy weather prevailing most of the time.

According to the feelings of the people, Old Tehri was advantageous to them for many reasons. Respondents consider that geographical distance among the villages has been a great barrier for direct communication. The

river served them as mother to the baby. Her fresh water was used for bathing, domestic work and even quenching their thirst. Close proximity to river provided them convenience in carrying water. The civilization of Old Tehri was more than hundred years old where amenities like shops, markets, schools, colleges and hospitals were easily accessible. The town was nicely equipped with a number of play grounds, 'Ghanta Ghar, temples, Gurdwara, cenotaph, palace, primary health centre, district offices and other establishments like studio, T.V. shops etc. — all lying in a stone's throw distance. Almost all the residents in Old Tehri had their own pieces of cultivable land which were used in cultivation. The relatives they had, lived nearby with kith and kin relationship. The town was also well connected with the surrounding villages.

People did not conceal their frustration on health service also. According to them the infra-structure of the hospital in New Tehri is not modernized. Patient with critical syndrome is shifted to Dehradun for proper treatment. Hardly any patient can bear such tiresome long journey. Besides this, the location of the hospital, on the top of the hill is another disadvantage to the villagers of the foothills. Transportation problems also aggravate the situation.

CONCLUSION

Environmental activism has had a real impact on raising public awareness towards sustainable development. With the growing concerns in the history of environmental movement dozens of environmental laws in the United States have been signed during 1970s which contribute a fair share to cleaner environment. The Chipko Movement resulted in the cessation of unscrupulous felling of trees and abolition of private contractual system. It also urged implementation of frequent afforestation programme which enabled prevention of unplanned developmental schemes as well as transforming into planned ones. The big gain yielded from the Anti Tehri Dam Movement was that the Government has made the practice of Environmental Impact Assessment (EIA) mandatory before undertaking any project.

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Man and Environment Interface: A Wake Up Call!

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ABSTRACT

Today all over the world there is growing concern about the deteriorating quality of environment and efforts are being made to stop the widespread abuse of environment and improve its quality. The relationship between the man and the environment has been established in the early periods itself. The environment in which we live and work affects our thoughts, feelings, and behaviours. Human beings live in the kingdom of nature and interact with it constantly. Any change in the environment can not only result in devastating effects, but can also pose a threat to the mankind. The relationship of man and environment is, however, bi-directional. That is, human beings are affected by the environment and they also affect the environment.

Keywords: Man, Environment, Health, Nutrition.

INTRODUCTION

Everything that affects us during our life-time is collectively known as environment. As human beings we are often concerned with surrounding conditions that affect people and other organisms. Just as conditions within our homes have important implications on our health; conditions in the neighborhoods surrounding our homes also can have major health effects. Social and economic features of neighbourhoods have been linked with mortality, general health status, disability, birth outcomes, chronic conditions, health behaviours and other risk factors for chronic disease, as well as with mental health, injuries, violence and other important health indicators. Today, all over the world there is growing concern about the deteriorating quality of environment and efforts are being made to stop the widespread abuse of environment and improve its quality. Natural environment is fundamentally important to both our physical and psychological wellbeing, so actions that promote and protect our natural environment help to increase our ability to flourish in life. In turn, people and communities that are flourishing, i.e. have high levels of wellbeing, tend to be environmentally responsible in their behaviour and can, therefore, contribute to environmental sustainability.

Major Types of Environment

1. **Physical Environment:** It includes both physical and social-cultural phenomenon that surround us. The noise, the temperature, the quality of air and water, and various objects and things constitute the physical world around us.
2. **The Social and Cultural Environment:** It includes the aspects of social interaction including its products such as beliefs, attitudes, stereotypes, etc. The material and non-material aspects of environment are included in it. It also includes all the aspects dealing with other people and their creations.
3. **Psychological Environment:** It includes the perceptions and experiences pertaining to any environmental setting. Some environments may be stimulating and exciting while others may be dull, boring and depressing.

Effect of Environment on Human Beings

Environment has both nourishing as well as destructive effects on human beings. Throughout human history, people have been threatened by floods, earthquakes, and other natural disasters. In spite of enormous scientific development, we have not been able to control the effect of natural calamities and we have not been able to control natural disasters either. In recent times, technological innovations and advances have brought us new

potential threats from the environment, which are man made. These threats are physically harmful and stressful. People have to cope with these stressors. Such man made environmental stressors are many. These stressors are called pollutants and basically there are four: air pollution, water pollution, noise pollution and Crowding. We find many natural disasters that affect human behaviour in many ways. These natural disasters include earthquake, volcanic eruptions, windstorm, tornado, cyclone, famine, flood etc.

Natural disasters such as earth quakes at Latur and Bhuj (2001) and Super cyclone in Orissa (1999) not only caused extensive damage to property and physical environment (uprooting of trees etc) but also had long-term effect on the lives of the people. There are various man-made disasters also. Man made technological disasters such as, Chernobyl (1986) and Bhopal Methyl Iso Cyanide (MIC) Disaster (1984) etc. had intense and long-term adverse effects on the lives of the people. In the Bhopal disaster more than 8,000 people died and over 2,00,000 were physically affected. Thousands of gas victims are still suffering from mental and physical health problems. Research studies indicate that the survivors of such disasters suffer from anxiety, withdrawal symptoms, depression, stress, anger and nightmare.

Physical and social environments in neighbourhoods can be overtly hazardous too.

For example, polluted or crime-infested area. They also can severely limit the choices and resources available to individuals. Areas that are inhabited by poorer and minority youths become soft targets for tobacco and alcohol companies that bombard the vulnerable people with advertisements that are attractive and tempting, have liquor shops in abundance, resulting in excessive drinking and smoking. The motivation to exercise does not exist in such a physical environment.

Studies have shown that a neighborhood's socioeconomic conditions can affect the health of the residents, whether its residents smoke [4] or have healthy diets [2]. Healthy neighbourhood environments, such as the presence of footpaths and playgrounds, physical activity programmes for children and youth in schools and colleges, and availability of affordable nutritious food can promote health by encouraging healthy behaviours and make it easy to adopt and maintain them. Similarly, people are more likely to receive recommended medical care when facilities are accessible from where they live, either because they are located nearby or because safe and convenient transportation is available.

Neighborhoods can influence health in many ways. Physical characteristics of neighbourhoods are the most obvious. Health can be adversely affected by poor air and water quality or proximity to facilities that produce or store hazardous substances; by substandard housing conditions; by lack of access to nutritious foods and safe places to exercise combined with concentrated exposure and easy access to fast food outlets and liquor stores; and by adverse traffic conditions.

Research has examined the effect of physical characteristics of the buildings, streets and other constructed features of neighbourhoods also referred to as the "built environment", on smoking, exercise and obesity [1]. For example, proximity to supermarkets (which typically sell fresh produce) has been linked with less obesity, while proximity to small convenience stores (which generally do not sell fresh produce) has been linked with more obesity [3].

People are more likely to be physically active when they live in neighbourhoods with better resources for exercise, such as parks and walking or jogging tracks and clean surroundings. Many characteristics of the physical environment, such as supermarkets and parks, can also be thought of as characteristics of the service environment.

Health can also be shaped by the social environments of neighbourhoods that is, by characteristics of the social relationships among their residents, including the degree of mutual trust and feelings of intimacy among neighbours.

Residents of "close-knit" neighbourhoods may be more likely to work together to achieve common goals (e.g., cleaner and safer public spaces, healthy behaviours and good schools), to exchange information (e.g., regarding childcare, jobs and other resources that affect health), and to maintain informal social controls (e.g., discouraging crime or other undesirable behaviors such as gambling, smoking or alcohol use among youths, drunkenness,) all of which can directly or indirectly influence health. Children in more closely-knit neighbourhoods are more likely to receive guidance from multiple adults and less likely to engage in health-damaging behaviors like smoking, drinking, gambling, and drug abuse or gang involvement.

Effect of Human Activities on the Environment

Human activities also affect the environment. In fact, almost every human being adds, through his activities, some effect that contributes cumulatively and negatively to the environment he live in. Whenever, some one drives a scooter, motor cycle or car, uses hair spray, cooks food, etc. the environment is affected. We do not perceive the role our simple activities play in degrading our environment. Billions of people live on this planet and affect the environment in some way or other. The cumulative effect is tremendous. The effect of human activity (e.g. polluting air) is long-term and irreversible and will affect the lives of generations.

Environment is a naturally given capital having certain limits and we have to learn to use the resources judiciously. Air, water, food, fuel, etc. are all gifts of this environment to the human kind and we have to learn to judiciously use and conserve them. We have to pay greater attention to conserve water and air. Disposal of waste material we produce, ranging from sewage to garbage needs special attentions.

Water: We are using natural resources that we are not replenishing, and water is one such resource. On our planet, there are now at least 80 countries having serious water shortage with serious threat to agriculture. India is one among these countries where water shortage is adversely affecting agriculture. The water shortage in Karnataka and Tamil Nadu is an example. The water shortage is assuming serious threat to the big cities also. For example, during the summer months there is serious shortage of water in Delhi region and due to population influx from the neighbouring cities the problem is getting worse day-by-day. The solution lies in harvesting rain water and efforts are being made to use rain water to augment water supply. A peculiar problem that contributes towards Water related issue is that of abundance of water in one state and scarcity of the same in another state. Man made political issues prohibit the distribution of water from states of abundance to the states of scarcity. This scarcity, indirectly results in lack of hygienic conditions and the spread of infectious diseases. The ultimate result is drop in efficiency and productive work by people living in these areas of scarcity.

Air: The quality of air has been adversely affected by automobile and industrial emission. Large quantities of emissions from such sources have increased the presence of harmful and toxic gases like carbon monoxide, nitrogen dioxide, sulphur dioxide etc. in the air that we breathe. Serious efforts are required in stemming the rot and saving the public health. In this direction Delhi administration has taken the first serious step in introducing CNG (Compressed Natural Gas) as a fuel for public transport system and it has made a significant improvement in the quality of air in Delhi. Such innovative intervention is required to restore the quality of air.

Waste Material: Perhaps the most obvious by - product of human activity is waste material we produce. This waste product of our activity range from sewage to garbage. It is a very serious problem for municipalities, corporations, and local governments to manage them. So far, much of our sewage disposal is flushed untreated into the rivers. This has created serious problem of water pollution. This makes our river water unfit for human consumption. There is now awareness of this serious problem and efforts are being made in pre treating the sewage disposal before throwing it in the rivers and sea. Industrial wastes, which contain toxic chemical substances, are also flushed out in the rivers or the sea. The same is consumed by people and animals, thus affecting human beings as well as the animal life too. Another serious problem arises from the tremendous amount of garbage we produce. The disposal of the garbage, especially of non bio degradable material (e.g., plastic bags) is a serious problem. We must take care not to use such material, like plastic bags for daily use. Recycling the waste should be undertaken to save the land from the polluting effects of such garbage.

Bio Medical Waste: This is produced through health care agencies is creating serious human health problems. The bio medical waste includes infectious material, pathological wastes, sharp needles and other injurious materials, pharmaceutical wastes, cytotoxic drugs and chemicals, radioactive wastes, wastes containing heavy metals etc. This is an important cause for spreading various diseases among society.

CONCLUSION

Health starts from our homes, schools, workplaces, neighbourhoods, and communities. Taking care of ourselves by eating well, staying active and judicious use of the resources that enhance the quality of life can have a significant positive influence on health of population. The only way we can save our future generation from extinction is to check our behaviour today and enrich our environment what we have bestowed with.

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Sustainable Indoor Landscapes for Enhancement of Indoor Air Quality Application of Contemporary Landscape Design Considerations in Interior Environments

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ABSTRACT

It all started out with Kamal Meattle quote “we can grow all the fresh air we need, indoors”. Surprisingly, not only is it possible to grow all the fresh air indoors, but the IAQ is cleaner and free of pollutants. Introduction of landscaping indoors increases productivity and work concentration. It is also known to reduce anxiety, stress and sadness, enriching and improving the overall quality of life. The importance of indoor landscaping prompted this dissertation. Plants have been filtering air and humidifying and cooling adiabatically long before we started synthesising these processes and building complicated overstretched infrastructure. The engineering benefits of plants also include acoustics, water polishing, air scrubbing, humidification and evaporative cooling. Indoor landscapes benefit human psychology and augment the indoor environment. Indoor Landscapes reduce ambient air temperature, mitigating UHI and reducing the need to artificially cool indoor spaces, bringing us, one step closer to living more sustainably and reducing our carbon foot print. Unfortunately, not much has been done, to implement landscaping indoors apart from the occasional potted plants and the trend setting indoor vertical greenery. Thus, this dissertation explores the design and application of indoor landscaping, to suggest an optimal solution for indoor spatial design. The proposal has aimed at a comprehensive study of botanical, psychological, technical and design considerations & limitations. Indoor greenery needs to be well planned and designed, in order for it to be easy to execute and maintain along with it being economical to ensure wide spread adoption. A major deliberation for this project was to design purely for the indoor landscaping context. Outdoor landscaping has evolved fabulously over the years and is pushing boundaries, but indoor landscaping is limited to the conventional ways, where design is uninspiring. Thus, the major focus for this dissertation was to bring in life and thoughtful design into indoor landscaping. Furthermore, the project is based in Singapore, which is a growing hub for sustainable design and architecture, and the project type would be a commercial design space, where the introduction of indoor landscaping would appreciate the project value.

INTRODUCTION

Indoor landscaping is the introduction of greenscapes and waterscapes inside interior environments. Similar to outdoor landscapes, interior landscapes provide spaces with ornament, color, sculptural elements, focal points, and an overall pleasant environment.

Spending time indoors makes us lose touch with our outside world. Indoor landscaping is that link between the architecture, landscapes and gardens, which brings back nature into our surroundings. Indoor landscapes are the oasis of calm especially with the growth of hectic, indoor oriented lifestyles.

However, indoor landscaping in the sphere of interior design is still at a nascent stage, where there is a lot of scope for further design exploration. People should be able to enjoy nature indoors, where it becomes tangible for people within buildings to be able to form a connection between man, enclosed spaces and open nature. Plants and foliage change with seasons and age with architecture, which enhances its character and charm.

Given the nature of indoor landscapes, there are a lot of technical considerations that need to be adhered to. Indoor landscapes, comes with its own set of limitations and technical challenges. However, if well planned and designed, it can lead to easy execution and maintenance thereafter. The need for holistic indoor landscape design is essential for its growth and widespread adoption.

Dissertation Statement

“This Dissertation explores the design and application of landscapes in indoor environments. The research involves a comprehensive study of user psychology, plant typology, design trends and considerations, technical aspects and constraints, to obtain optimal contemporary indoor spatial design solutions”.

Sick Building Syndrome is used to describe situations where the occupants and residents of a building experience acute health problems and discomfort that appear to be linked to the time spent in a building, where no specific illness or cause which can be identified. These symptoms are effects of inadequate ventilation, chemical contamination and biological contaminants of indoor air.

With the detection of the Sick Building Syndrome, in the 1970s, there was a rise in interest in indoor air quality. Since then, there has been an increasing incidence of research conducted in this field. A number of organizations like the World Health Organization (WHO), Environmental Protection Agency (EPA) and National Aeronautics and Space Administration (NASA) have done extensive research on this subject.

According to the NASA plant study, conducted by Dr. Wolverton, it was determined that low-light requiring houseplants, along with activated carbon plant filters, have demonstrated the potential for improving indoor air quality by removing trace organic pollutants from the air in energy-efficient buildings. This plant system is one of the most promising means of alleviating the sick building syndrome associated with many new, energy efficient buildings [1].

More recently, Mr. Kamal Meattle an Indian environment activist and the inspiration for this dissertation founded of the greenest building in India. After becoming allergic to New Delhi's polluted air, he discovered that three common houseplants, that could help reduce the pollutants in indoor air, which are Areca palm, Mother-in-Law's Tongue and Money plant (See Figure 1).

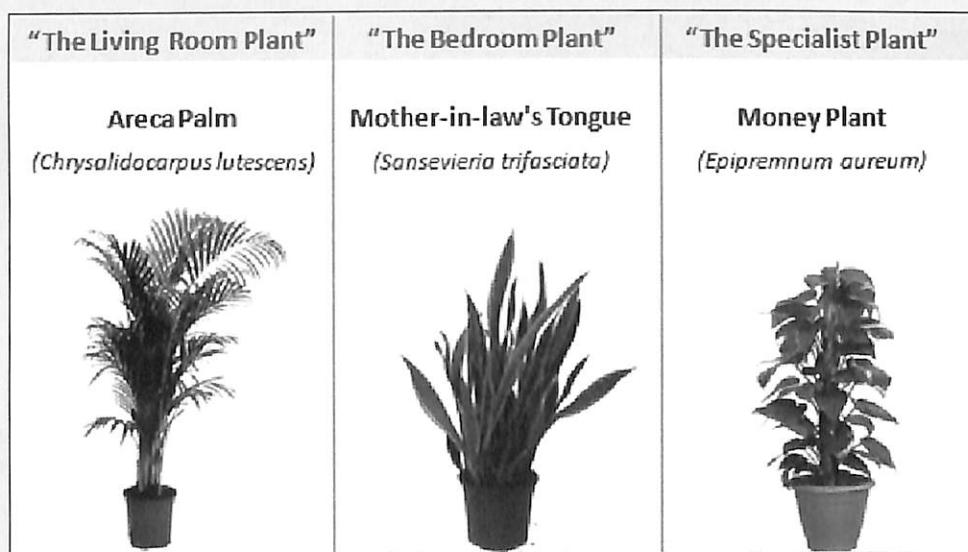


Figure 1: Environments According to Kamal Meattle

AIMS AND OBJECTIVES

With the evolution of man, and the onset of civilization, we have continually altered our surroundings. From living in forests, to cave dwellings, to huts and sheds, and now to building and skyscrapers, we have come a long way. Over the years, we have become more and more detached from our natural environ, by moving away from nature, and building vertically and higher.

People have increasingly hectic lifestyles, where they are cooped up in built-environments for the maximum part of the day, leaving very little time for being amidst nature. Indoor landscaping through extensive research has proven to be quite beneficial for human psychological comfort. Indoor landscaping, plays a major role in making the environment more comfortable, enabling the user to feel content and at ease. *Landscaping is man's way of bringing back nature into his surroundings.*

Sick Building Syndrome and indoor air quality are subjects, which are extremely important for indoor human health. Air-conditioning systems require buildings to be sealed off and circulate the same air with-in. According to the *Environmental Protection Agency* indoor air quality can be two to five times more polluted than outdoor air. With increasingly hectic lifestyles, we tend to spend more and more time indoors, breathing the same polluted air.

With our high stress environments, and pressured lifestyles, a simple plant in the room can ease our nerves. Thus this project has great significance, as indoor landscaping should become a part of human everyday life, to reap the benefits of nature and not only add aesthetical value to our built environments but also enriching our lives and human health.

The project has immense implication in bringing about a change in interior design, where indoor landscapes can be used as an integral part of building design, opposed to being used as an aesthetical tool or an afterthought, to enhance IAQ and mitigate UHI. Design can be used to tackle the greater problem of human health and wellbeing, by nurturing nature in the built environment.

METHODOLOGY

The methodology for this project covers a vast scope of research and design to help come up with optimal indoor landscapes. Structured research and iterated planned design has helped form consistent, thoughtful design.

Research Methodology

This dissertation has looked at both qualitative and quantitative methods of research methodology, and incorporated literature review, observational research and interview research to give a comprehensive synthesis of all the collective research. This compilation of research synthesis has assisted and aided the design of this dissertation.

This dissertation has looked at books and articles on design trends, case studies on existing contemporary landscape designs, plant typology, indoor technical needs and user psychology. Singaporean organizations like CUGE and NParks have extensive research on botany and plant studies, which are regularly published, and have been thoroughly studied to help a meticulous understanding of the subject [2].

The Government of Singapore is making a remarkable effort to adopt skyscraper greenery and is bringing hosting conferences like the "International Skyscraper Greenery Conference." More and more buildings are adopting greenery and the incidence of indoor landscapes is increasing in the form of vertical greenery.

Many buildings like the Zero Energy Building, the Toa Payoh Town Park, Khoo Teck Puat Hospital, the National Library, SOTA, Singapore Management Institute, Changi Airport Terminal 3 and the Republic Polytechnic Campus have adopted innovative landscape designs. These buildings along with some new projects under construction like the Fusionopolis and Gardens by the Bay have been observed as case studies.

As a part of the dissertation research, Mr. Kai Uwe Bermann from Bjarke Ingels Group, and Mr. Henry Steed of ICN Design International have been interviewed on their thoughts on indoor landscaping. Their input was very relevant and insightful to help formulate some of the dissertation analysis.

For further opinion, Mr. Kamal Meattle, of Paharpur Business Centre, which is deemed to be India's greenest building, situated in New Delhi, was also questioned via emails.

Design Methodology

This dissertation approaches a comprehensive design methodology to discover holistic design. The *research*

synthesis has helped determine the *design strategy* for the project, which is the basis of the design core. *Innovative design thinking* has been applied to help come up with the design strategy followed up by the *design brief* and the *user profile*, making the design requirements clearer (See Figure-2).

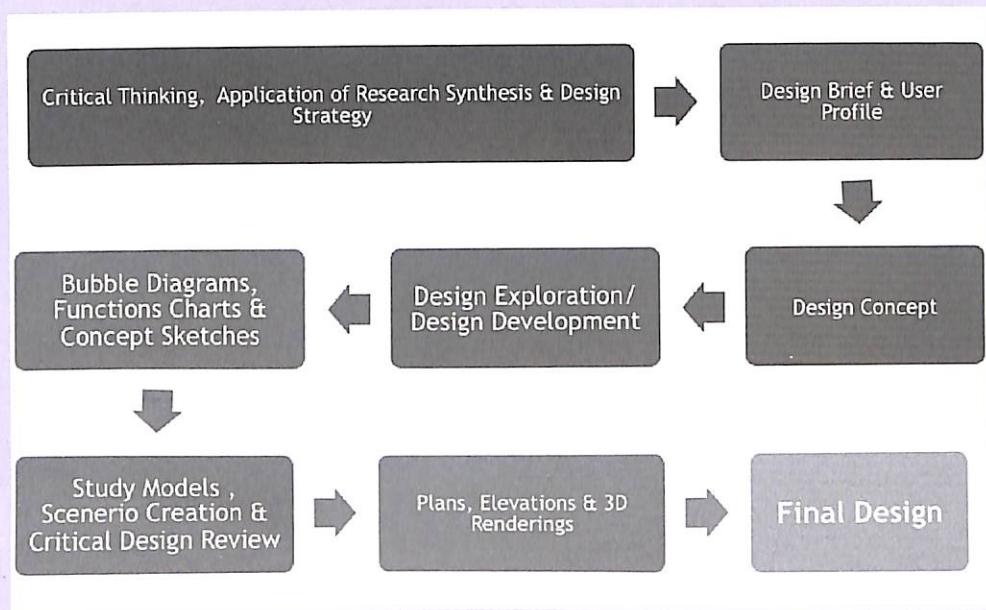


Figure 2 : Diagrammatic Representation of the Author's Design Methodology

The *design concept* followed the finalizing of the design strategy, design brief and user profile. *Case studies* from the research have been revisited to help discover the project design concept. The exploration of the design, or the design development, was a very interesting phase.

There were a lot of different elements which were addressed while working on the design. *Bubble Diagrams, functional charts and concept sketches* assisted in the task of design development. Due to the nature of the project, *study models*, helped formulate the ideas and helped generate a clearer 3D understanding. *Scenarios* were also created to help assist the functional requirements of the space.

A very interesting approach for the design development of the project was the application of *critical design review*, which involved expert opinion of professionals from the industry of landscaping and focus groups of design experts, during the design exploration stage. A combination of these various tools helped create the floor plans, elevations and 3d views, resulting in the final design of the project.

RESULT AND DISCUSSION

Through a methodical and through study of all aspect of indoor landscapes, this dissertation explores landscape design in the field of commercial indoor spatial design, as indoor landscapes have great potential in this field, where not only does it add aesthetical value and benefit the health of the users, but also enriches the value of the property fetching higher commercial price.

Through a thorough research and analysis of the *history of indoor landscaping*, its growth and future scope and design direction, *environmental psychology* of indoor landscaping along with its benefits and user experience, *botanical study* specific to indoor greenery including plant typology, ecological studies and ethnobotany, *indoor technical studies* of lighting, soil body, irrigation and drainage, temperature control, indoor air quality, thermal cooling and sound barrier studies, the results have been a comprehensive study of the synthesis of these researches (See Figure-3).

Precedent studies of projects from all over the world and Singapore were also studied to gather a world perspective on indoor landscaping. The design direction is the result of the rigorous study of *user experience*,

ergonomics of design and spatial design settings. The final outcome of the project is in the form of plans, elevations and 3D views of the project, following a thorough site survey and analysis of a commercial complex, based in Singapore.

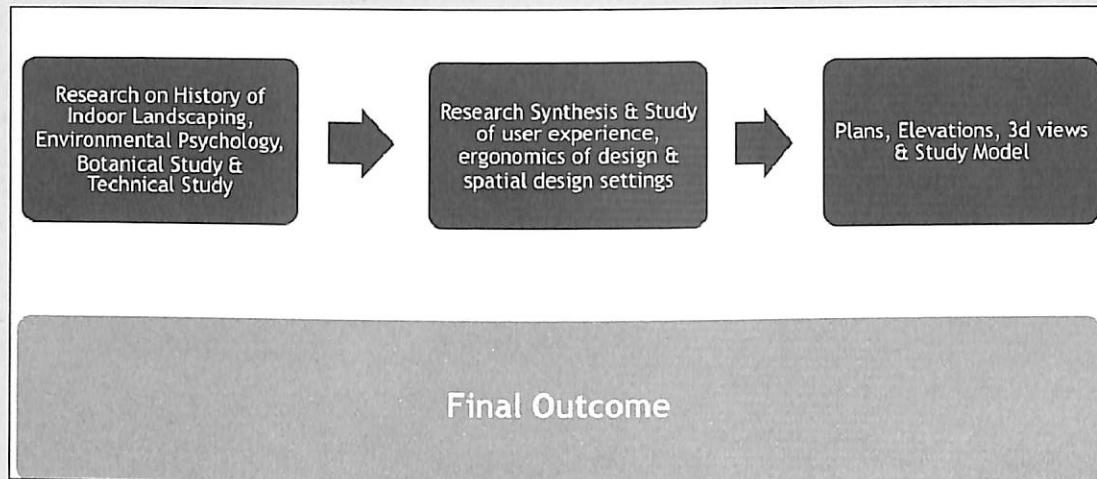
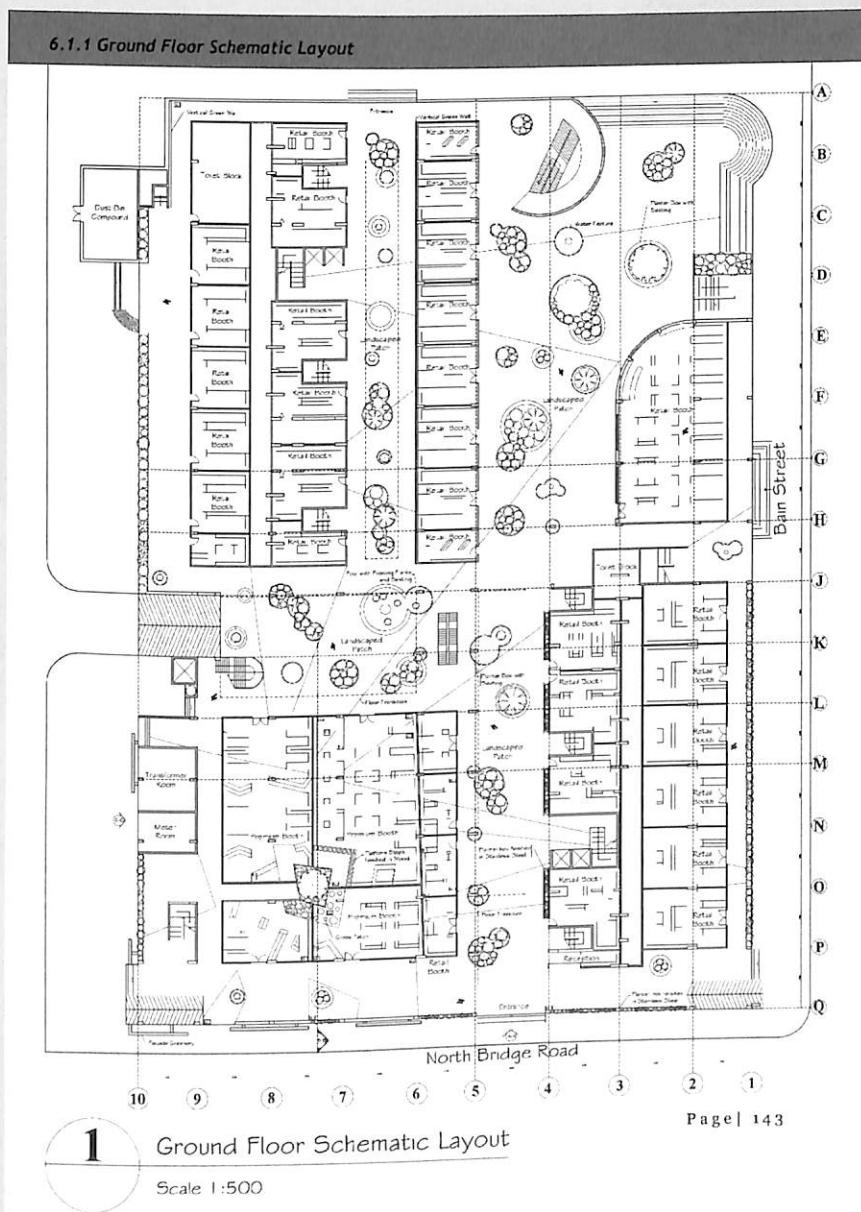
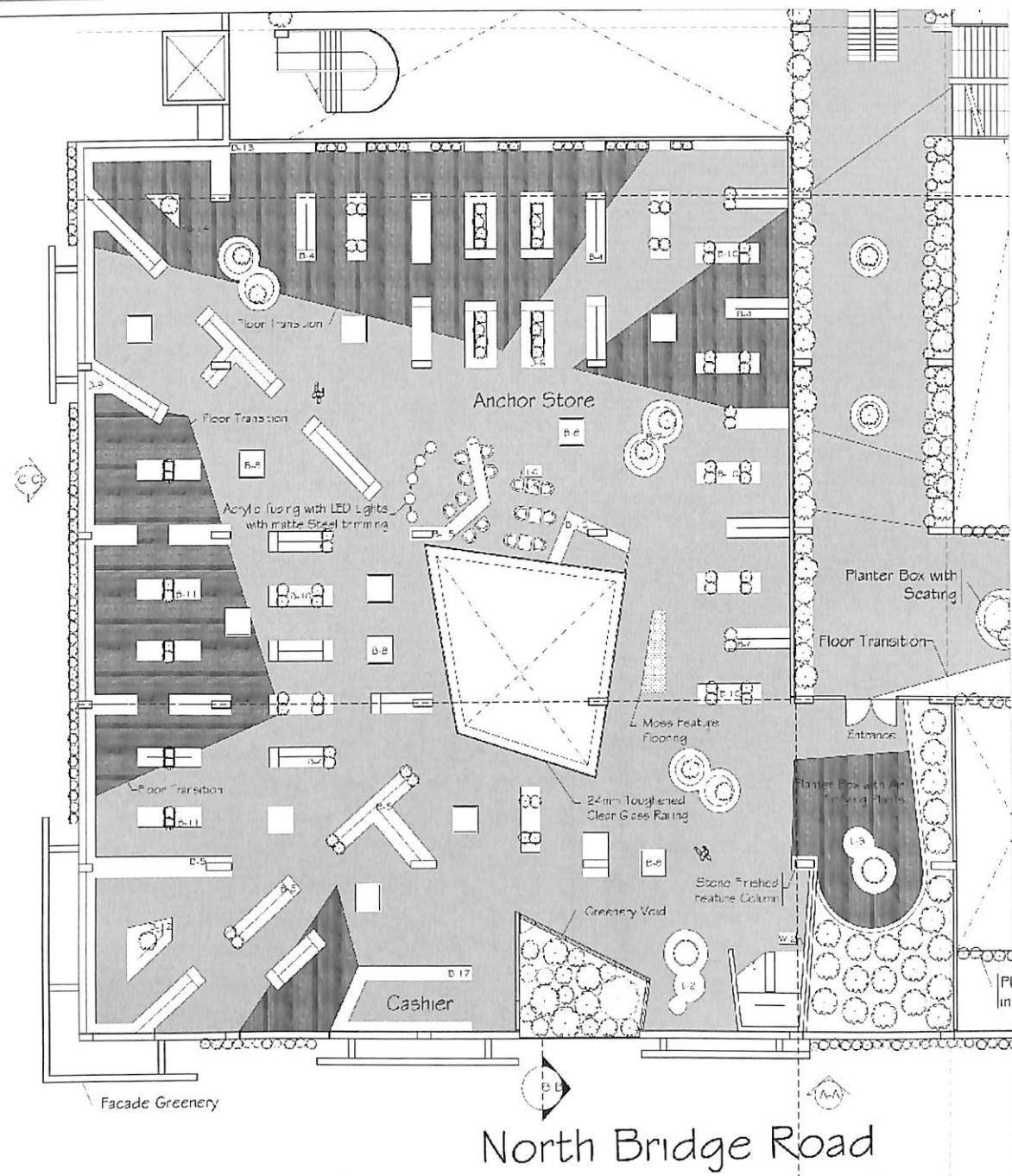


Figure-3 : Diagrammatic Representation of the Dissertation's Expected Outcome



6.1.15 Calculation of Greenery: Focus Fourth Flooring Plan



North Bridge Road

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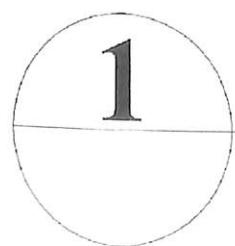
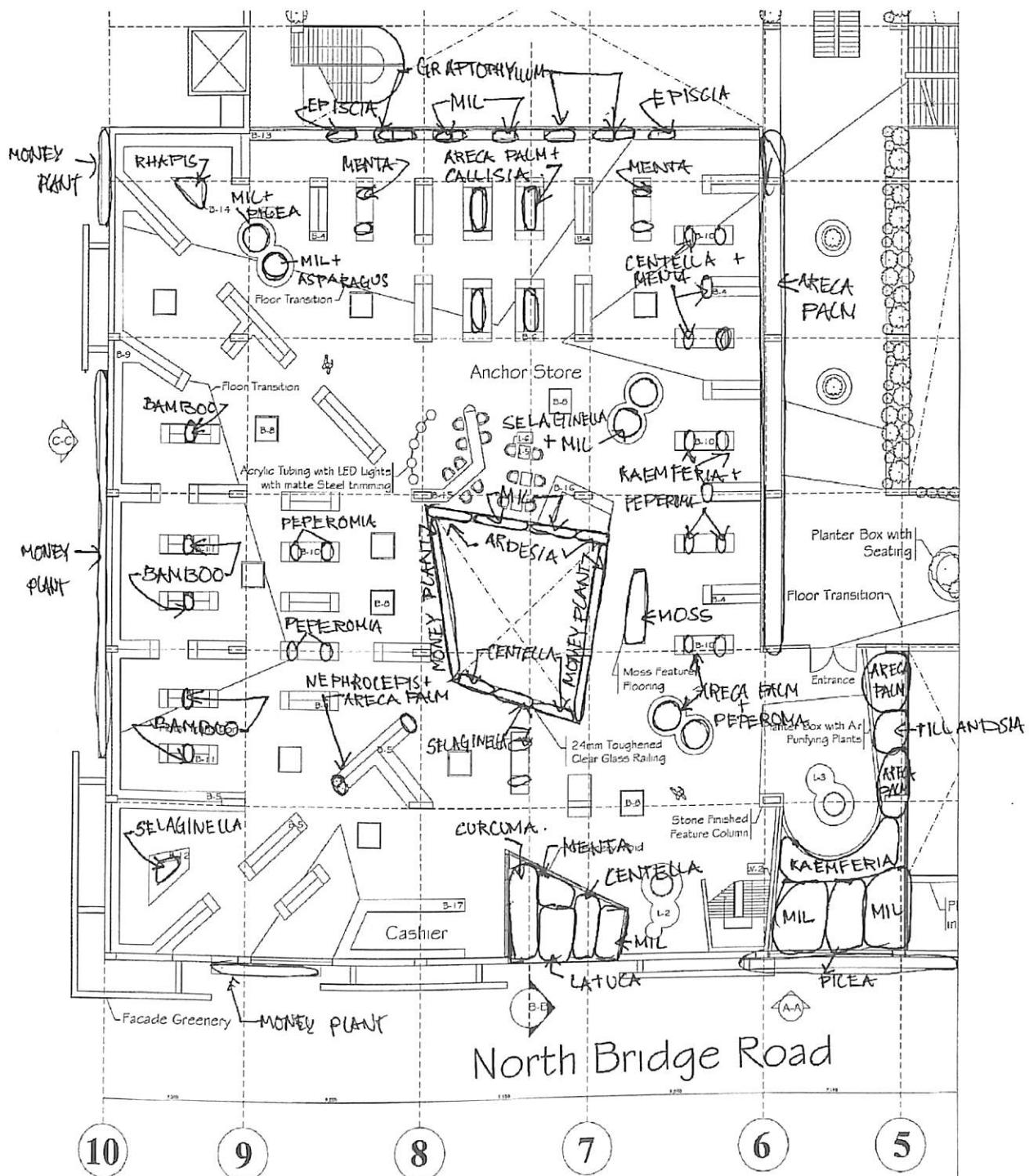
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Focus Fourth Floor Plan

Scale 1:250

Page | 157

6.1.15 Calculation of Greenery: Focus Fourth Flooring Plan



Focus Fourth Landscape Plan

Scale 1:250

Page | 158

Calculation of the Requirement of Indoor Landscape in the Focus Fourth Floor:

Number of Plants Required Per Person = 3-4 Plants = 3.5 Plants

Square Area of one average potted plant = $0.3\text{m} \times 0.3\text{m} = 0.09$ Square Meter

Total Square Area of the Focus Area of the 4th Floor = 1444 Square Meters

Estimated Mean of the number of visitors at any given time = 200 pax

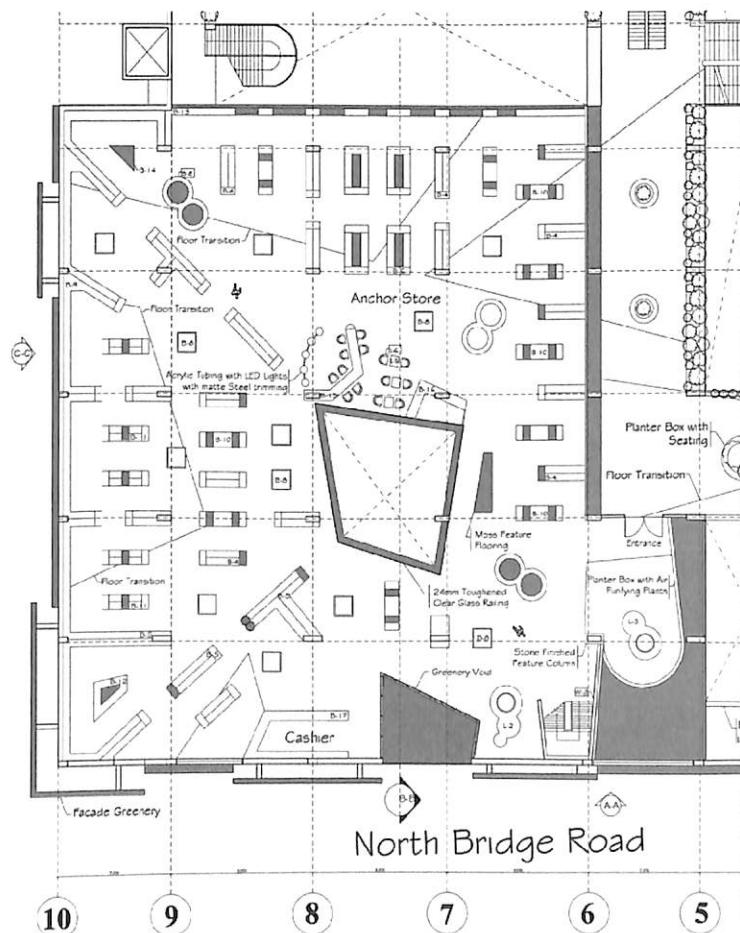
Square Meterage of Plants required per person = $0.09 \times 3.5 = 0.315$ Square Meterage
of Plants required for 200 pax = $0.315 \times 200 = 63$ **Square Meters**

Calculation of Area of Indoor Landscape in the Focus Fourth Floor:

Total Area of Indoor Landscaping in the Focus Fourth Floor = Area of Greenery Void

+ Area of Entrance Planter Box + Area of Airwell Planter Box + Area of Built in

Furniture Planter Box = **123.49** Sqaure Meters



6.1.16 Scale Model Images

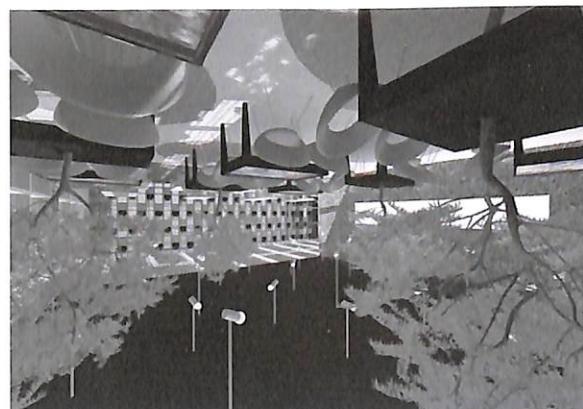


Various Views of the Model

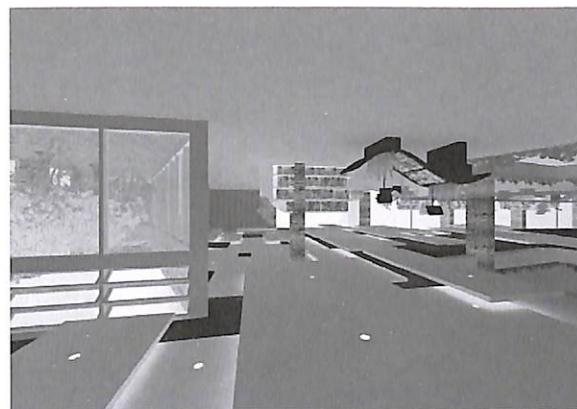
In this survey, senior designers of these firms were given a presentation as well as the chance to examine the practical model. The survey forms were generally filled after a half-hour discussion with the author, and forms themselves contain several comments and observations about the overall project design.

The design outcome of the dissertation was reviewed through a industry survey based on the final design outcome. A total of 5 leading design firms were surveyed, which included DP Green, Ong & Ong, WOHA, Merge OTR and White Space Corporation.

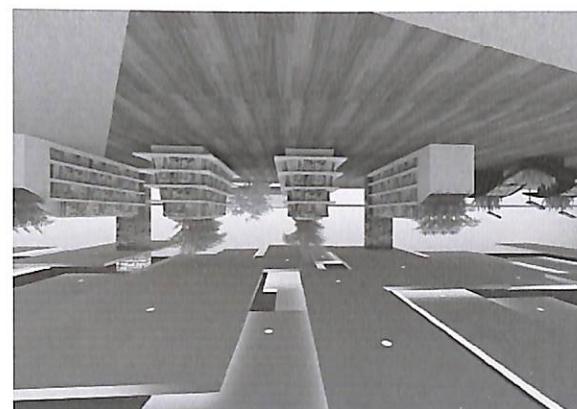
Industry Survey of the Design Outcome



Food Court & Restaurant 3d Views



Detail Area 3d Views



Survey Structure

Each designer was asked 6 questions directly related to the project design. This involved asking (based on their professional experience) if they felt that the project design:

- Incorporated elements of Sustainable Design?
- Incorporated processes to reduce the building's carbon footprint?
- Integrated techniques to mitigate the building's Urban Heat Island?
- Aided in increasing User Psychological benefit?
- Increase real estate prices of its retail spaces and in the neighbourhood?
- Of sufficient calibre to improve the building's Indoor Air Quality?

Each designer was asked to give his personal opinion if he/she felt that Indoor Landscaping should be incorporated as an Industry Standard, owing to its proven scientific benefits. Each designer was asked to summarize how commercially viable he/she felt this project to be.

The Survey Responses are presented in the following table:

#	Question	Survey Questionnaire				
		DP Green	Merge	White	Ong & Ong	WOHA
		OTR	Space			
1	Incorporate elements of sustainable design	√	√	√	√	√
2	Reduce carbon footprint	*	X	√	√	√
3	Mitigate Urban Heat Island	√	X	√	√	√
4	User Psychological Benefit	√	√	√	√	?
5	Help increase neighborhood real estate prices	√	X	X	X	√
6	Improve indoor air quality	√	*	√	√	*
7	Personal Viewpoint of Indoor Landscaping being Industry Standard	√	X	√	√	X
Summary - Project Commercial Viability		Very Viable	Somewhat viable - needs some tweaks	Somewhat viable - needs some tweaks	Somewhat viable - needs different design approach	Somewhat viable - needs some tweaks

Legend

√ Yes

X No

* Others

Survey Response Analysis

The survey responses have been graphed below, and provide a question-by-question analysis of many firms gave positive and negative answers to the project design.

On an overall basis, there were 30 total responses (5 firms*6 questions per firm). Final tally:

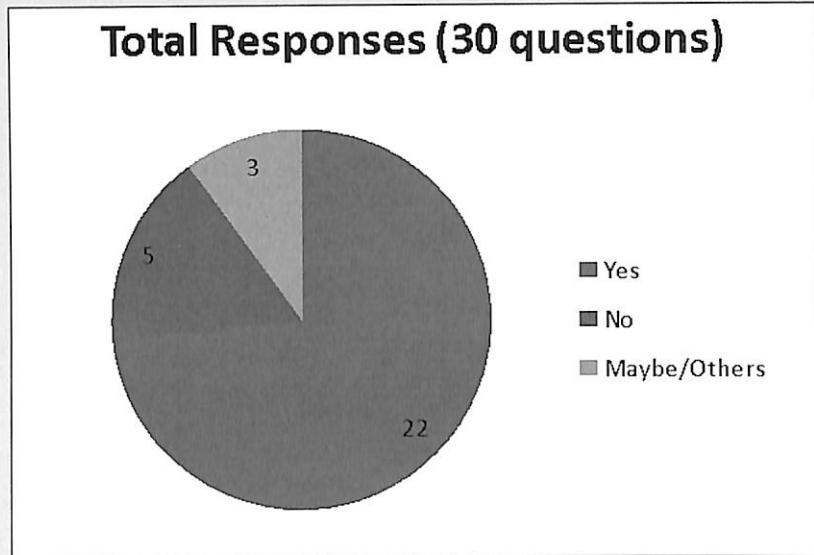


Figure-4: Pie-Graph of Total Responses

73% of the Survey Questions were answered positively, with only 17% negative responses. For a more granular analysis:

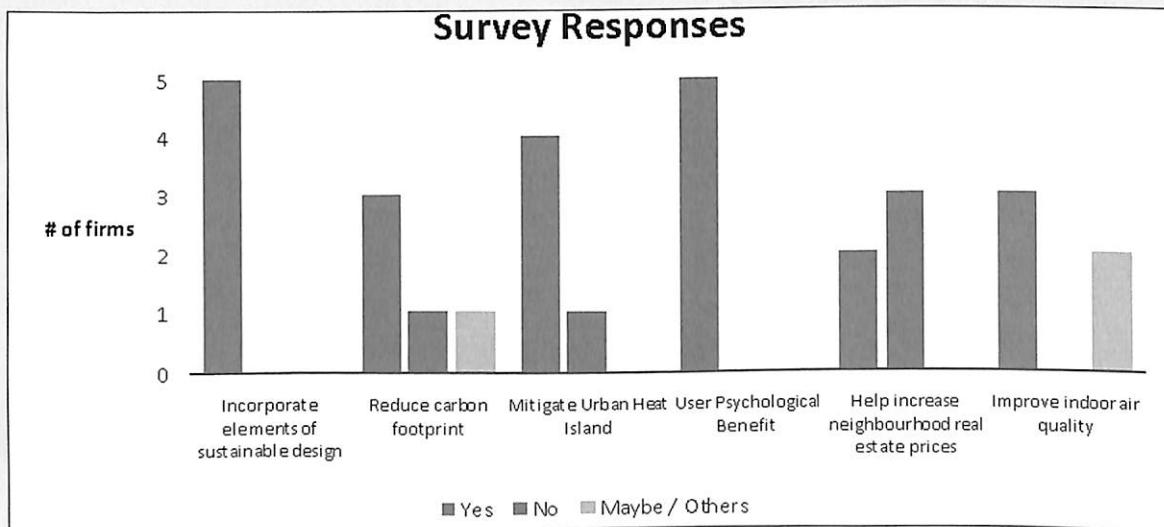


Figure-5: Bar Graph of Survey Responses

2 of the 6 questions got unanimous approvals (All 5 firms responded with a ‘Yes’). These questions are:

- Does the project design incorporate elements of Sustainable Design?
- Does the project design aid in increasing User Psychological benefit?

3 other questions got a majority approval. In order of decreasing positive percentage, these questions are:

- Does the project design integrate techniques to mitigate the building’s Urban Heat Island?
- Does the project design incorporate processes to reduce the building’s carbon footprint?
- Is the project design of sufficient calibre to improve the building’s Indoor Air Quality?

Only 1 question got more No’s than Yes’s. This was:

- Does the project design help increase neighborhood real estate prices?

It can be determined that the project design was found to be successful on an overall basis. All designers felt that Sustainable Design was widely used overall, and such a structure would greatly help improve user psychology.

Some tweaks were found to be required to assist in reducing carbon footprint and mitigating Urban Heat Island. Improvement was required in the commercial aspect, as this project was not determined to be able to boost neighborhood real estate prices. In conclusion, the project had a 73% success rate, and was received well across the leading design firms across Singapore.

An interesting finding of the survey was that the majority of the designers (3/5) did NOT agree that Indoor Landscaping should be incorporated as Industry Standard (given its proven scientific benefits). Finally, the designers summarized the project design and answered how commercially viable the project was.

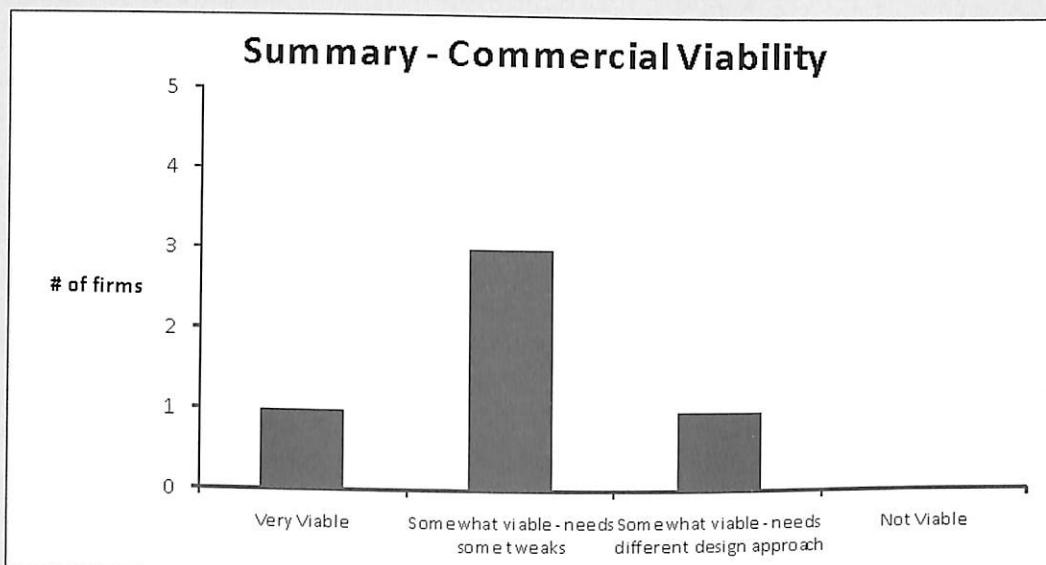


Figure-6: Bar Graph of the Commercial Viability of the Design Outcome

As indicated above, the majority (3/5) design firms feel that the design is somewhat commercially viable; it simply requires some tweaks. 1 firm felt that the design is very viable as it is, while another was in favor of an alternate design approach.

CONCLUSION

This is the last chapter of the dissertation report, which is a two-part chapter, consisting of the final design outcome, along with an industrial survey. This chapter brings the dissertation to an end, where this chapter showcases the final design, along with the feedback on design by the working design community in Singapore.

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Electricity Generation 3 in 1 Way by Solar Panel Blade Turbine

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ABSTRACT

Renewable energy facilities generally require less maintenance cost effective green energy compare than traditional electricity generation by nuclear and thermal. In this concept paper we thing if we decentralized the urban and rural domestic energy transmission system through renewable energy sources by three the way (solar, wind, hydro energy). We can fulfill the energy demand and independency in any environmental and weather condition. These available renewable resources reduce the costs of operation and production. Renewable energy projects can also bring economic benefits to many regional areas, as most projects are located away from large urban sectors and small towns of the capital cities. These economic benefits may be from the increased use of local services as well as tourism.

INTRODUCTION

Direct or indirect energy from the sun can be transformed into electricity via a number of alternative and renewable sources. Electrical energy can be produced from Wind, Hydro, Tidal and Wave Energy, Photo-voltaic Cells, Solar Thermal and Bio-energy (Biomass and Biogas) cogeneration facilities.

The natural conversion of solar energy occurs in the earth's atmosphere, oceans, and plant life. Interactions between the sun's energy and the atmosphere produce the winds, which have been used for years to power sailing ships and drive wind mills. Today we can use wind energy to produce electricity from wind turbines. About 2% of solar energy reaching earth is converted into wind energy.

The interaction between solar heat energy and our oceans drives the hydrological cycle. Approximately 30% of the solar energy reaching our atmosphere drives this "water" cycle, which produces rainfall and the potential energy of water in mountain streams and rivers.

The power produced by these flowing waters as they pass through modern turbines is called hydroelectric power. The rivers flow to the sea where the tides and the waves could also be harnessed to produce electrical power.

Through the process of photosynthesis, solar energy contributes to the growth of plant life (biomass) that can be used as fuel, including wood and the fossil fuels that are derived from geologically ancient plant life. Fuels such as alcohol or methane can also be extracted from biomass as biogas.

The amount of solar energy reaching the earth's surface is 6000 times the amount of energy used by all human beings worldwide.

Now, this time we are able to generate the electricity by three way (like wind energy, rain water, solar energy) simultaneously.

According to figure which shown below, it is a solar panel blade turbine, which will be connected with energy

storage battery. This solar turbine will setup on roof of house, office, schools etc.

This solar turbine will help us to generate more and more electricity by sun, wind, rain water.

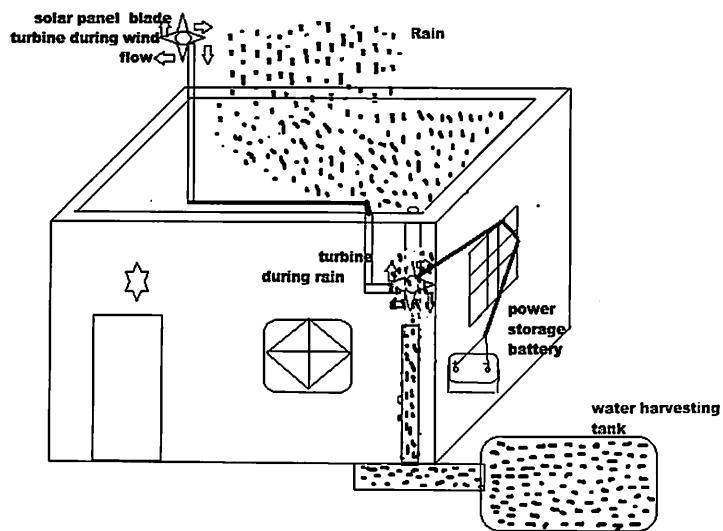


Figure-1: Solar Panel Blade Turbine Working Diagram

First of all we will setup it on top place of house, industries, colleges, government office etc.

On sunny days it will work as solar panel and absorb the sun rays and converted into electricity. But on summer season in north India when air is blowing on full speed as sunstroke then our panel will start to rotate and generate the wind energy to create the electricity.

In north India the rainy season occurs from June to September month, during this period our solar panel also work as turbine. Because whenever the heavy rain drops fall on the panel, then by the high potential energy of rain drops, it provides the kinetic energy to turbine to moves the generator for generation of electricity. We can also store the rain water by the process of water harvesting and we will be able to fulfill our requirement of water by the use of that stored rain water. And in future we never face the water shortage problems.

Solar Energy

It is a process of conversion of solar energy into electrical energy. A solar cell is the basic building block of a PV system. A typical cell produces 0.5 to 1.0V of electricity. Solar cell are combined together to become modules or if large enough, known as an array. A structure to point the modules towards the sun is necessary, as well as electricity converters, which convert dc power to ac. All of these components allow the systems to power a water pump, appliances etc.

Wind Energy

Wind energy or Wind power is the process by which the wind is used to generate mechanical power or electricity.

- Wind turbines convert the kinetic energy in the wind into mechanical power.
- Mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity.

Wind Power Generator

- Wind power generators convert wind energy (mechanical energy) to electrical energy.
- The generator is attached at one end to the wind turbine, which provides the mechanical energy.
- At the other end, the generator is connected to the electrical grid.
- The generator needs to have a cooling system to make sure there is no overheating.

Material for Wind Turbine Blades

Steel - Heavy & expensive

Aluminum - Lighter-weight and easy to work with and expensive

Wind Energy Natural Characteristics

Wind Speed

- Wind energy increases with the cube of the wind speed
- 10% increase in wind speed translates into 30% more electricity
- 2X the wind speed translates into 8X the electricity
- Height
- Wind energy increases with height to the 1/7 power
- 2X the height translates into 10.4% more electricity

Advantages of Wind Power

- The wind blows day and night, which allows wind turbine to produce electricity throughout the day. (Faster during the day)
- Energy output from a wind turbine will vary as the wind varies, although the most rapid variations will to some extent be compensated for by the inertia of the wind turbine rotor.
- Up to 95 percent of land used for wind farms can also be used for other profitable activities including ranching, farming and forestry.

Hydro Energy

It is a type of energy in which water potential energy convert into kinetic energy, by this blades start to rotate and start to produce electricity.

Advantages

- Fairly low operating and maintenance costs
- Low pollution

Following components are required for solar panel blade turbine

Sl. No.	Components	No. of Quantity
1	Solar panel as a blade	3
2	Turbine	1
3	Generator	1
4	Power storage battery	1
5	Connecting wires	25 meter
6	Setup Pipe	10 foot
7	Panel setup Stand	1
8	Electrical instruments	1 kit
9	Testing equipments	1 kit
10	Solar CFLs	10
11	D.C Fan	2

CONCLUSION

By the help of this project we will able to generate more and more natural energies for human welfare, as well as we will also conserve our electricity bill. By the use of Renewable energy resources we will be able to increase the growth and development of our country. Renewable energy resources don't affect to our environment, it make it fresh and clean.

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COMMERCE & MANAGEMENT
(Research Papers)

Green Economy in Sikkim and its Impact on Environment

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ABSTRACT

Environmental degradation have assumed alarming proportions, the ill effects are seen in the form of global warming, erratic rainfall, devastating floods, glacier melting, acid rain, and a host of other environmental problem, threatening the human survival on long term basis. This is engaging the attention of the World leaders, policy makers, and general stakeholders. Recent international meetings convened by the United Nations have focused on the challenges of actualizing the promise of sustainable development, of recreating a world economy that is “greener” and more sustainable, and identifying institutional frameworks that could help achieve this vision. Sikkim, one of the youngest and smallest states in India has initiated a number of steps to realize its dream of green economy through environmental governance framework. The most notable among them are Green Mission, Organic Mission, 10 minutes to earth, etc. The unparalleled participation and enthusiasm with which all the stakeholders have come up, the dream to make Sikkim a Green economy state may not be a distant reality.

Key Words: *Green Economy, Green Mission, Organic Mission, Environmental Governance.*

INTRODUCTION

Governing our planet's rich and diverse natural resources is an increasingly complex challenge. In our globalised world of interconnected nations, economies and people, managing environmental threats, particularly those that cross political borders such as air pollution and biodiversity loss, requires new global, regional, national and local responses involving a wide range of stakeholders. Effective environmental governance at all levels is critical for finding solutions to these challenges. Environmental Governance comprises the rules, practices, policies and institutions that shape humans interaction with the environment. Good environmental governance takes into account the role of all actors that impact the environment. From governments to NGOs, the private sector and civil society, cooperation is critical to achieving effective governance that can help us move towards a more sustainable future.

Sikkim, one of the youngest and the smallest states of India is poised to make green economy as its future to attain growth in an unprecedented pace with due regards to the sustainable development. It is important to introduce Sikkim to the readers before we dwell upon the green economy efforts initiated by Sikkim Government in a participatory mode. Sikkim is one of the youngest and smallest North eastern States of India, having a population of only 6 lakh, recording highest GSDP during last seven years (2007-12). The state is primarily mountainous and a land locked one which is surrounded by three international borders (Nepal, Bhutan and China (Tibet) and state of West Bengal in the southern side as shown in the map.

Green Economy

Green economy is an economy or economic development model based on sustainable development and knowledge of ecological economics. A feature distinguishing it from prior economic regimes is the direct valuation of

natural capital and ecological services as having economic value and a full cost accounting regime in which costs externalized onto society via ecosystems are reliably traced back to, and accounted for as liabilities of, the entity that does the harm or neglects an asset. Thus, the Green Economy is one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities.

“Green economics” is loosely defined as any theory of economics by which an economy is considered to be component of the ecosystem in which it resides. A holistic approach to the subject is typical, such that economic ideas are commingled with any number of other subjects, depending on the particular theorist. Proponents of feminism, postmodernism, the ecology movement, peace movement, Green politics, green anarchism and anti-globalization movement have used the term to describe very different ideas, all external to some equally ill-defined “mainstream” economics.

According to Karl Burkart, Green economy is based on six main sectors, i.e.; Renewable energy (solar, wind, geothermal, marine including wave, biogas, and fuel cell); Green buildings (green retrofits for energy and water efficiency, residential and commercial assessment; green products and materials, and LEED construction); Clean transportation (alternative fuels, public transit, hybrid and electric vehicles, car sharing and carpooling programs); Water management (Water reclamation, grey water and rainwater systems, low-water landscaping, water purification, storm water management); Waste management (recycling, municipal solid waste salvage, brownfield land remediation, Superfund cleanup, sustainable packaging); and Land management (organic agriculture, habitat conservation and restoration; urban forestry and parks, reforestation and afforestation and soil stabilization).

Relevance of Green Economy in Global Context

Worldwide, risks to development are rising as the current models of growth continue to erode the stocks of natural assets and undermine services provided by ecosystems. A lack of action to preserve natural capital will result in increasing costs to substitute it. Moreover, policy needs to take account of evidence that changes in ecosystems, and their capacity to support growth, do not necessarily follow a smooth, foreseeable trajectory. New ways of production and consumption, as well as new approaches for defining growth and measuring human progress, are required in order to avoid the degradation of current living standards. Green growth strategies aim to foster economic growth and social development while ensuring that natural assets continue to provide the material inputs and services on which our economies and well-being rely. The green transformation can bring many positive development outcomes, such as enhanced productivity and innovation, creation of new jobs and markets, and fiscal revenue generation. Furthermore, by achieving climate change resilience, water and energy security, and adequate functioning of ecosystems, the likelihood of abrupt changes that may trigger economic and social shocks is reduced. To enable greener growth, market signals and policies must catalyse investment and innovation into new ways of sustainably managing natural capital and extracting higher, long-term benefits from its use.

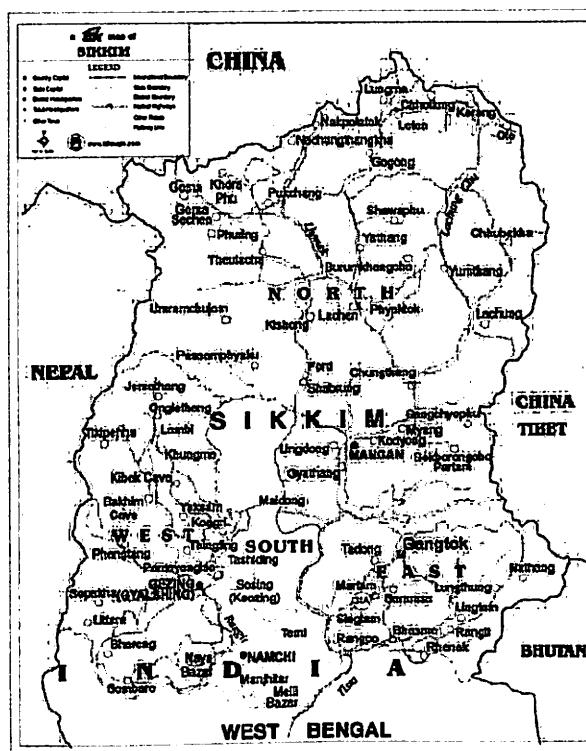
A genuine transition to a green economy needs to involve fundamental changes to both macro-economic and micro-economic conditions and, therefore, institutions. The most obvious case for a shift towards a green economy is in macro-economic policy instruments relating to structures and principles for international trade and finance issues. For example, the role of trade in resources especially in energy-related resources and also including the security implications of resource trade is central to a green economy. Any shift in this area will require carefully crafted incentives to align international markets simultaneously towards environmental and resource goals. At the micro-economic level, the institutional challenge is to create individual incentives (including negative ones) to realign consumption and production decisions that can have significant environmental and economic ramifications.

The period right before and after both the 1972 Stockholm conference and the 1992 Rio Earth Summit saw a frenzy of new international treaty-making and institution-building for the environment. This gave a rich edifice of institutions and instruments that will be central to creating and managing a green economy. However, the system as it has evolved, remains focused on negotiation rather than on implementation. A functional green



economy will require that societies shift their attention much more towards implementation. Rio+20 provided an ideal opportunity to accelerate this transition. There has been growing restlessness amongst industrialized and developing countries alike, although for different reasons, to make implementation a more central focus.

A global green economy will therefore necessitate an emphasis on implementation and on implementation coordination. Such a focus involves at least two important changes. First, it will require better incorporating public, private, and civil society actors who are closer to implementation, including at the national and sub-national levels. A green economy and any institutions devised for it must make their core focus the well-being of people, of all people, everywhere, across present and future generations. It also brings to the fore the centrality of consumption questions, not only among nations but within societies. It would be a folly to forget that a green economy demands not just “green consumers” but “green citizens.” Therefore, a green economy is one that takes us toward sustainable development. Once a green economy is fully in place, we might say that our form of development can be deemed sustainable. A green economy recognizes that it is the form of organization of humankind’s economic activity that will, in the end, determine whether or not we are successful in addressing the problems of social marginalization and environmental destruction. In a green economy, actions taken to reach economic ends also advance social and environmental ones, just as actions taken to meet social and environmental ends strengthen and develop the economy.



Green Economy and Sikkim' Environment

The Sikkim state has realized the importance of sustainable development and initiated effort towards environmental governance for attaining Green economy. For this, a number of statute, acts, laws and rules have been framed for compliance by all stakeholders. The Green Governance has always been in the forefront of the agenda in Sikkim. The conservation paradigm of Sikkim is always very imaginative. It is not based on growth versus green but growth with green. This unique innovative programme was conceived by the Chief Minister, Shri Pawan Chamling himself and formally launched by him on 27 February 2006. The programme started with avenue plantation for beautification and gradually went on to become mass movement. Now all vacant lands, ranging those from monastery lands to community lands in village are being covered under the programme and all walks of life ranging from government officers, to public to housewives to army enthusiastically participate every year in the programme voluntarily.

Important Areas of Green Governance Efforts Paving Way to Green Economy for Sikkim -The State Green Mission

Of all the forestry sector programmes, the State Green Mission launched on 27th February 2006 in Sikkim occupies a flagship position in as much as its outreach, content and substance of objective is concerned. The brainchild of the Chief Minister's pragmatic policy – it aims at shifting the theatre of forestry activity from the Government and departmental level to that in the people's arena. The participation by bureaucrats, peoples' representative, the Panchayats, the students and the teaching community all in all is the hallmark of this Mission. Whereas at the State level, the Chief Minister himself heads as Chairman at the Constituency level it is headed by MLAs as the Chairmen of the Green Task Force, an implementation body of the State Green Mission at the District/Constituency level. The concerned District Collector is the Member Secretary of all the constituencies within his District. Similarly in the field level officials and members drawn from different Departments and society within the Constituencies have been constituted to be called as Sub Committees. This is headed by one Nodal Officer. It is such a comprehensive manpower manipulation that no member of the civil society not even the Non Government Organizations, Self Help Groups, Community Based Organizations, Eco-clubs, local Societies are excluded from the purview of its scope and zenith.

The articulation, formulation and preparation of such a broad based manpower tool with all Government Departments also as implementers of this mission is an act of profoundest maturity and far-sightedness. It brings under its fold all that can be comprehended by way of manpower input into the working, improving and strengthening the system of delivery in the forestry sector. Unless the peoples' component of participation is infused in the developmental process it can safely be termed as half-successful as we all have been experiencing at one time or other. It is an act that reminds the people that resource belongs to them, they are the custodians and managers, they are the consumers and protectors as well. The planting, protecting and propagating responsibilities throughout the State is now vested in the people, in the entire Government machinery, the Forest Department not being a lone manager as has been the usual tradition and practice. This is a paradigm shift in policy, approach and execution. The response was not only overwhelming but spontaneous and warm. It is no surprise therefore that people throughout the State took religiously to planting saplings in every vacant land, road side and in their back yard. It was a green revolution, a people's movement in greening the Sikkim hills. Towards this goal, the State Green Mission stands tall and towering.

What is Green Mission?

- Is a new direction and dimension in the State's efforts and endeavor to sustain, maintain and enrich Sikkim's environment and ecology.
- Is a programme to give to people the mandate to won, regenerate and protect their resources by themselves.
- Is about synergizing development and environmental protection, integrating ecology with economy for bequeathing it to the posterity.
- Is broadbasing greening activities through people's participation, support and guidance.
- Is converting Sikkim into a green paradise, a garden state and tourist's ultimate dream and destination.

Organic Mission Objectives

- Prepare a clear cut implementable road map of organic farming.
- To implement the programme of organic farming with a systematic approach to achieve the target set by the Govt.
- To develop and explore markets of organic commodities.
- To develop linkage between the organic farmers and the marker with intervention of certification agencies so as to continue the policy permanently.

The State Organic Mission

Organic farming is yet another environmental governance effort initiated by the State Government of Sikkim. Green revolution launched in India in the early seventies enhanced chemical use in agriculture leading to enhanced production and productivity of crops under irrigated agriculture. But mountainous state like Sikkim and other North Eastern states where basically agriculture is rainfed, the chemical use did not have significant impact on

production and productivity. Considering this, Government of Sikkim took a decision to adopt organic system of farming in the entire state and probably the first state in India to bring resolution in the State Assembly. Concern for the people of the state for a healthy and wealthy living in a sustainable way keeping due care of ecology and environment has been taken as the prime duty. Now Sikkim is taking a lead in the North East part of the country on Organic farming and has targeted to convert the entire state into Organic by 2015.

It was in 2003, the State Government advocated the idea of making Sikkim an organic state. It was part of a larger concept of making whole of North Eastern region as wholly organic zone of India. The decision of Government of Sikkim to go organic was based on the premise that farming in this hilly state was traditionally organic and it will be to the benefit of not only to the sixty two thousand farming families of the state who own an average of 1.9 hectares of farmland but also to maintain quality of environment of the state. Government saw comparative advantages in promoting organic because use of chemical fertilizers and pesticides was still minimal by farmers and therefore it was relatively easy for them to shift to organic or improve their already known organic ways of farming. Average fertilizer use on the one lakh hectares of farmland, that Sikkim has on record, was never more than 12 kg/ha, as compared to national average of 90kg/ha.

There is a growing thinking that hilly state is increasing its dependence for food commodities, especially vegetables and fruits, on outside state supplies. It is seen as money not going to its farmers as well as questions about safety of food to consumers. Government wants to reduce dependence of the consumers of the state for vegetables / fruits on outside state supplies to help its farmers benefit from the consumer boom and discourage Sikkim becoming a consuming society, particularly when rural population starts moving away from farming increasing dependence on Public Distribution System. In the face of increasing consumer demands, it would benefit farmers and the state of Sikkim if farmers could substantially diversify farming to meet much of the consumer demands of vegetables, within the state through organic farming. It will help improve rural economy as well as provide farm employment to so many in rural areas.

Eco-tourism

Eco-tourism is another environmental governance effort in Sikkim. This is more so as state receives a lot of tourists and a sizeable number of local people earn their livelihood from tourism and allied activities. The environmental effort in the form of ban on plastics, non bio-degradable, green mission, etc. promoted eco-tourism in state. The Tourists' information leaflet included dos' and don'ts which essentially solicit cooperation and support from visiting tourist to promote eco-tourism in the state through green governance. This has given boost to eco-tourism in addition to increasing green cover.

Ten Minutes to Earth

It is a very unique programme conceived by Chief Minister of Sikkim, Shri Pawan Chamling where everybody commits him/herself to earth for ten minutes by planting a sapling. It was launched on 15th July 2009 when the thousands of hands in Sikkim lovingly lifted the seedlings for plantation on mother earth. This initiative also supported The United Nations Environment Program (UNEP) worldwide tree planting campaign. Plant for the Planet: Billion Tree Campaign. About 6,10,000 seedlings were planted throughout the Sikkim. The idea was to plant trees equivalent to the population of Sikkim in ten minutes; one tree for one person. This was also a record that within ten minutes the plants numbering population of the State were planted anywhere. This ten minutes activity would be able to sequester about 1400 tons of carbon di-oxide annually. This is the Sikkim's own unique way of contributing to climate change mitigation. The Greenest Chief Minister of India has further emphasized on important native species like quercus (oak), rhododendron, magnolia and native wild fruits to have a well-balanced forest ecosystem and preserve local biodiversity. The people of Sikkim, communities, industries, government officials, civil society organizations and religious institutions participated on a massive scale. The objective was not only to make tree planting as a Sikkimese way of life but also to send the message to the world community at large that 'we care for nature'. The year 2010 was equally illustrious. Cumulative seedlings planted under the programme have gone up to 9,24,600. This unique programme continues with innovative themes every year and the idea 'Each one plant one' have taken deep root. Ten Minutes to Earth has become annual ritual.

Environmental Policies and Practices

To attain the goals of green economy, a number of environmental regulations in the form of act, rules and notifications have been passed by the State Government which have a far reaching ramifications. Important ones are mentioned below:

Hari Kranti diwas: Government declared 1995-96 as “Harit Kranti” year for greening Sikkim through people’s participation and also adopted the ten- year period from 2000-2010 as “Harit Kranti Dashak”.

Eco-friendly Industrial policy: Incentives for eco-friendly, pollution- free and green industries under State Industrial Policy 1996.

Participatory forest management policy introduced: Participatory forest management involving active peoples’ participation through Joint Forest Management Committees (JFMCs) and Eco-Development Committees (EDCs) in each villages (1998).

Eco Clubs and Green fund: Eco Clubs and Green fund instituted for Schools and Colleges (2000).

Environmental Education introduced in Schools: Environmental Education introduced in Schools from Nursery to Class-VIII; implemented various action oriented schemes like National Green Corps Programme, National Environment Awareness Campaign, Green School Programme (2002).

Sikkim Ecology Fund and Environment Cess Act: Sikkim Ecology Fund and Environment Cess Act, 2005 framed; One of the very unique Act providing for levy of cess on industries, traders and consumers for using non-biodegradable materials.

CONCLUSION

The state of Sikkim, although, endowed with rich flora and fauna and also natural environment; realizing the importance of sustainable development, initiated a number of environmental governance effort towards attaining green economy. The idea is to grow with greenery which means development without damaging nature- a fine balance between growth and natural balance. Given the effort, initiatives and the people participation; Green economy for the state may not be a distant reality, provided the policies are practiced and pursued vigorously with right earnestness by all the stakeholders.

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Outcome and Consequences of the Use of Consumer Products in Relation to Counterfeit Products

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ABSTRACT

The production and sale of counterfeit goods is a global problem and one that has serious effect on economy and health of Government, businesses and consumers. Counterfeiting is everywhere - it can affect what we eat, what we watch, what medicines we take and what we wear. The result of counterfeiting affects everyone, with Governments, businesses and society being robbed of tax revenue, business income and jobs. The flood of pirated products creates an enormous drain to the society and nation by creating an underground trade that deprives Government, of revenue for vital public services and imposes greater burdens on taxpayers. It also leads to more public resources being spent on fraud-detection methods. Counterfeit goods also undermine employment, as products are copied and produced illegally, thereby displacing sales of original merchandise and reducing the turnover of legitimate companies. The prices of products also go up because companies increase security systems to counter organized criminal activities. Counterfeiting is a hugely lucrative business, with criminals relying on the continued high demand for cheap goods coupled with low production and distribution costs. The illegal activities related to counterfeiting take advantage of unwitting consumers and bargain-hunters, exploiting people's appetites for cut-price brands. Data collection was through descriptive Research Design; conducted through Survey method, on families residing in Mumbai city. The data was suitably analyzed and the finding shows the effect of these malpractices in the society.

Key Words: Market Malpractices, Environment Concerns, Health Hazards

INTRODUCTION

In general terms, commercial counterfeiting can be described as the fraudulent practice of affixing a false trademark to a product. The false trademark then appears superficially indistinguishable from its legitimate counterpart. The purpose of this fraudulent activity is to dupe the consumer into purchasing the counterfeit under the mistaken belief that the product is the genuine article. For the consumer who unknowingly purchases a counterfeit, the result is typically dissatisfaction; for the firm whose goods are counterfeited, loss of revenue and goodwill are possible; for the counterfeiter, profits are reaped with little financial or legal risk and with minimal marketing effort.

Thus the impact of counterfeiting is both tangible and intangible; it affects both the individual firm and society; and injury befalls both the corporation whose goods are counterfeited and the consumer who unknowingly purchases the counterfeit products. Tangible impacts include the revenues lost by the trademark owner to the counterfeiting manufacturer. Intangible impacts include the loss of goodwill and consumer confidence.

In India alone, the “fakes” market is estimated to be worth more than Rs.2 billion and it’s growing by nearly 20% every year. The Indian Government is losing almost Rs.6 billion in revenues that would have been generated on excise, octroi, sales and income taxes that would have been paid on these sales.

Indian metros have become bases for manufacturing counterfeit products more than 50% of the Indian market

is filled with these products and account for maximum Intellectual Property Rights violations. Nearly 70 per cent counterfeit products originate here. Fast moving consumer Goods, software, automobile, and packaged water, are the most affected by IPR violations. "Lengthy legal proceedings often yield no results; Indian courts are becoming aware of the need for the Judiciary to develop progressive and novel methods.

AIMS AND OBJECTIVES

The current study has been taken to seek answers to key aspects such as the range of products purchased by consumers which are counterfeited, to what level these products effect on their health, how these products are affecting the Indian economy and regarding various organizations functioning to protect the consumers with specific objectives such as:

- a) To assess the awareness of respondents towards common malpractices occurring in market
- b) To study the effects of counterfeit products on consumers (health and safety risks and consumer utility) and
- c) Effects on government (tax revenues, expenditures and corruption).

METHODOLOGY

The methodology used to conduct this study is as follows

- a) Descriptive Research Design: Conducted through Survey method with structured type questionnaire as a data collection instrument.
- b) Sampling Procedure: The sample for the study was selected from Mumbai city. Selective sampling was chosen after critical review of literature. It was observed that consumer behaviour has been imposed on range of people belonging to specific economic groups who become an easy target of such malpractices.
- c) Data Collection: In total 200 questionnaires were distributed out of which 150 samples were finally selected. Age ranging from 25 yrs to 40 yrs and above.
- d) Analysis of Data: The statement on consumer awareness was framed after critical review of literature. The answers to this statements were sought in terms of 'Yes', 'No' 'Marking of correct options 'Don't know'

In the present study questionnaire was prepared related to following aspects:

- a) Background information of the respondent,
- b) Buying practices of the homemakers and its effect on their health,
- c) Awareness scale on Branded products.
- d) Awareness towards Consumer Protection Organisation

RESULTS & DISCUSSION

Every day, consumers and households make decisions about the goods and services they purchase. The amount of money the consumers are willing to spend and the product's price are two of the most important factors affecting decisions as a consumer.

It thus became essential to have background history of the respondents i.e. age, qualification, type of family, income an important factor which helps the consumers in selection of the consumer durable goods. This target group 'House Maids' were selected as their income level is comparatively low and they become easy target to such malpractices.



Income Levels of the Consumers

S.No	Consumers income level	No. Of consumers	%
1	Rs 10,000 – Rs 20,000	63	42%
2	Rs 20,001 – Rs 30,000	30	20%
3	Rs 30,001- Rs 40,000	23	15%
4	Rs 40,001 - Rs 50,000	34	23%
	TOTAL	150	100 %

Most popular Brands:

S.No	Popular Brands.	No. Of consumers	%
1	Everest	150	100
2	Lux	150	100
3	Taza Tea	135	90
4	Sunsilk	118	79
5	Coffee bite	116	77

Brand name signals quality. Brand awareness refers to customers' ability to recall and recognize the brand under different conditions and link to the brand name, logo, and jingles and so on to certain associations in memory. Brand awareness is of critical importance since customers will not consider the brand if they are not aware of it.

Lux and Everest are the most popular Branded products amongst the consumers 100%. Popularity due to use of multiple mass media i.e. television. These products are also popular due to its availability in market on a larger scale.

Realization of Products being Fake:

S.No	Fake product realisation	No. Of consumers	%
1	Taste difference	150	100
2	Colour difference	110	73
3	Odour difference	90	60
4	Skin allergy	53	35
5	Any other	12	08

After purchase of unpacked cheap fake products 100% of consumer realised the fakeness due to difference in taste, 60% complained of peculiar odour especially ghee, 73% found colour difference i.e. yellow colour in ghee and turmeric powder, red colour in chilli powder. 35% complained of skin rash after using certain cosmetics like cream, lipsticks, kajal etc. The consumers thus pay in the form of dissatisfaction with counterfeit products, personal injury from faulty counterfeit products, and confusion regarding avenues for redress.

Fake Products purchased by consumers:

S.No	Fake Products purchased	No. Of consumers	%
1	Chocolates	119	79
2	Detergents	108	72
3	Shampoo	65	43
4	Electronics	54	36
5	CD's	50	33
6	Any other	17	11

In today's market in place of standard goods, sub-standard goods are sold at higher price. For example, selling of electrical gazette were duplicate parts are used, furniture made up of inferior quality wood, using sub-standard sheets in steel cupboards. Consumer knows it only after use. Counterfeit consumer products have a reputation for being low quality and the easy target is the Low Socio Economic Strata of the society. Consumers *unwittingly* buy counterfeit or pirated products thinking that they have purchased genuine items, or knowingly buy lower-priced counterfeit or pirated items. The degree to which consumers knowingly buy counterfeit or pirated products depends on the characteristics of the products concerned. 79% of the consumers were target of fake chocolates, realization came through taste, Texture of the product, 79% were the target of Fake detergent powder which resulted in rashes in hand, peeling of skin, itching sensation. The market is full of pirated CD's, 33% of the consumers complained of fake CD's in market, which are comparatively sold at a very low price.

The studies have also shown that, Asia is emerging as the single largest pirated good producing region. In recent years there has been an alarming expansion of the types of products being infringed, from luxury items (such as deluxe watches and designer clothing), to items that have an impact on personal health and safety (such as pharmaceutical products, food and drink, medical equipment, personal care items, toys, tobacco and automotive parts)

Consequences of use of Counterfeit products:

S.No	Consequences of use of Counterfeit products:	No. Of consumers	%
1	Health Hazards	150	100
2	Damage to Brand reputation	40	27
3	Customers loyalty	34	23
4	Damages the Indian Economy	20	13
5	Any other	13	09

Most troubling is the widespread threat counterfeiting poses to, is public health and safety. Counterfeit shampoo has caused hair loss, 100% of the respondents are aware of this consequences, exactly one-third of music CDs are counterfeit products, with losses to the recording industry of up to 5 billion. Finally, an approximate 1.2 billion loss is incurred annually by motion picture companies as a result of the sales of bootleg DVDs and 27% of the consumers are aware that this piracy is damaging the Brand reputation. There is, however, only a small amount (09%) of hard data in support of these claims. Thus counterfeiting is endangering the health and safety of consumers.

Awareness of consumers towards Standardised marks

S.No	Awareness of consumers towards Standardised marks	No. Of consumers	%
1	I.S.I	77	51
2	AGMARK	71	47
3	HALL MARK	49	33
4	F.P.O.	11	07
5	Not aware at all.	12	08

Before buying any product, it is necessary to note standardization mark issued by BIS (Bureau of Indian Standards). For example, ISI mark for electrical goods, mineral water, biscuits etc. Before buying one should check whether the product bears ISI certification mark with number. The mark carries different numbers for different products. ISO mark, FPO, AGMARK, Wool mark, Silk mark, Eco-mark, Hallmark, Vegetarian and Non-vegetarian mark are such standardization mark which are to be taken while purchasing any product. Consumers create a demand for a variety of items. Material resources available in the market are directed towards satisfying human requirements. Purchasing is often daily routine. The basic knowledge of economic principles, selection of products and awareness of consumer rights are both useful and necessary for any one. The results indicated that awareness of ISI mark was highest among respondents (51%) followed by AGMARK (47%). Regarding awareness of rights revealed that awareness of right to choose was highest among homemakers.

CONCLUSION

In recent years expenditure on food and cosmetics has become one of the largest components of domestic cost of living. Markets these days offer a wide range of such products. At the same time, the issue of food safety is also gaining importance amongst buyer. In future, development of mass market and advent of new technology would help improve the science of food safety and reduce the health hazard due to counterfeit products. Strong legislation is required to stop the sale of pirated goods, not alone because of the protection it affords to the health of its citizens, but also because it will prove beneficial in a commercial sense.

Counterfeiting and piracy can have negative effects on the environment. Firstly the growing volume of seized goods raises environmental issues since destruction can be a costly process that creates considerable waste. Secondly substandard counterfeit products can have environmentally damaging consequences. A case in point is the chemical industry, which has documented cases where the use of counterfeit fertilizers caused serious damage to the environment.

Thus Counterfeiting and piracy has affected economy very widely where innovation is undermined, criminal networks have financial gain, the environment is negatively affected, and workers are worse off. Moreover, if counterfeiting and piracy is widespread, foreign direct investment may be lower and the structure of trade may be affected

Purchasing for the home involves many decisions related to the use of money and time. A satisfactory standard of living is more nearly attainable if the family makes purchasing decisions based on goals and values and on knowledge of commodities. The present-day market offers varied products and services for our use. Everyday new products and services are introduced in the market and existing products are improved. It is necessary to know about different products, their brands and models available.

Thus the aim of this case study was not only to study the effects of counterfeit products on consumer's health but also its impact on Indian economy in terms of tax revenues, expenditures and corruption.

Keeping all these aspects, the data was suitably analyzed and the findings show Consumers is aware of what are counterfeit products; Majority defined counterfeit products as duplicate products which are illegally imitated. Cosmetics are the most common Branded products. Used by them; they have no idea about the consumer organizations and it has become essential to create awareness towards the consumer organizations who are actively involved towards various consumer protection activities. And also its become necessity that each consumer should identify ‘needs’ and differentiates them from ‘wants’, she should obtain information about goods and service, should compare prices, quality and other features with competing goods and most important she should not enter in schemes like “We will make you rich”, “We will make you slim within one month”, etc. As most of the respondents were house maids (female) the knowledge regarding legal laws was very minimum. An interesting finding was that each consumer Complaints against poor attitude of shopkeepers services. One can also conclude that following are the features that motivates consumers to buy the products

- a) Consumers buy a fake because they do not think it is illegal or immoral to do so.
- b) Consumers buy a fake because it is easy to obtain.
- c) Consumers buy a fake because they cannot afford a genuine product and
- d) Consumers buy a fake if they thought it was just as good as a legitimate product.

RECOMMENDATIONS

Thus to create awareness an ongoing programme is being organized by the college students as part of their extension activity at regular interval. A programme is being formulated in collaboration with Consumer Organisations to create awareness amongst this low income –illiterate group of society to be more alert and be responsible to protect themselves from such malpractices occurring in the market.

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Consumer Products – Is the Lifeline Cutting Short Our Lives

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ABSTRACT

Purpose – The purpose of this article to is point out few of the important chemicals that have become a part and parcel of our everyday lifestyle and their harmful effects. With the rapidly increasing web of various consumer products that claim to make out lives easier, this article aims to provide an insight into what goes in making these products and how they affect us.

Key Words: Consumer products, Effects, Personal Care.

INTRODUCTION

The consumer products industry has been growing at a brisk pace in the past few years backed by robust economic growth and rising rural income. Growth drivers such as, rapid urbanization, evolving consumer lifestyles and emergence of modern trade have shielded the industry from the slowdown.

According to FMI 2012 report there are a total of seventy- one consumer product categories. Every day we bring products to improve our lives These include products for washing clothes, dishes, windows, floors, tile, and bathroom fixtures. There are waxes and polishes for floors, furniture, shoes, and cars. Personal care products comprising of hand and body soaps, hair shampoos and conditioners, toothpastes, cosmetics, and deodorants.

Humans are being exposed to a cocktail of chemicals several of which are persistent. Modern society uses tens of thousands of chemicals in everyday products. Alcohol, cosmetics, household adhesives and cleaning products, insect sprays, paints, petrol, weed killers, foods and medicines are just a few examples. However, a large group of emerging contaminants exist, of which little is known about their possible exposure routes and possible toxic effects.

Household products do not only pose a problem through direct exposure via their intended use, but can also cause long term problems.

AIMS AND OBJECTIVES

The purpose of this article to is point out few of the important chemicals that have become a part and parcel of our everyday lifestyle and their harmful effects. With the rapidly increasing web of various consumer products that claim to make out lives easier, this article aims to provide an insight into what goes in making these products and how they affect us.

METHODOLOGY

The data for the paper was obtained through extensive literature review of articles published in various journals and books. Reference was also made to the resources available online. The information collected was organized and original inputs were inserted.

RESULTS AND DISCUSSION

The Emerging Contaminants and Reasons for Concern

There are literally hundreds of sources of these emerging contaminants coming from consumer products that end up harming the human beings. Frequently used products like shampoo, sunscreen, pesticides, plastics, flame retardants and pharmaceuticals are possible exposure routes of these emerging contaminants besides industrial processes. Some of these contaminants are:

Perfluorinated Compounds (PFCs)

- a) A family of fluorine-containing chemicals with unique properties to make materials stain and stick resistant.
- b) The products which make use of this compound- Teflon products , microwave popcorn bags , personal care products like shampoo , dental floss , hair irons

Reason for Concern:

1. PFOA is a likely human carcinogen; it causes liver, pancreatic, testicular, and mammary gland tumors in laboratory animals.
2. PFCs cause a range of other problems in laboratory animals, including liver and kidney damage, as well as reproductive problems.
3. In humans, researchers have found that PFOS is able to cross the placenta.

Polybrominated Diphenyl Ethers

- a) Polybrominated diphenyl ethers (PBDEs) are manufactured, flame-retardant chemicals that are used in many consumer products to make them difficult to burn. Products treated with PBDEs have been used in the home, businesses, and the transportation sector.
- b) These are used in thermoplastics, thermosets, foam-based packaging materials, carpet padding, textiles and coatings that inhibit or resist the spread of fire..

Reason for Concern:

1. Preliminary evidence suggests that high concentrations of PBDEs may cause neurobehavioral alterations and affect the immune system in animals.
2. Laboratory animals exposed to PBDEs show deficits in learning and memory.
3. PBDEs affect thyroid levels in laboratory animals and in wildlife, and may cause birth defects.

Phthalates

- a) Phthalates are plasticizing and softening chemicals used in a wide array of consumer products, especially those containing PVC (polyvinyl chloride).
- b) These are found in -PVC products such as vinyl flooring and children's toys, personal care products, such as perfumes, nail polish, and lotion , medical devices, such as IV bags and tubing that are made with PVC and automobile interiors.

Reason for Concern:

1. Phthalates may also cause asthma as well as liver and kidney damage.
2. Women may be at higher risk for potential adverse health effects of phthalates due to increased cosmetic use. According to *in vivo* and observational studies by Davis *et al.* (1994) and Lopez-Carillo *et al.* (2010), there is an association between phthalate exposure and endocrine disruption leading to development of breast cancer.
3. In studies of rodents exposed to certain phthalates, high doses have been shown to change hormone levels and cause birth defects

Formaldehyde

- a) Formaldehyde (CH₂O) is a volatile organic compound that is readily soluble in water, breaks down rapidly, is produced and metabolized in the human body.
- b) Formaldehyde is used in:-manufacturing many materials, such as plastics, foam insulation, mirrors , building materials, such as sheet vinyl flooring, doors, decking , cosmetics and personal care products, such as cleansers, fingernail varnishes and hardeners, shampoos and hair straightening solutions and household cleaning products, such as carpet and rug cleaners, disinfectants, dish washing liquids, and floor cleaner and polish.

Reason for Concern:

1. Exposure to high levels of formaldehyde can cause adverse health effects including significant sensory irritation, breathing difficulties and allergic contact dermatitis.
2. People who have become sensitized to formaldehyde may suffer: asthma and contact dermatitis.
3. The United Nations International Agency for Research on Cancer (IARC) currently classifies formaldehyde as being ‘carcinogenic to humans’.

Bisphenol

- a) A (BPA) is a high-volume chemical first identified in 1891 that manufacturers have used in various plastics for over 50 years.
- b) BPA-based plastic is clear and tough, and is used to make a variety of common consumer goods such as baby and water bottles, sports equipment, and CDs and DVDs) and for industrial purposes, like lining water pipes.

Reason for Concern:

1. Bisphenol A is an endocrine disruptor which can mimic estrogen and has been shown to cause negative health effects in animal studies
2. A panel convened by the National Toxicology Program (NTP) of the U.S. National Institutes of Health determined that there was “some concern” about BPA’s effects on fetal and infant brain development and behavior.
3. A 2009 review summarized BPA adverse effects on thyroid hormone action

Heavy Metals

- a) A heavy metal is a member of a loosely defined subset of elements that exhibit metallic properties
- b) Use of heavy metals: Mercury - fluorescent light bulbs, electrical fixtures, thermometers, Lead- PVC products, art supplies automobile components, some hair dyes, and even candy. Arsenic - used to make special glass, semi-conductors (gallium arsenide), some paints, dyes, metals, soaps, and drugs.

Reason for Concern:

1. Mercury causes blindness and deafness brain damage, digestive problems, kidney damage, lack of coordination and mental retardation.
2. Lead causes behavioral problems , high blood pressure, anemia , kidney damage , memory and learning difficulties, miscarriage, decreased sperm production and reduced IQ
3. Arsenic causes breathing problems, death if exposed to high levels, decreased intelligence, known human carcinogen: lung and skin cancer, nausea, diarrhea, vomiting and peripheral nervous system problems

Sodium Dodecyl Sulfate

- a) It is an organic compound used in many cleaning and hygiene products



- b) SDS is mainly used in detergents for laundry with many cleaning applications. It is found in higher concentrations with industrial products including engine degreasers, floor cleaners, and car wash soaps. It is found in toothpastes, shampoos, shaving foams, and bubble bath formulations in part for its thickening effect and its ability to create lather.

Reasons for Concern

1. It has been shown to irritate the skin of the face with prolonged and constant exposure (more than an hour) in young adults.
2. SDS in toothpaste affects the recurrence of aphthous ulcers, commonly referred to in some countries as canker sores or white sores.

Triclosan

- a) Triclosan is an antibacterial and antifungal agent.
- b) Triclosan is used mainly in antiperspirants/deodorants, cleansers, and hand sanitizers as a preservative and an anti-bacterial agent. It is also used as an antibacterial agent in laundry detergent, facial tissues, and antiseptics for wounds. Other products include garbage bags, toys, linens, mattresses, toilet fixtures, clothing, furniture fabric, and paints. Triclosan also has medical applications.

Reason for Concern:

1. Triclosan can pass through skin and is suspected of interfering with hormone function
2. The European Union classifies triclosan as irritating to the skin and eyes, and as very toxic to aquatic organisms, noting that it may cause long-term adverse effects in the aquatic environment.
3. The extensive use of triclosan in consumer products may contribute to antibiotic-resistant bacteria.

Paraben

- a) Parabens are a class of chemicals widely used as preservatives by cosmetic and pharmaceutical industries. These compounds, and their salts, are used primarily for their bactericidal and fungicidal properties.
- b) They can be found in shampoos, commercial moisturizers, shaving gels, personal lubricants, topical/parenteral pharmaceuticals, spray tanning solution, makeup,^[1] and toothpaste. They are also used as food additives.

Reason for Concern:

1. Parabens easily penetrate the skin and are suspected of interfering with hormone function (endocrine disruption). Parabens can mimic estrogen, the primary female sex hormone.
2. In one study, parabens were detected in human breast cancer tissues, raising questions about a possible association between parabens in cosmetics and cancer.
3. Parabens may also interfere with male reproductive functions.
4. In addition, studies indicate that methylparaben applied on the skin reacts with UVB leading to increased skin aging and DNA damage.

CONCLUSION

Outstanding consumer products can be about making our life a little better, as Dieter Rams says. But at their most ambitious, they can solve the more fundamental problem of introducing us to brand-new technologies or ways of interacting with the world. We interact with brands almost every moment of our day. From the moment

we wake up, we're being bombarded with logos, advertisements, and products, all designed to make our lives easier but also to make us feel a connection to companies. As such today it is nearly impossible to imagine our lives without these, however being aware of the same will help us in countering their harmful effects to a great extent.

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Consumer Attitude towards Green Marketing

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ABSTRACT

Green marketing has emerged as an important concept as it facilitates sustainable development. In this paper, focus has been on consumer attitudes towards green marketing. The ABC model of attitude was used to understand the components of attitude. The objectives of this paper are to understand the consumers' level of awareness of green products, consumers' perception about green products, the parameters consumers' consider for buying green products and whether green marketing really affect their decision to buy products.

The study has been based on primary data collected through a structured questionnaire. The data were then subjected to descriptive analysis and factor analysis.

The study revealed that consumers are well aware about the need for green marketing in India. They agree that green products are a real ecological need that will ensure a sustainable future. However, consumers have expressed dissatisfaction regarding the packaging of green products.

Hence, with the threat of global warming looming large, green marketing is the required norm. To ensure sustainable future, there is a need for a shift in consumers' attitudes towards more environmental friendly lifestyles.

SUSTAINABILITY OF MICROFINANCE INSTITUTIONS IN INDIA

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ABSTRACT

Microfinance is an effective tool for poverty alleviation. The sustainability of microfinance institutions is essential to create desired social impact. In microfinance today the split continues between those in the “poverty” camp and those in the “sustainability” camp. Making financial services available to the poorest people, especially investment loans for micro-business development, is recognized as an important part of poverty reduction strategies. However, in spite of its successes, microfinance has barely scratched the surface of need. This paper highlights the latest technological innovations and existing delivery models of Microfinance Institutions in India. This paper also provides suggestions for building sustainable Microfinance Institutions in India. It has been observed that an increasing outreach has been the catch-cry for at least the last five years, the present delivery models are not quite meeting the challenge, especially when it comes to serving communities in remote locations characterized by low population density. Technological innovation is the great hope, although it brings with it fundamental changes to the microfinance delivery mechanisms that have become almost sacred for the microfinance sector.

Key Words: Microfinance Institutions, Delivery Models, Technological Innovations

INTRODUCTION

India is perhaps the largest emerging market for microfinance. Over the past decade, the microfinance sector has been growing in India at a fairly steady pace. This sector in India is characterized by a wide diversity of methodologies and legal forms. However, very few Indian MFIs have achieved sustainability yet. Sustainability itself has to be seen in a broader sense than just financial sustainability. The sustainability of demand, of the MFI's mission, of its ownership and governance structure and the legal and regulatory framework under which it works, are all contributory to overall sustainability of an MFI. Further, the sustainability of an MFI by itself may not be enough unless a full-fledged micro-finance sector (MFS) is established on sustainable lines. Microfinance is the provision of relevant and affordable financial services to poor households. The “micro” prefix refers to the size of the financial transactions; it does not imply that the microfinance providers (MFPs) themselves are small. Microfinance is primarily concerned with credit and savings although, in recent times, allied services such as insurance, leasing, payment transfers and remittances are being introduced to the mix. In the early days, the forerunner known as “micro credit” was focused on providing working capital to people who generate income for themselves in very small business activities. While this important emphasis remains, the sector has broadened its definition to the delivery of financial services to poor households so that they can manage their financial resources more effectively. Hence the more recent but broader descriptor is “micro finance”. Providing microfinance to poor clients requires innovative operating methods to manage risk and reduce transaction costs. Poor households do not usually have physical assets to offer as collateral for loans, so MFPs have developed substitutes. The most common form of substitute collateral has been the formation of groups of borrowers and the establishment of joint-liability procedures, where loan group members effectively guarantee one another's loans. To reduce transaction costs, MFPs primarily deal with these loan groups rather

than with individual clients and they outsource certain administrative tasks to the group.

AIMS AND OBJECTIVES

This paper highlights the latest technological innovations and existing delivery models of micro finance institutions in India and provides suggestions for building sustainable microfinance institutions in India.

METHODOLOGY

This is entirely a conceptual paper clearly based on secondary data collected from different journals and websites.

RESULTS & DISCUSSION

Legal and Regulatory Framework to Promote Sustainability of MFIs

Regulation helps in long term sustainability, even though MFIs may rub under it in the initial years. The need for regulation and supervision of MFIs arises from several considerations like protecting the interests of the small savers, ensuring proper terms of credit, instilling financial discipline and having a proper reporting and supervision system. Regulation and supervision ensure that MFIs are run prudently and cases of poor people losing their money due to fraud or incompetence, are minimised. At present, most Indian MFIs are NGOs, and thus not treated as part of the mainstream financial sector. The question of their supervision and regulation from the financial angle has recently arisen. Reservations have been expressed about the legality of NGO-MFIs providing financial services, particularly savings and insurance. However, there has been a general acceptance of the social intermediation role of such institutions for the delivery of financial services to the poor. Various actions and announcements of the Government and the RBI are indicative of the acceptance and recognition of the role of NGO-MFIs as part of the micro-finance sector. NGOs do not have the appropriate financial structure for carrying out micro-finance activities. Because NGOs are registered as societies or trusts, they do not have any equity capital. Thus, they can never be “capital adequate”. The recent Microfinance Task Force set up by the RBI Governor has suggested that NGO-MFIs may carry on financial intermediation activities till a business volume (deposits plus loans) of Rs 5 million. Beyond that scale, there is a need to shift the activity to an MFI registered either as a co-operative or as a company. The latter are required to have a minimum capital of Rs 20 million at start-up. Apart from having a start up capital requirement beyond the reach of most MFI promoters, regulations related to interest rates come in the way of establishing sustainable MFIs. The RBI and in turn, apex financial institutions have been imposing restrictions on the interest rates that MFIs can charge to the poor. The spread is inadequate to cover operating expenses and loan losses. The interest rates should be deregulated so as to enable MFIs to meet their costs and earn a reasonable margin for it to sustain in the long run. There is also restriction on the usage, volume of credit and channel of lending.

Technological Innovations

There are two current imperatives within the microfinance sector – *increasing outreach* and *improving sustainability*. There is, however, a creative tension between these two imperatives. On the one hand, if increasing outreach is taken to mean more clients from a similar demographic, then outreach and sustainability are effectively synonymous terms. Increasing client outreach provides economies of scale that in turn makes the MFP more efficient and therefore more sustainable, at least in immediate financial terms. It is a case of more of the same, while continually seeking incremental improvements in operational efficiency. On the other hand, if increasing outreach is taken to mean “targeting hard-to-reach clients” such as people living in remote areas, then outreach and sustainability are effectively competing terms. Reaching clients in remote areas is relatively expensive, which makes the MFP less efficient and therefore less sustainable. This is the real outreach challenge for MFPs because it requires new, as yet unproven business models and processes, including technological innovation.

Back-Office Management Information Systems

Many microfinance practitioners see ICT innovation as a key strategy to take microfinance to the next level in terms of outreach and sustainability. The most fundamental ICT application is the back-office MIS. A suitably sophisticated MIS is prerequisite for the MFP to monitor the quality, sustainability and efficiency of its loan portfolio, to monitor development impact, and to manage general administrative tasks. It is not possible for an MFP to upscale significantly without an MIS that can grow with the institution. The larger MFPs have sophisticated back-office systems based on the same functionality provided by mainstream banking software. Indeed, some MFPs use off-the-shelf packages that might be found in any commercial bank. There are, however, a number of difficulties that arise when using these packages. Microfinance differs from traditional banking in a number of fundamental ways, with respect to products offered, clients served, the environment in which it operates, and the non-financial information that needs to be recorded and tracked. Many off-the-shelf software packages lack the functionality or flexibility to deal with these realities and requirements. This raises the need to either modify off-the-shelf software or develop in-house software, which assumes that the MFP has the internal capacity to develop and maintain software or the financial resources to outsource this work. More needs to be done to make standard and affordable MIS software accessible to smaller but expanding MFPs. In the “Microfinance and ICT Innovation” discussion, these MISs are not considered the most exciting innovation – indeed, they are hardly even referred to as innovative. They are, nevertheless, the most critical and fundamental aspect of an MFP’s hi-tech infrastructure. Further ICT innovation, of the type discussed below, is not possible without a sophisticated and appropriate back-office MIS. With this understanding, it is now possible to explore opportunities to apply ICTs closer to the client interface, to create significant new efficiencies and allow MFPs to serve the hard-to-reach clients in more remote areas.

Mobile Computing

While the back-office MIS enables the MFP to monitor its loan portfolio, this functionality is undermined if the data analysed by the MIS is not up-to-date or contains errors. With dispersed branch offices, paper-based transaction records and manual data entry, there can be a data delay of days and even weeks, and the possibility of introducing errors during the data entry process is high. A recent innovation that serves to overcome these issues is mobile computing systems – palmtop computers that loan officers take to the field so that financial transactions can be recorded directly into the MIS, without the need for intermediary data entry at the branch office. The data entered in the palmtop computers is typically uploaded to the MIS at the end of the day, either directly in the branch office or via a remote communications link. Furthermore, the roll-out of wireless broadband infrastructure will enable these systems to be “always online”, resulting in true real time data collection and monitoring of the loan portfolio at branch and institutional levels. These mobile computing solutions also have significant implications with respect to data accuracy and integrity. Electronic data entry at field level, with on-the-spot, system-generated receipts for clients, significantly reduces data entry errors. Data accuracy is a fundamental requirement for any bank. An MFP will quickly lose credibility with its clients if errors are introduced during data entry, and “client confidence” is of paramount importance to any bank.

The Branch Office Franchise Model

Serving new clients from remote locales is a key outreach challenge for MFPs. These locales include rural areas where the population density is low, the market is smaller and service provision is more expensive. MFPs find it difficult to serve these areas, especially when the overwhelming pressure is to reduce transaction costs and increase profit margins. One approach to meet this challenge is the branch office franchise model, where an MFP links with third-party merchants in remote areas. This is an extension of the mobile computing solution discussed above. These branch office franchisees manage transactions on behalf of the bank, and they receive an agreed payment for service on a per-transaction basis. Fees might be shared by the client and MFP, on the basis that the transaction costs would otherwise be significantly higher for both parties if the service were delivered by more traditional models. Transaction data is transferred electronically to the bank either in real-time or, for example, at end-of day.

The key qualities of franchisees are that they are long-term businesses, respected and trusted in their communities,

with computer skills and connectivity. A recent player in this mix, notably in India, are the rural telecentre networks that are particularly suited to serving as retail outlets for a distributed microfinance network, because of their innovation-business orientation and their familiarity with IT systems and telecommunications services. Given that these (non-regulated) branch office franchises collect deposits as well as loan repayments, the model requires some consideration by financial sector regulators.

Card Services and ATMs

There are many similarities between consumer credit cards and micro credit services. Like microfinance methodologies, credit cards were introduced to reduce the high costs associated with small transaction lending. Common characteristics include unsecured credit for unspecified purposes, small transactions, and predefined credit limits. Other salient features of credit cards, which many microfinance clients would like their providers to duplicate, include on-demand borrowing, a re-draw facility, and repayment flexibility within predefined guidelines. We know that microfinance clients desire these features because they continue to utilize local moneylenders for these very services where they are not provided by their MFP. Given the similarities between consumer credit cards and micro credit services, the concept of a micro credit card arises as a logical innovation. The introduction of card-based services also requires the roll-out of either EFTPOS - Electronic Fund Transfer at Point of Sale EFTPOS functionality with third-party merchants. The former is probably the better solution for microfinance, because it facilitates immediate receipt for repayments and savings, which reduces the possibility of intermediary error or fraud. With ATM solutions, deposited repayments and savings are processed “back at the office” and receipted later, a process that is unlikely to secure the confidence of clients. In either solution, withdrawal of credit or savings is equally straightforward. The delivery of card-based microfinance offers even more opportunities. MFPs can implement microfinance-tuned credit-scoring algorithms, allowing clients who have proven their creditworthiness over time through successful repeat business to have their borrowing limit automatically increased, be given access to additional products and services, and be granted greater borrowing and repayment flexibility. MFPs can also consider smart card technology as part of their micro credit card solution. Smart cards have an embedded computer chip that can store client and transaction data, as well as process information. Smart cards function as electronic passbooks, thereby reducing reliance on printed receipts. Because all relevant client data is stored on the card, MFPs can utilize EFTPOS systems and ATMs that do not need to be always online. This is a significant advantage in areas where telecommunications are unreliable and/or expensive. Finally, smart cards can be used in conjunction with biometric technologies (such as fingerprint scanners) to enhance the process of client identification, thereby enhancing privacy and data security. These days, MFPs rarely hold to the claim that their lending is purely for micro-enterprise development. Some smart cards have a memory chip only; others have memory and a microprocessor.

Internet Banking

Internet banking provides clients with real-time information about their accounts, and the ability to transfer funds between their accounts. It is an empowering tool because it gives bank clients the flexibility to manage their financial resources deliberately, at their own leisure, and without having to visit a bank office during opening hours. In particular, it is a vital accompaniment to card-based services, allowing clients to keep track of numerous small electronic transactions. From the bank perspective, Internet banking is an efficiency tool because it reduces the work of (human) tellers and therefore reduces labour costs. It is a relatively easy and inexpensive service to offer, and the incremental cost of having 1.000, 10.000, or 100.000 Internet banking clients is negligible. The main constraint to MFPs implementing Internet banking is their clients' minimal access to the Internet. In some areas, this will be overcome somewhat with the roll-out of rural telecentre networks. It is also possible for MFPs to develop modified ATMs that provide this functionality.

Delivery Models of Microfinance Institutions

Direct Service Model

A first model is direct service delivery to the poor. This is practiced by quite a few micro finance institutions as they are generally the only financial institutions working at the doorsteps of the poor, especially in rural settings.

Quite common among these MFI's is the provision of life and loan insurance.

The reasons for microfinance institutions to become involved are not difficult to understand: have a unique distribution system in place already and they witness the growth of demand on a daily basis. Clients may ask for insurance and they do so frequently. So the temptation for involvement is there, but so are the risks.

Some MFI's developed the practice of reinsuring their risk exposure through their loan-portfolio. Whereas the exposure of this portfolio is normally limited to non-repayment of loans, in these cases it is added to the risk of having to compensate for insurance losses. This may negatively affect financial prudence of the institution and may run it into trouble with supervisors in regulated settings.

Agent role for MFI's

A second model is the agent role of the MFI. This looks like a win-win situation up front as it combines the distribution potential of the MFI with the institutional capacity of an established insurance firm. The MFI essentially acts as an agent for the firm and is a go-between for both clients and the firm.

A first main advantage of this approach is that the MFI itself will not place any risk on its own portfolio: it is just the agent, not the actual service-provider, similar to many MFI's working these days as agents for money transfer companies. A second advantage is the leverage potential on the part of the insurance firm. It can take higher risks as it may be able to reinsurance part of its exposure, something the MFI would not easily be able to do by itself. This may enhance growth opportunities considerably.

A possible disadvantage could be that existing insurance products are too mechanically down-streamed to the poor, without proper specialized product development based on their needs and capacities. The firm may be inclined to sell more of what is already in place, rather than develop new products which may drive up costs. In such a set-up it would be the task of the MFI to take care that insurance becomes genuine micro-insurance. If it fails to do so, it runs the risk of losing credibility.

Affiliated co-operatives

A somewhat hybrid model of co-operatives is the system where not individual clients act as members but where for instance a farmer co-operative or an NGO, or a chain of those, set up their own insurance co-op. They become the owners of the new insurance company, which is expected to service the members of the affiliated organisations.

This model has been in place for a long time and is quite popular in many developing countries. An educated guess has it that these affiliate insurance co-operatives to date have carried the bulk of the task of providing insurance products to lower-income groups. Rather than outsourcing its members' insurance needs to a commercial firm, the NGOs and co-ops establish their own organisation. Potential advantages are obvious: the new firm is statutorily obliged to service organised low-income clients, it can avail of the distribution networks of its affiliates, and profits remain in the system and do not leak away to an external third party.

Suggestions for Building Sustainable MFIs in India

In this section, we look at specific, detailed recommendations for establishing an enabling environment to promote sustainable MFIs in India. International readers may only want to look at the headings since the detail is specific to Indian laws.

Need to Enact or Amend Laws and Regulations

Amend the RBI Act, 1934 to add a Chapter on MFIs

A Task Force on Micro-Finance Policy was set up by the Governor of RBI under the Chairmanship of the Managing Director of NABARD, with members drawn from leading MFIs and banks. BASIX made the following suggestions to the Task Force. A new Chapter IID was suggested in the RBI Act, 1934. The highlights of the chapter are as follows:



1. The term micro-finance and MFI has been defined as provision of thrift, credit and other financial services and products of very small amounts to the poor in rural, semiurban or urban areas for enabling them to raise their income levels and improve living standards".
2. Regulation of micro-finance activity, particularly deposit taking has been recommended
3. Building Sustainable MFIs in India in a graded manner. The regulation could be light at the initial and small scale, rising to full regulation once business volume rises to Rs 20 million.
4. As micro-finance activity is largely promoted by NGOs, this activity can be carried out at small scale, by NGOs and people's organisations, registered as Societies or Trusts.
5. After reaching certain business volume (say Rs 5 million), it becomes necessary to shift the micro-finance activity of a Society or a Trust to a Co-operative or a Company.
6. With the likely large number of MFIs in the sector, self-regulation and supervision may be desirable. As self-regulation is a new concept, an intermediate stage of RBI recognized self-regulation has been proposed. RBI may carry out supervision through recognised self-regulatory organisations.
7. MFIs whose business volume exceeds a substantial level (Rs 20 million), should be regulated as per the normal regulatory framework, except for entry level capital, which should be smaller and capital adequacy, which should be higher. Such MFIs should be supervised by the normal supervision agencies.

Establishing a new form of NBFC – the Micro Finance Company

When an NGO or a microfinance entrepreneur starts a microfinance activity, it faces the problem of how to incorporate it. At a small scale, the work can be done as an unincorporated body, although it cannot take deposits. But as the size grows, an MFI has the choice to be either a cooperative or be incorporated as a company under the Companies Act and then become an NBFC or a Bank.

Permitting MFIs to take deposits from members/borrowers

NGO-MFIs are registered as Societies or Trusts, registered under the Societies Registration Act, 1860 or the Indian Trust Acts, 1882. The savers and borrowers of such NGO-MFIs are legally not members of the NGO-MFIs, as membership in case of societies comprises the promoters of

the societies who themselves cannot avail of any benefit from the societies. In case of Trusts, there are only Trustees and no concept of membership. Consequently, the members of such NGO-MFIs can be classified at best as clients or beneficiaries of the various interventions of the societies. Hence, savings mobilised by NGOs are virtually collected from the members of the public. Many of the NGO-MFIs who are involved in microfinance are mobilising savings from their clients or borrowers with the objective of inculcating a savings habit among the poor and for enabling the use of such resources for acquisition of assets or linkage with banks. Till these NGOs convert to other legal forms such as co-operative, NBFC, or bank, they may have to be allowed to mobilise savings only from their poor clientele.

Changes in the Income Tax Act

NGOs are registered as charitable entities under section 12A of the Income Tax Act. This allows them to accept grants and carry forward a surplus of income (including grants) over expenditure without the surplus being taxed. This provision is crucial to the financial survival of an NGO. NGOs can carry on business activities incidental to its main objects, which have to be charitable, as defined in section 2(15) of the Act. If an NGO earns a substantial part of its total income from lending activity, an Assessing Officer (AO) can take the view that it is the main activity and is not charitable, since lending to anyone, including the poor, is not defined as charitable. This is more likely to happen when the AO takes the view that lending at sustainable interest rates is not charitable. Thus an NGO can lose its charitable status under section 12A, which would then disable an NGO from receiving grants and carry forward its surplus without being taxed.

Tax benefits need to be extended to the microfinance sector

1. To enable MFIs to avail of tax benefits, a new Section 10 (23-H) may be introduced in the IT Act to exempt any income from dividends or capital gains from investments in the equity shares of MFIs, on the lines of the infrastructure companies.
2. To encourage MFIs to adopt prudential norms in regard to provisioning for bad and doubtful debts the benefit of tax deduction available to banks may be extended to MFIs
3. Section 36(1)(viii) of the IT Act may be amended to include micro-finance to the list of admissible purposes for tax exemption to the extent of 40 percent of total income, if placed in special reserve, as in the case of long-term finance for housing, industrial or agriculture development.

Making available more lending funds to MFIs

1. To facilitate bank credit to MFIs, the RBI should treat bulk lending to MFIs by commercial banks, particularly new private banks that do not have a rural low-income area branch network, as priority sector lending.
2. SIDBI, NABARD should consider extending refinance facilities or lines of credit to MFIs, which are incorporated as NBFCs or MACS. The interest rates can be nearly commercial – from 13.5 to 15 percent.

Simplify foreign investment regulations to enable MFIs to raise foreign equity

Once an MFI is registered under the Companies Act, for it to undertake micro-credit activities, it needs to be further registered as either a NBFC under the RBI Act, 1934 or licensed as a local area bank (LAB) under the Banking Regulation Act, 1949. The RBI requires that a new NBFC must have a minimum startup capital of Rs 20 million, while a new LAB must have a minimum start up capital of Rs 50 million. As most MFIs are not in a position to raise this level of start-up equity because the people's equity can be only Rupees one or two million, it becomes essential to raise the balance equity from development finance institutions.

Start up equity capital is difficult for most promoters of MFIs because most of them come from a developmental background. Yet, it is prudent to have reasonably high startup capital requirements to ensure that MFIs are established as serious institutions.

CONCLUSION

Micro-finance is one of the ways of building the capacities of the poor and graduating them to sustainable self-employment activities by providing them financial services like credit, savings and insurance. To provide micro-finance and other support services, MFIs should be able to sustain themselves for a long period. A three track approach should be adopted to promote the microfinance sector

1. by incentivizing existing mainstream financial service providers,
2. by encouraging new microfinance institutions with a supportive policy and financial resources to enlarge and expand their services,
3. and finally by building from the grassroots up, a network of community-based development financial institutions (CDFIs).

The paper asserts that India is the largest emerging market for microfinance. However, the demand needs to be organised and converted into effective demand. The need for credit by the poor should be backed by willingness to pay the price for the financial services. Only then demand is sustainable. MFIs should offer sustainable financial services and reach a stage of high access and high sustainability, which is the desired level. There is emerging price competition from mainstream banks as they are able to cross-subsidize their micro-credit operations and charge interest rates below cost.

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Corporate Sustainability: A Case Study on Toyota Motor Corporation

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ABSTRACT

Corporate sustainability is an evolution which describes ethical corporate practices that meet the needs of the people today by not sacrificing the ability of future generations to meet their needs. Global environmental concerns increased the number of environmental activists. In developed countries, environmental protection agencies are coming up with various rules and regulations relating to several environmental issues. Corporations can no longer operate if they become isolated from the social and environmental matters. Therefore, many companies are adopting Triple-Bottom-Line (TBL) accounting to pay and assess the present and future needs accruing to the stakeholders and society at large through sustainable excellence. The paper highlights contribution of Toyota towards maintaining a sustainable society through manufacture and provision of quality products and services.

Key Words: Corporate Sustainability, Corporate Social Responsibility, Environmental Degradation, Social Degradation, Triple Bottom Line Reporting.

INTRODUCTION

Corporations are the fundamental cells of modern economic life and their great success in transforming the earth's resources into wealth has shaped the physical and social world in which we live. The main question that need to be asked that whether the current model of the corporation needs to be modified to contribute for the survival of human beings, for the development of the society at large through creation of work that brings dignity and self-fulfillment to those undertaking it. For long, the corporate houses for their expansion has destroyed forests, polluted rivers, extracted mineral resources and destructed ecosystems as a whole for their own profit making objective without looking at the fate of future generations. Since the last decade, it has been witnessed that the corporate houses are trying to be more conscious about environment and are discharging responsibilities towards it.

In the emerging global economy, the internet, the news media and the information revolution throw light on business practices around the world. The companies are not only going abroad but also serving the overseas customers. Companies are judged on the basis of their environmental stewardship. Consumers want to know more about a company. Therefore, the concept like corporate sustainability emerged which takes into account corporate obligations of not just the investors but of the communities and environment as well. The multinational companies are publishing their annual reports along with the corporate sustainability report through online source.

Corporate social responsibility and corporate sustainability are often used interchangeably but it is necessary to think about corporate social responsibility in terms of vision and mission of the business. Corporate social responsibility consists of those activities which creates a positive impact on society at large whereas corporate sustainability is a business approach that creates long term consumer and employee values by taking into consideration operational dimensions of the business i.e. social, cultural and economic environment.

AIMS AND OBJECTIVES

The objective of the study is to measure the overall performance of Toyota Motor Corporation by using three parameters of Triple Bottom Line Reporting i.e. social, economic and environment.

METHODOLOGY

Sample Selection: Toyota Motor Corporation has been selected for performance evaluation based on their corporate sustainability report.

- a) **Nature of Variables:** Performance is evaluated based on three parameters of Triple Bottom Line Reporting i.e. social, economic and environment.
- b) **Collection of data:** The relevant data has been collected from corporate sustainability report of Toyota Motor Corporation 2011-12.

RESULTS AND DISCUSSION

Application of Triple Bottom Line Accounting

Earlier the organizations are confined themselves in voluntary reporting of some selected environmental and employee matters which usually appeared in the conventional annual report of the companies. A severe change occurred in 1990s in Europe, UK, Canada and USA when the large corporations are concentrating on separate voluntary reports on environmental, social, health and safety matters which means sustainable development focuses on incorporating a forward thinking approach by the corporations to gather ideas on how to make use of natural resources without exploiting it. The company whose mission is true sustainability need to have a better understanding of what “sustainability” defines. Long term sustainable success can only be achieved if one can move away from individualism. One of the approaches to measure the sustainability is Triple Bottom Line accounting (Elkington, 1997)

Triple Bottom Line reporting captures an expanded spectrum of values to measure the success of an organization in terms of economy, environment and society. It focuses on value addition for three types of shareholders in a company- shareholders investing in a company for profit motive and economic prosperity, shareholders investing in a company that works for the benefit of the environment and the shareholders investing in a company discharging strong social responsibility. Therefore TBL incorporates 3pillars mainly 3Ps-Profit, Planet and People.

In a TBL reporting, Economic sustainability encompasses economic profitability, employment generation, competitiveness and market creation. Environmental sustainability focuses on efficient use of natural resources, environmental management and protection whereas Social sustainability pertains to fair and beneficial business practices towards the community and the region in which a corporation conducts its business.

Toyota Motor Corporation: An automobile giant

A Japan based company operates mainly through automobile and finance segments. The automobile segment is engaged in the design, manufacture and sale of car products. The finance segment is engaged in the provision of financial services related to the sale of the company's products. The history of Toyota dated back to 1937 when Toyota Motor Co. Ltd was established. In the year 1947, it launched its first small passenger car, SA model. During 40s the company extended its operations by adding different models in its product line-up. In 1957, the company established Toyota Motor Sales, U.S.A., Inc. and Toyota do Brasil S.A. in 1958. The company exported its first passenger car ‘Crown’ in the United States in the year 1957. In 1962, it produced 1 million vehicle domestically and in the same year the company entered Thailand by establishing Toyota Motor Thailand Co. Ltd. The cumulative exports of Toyota reached 1 million units in 1969 which again increased to 5 million units in 1975 and to 10 million units in 1979. In 1982 Toyota Motor Corporation was established with the combination of Toyota Motor Co. Ltd. and Toyota Motor Sales Co. Ltd. In 1988, the annual domestic sales of Toyota reached to 2 million units. Toyota is strengthening their presence in USA with the establishment of

Lexus dealerships. In 1999, the annual overseas sales of Toyota exceeded 3 million units. In the same year it got listed on the New York and London Stock Exchanges. Since 2000s, Toyota expanded its operations in markets of Asia, North America and Europe. The company announced its first hybrid car under the brand name 'Prius' in 1997 whose world wide sale achieved 1 million mark in 2008.

Toyota Motor Corporation group companies are manufacturing cars under Toyota, Lexus, Daihatsu and Hino Motors. Daihatsu Motors produces small vehicles and Hino Motors produces trucks and buses. Toyota Motor Corporation is a part of Toyota group which is the largest conglomerates in the world. In 2011, Toyota ranked tenth among the top 500 most admired companies by Fortune Global 500 with revenue of US\$235.3 billion. Productions were disrupted in 2011 due to earthquake and tsunami in Japan followed by floods in Thailand which prevents the suppliers of the company to make up for the earlier output losses of Toyota. Toyota forecasted a brighter 2012 with a jump of 20% in global sales to a record 8.48 million vehicle. As of March 2012, Toyota generated net revenue of US\$18692 millions.

Table 1: TBL Reporting of Toyota in a Snapshot

TBL Approach	Indicators	Position of Toyota
Economic Performance	Business generated	Automotive manufacturers with interest in designing and manufacturing luxury cars, sports vehicles, trucks, minivans and buses with combustion or hybrid engines. Toyota also makes automotive parts for its own use and also for sale.
	Net revenues	Unit sales increases by 44000 but the net revenues decreases by 2.2% to 18583.6 billion yen (2011-12)
	Operating income	355.6 billion yen (2011-12)
	Net Income	283.5 billion yen (2011-12)
	Shareholder's equity	10550.2 billion yen (2011-12)
	Dividend per share	50 yen (2011-12)
	Research and Development expenses	779.8 billion yen (2011-12)
	Vehicle Production	7435 thousand units(2011-12)
	Vehicle Sales	7352 thousand units (2011-12)
	Material use	Iron, copper, aluminum, platinum, vanadium, nickel, lithium, rare earth and water.
Environmental Performance	Environmental Action Plan System	Toyota Earth Charter (formulated in 1992, revised in 2000) was based on the guiding principles and policies (formulated in 1992, revised in 1997) encompass environmental issues. In March 2011, Toyota announced Toyota Global Vision which focuses on reduction of CO2 emissions, recycling of waste, human resource development and various afforestation activities.
	Fuel efficiency standards	Six out of eight vehicles have cleared Financial Year 2010 Fuel efficiency standards. 98% of Toyota's

TBL Approach	Indicators	Position of Toyota
	Reduction of Carbon-dioxide emission in production area	Reduction of Carbon-dioxide emission in logistics area
	Reduction of Carbon-dioxide emissions of 4.6% per unit (2011) produced in production area by consolidating and optimizing production lines.	Reduction of Carbon-dioxide emissions volume to 286,000 tons (2011)
	Volatile Organic Compound (VOC) Reduction	Toyota recapture a larger percentage of solvent and use deionized water for washing as a result total VOC emissions from body paint lines averaged 21g/m ² (2011).
	Resource Recycling	Resources are to be used effectively to reduce the waste and the industry's impact on global environment.
	Reduction of the volume of discarded materials in production area	Reduction of the volume of waste to 44000 tons in 2011) which is 10.8% less than 2010.
	Reduction of the volume of discarded materials in logistics area	Reduce usage of packaging and wrapping materials to 57,600 tons (2011).
	Reduction of water consumption	1.6% reduction of water consumption in 2011 over 2010.
	Recycled Sound Proofing Products	The recycling process of Toyota sort out urethane foam and fiber materials that offers a better mix of sound absorbing and sound isolating features and has been used in 21.9 million vehicles up to 2011.
	“Battery-to Battery” business	Nickel included in used hybrid batteries is recycled as material for new batteries.
Social Performance	Job creation	Total numbers of Global Production Centre trainees from various regions are 33508 and percentage of non white employees is 91.4.
	Stable Employment and Labor Management Relationship	The Toyota Way 2001 aims to create a healthy corporate culture through equal employment opportunities, ensuring employees health and safety, diversity and inclusion, greater human resource development and fostering pride and loyalty of the employees towards work place, colleagues and the company through mutual trust, understanding and better communication.
	Fostering Mental Health Care Programmes	Many active listening courses are being conducted for managers and young employees for enhancing their ability to notice the signs of poor mental health.



TBL Approach	Indicators	Position of Toyota
	Reinforcing the Health Management Programmes for Locally Stationed Staffs and Overseas Personnel	Committed to conduct routinely health check ups, making rounds at local sites on medical conditions, providing medical information through Internet and Tele-Conferences.
	Developing Human Resources with Strong Language abilities, Local View and Local Sense of Regions around the world	84 trainees are working in 37 affiliates in 20 countries (as of January, 2012)
	Promoting Self-reliance for overseas affiliates	450 transferees from 48 affiliates in 27 countries are working in Japan
	Measures for female workers to balance work with childcare leave	Total childcare leave is 399 (2011-12)
	Employment of people with disabilities	The number of people with disabilities employed was 1015 (2011-12)

Source: Source: "Corporate Sustainability Report", Toyota Motor Corporation, 2011-12¹³.

TBL, a true measure for sustainability: Controversy Builds

Resistance comes with adoption of new procedures or regulations. Some companies think that nothing will change whereas other companies are more concerned with nothing will remain the same. Triple Bottom Line Reporting is being criticized in many ways. For any business, profit can be explained in monetary terms but how to measure social and environmental responsibilities. There is no common standard method for calculating the parameters of TBL. So basically TBL reporting is qualitative in nature and finding a common unit of measurement would be a challenge for the companies. Not only that, any concerns for social and environmental matters are very much rare in poor societies. People will never go for sustained recession in order to regain the lost ecosystem. A compassionate society can form only when people are rich and are contributing tremendously towards making environment clean and protecting the wild life.

Other arguments following are the cost, additional risks, time involved and different expectations of the society at large. To make TBL effective the entire corporate environment has to be rebuilt, the employees have to be made well prepared with new procedures and the whole operations of the company should be readjusted

Social and environmental expenses meeting the degradation loss: A Myth

Transportation is the largest source of air-pollution. Many unburnt gases like Hydrocarbons (HC), Carbon Monoxide (CO), Oxides of Nitrogen (NOx) are causing pollution resulting degradation of human health, damaging natural resources and destruction of wildlife. Among the entire TBL factors environment is mostly affected. Automobiles are responsible for environmental degradation in the following ways:

Automobile sector causes major degradation to the global environment and Toyota is not an exception to it. Apart from Prius, all others cars, might be complying the environmental needs as per respective Motor Vehicles Act, but are not environment friendly. The following are the major degradation caused by the automobile sector globally.

Environmental Degradation

1. The exhaust from the cars contains various greenhouse gases such as carbon monoxide and nitrous oxide. These gases have an ability to block the sun-rays reflected from the surface of the earth which causes variances in temperature resulting in global warming.
2. Smokes from the exhaust combine with rain and causes acid rain.



3. Oil released from cars due to leakages mixes with storm water and pollutes the natural resources of water.
4. Vehicles are causing noise pollution which ultimately leads to a disturbance in the ecological cycle causing many diseases such as high blood pressure and mental stress.

Social Degradation

1. Toyota is mainly focused on developed economy. Customers of developing economy may not afford to buy luxury range of cars of Toyota.
2. Toyota "Prius" has become a symbol of environmental concern portraying that the owner is aware of the humanity's need towards the environment but the car is priced INR 35, 00,000 which is beyond the capacity of middle income group people. Hence Prius is not "People's Car".
3. Social repairing is focused mainly on developed economy mostly Japan. However, their market is global. Hence the company is lacking in discharging the social responsibility in the developing economy.

CONCLUSION

TBL is an environment degradation management technique. Hence it is a parameter for measuring environmental degradation but not a controlling device. Companies on one hand are causing environmental degradation and then showing their responsibility through TBL reporting. But whether it is a perfect device for measurement of the degradation is still a matter to be proved. Specific standards have not been set in response to the environmental reporting but the standard setting bodies are trying to come up with certain stringent norms for the purpose of reporting environmental degradation. Hence, introduction of an internationally recognized standard has been the call of the day.

Toyota is selling cars globally whereas discharging social responsibility mainly in Japan. A balance need to be maintained between environmental procurement and environmental degradation globally. Due to increase in population, increase in the number of vehicles and with increasing pollution the need for hybrid cars are tremendous in emerging markets. The challenge for Toyota is to make "Prius" popular in emerging markets for which the price of the vehicle needs to be reduced. Hence, the debate can be raised on the issue whether discharging environmental and social responsibility is the ultimate objective of the organization or being an ethically oriented company reflecting environment and social responsibility in its vision, mission and strategy in true sense would be the ultimate goal.

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The Trade-off between Inclusive Growth and Environment Protection in Indian Economy

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ABSTRACT

Today while India stands as the second fastest growing economy in the world, she is still characterized by the presence of rampant unemployment, poverty and mass destitution. In order to trickle down the benefits of the ongoing growth process to the grass root level, the recent five year plans have been focusing on the agenda of 'inclusive' growth that ensures all sections of the society would be contributing to and benefited of this growth process. In this regards it has been equivocally acknowledged by all that this objective could only be achieved by accomplishing a high growth rate of income followed by providing the general mass with gainful employment. Again, being an associate of the United Nations as well as the UNEP (United Nations Environment Protection), India too has joined hands with the other member nations to enhance the course 'Greening of Economic Growth' that aims in establishing harmony between growth process and the protection of mother nature by striking off a balance between economic, social and environmental needs of the present and future generations (commonly referred as sustainable development).

It is in this context that many conjecture presence of a trade-off between the objectives of inclusive growth and sustainable development as it is often found that the sectors with potential of generating high growth rates of income and employment are environment degrading.

Hence this paper aims to examine whether in reality there exists any considerable trade-off between these two objectives by using the concept of environment Kuznet curve between 1983 and 2009-10. Further, in order to analyze if this phenomenon (if exists) has been stimulated by globalization of the economy that was initiated in early 1990s, suitable modeling and testing of time series data has been conducted to scrutinize whether there has been any significant difference between the pre-reforms period (1980-1993-94) and post-reforms period (1993-94 to 2009-10 in terms of inclusive growth (measured by growth rate of income & employment) and sustainable 'Green' development (considered in terms of CO₂ intensity). Finally, the environmental impact of the construction sector that has improved markedly in terms of both growth rates of income as well as employment in the recent past has been evaluated as a case study to diagnose how economic growth is related with environmental development in case of our economy.

Key words: Inclusive Growth, Environment Protection, Environmental Kuznets Curve

INTRODUCTION

The Issue of Inclusive Growth

In order to ensure achievement of overall economic development, the importance of expansion in employment along with increased growth of income has been acknowledged at various levels. Moreover, it has been proved

time and again that extensive prevalence of productive and quality employment is the only sustainable medium that has the potential to eradicate various socio-economic problems and establish equity and harmony in long run. Consequently, the primary goals of a nation especially if it is either less developed or is developing are in general to fulfill the twin objectives of accelerated growth of income coupled with enhanced employment opportunities. In case of our economy, this target gets further focused as we aspire to achieve ‘inclusive growth’. In this course several attempts have been made to enhance the growth rate of income as this has been considered both necessary as well as sufficient to accelerate the growth rate of employment. It is well known that in a developing economy, employment, especially decent employment is crucial for bringing an overall inclusive development. The rise in the level of employment leads to pro-poor growth thereby leading to poverty reduction. The United Nations has recognized employment to be one of the universal human rights. The approach paper to the Twelfth Five Year Plan (2012-2017) too highlights that inclusive growth is a multi-dimensional concept which can be realized only with presence of adequate employment opportunities. Thus employment is the basic economic firewall that can protect people in a developing or less developed economy from getting trapped into the vicious circle of poverty. In case of the Indian economy, it is often found that a major share of the people entering the labour force is devoid of the basic skill and expertise needed to achieve a gainful employment. Further, the size of the population leads to continuous flow of enormous numbers of unskilled labourers in the labour market that creates an excessive pressure in the labour market widening the gap with full-employment equilibrium. This gap is further enhanced by the demand side constraints mostly in terms of stringent labour laws that regulate the labour market. Primarily, there are three major categories of labour laws that inhibits the employers’ decisions of employment- those relating to payment of reasonable compensation to the workers in case of closing down of the enterprises, those regarding fixation of minimum wages and the others which are concerned with the permanence of the casual and contract workers after a specified period of time (Ghosh, 2004)^[12]. In addition to these, the sole attention of government towards formulation of strategies and policies for enhancing income growth and treating employment only as a corollary to it has also been another key reason behind the lag of employment opportunities from adequate level. Further, the focus on the achievement of ‘inclusive growth’ has gained momentum in the recent years resulting from the empirical data that

Globalization as a Facilitator of Economic Growth, Employment and hence ‘Inclusive Growth’

Globalization is defined as integration of the domestic economy to the world economy that leads to free trade in world market, advancement of means of communications, spread of upgraded technology and interchange of global views, products, ideas, and other aspects of culture. The term has been coined from the word ‘globalize’ which refers to the emergence of an international network of social and economic systems. The discourse on globalization has its root entrenched in the classical trade theories which portray ‘trade as an engine of growth’. The basic seeds of these theories were conceived in the 18th century when the industrial revolution in Europe gave birth to a new mode of production called capitalism which was strictly dependent on accumulation of capital through progressive transformation of a part of surplus value into productive capital. Since, the key requirement of capital accumulation is the increasing scale of production and formation of surplus values, expansion of the market becomes a prime requisite for sustaining the overall process of capitalism. Hence the expansion of capitalism has initiated the search for markets even outside the confinements of domestic territory that has resulted in engulfing the hitherto untouched backward economies across the globe.

The entire issue of trade as an engine of growth revolves around the orthodox classical trade theory developed by Adam Smith (1776)^[27] that assumes that free trade brings economic development via the links between trade and efficiency, efficiency and income, income and investment and finally investment and economic growth. Further, David Ricardo (1817)^[25] advanced the concept of comparative advantage in explaining the static gains from trade due to a more efficient allocation of resources. Both these theories formed their basis on the presence of difference in labour productivity as determining the direction and pattern of trade. As against the classical theories, the neo-classical theories considered capital as a separate and important factor in determining the production and exchange of a nation that engages in free trade. The most eminent amongst these is the

Heckscher-Ohlin theory developed in 1933. This theory forms the difference in relative capital endowment as the basis of international trade. According to this, the country which is relatively abundant in one input would specialize in production and exportation of the good which requires intensive usage of that input leading to optimum usage of the resources in each country thereby leading to static gains accruing from specialization from production and exchange. Further, apart from efficiency gain from proficient usage of resources, various other sources like reduced cost arising from economies of scale and reduction in market distortion in absence of government (which is one of the pre-requisite of free trade) also contributes to static gains. In addition to this, international trade is also capable of delivering dynamic or indirect gains that arises through increase in innovations, improvement of technology, widening of market, increased investment through free flow of foreign capital, acquisition of new knowledge and improved skills. These are expected to contribute immensely to the overall development of both the trading partners.

As against the theories that highlight the benefits of trade on economic development, there are several others that point towards various flaws in the mechanism of globalization itself. For instance, the theories advanced by Ragnar Nurkse, Gunnar Myrdal, Raul Prebisch and Hans Singer in the fifties challenged the optimistic trade theories on various grounds. Nurkse criticized the concept of 'trade as an engine of growth' based on his observation that since the start of the 20th century, the secular decline in the demand for exportable from the developing counties (which are generally primary products) has led to failure of trade generating considerable positive impact on the development process of the developing nations. His conclusions were strongly supported by the Singer-Prebisch theory that confirmed that the developing countries which in general specialize in the labour-intensive primary commodities face deteriorating terms of trade in international market vis-à-vis the manufacturing products supplied by the developed countries. Myrdal's theory prefaced the fact that the assumptions required by the argument for free trade theory to facilitate economic growth were not applicable to developing countries as they lacked access to the upgraded technology and that there were no mechanisms to ensure that all countries could equally share the fruits of technological progress.

While considerable debates continued regarding the link between international trade and economic development of the developing countries, another issue that gained momentum in this regard was the mechanism through which international trade was expected to kindle the growth of employment. The most prominent theory that explained this connection was the Heckscher-Ohlin theory that proposed that a country abundant in labour would specialize in the labour-intensive product and the one with profuse capital would specialize and trade in capital intensive good. Hence, with the evolution of international trade, it was expected that the developing economy would experience expansion in employment opportunities arising from specialization in production of labour-intensive products. This proposition was strongly criticised in 1958 by Leontieff as he observed that US, which is the world's most capital abundant economy by any criterion, is an exporter of labour-intensive goods and importer of capital-intensive goods [28]. This immediately challenged the Heckscher-Ohlin theory and denounced the notion of automatic employment expansion in developing nations through expansion of trade.

Further, it has been often seen that for many developing countries, the primary force that drives them towards outward-oriented policies is that of attracting FDI which is in general considered to be a complement of the scarce domestic financial resources as investment is considered to be a fundamental element for output growth and employment generation [11]. However, the FDI has the flexibility to flow into the economic sectors which are characterized by low wages and poorly protected labour rights. In this context, it has been often observed that the governments of the developing countries themselves dismantle the protective labour laws to attract the flow of FDI, thereby leading to the deterioration of the job quality [7].

It has become evident from the above discussions that the theoretical doctrines involving the issues such as 'connection between income with employment' and 'international trade as a mediator of economic development' have been highly debated in economic literature. Hence, considerations of empirical evidences are necessary to judge the validity of these theories in case of the Indian economy.

Globalization and the Environment



Similar to the topics of impact of the globalization on economic growth and employment, the issue of the impact of globalization on environment is another frequently debated issue in international economics. While several theses [9, 19] promote globalization as a facilitator of environment protection, many others conclude that globalization does have harmful effect on environment, especially on the ‘peripheral countries’ i.e. the developing or less developed ones. One such doctrine is known as the Pollution Havens Theory that claims that due to presence of several rigorous laws regarding environment protection in the ‘centre’ i.e. in the developed nations, the specialization of the commodities or services that create environmental degradation are often passed on to the developing countries. For instance, often the MNC and the TNC that are found to transfer inferior quality technology to the sister concerns in the developing countries or LDCs that are banned in the mother nations owing to their negative impact on the environment. The United Nations has joined hand with its member nations to spread the concept of sustainable development. The most recent development on this has been the Rio+20 summit which has added the concept of ‘Green Economy’ that aims to strike a cordial balance between ecology and economy by replacing the model of ‘Brown Economy’. The slogan declared in the summit has been ‘Future We Want’ that commits to bring in sustainable development and promote an economically, socially and environmentally sustainable future for the world as a whole.

The Indian Experience

Similar to the experiences of many other Asian countries (e.g., China), globalization has indeed turned out to be an important source of income growth for Indian economy. The era of ‘Hindu growth rate’ till the end of seventies was followed by an episode of high but unsustainable growth rate in the eighties, which have been ultimately replaced by a period of steady growth of income. This becomes evident from the several past studies on the subject of several researchers [2, 3, 4, 5, 18, 20, 23, 26]. Of course, there are contrary views to this as presented who observed no statistically significant rise in GDP growth rate in the Indian economy [21].

Turning towards the experience in terms of employment, it can be observed that the Heckscher-Ohlin theory which propagates globalization as a facilitator of employment in a labour abundant economy has not actually worked in case of Indian economy has been observed by several researchers that the employment scenario in India continued to deteriorate in the post-reforms period [3, 6, 12, 16]. However, their observations were first contradicted in the early 2000s when the data 61st round of EUS by the NSSO were released [17, 22, 24, 29, 31]. The high hopes regarding the reversal of the era of jobless growth was shattered once again when the data of the 64th round of survey revealed a catastrophic fall in the level of employment during 2004-05 / 2007-08 as researchers observed a sharp decline in the growth rate of employment (US basis) over 2004-05/2009-10 [8, 17].

Turning towards the issue of environment protection, it can be seen that The Constitution of India directs the state and every citizen to protect and improve the environment and to safeguard the forests and wildlife of the country. Reference to the environment has also been made in the Directive Principles of State Policy as well as the Fundamental Rights. The Department of Environment was established in India in 1980 to ensure a healthy environment for the country which later became the Ministry of Environment and Forests in 1985. Yet the issue of environment in the country has been proven to be a threat several times.

AIMS AND OBJECTIVES

This paper aims to examine whether the reforms mediated growth has been ‘inclusive’ or not. Further, we seek to analyse that whether there has been any negative impact of the reform –mediated growth on environment. Finally, it seeks to investigate there exists any trade-off between the objectives of inclusive growth and environment protection in terms of impact of the economic sectors that are conducive to economic growth. Finally, as a case study, the pattern of relation between the income generation, employment generation and environmental impacts of the construction sector has been re-visited with help of empirical evidences.

METHODOLOGY

This study is exclusively based on secondary data spread over a period of about thirty years (1983 to 2009-10). This total period of study has been segregated into two parts: 1983 to 1993-94 which has been referred to as the pre-reforms period and 1993-94 to 2009-10 to the post-reforms period. Although the new economic reforms

were introduced officially in July 1991, in our study, 1993-94 has been taken as the point of transition of the economy from the pre-reforms period to the age of the reforms. The choice of this year has not been based on any statistical exercise but has been derived primarily from economic point of view. It has been agreed at various levels that in a large heterogeneous country like India, the gestation period of newly implemented strategies should be moderately high. In this connection, it would not be far from reality to view that the effects of the reforms introduced in early 1990s would take a year or two to show up its effects. We must also admit that, apart from this consideration, choice of 1993-94 as the divider between pre- and post-reform periods is guided by the availability of employment data.

The Data Base

The Data Base for Income

To examine issues relating to growth of income, data on NSDP and per capita NSDP (PCNSDP), as released by the Central Statistical Organization (CSO) have been used. However, data of NSDP and PCNSDP have also been collected from the website of Reserve Bank of India. Both NSDP and PCNSDP when observed over a period of time, reveal the real growth in the level of income and hence development of the economies of the states. Analysis of these data facilitates the academicians, policy makers, and administrators in formulating plans for balanced economic development. Estimates of NSDP at current prices reflect the value of income during that concerned year, whereas those measured at the constant prices reflect the growth in real income disregarding the effects of price fluctuations.

Of late, CSO has revised the base year of the NSDP series for 1983 to 1993-94 and introduced a new system of National Statistical Accounting (SNA). This revision involved a number of methodological and conceptual improvements in the data base. Not only the base year has been changed over time but the production boundaries for the sectors like agriculture, real estate and finance have been redefined and redesigned. Changes have also been made in occupational categories considered. Instead of defining these categories as par the Census as done earlier, they have been redefined by using the NSSO occupational data base. This implies that any comparison of income growth based on the two series having different base years would lead to incorrect conclusions. Therefore, before starting the analysis of the data, a comparable income series with a single base year, namely 1993-94, has been constructed by us by following the popularly used 'splicing method'. Thus, we used the NSDP data series for the entire period of 1983 to 2009-10 at 1993-94 base year prices.

The Data Base for Employment

To get a clear view of the changes in workforce and labour force patterns we have considered EUS data from three thick/quinquennial rounds corresponding to the years of 1983 (38th round), 1993-94 (50th round), and 2009-10 (66th round). We have purposefully avoided the data from the thin or annual rounds on the grounds that they are often incomparable to the thick rounds owing to their smaller sample sizes, and are generally conducted with some special issues as the main reference frame for enquiry all of which might not match with those from the quinquennial rounds.

To get a clear view of the changes in workforce and labour force patterns we have considered EUS data from five thick/quinquennial rounds corresponding to the years of 1983 (38th round), 1993-94 (50th round), 1999-00 (55th round), 2004-05 (60th round) and 2009-10 (66th round). We have purposefully avoided the data from the thin or annual rounds on the grounds that they are often incomparable to the thick rounds owing to their smaller sample sizes, and are generally conducted with some special issues as the main reference frame for enquiry all of which might not match with those from the quinquennial rounds.

The Data Base for Carbon Dioxide Intensity (Kg per Kg of Oil of Equivalent Use)

The data for Carbon Dioxide Intensity (Kg per Kg of Oil of Equivalent Use) has been taken from the website of World Bank indicators.

Methodology to analyze income data

As regards the methodology of estimating the growth rate (per annum) of both NSDP and PCNSDP, the most popular method of fitting exponential (log-linear) trend equation has been followed. This implies that any comparison of income growth based on the two series having different base years would lead to incorrect conclusions. Therefore, before starting the analysis of the data, a comparable income series with a single base year, namely 1993-94, has been constructed by us by following the popularly used ‘splicing method’. Thus, we used the NSDP data series for the entire period of 1983 to 2009-10 at 1993-94 base year prices.

Methodology to analyze employment data

The unit level data from the NSSO have been processed by using two statistical software packages - ‘SPSS’ and ‘FoxPro’. While FoxPro has been used to tabulate the unit level data, the entire data analysis part has been carried out with the help of SPSS. However, MS Office Excel too has been used for final tabulation of the results. In the process of estimation, first the unit level data have been weighted by suitable ‘multiplier’ as per the instruction given in the schedules of the NSSO rounds.

RESULTS AND DISCUSSION

The Scenario of Economic Growth

We begin the discussions by analyzing the performance of the Indian economy in terms of fulfillment of its objective of inclusive growth. Inclusive growth as it has been already defined in the previous sections is a multi-dimensional concept which aims to enhance the overall well-being of all the sections of the society in terms of their economic status, various social parameters, political environment and so on. In this context it has been equivocally agreed that a spurt in the economic growth is a necessary criteria to achieve the dream of inclusive growth. Since, the (official) inception of the economic-reforms during the early nineties in the Indian economy was expected to ignite this growth spurt, here we first examine the changes in the growth rate of income in the economy during the pre-reforms and the post-reforms periods.

Table 1: Growth Rates of NSDP and PCNSDP in the Pre-Reforms and Post-Reforms Periods

Growth Rates	Pre-reforms period (1983-84 to 1993-94)	Post-Reforms Period (1993-94 to 2009-10)	Wald Chi-Square statistics
Growth Rate of NSDP	5.25	5.85	4.238*
Growth Rate of PCNSDP	3.82	4.59	4.652*

Source of data: Central Statistical Organisation (CSO) * Indicates significance at 5% level of significance

Table 1, depicts the estimated growth rates of NSDP and PCNSDP in the Indian economy and its major states. It can be seen that at the all-India level (considering all states and union territories), the growth rate of NSDP increased from 5.25 per cent in pre-reforms period to 5.85 per cent in the post-reforms period leading to a growth rate of 5.38 per cent for the entire period (1983-84 to 2009-10). In this context, it should be noted here that the fiscal expansion of 1980s led to an increased growth rate since mid-1980s (from an average of 3.5 per cent per annum since the post-independence period to a figure above 5 per cent in the mid 1980s), which further accelerated after the official introduction of the reforms in July 1991 and continued to increase thereby. However, the quality of growth differed between the two periods. While the accelerated growth of 1980s was unsustainable and ultimately drowned the nation into the trap of heavy external debt and instability, the growth in the post-reforms period does not appear to be detrimental for the Indian economy till date.

The estimation of the growth rates of PCNSDP depicts that at the all-India level, growth rate of PCNSDP increased to 4.49 percent in the post-reforms period as compared to 3.91 per cent in the pre-reforms period. When considered for the entire period (1983-84 to 2009-10), the growth rate of PCNSDP was 4.08 per cent per annum.

Though growth rates of both NSDP as well as PCNSDP are observed to have increased in the post-reforms



period compared to that in the pre-reforms period, another issue that deserves attention in this regards is the performance of the major economic sectors and sub-sectors in this context. This would be important in two ways. First, this would help us to identify the sectors that are conducive to generate high growth rates of income in the post-reforms period compared to that in the pre-reforms period as well as it would also help us to conceive a clear picture regarding the problem of environment protection because growth in several sectors are environment degrading in nature. The observations in this regards follows from Table 2 which specifically presents the growth pattern of the production sectors in terms of NSDP series over the period of 1983-84 to 2009-10. The performance of the states in terms of their sectoral NSDP growth rates should be examined thoroughly because it is obvious that different sectors would perform differently in response to the changes brought about by the reforms. In order to examine the performance of the major sectors, we have used the NSDP data classified by industry of origin. The agriculture & allied activities sector is an aggregation over agriculture, forestry, fishing and logging. Manufacturing sector, on the other hand, refers to both the registered and unregistered units taken together. The other major sectors that have been considered are mining & quarrying, electricity, gas & water supply, construction, transportation & communication, trade, banking & hotels, real estate, public administration and other services.

Table 2: Growth Rates of Sectoral NSDP in Pre-reforms Period (1983-84 to 1993-94) and Post-Reforms Period (1993-94/2009-10): all-India

Period	Agrl. & allied Activities	Mining & Quarrying	Manufac-turing (reg + unreg)	Gas, power & elec.	Const-ruction	Trans-port & comm.	Bank, hotels	Real estate & insu-rance	Public admn.	Other ser-vices
Pre-Reforms										
Period (1983-93/94)										
3.27	3.76	6.12	12.14	4.78	4.58	5.98	5.65	1.17	6.13	5.67
Post-Reforms										
Period (1993/94 - 2009-10)										
2.22	7.61	5.4	4.25	7.29	12.01	7.48	10.98	6.83	6.02	7.23

Source of Data: Central Statistical Organisation (CSO)

Table 2 clearly depicts that as regards the sectoral composition of growth ‘transport and communication’ appears to have experienced the highest acceleration of growth rate in the post-reforms period compared to the pre-reforms period. It is followed by the sectors of ‘real estate & insurance’, ‘services’, ‘banks, hotels & restaurant’, ‘construction’ and ‘public administration’. On the other hand, ‘gas, power & electricity’ faced the greatest set back in the post-reforms period compared to the pre-reforms period. The other important sectors to suffer decline in growth rates during the post-reforms period are ‘manufacturing’ and ‘agriculture & allied activities’. Hence, implementation of policies further promoting the growth rates in ‘transportation’, ‘real estate & insurance’, ‘services’, ‘banks, hotels & restaurant’, ‘construction’ along with application of suitable strategies would help to further boost the ongoing upsurge of growth in the economy. Hence, as far as economic growth is considered, both quantity as well as quality seems to be more appreciable in case of post-reforms period compared to the pre-reforms period.

The ‘Inclusiveness’ Factor of the Ongoing Growth Process

Since, presence of productive employment is one major of the tools of percolating down the benefits of economic growth to the grass root level, the growth rate of employment can be considered as one of the indicators of inclusiveness of the growth. Table 3 thereby presents the estimates of the growth rate of employment for the major sectors in pre-reforms and post-reforms periods at the all-India level.

Table 3: Growth Rates of Employment in Pre-reforms Period (1983-84 to 1993-94) and Post-Reforms Period (1993-94/2009-10): all-India

Period	Agrl. & allied Activities	Mining & Quarrying	Manufacturing (reg + unreg)	Gas, power & elec.	Construction	Trade	Transport & comm.	Financial service	Public admn.	Overall Econ-
Pre-Reforms Period (1983-93/94)										
1.59 3.87 2.18 4.57 5.85 4.05 3.76 5.71 3.79 2.33										
Post-Reforms Period (1993/94 - 2009-10)										
0.01 0.67 1.88 -0.92 6.98 3.98 4.22 6.82 0.57 1.38										

Source of Data: National Sample Survey Organization (NSSO)

As regards the growth rate of employment at the all-India level (as per UPSS approach), we observed that the growth rate of employment for both males and females in the rural as well as urban areas faced decline in the post-reforms period compared to the pre-reforms period. The fall in employment growth rate has been from 2.33 per cent during pre-reforms period to 1.38 per cent during post-reforms period. Attempts made to identify the major sectors responsible for the downslide in the growth rate of employment in the post-reforms era revealed that six of the nine major sectors in the Indian economy have suffered in terms of fall in employment growth. While the growth rates of employment improved in the sectors of construction, transportation & communications and financial services, they deteriorated in the sectors of agriculture & allied activities, electricity, gas & water, mining & quarrying and public administration & defense, and trade, hotel & restaurant.

Hence, as far of inclusiveness of the growth process in terms of employment generation is concerned, the experience of the overall economy in post-reforms period hasn't been as par the expectations. Yet, some of the sectors still depict considerable opportunity for further generation of employment.

It is important to note here that even though the growth rate of income in the country has increased considerably as a result of globalization, the employment has indeed lagged behind. In this context the sectors that have potential to generate more employment needs to be promoted further. However, the often overlooked part here is the impact of these income and employment generating sectors on environment.

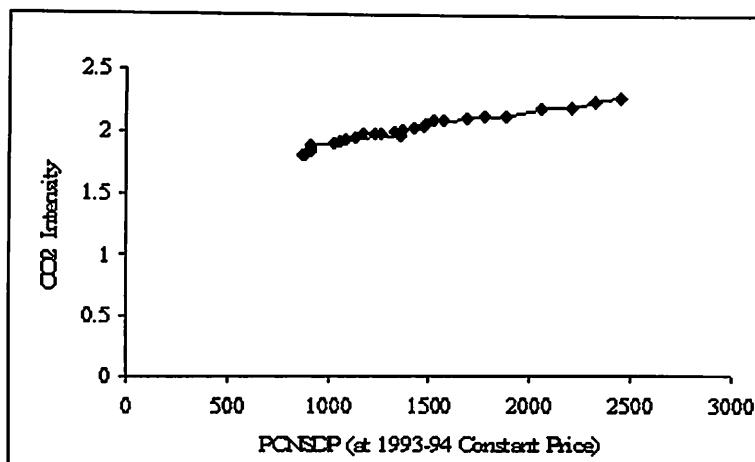
The Relation between Economic Growth and Environment in Case of Indian Economy

While empirical evidences reveal that the growth rates of income (in terms of both NSDP and PCNSDP) have increased in the economy, what has been the impact of this growth process on environment needs further attention.. For this purpose we have graphed the Environmental Kuznet Curve (Figure 1) for the Indian economy over the period of 1983 to 2009-10, that shows the relation between the PCNSDP and intensity of CO₂. Environmental Kuznet curve depicts the hypothesized relationship between environmental degradation and income per capita. It is an inverted U shaped curve which illustrates that though in the early stages of economic growth there exists a positive relationship between the two variables; with the rise in prosperity of the country, a per capita income level is eventually reached when the trend reverses. Figure 1, clearly reflects that the extent of environmental degradation measured in terms of carbon dioxide intensity has increased with the increase in the PCNSDP. Even though the Wald Chi-Square statistic has depicted that the post-reforms period has been characterized with a statistically significant increase in the growth rate of PCNSDP (please refer to



Table 1), the environmental degradation has also increased.

Though it might be argued that the threshold level of per capita income after which the trend of environmental degradation reverses has not yet been reached. However, empirical evidences suggest that though the post-reforms Indian economy has performed satisfactorily as far as economic growth is concerned, no compact achievement regarding environment protection has been reached. Thus, indications of presence of Pollution Havens Theory in case of Indian economy seem to be obvious.



A regression done by using time series data to examine the impact of income (NSDP) and level of employment (UPSS) on environmental degradation measured in terms Carbon Dioxide Intensity (Kg per Kg of Oil of Equivalent Use) of revealed (refer Table 4) that in the pre-reforms period, while only employment has significant impact on employment degradation, in the post-reforms period, both the income as well as employment exhibit significant negative impact on employment.

Table 4: Results of Regression (*indicates significance at 5% level)

Period	Covariates	Estimated Coefficients
Pre-Reforms	Income	1.263
	Employment (UPSS)	1.739*
Post-Reforms	Income	4.362*
	Employment (UPSS)	5.679*

This reinforces our conclusions regarding the negative impact of rising income as well as employment on environment, especially in the post-reforms period.

The Case of the Construction Industry

At present, the construction industry is one of the most growing throughout the globe and our economy is not an exception to it. In the post-globalization era of the Indian economy, this has been one of the most dynamic sectors that have contributed to enhanced growth rates for both income and employment. Table 2 and Table 3 reveal that while compared to the pre-reforms period, the growth rate of income in this sector has increased from 4.78 per cent to 7.29 per cent; data for employment growth rate has accelerated from 5.85 per cent to 6.98 per cent, making it the sector with highest growth rate of employment. Since, this sector is generally more labour-intensive and is amiable to absorb both skilled and unskilled labourers, this has evoked as one of the fastest employment growing sectors in a labour surplus economy like India. Further the estimated share of employment of this sector [per thousand of total employed] computed from the unit level data of employment and unemployment in our economy has been found to increase over the years from 22 in 1983 to 33 in 1993-94 and finally to 96 in 2009-10 which readily indicates that this sector has potential to expand in terms of employment

generation.

Now the impact of any sector on industry is being judged by the environmental Sustainability Benchmark Index that provides industry specific standards for consumption of natural resources, energy, water; generation of wastes, effluents and emissions. The construction industry affects the environment both by consuming resources and ejecting various forms of wastes. In the study by Willmott Dixon Group, it was found that the construction industry accounts for around 45-50 per cent of global energy usage, about 50 per cent of worldwide water usage and around 60 per cent usage of the raw materials. Moreover, as per the report of the US Department of Energy (2008), the sector contributes to about 40 per cent of the total emission of carbon dioxide across the globe. On the other hand it accounts for nearly 50 per cent of climate change gases, 40 per cent of water pollution and is further responsible for 23 per cent of air pollution. Hence in terms of Sustainability Benchmark Index, it is one of the sectors that need immediate attention in terms of environment degradation. However, owing to its important role in the terms of economic growth and employment generation the promotion of this sector has been advised at various levels.

CONCLUSION

Though Indian economy is presently the world's second fastest growing economy after China, it is still raged by chronic problems of poverty, unemployment and mass destitution. Though after the introduction of the reforms since the early nineties has enable it to overcome the sluggish growth rate which was faced since the starting of the post-independence period (called the Hindu growth rate), the expectations of making the growth process 'inclusive' is still being a distant dream. Although it has been accepted at various levels that one of the pertinent way to eradicate these chronic problems is to provide gainful and productive employment to all sections of society, but the performance of the country in this regards has not been satisfactory. Hence to bring overall development in the economy identification of the sectors that would be able to generate sufficient levels of income as well as employment has been the need of the hour. In this context our analysis has recognized certain sectors like construction, transportation & communications and financial services to be the beneficial in this regards. Though the primary sector still bears the burden of the massive employment but owing to its characteristics of lower productivity and disguised employment, attempts have been taken to transfer this burden to the secondary and the tertiary sectors.

The problem that arises here is that often the sectors which are found to be conducive to employment growth and hence can be considered to be the facilitator of 'inclusive' growth are found to be environment degrading. India being a member nation of the United Nations and UNEP has also joined hands to make the mother earth greener and hence promote sustainable development which ensures that the economic growth of the present generations is not obtained at the cost of the development of the future generations. For instance, while the construction sector is both conducive to economic growth as well as employment generation in our economy, it has turned out to be the one of the most environment degrading sectors that has adverse impact on the environment in multiple ways.

Hence, while several doctrines have place globalization as a promoter of environmental development, their applicability in case of the Indian economy is doubtful. While, globalization of the economy has increased the growth rate of per capita income, the Environmental Kuznets Curve failed to provide the evidence of any trend changing positive impact of this growth process on environment. Although, it might be argued that with the lowered growth rate of population as reflected by the consecutive census reports, we can expect to soon catch up with the threshold level of per capita income beyond which the Environmental Kuznets curve for our economy might change its course.

The study on the construction sector that is emerging as one of the most promising sector both in terms of income growth and employment generation is one of the most environment degrading sectors.

Hence, there is indeed presence of a trade-off between the objectives 'inclusive' growth and environment protection to achieve sustainable development in the long run. Thus the challenge lies in forming suitable strategies and policies that would be favourable to both society and environment. The impact of growth on environment is



country specific; several factors like production structure, extent of migration, share of various sectors in GDP, corruption are some of the main elements that influence the extent of it. Though difficult, this trade off can be reduced through cooperation and participation of all stake holders of the economy including government, industry (all economic sectors) and civil society. Further, technological innovations and R&D can promote adoption of technologies that would help to fulfill the dream of an economy exhibiting inclusive growth as well as protecting the environment simultaneously.

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Relationship between Attitude and Behaviour towards 3 R's (Reduce, Reuse and Recycle) for Sustainability: A Case Study

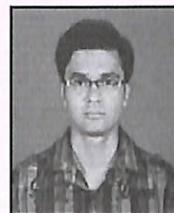
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ABSTRACT

The present study examines the relationship between students' attitude and behavior regarding 3 R's (Reduce, Reuse and Recycle) for sustainability. This study is unique as it delves to explore the extent of relationship between the two variables and their social impact on society. The responses were collected from twelfth grade students ($N=185$) studying in higher secondary schools affiliated to West Bengal Council of Higher Secondary Education. The research instrument consist of 10 pair of items related to 3 R's to measure the level of environmental attitude and the degree to which one practices the environmental behaviour. For analyzing the data chi-square with contingency of coefficient test was employed. Within the framework in environmental attitude and behaviour, the items were categorized into three components namely –reduce, reuse and recycle. The results showed that in case of reduce and reuse, the score of attitude and behaviour significantly correlated. Whereas weak relationship exists between these two scores in terms of items related to recycle. The study implies that positive measures are to be taken to improve the recycling behaviour of the students so that sustainable living can be ensured.

Key Words: Sustainability, Reuse, Reduce, Recycle, environmental attitude and environmental behaviour

INTRODUCTION

India in the 21st century is rapidly experiencing severe environmental threats and challenges. The large scale environmental pollution and degradation has made it imperative to involve education in environmental management and to deal with rampant technological development. To tackle these menaces and to channelize social change towards sustainability our knowledge of 3 R's (Reduce, Reuse and Recycle) is very crucial. Today, the ill effects of human behaviour are becoming a matter of great concern before mankind to ensure sustainability and to reduce its deterioration to society. From the conference, in the United Nations World Commission on Environment and Development in 1987, individuals from respective disciplines tried to grasp the word 'Sustainability' in their own way. Sustainability is now viewed as a national topic of public concern [1]. Sustainability is the ability to meet society's present need without compromising the ability of future generations to meet their own's need. One of the important strategies of sustainability is the practice of 3R's. To overcome the problem of un-sustainability, to assess the attitude held and the environmental behavior practiced by the people, understanding the concept of 3 R's is an imperative need. This study primarily focuses on students' attitude and behavior as a holistic approach related to sustainability. Further the practice of 3 R's will help to reveal students' sustainable perception and their social impact on environment.

According to World Class Communications Technologies, LLC (2011) 3R's are essentially the props of sustainable management. In the hierarchy of 3R's, reduction is the first step which persuades the consumer to buy only

those items which are absolutely necessary. It is a proactive action towards waste management. Reuse follows reduction. It is the alternative use of an item in some other ways when its original utility has ended. Instead of throwing it away as waste it is reused in different situations. Lastly the process of recycling involves the production of new goods from segregated discarded items which can neither be reused nor reduced. Today proper implementation of 3 R's has created societal, environmental and economic benefit (*World Class Communications Technologies, LLC*, 2011). Thus promoting the concept of 3 R's will ensure projecting a safer, greener and a healthier environment. To this end, education has to play a major role in developing the young minds of growing generation towards a more sustainable environment.

Several studies have been conducted on 3 R's and sustainability from various perspectives in different countries. However researches on attitude – behaviours as one of the dimensions reflecting 3 R's related to sustainability are very scarce. Are You Doing Your Bit? Campaign³ suggest some plans to promote sustainability. Peoples' attitude needs to undergo a change to facilitate environmental action. Although students' attitudes towards the environment were highly positive, their answers for behaviours were lower than those for attitudes⁸. In contrast Hini, Gendall and Kearns, 1995^[5] results suggest there is only a weak relationship between attitudes and behaviour. Environmental attitudes and behavior are also affected by socio demographic factors (gender, age, and educational background) and also by some psychological factors (environmental values, beliefs and ethics). Most research has found more pro-environmental attitudes and behaviour among females and more educated people than their counterparts^[7, 11, 12]. Again a study by Lahiri, 2010^[9] showed low correlation between Environmental Attitude and Responsible Environmental Behavior and Scientific Attitude. Similarly there are significant differences for both Environmental Attitude and Responsible Environmental Behaviour between in-service and pre-service teachers whereas a significant effect of courses of study is reported with no significant effect on Responsible Environmental Behaviour of pupil teachers. An analysis carried out by Chen and Chai, 2010^[2] revealed that consumer attitudes on the government's role and their personal norm towards the environment contributed significantly to their attitude on green product. The study conducted by Maleki and Karimzadeh, 2011^[10] shows significant relationship between the environmental attitude and environmental behaviour. Researches on 3 R's in the Indian perspective especially in school education context are not adequate. Hence this work is to be accepted as in right direction especially to understand the role of 3 R's vis-à-vis environmental attitude and behaviour.

AIMS AND OBJECTIVES

This research will seek to highlight the perceptions of the students regarding their knowledge (attitude) of 3R's. It will also endeavour to find out the barriers and impediments to the practice (behavior) of 3R's. The present study examines the relationship between students' attitude and behavior regarding 3 R's (Reduce, Reuse and Recycle) for sustainability. This study is unique as it delves to explore the extent of relationship between the two variables and their social impact on society.

METHODOLOGY

Sample

The sample was drawn from the schools (affiliated to West Bengal Council of Higher Secondary Education) of Twelfth Grade students, situated in the city of Kolkata. In the present study random sampling was done. It is a probability sampling. In random sampling the researcher selects sample units from the population following principle of random selection. The present sample comprises 185 (N) students comprising both girls and boys.

Instrument

The research instrument consist of 10 pair of items related to 3 R's to measure the level of environmental attitude and the degree to which one practices the environmental behaviour. Actually each item is essentially a pair of attitude and behaviour in the context of a particular environmental issue for example saving water. This item has two parts as indicated below-

- a) Attitude: Broken and dripping taps should be repaired



b) Behaviour: I repair or have someone to repair broken and dripping taps

All the items are framed in the same manner. Each item has two responses options- always/never for behaviour related part and completely agrees/ not agrees for attitude part.

RESULTS AND DISCUSSION

Table 1: Showing the Attitude-Behavior Item Related to Saving Water
Contingency Coefficient: 44.345/0.001

Behaviours	Completely Agree	Not Agree	Total
Always	93	34	127
Never	11	47	58
Total	104	81	1854

According to the findings of Table-1 regarding saving water, it was observed that the relationship between students' attitude and behaviour towards conservation of water was significant. That is, there was positive moderate correlation between the two variables.

Table 2: Showing the Attitude-Behavior Item Related to Saving Energy
Contingency Coefficient 5.222/0.022

Behaviours	Completely Agree	Not Agree	Total
Always	124	34	158
Never	15	11	26
Total	139	45	184

Findings of Table-2 revealed that students' general attitude towards reduce items were moderately correlated. More specifically results demonstrated students' perception for saving energy was not only high but they also implemented it in practice. i.e. they were aware of the utility of saving energy.

Table 3: Showing the Attitude-Behavior Item Related to Excessive Packaging
Contingency Coefficient: 7.04/0.008

Behaviours	Completely Agree	Not Agree	Total
Always	141	28	169
Never	9	7	16
Total	150	35	185

Results of the study from Table-3 revealed students' attitude towards excessive packaging was low and significant. This means that in view of practicing environmentally friendly behavior, students in general were not in favour of using excessive packaging.

Table 4: Showing the Attitude-Behavior Item Related to Reuse Empty Glass and Jars
Contingency Coefficient: 5.042/0.025

Behaviours	Completely Agree	Not Agree	Total
Always	36	57	93
Never	21	69	90
Total	57	126	183

From Table-4 it was demonstrated that student' responses towards the reuse of empty glass and jars was highly significant.

Table 5: Showing the Attitude-Behavior Item Related to Buy Second-Hand Books
Contingency Coefficient: 4.976/0.026

Behaviours	Completely Agree	Not Agree	Total
Always	94	41	135
Never	26	24	50
Total	120	65	185

According to the results of Table-5, it was found that students' attitude regarding the usage of second-hand book was high and positive. This indicated that there is a high possibility of purchasing the reused books.

Table 6: Showing the Attitude-Behavior Item Related to Donate Old Clothes and Books
Contingency Coefficient: 8.577/0.003

Behaviours	Completely Agree	Not Agree	Total
Always	83	53	136
Never	18	31	50
Total	101	84	185

Data from Table-6 revealed that there was high positive correlation between students' attitude and behavior regarding donating old clothes and books.

Table 7: Showing the Attitude-Behavior Item Related to Use Rechargeable Batteries
Contingency Coefficient: 6.342/0.012

Behaviours	Completely Agree	Not Agree	Total
Always	136	17	153
Never	23	9	32
Total	159	26	185

From Table-7, the scores of the students' attitude-behaviour relation to the usage of rechargeable batteries were significant. This implies that students' were more indented to purchase rechargeable batteries rather than use and throw ones (one time used ones).

Table 8: Showing the Attitude-Behavior Item Related to Carrier Bags
Contingency Coefficient: 5.876/0.015

Behaviours	Completely Agree	Not Agree	Total
Always	27	36	63
Never	31	91	122
Total	31	91	185

In the context of carrier bags, results from Table-8 show that there is a significant relation between students' attitude and behaviour. Perhaps students' who are conscious of their sustainable environment are more cautious regarding their behavior for sustainability.

Table 9: Showing the Attitude-Behavior Item Related to Buying Products Made from Recycled Materials Contingency Coefficient: 0.893/0.345

Behaviours	Completely Agree	Not Agree	Total
Always	112	33	145
Never	28	12	40
Total	140	45	185

Data from Table-9 shows that students' positive attitude do not necessarily result in recycling behaviour. Knowledge as well as attitudes is not enough to behave responsibly [14]. Thus the relationship between the two variables is low and weak.

Table 10: Showing the Attitude-Behavior Item Related to Sorting Disposals Contingency Coefficient: 0.021/0.886

Behaviours	Completely Agree	Not Agree	Total
Always	67	32	99
Never	54	27	81
Total	121	59	180

Results from Table-10 revealed that there is no significant relationship between students' attitude and behavior. Since sorting waste disposal is not a very common practice in our country. Probably the students are unaware of such services and failed to carry such behavior.

CONCLUSION

In of some previous studies postulated that there is a positive and significant relationship between environmental knowledge and energy consumption behavior. In contrast, the scores of attitude-behaviour relation regarding recycling items reflected low and weak relationship. Howe and Disinger's, 1998^[6].claim supports these results: 'a good knowledge of environmental concepts is not sufficient; knowledge of environmental issues, issue skill analysis, and attitudes and values related to taking action are also necessary for the individual to take action and to act responsibly'.

Thus it is realized that environment related issues cannot be merely solved by looking at from theoretical point of view only. It is quite evident that students' behavior for sustainability is not adequate. The study implies that positive measures are to be taken to improve the recycling behaviour of the students so that sustainable living can be ensured. This allows a comprehensive understanding and implementing newer ways of dealing with problematic sustainable issues. Since the destiny of our nation is being shaped by the children⁴ therefore there is the need for emphasizing the moral and ethical aspect of Environmental Education in our teaching-learning situation. Moreover some computer based learning activities related to environmental sensibility should also be incorporated to ensure sustainability.

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**HUMAN DEVELOPMENT, FAMILY & SOCIETY,
COMMERCE & MANAGEMENT**
(Review Papers)

Sustainability and Human Development: Relevance of Tagore's Vision Today

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ABSTRACT

The modern world today is at a juncture and the prevailing crisis necessitates redefinitions of models for sustainable growth and restructuring as well as reconceptualization of the response to environmental degradation, drastic climactic changes and resultant calamities in tandem with an appalling loss of biodiversity. The very concept of "development" is highly problematized. Mechanical "development" can scarcely be sustained and challenge the basic tenets of ecological and sociological balance that thrives and evolves on the basis of diversity. Tagore realized the gravity of the ecological and environmental question - the crucial need to bring the material and collective development of humanity into line with nature. Tagore anticipated the several current fractures caused by the economic, technological and scientific excesses and damages. He emphasized the necessity of rethinking the representation of the human race, its activities and its place within Nature and his vision posits a sustainable model of development through education.

Key Words Biodiversity, Sustainable Development, Eco-Ethics, Tagore, Education

INTRODUCTION

The modern world today is at a juncture and the prevailing crisis necessitates redefinitions of models for sustainable growth and restructuring as well as reconceptualization of the response to environmental degradation, drastic climactic changes and resultant calamities in tandem with an appalling loss of biodiversity. The very concept of "development" is highly problematized, being subjected to artificially engineered parameters that continually strive towards homogeneity and uniformity predetermined by the hegemonic Western convictions, in sharp contrast with the quintessential signification of the word "development" as spontaneous growth from within. As Vandana Shiva argues in Bio-Piracy

"Development is a beautiful word, suggesting evolution from within...the ideology of development has implied the globalization of the priorities, patterns, and prejudices of the West. Instead of being self-generated, development is imposed" [6]

The phenomenon of globalization has engineered a hegemonic ideology of priorities, developmental patterns and definitions that reflects a prejudicial stance of the West and challenges diversity that is the core of any development that may be sustained in the long run. At the ecological level, high commercial priorities often lead to alarming disruptions while at the related field of culture and multi-ethnic populace, this global aspiration of rapid homogenizing in the name of development practically has led to formation of agencies of strong resistance.^[2] Thus such mechanical "development" can scarcely be sustained. On the contrary, such efforts challenge the basic tenets of ecological and sociological balance that thrives and evolves on the basis of diversity.

AIMS AND OBJECTIVES

The present study intends to explore the manifold crisis evolving with an exogenous hegemonic nature of

imposed knowledge, largely fetishized as a mental space engineered after the Western models dissociated from social and physical spaces comprising of indigenous knowledge base, that causes epistemic violence and endangers the world today through a systematic effort of homogenization and an absolute negation of diversity. The paper endeavours to investigate the relevance of Rabindranath Tagore's vision regarding education that may redeem the critical state if implemented in the modern global perspective.

METHODOLOGY

An in depth study and analysis of the nature of "development" practiced today all around the world in tandem with the evolving threats and crises in the form of ecological imbalance, calamities and dissidence with far reaching consequences followed by analysis of Tagore's visions and their anticipation of globalization that embraces indigenous knowledge forms necessary for sustenance of bio-diversity and sustainable development on the true sense of the term. The paper also tries to propose certain developmental praxis that mediated by education, may act as redemptive agency.

RESULTS AND DISCUSSION

The production parameters, essential facets of the modern definition of development and growth are restrictive in a sense because they tend to exclude regeneration from the domain of production. Vandana Shiva in her book Biopiracy^[7] brings to the forefront the profound fallacy of the political and economic definition of productivity and growth, which is reflected in the assumptions made by the National Accounting Systems. This system is used for calculating growth through the GNP and is based on the assumption that if producers consume what they produce then they may be said to be producing nothing at all. Economies ruled by the market or a patriarchal capitalism, thus conceives of reproduction, regeneration or self-sufficiency as an economic deficiency. Knowledge is categorized in a similar fashion. The natural creation is deemed mechanical repetition, totally discarding the subtle process of evolution and development that continues through such processes of reproduction, adaptation, alteration and regeneration. The prevalent tendency of upholding industrial production as creative and novel just because it can invent or "create" from nothing strangely overlooks the concomitant destruction of ecological cycles that generates the tremendous crisis of sustainability^[7]. What is at stake is not simply extinction of one or two species as a result of such tendencies, but the entire human civilization, which is being exposed to severe threats due to this near absolute disruption of evolutionary rhythm.^[5]

The price paid is significantly high and the process more complex than what apparently draws our attention in the form of flash floods as in Uttarakhand in June, 2013 or earthquakes. Speaking after inaugurating the international conference on 'Disaster Management: Preparedness, Response and Rehabilitation' at the National Geophysical Research Institute (NGRI) on October 18, 2012, Smt.D.Purandeswari, Minister of State for Human Resource Development (Higher Education) Govt. of India, noted, "the reason why we are faced with many kinds of man-made disasters could be attributed to loss of biodiversity. We have forgotten to use our biodiversity for our utility but rather we are looking at biodiversity to exploit it." She pointed out that when Tsunami had struck India in 2004, Puducherry was largely not affected compared to others states due to presence of its mangroves which are increasingly exploited to the level of extinction today. Examples from the whole world today expose deep dynamics of crisis and destruction under the façade of development engineered by the modern education. The Three Gorges Dam , the largest power station in terms of installed capacity, spanning the Yangtze River by the town of Sandouping, China, was considered a historic engineering, social and economic success by the Chinese government, but a reduction of biodiversity led to frequent major landslides in 2009 and 97 significant landslides in the first four months of 2010.

The nature of the impending crisis however is much more complex with far reaching consequences. An article titled "Nature's sting: The real cost of damaging Planet Earth" by Richard Anderson Business reporter, BBC News(2012), reveals the stunning plurality of the threats associated with mechanical non-sustainable developmental work with scant regard for conservation and regeneration. A recent, two-year study for the United Nations Environment Programme, entitled The Economics of Ecosystems and Biodiversity (Teeb), shows Anderson, put the damage done to the natural world by human activity in 2008 at between \$2tn (£1.3tn)

and \$4.5tn. In 1998, flash flooding in the Yangtze River in China killed more than 4,000 people, displaced millions more and caused damage estimated at \$30bn. People have to pay to protect or replace services that nature has historically provided for free, and will be forced to pay by regulatory instruments such as pollution taxes, like carbon credits and landfill taxes that already exist, and higher insurance premiums. And higher costs for business mean higher prices for consumers as evident from the forced hike in the global cotton price to 15-year highs, pushing up the costs of clothes, with retailers such as Primark, Next and H&M warning of higher prices due to floods in Pakistan and China. Again, massive floods and wildfires in Russia also sent wheat prices rocketing, sending global food prices sharply higher. As Trucost's research shows, argues Anderson, earnings and profits of the world's largest companies are under increasing pressure, undermining share price growth and it is precisely these companies that pension funds invest in. Pension values, therefore, are likely to suffer, reducing retirement incomes for all. This predicts poverty, suffering, dearth of food and cessation of all such developmental activities that the world takes pride in today, due to paucity of funds in the long run^[1].

The urgency is being increasingly realized and the Statement by UNESCO on the occasion of the First Meeting of the Open Working Group on SDGs held on 14 – 15 March,^[4] 2013 identifies the relevance of education to sustainable development as one of the preliminary outcomes of the post-2015 thematic consultation on education, led by UNESCO and UNICEF. The call for a broader education agenda, encompassing transformative, quality and relevant education for all people, is recognized as emerging consistently as an important theme including the ones on Environmental Sustainability and Inequalities. Scientific evidence along with ethical principles was deemed crucial in informing behaviors, policy action and governance decisions in support of sustainable development. The natural and social sciences, and most significantly traditional and indigenous knowledge, have been identified as key drivers to developing and realizing sustainable solutions with UNESCO standing ready to mobilize this knowledge to support the work of the Working group. UNESCO Bonn Declaration, 2009, had asserted earlier that

"We, the participants gathered at the UNESCO World Conference on Education for Sustainable Development held in Bonn, Germany on 31 March to 2 April 2009 issue the following statement and call for action"

- i) Despite unprecedented economic growth in the 20th century, the global financial and economic crises highlights the risks of unsustainable economic development models and practices based on short-term gains. Unsustainable production and consumption patterns are creating ecological impacts that compromise the options of current and future generations and the sustainability of life on Earth, as climate change is showing.
- ii) A decade into the 21st century, the world faces substantial, complex and interlinked development and lifestyle challenges and problems. The challenges arise from values that have created unsustainable societies. The challenges are interlinked^[7].

The need for restructuring education is thus realized increasingly. In this context emerges the significance of the vision of Rabindranath Tagore. "India faces two choices at this critical moment in history", asserted environmentalist Vandana Shiva in an event on 2nd October, 2011, organised jointly by her NGO, Navdanya, and the Ministry of Culture, "to either live in the vision of Gandhi and Tagore for sustainability and justice for all through protecting and rejuvenating the soil or continue the predatory path of destruction of earth". Rabindranath had highlighted the true nature of development in consonance with regeneration and evolution and not through direct assault against the same. Tracing the inevitable connection between global violence and indiscriminate plunder of nature, Tagore had asserted in "The Robbery of The Soil" published in English Writings of Tagore, Vol. III.

"The temptation of an inordinately high level of living, which was once confined only to a small section of the community, becomes widespread. The blindness is sure to prove fatal to the civilization which puts no restraint upon the emulation of self indulgence... When they had reduced the limited store of material in their immediate surroundings, they proceeded to wage various wars among their different sections,

each wanting his own special allotment of the lion's share. In their scramble for the right to self-indulgence ...they exhausted the water, cut down the trees, reduced the surface of the planet to a desert, riddled it with enormous pits and made its interior a rifled pocket, emptied of its valuables".^[12]

Tagore realized the gravity of the ecological and environmental question - the crucial need to bring the material and collective development of humanity into line with nature. He emphasized the necessity of rethinking the representation of the human race, its activities and its place within Nature. Rabindranath Tagore saw nature and culture as intimately linked. It was in remaining faithful to the Indian tradition of the Upanishads, while having relevant information about the choices and processes being introduced by industrial civilization, that Tagore foresaw the gravity of the ecological issues in perspective of the modern western conception of progress as an end in itself. Human arrogance and greed were proliferating in a predatory approach that sacrificed indigenous knowledge, showed contempt for nature and invited destruction. His vision reformulates the relationship between humans and Nature by redefining the meaning of sustainable actions of development, which should rather turn towards a sensible association built on the respect of natural rhythms, sustainable management of natural resources, protection of the environment and sustainable development. In 'Samabaya Niti'^[10] (Cooperative Policy: Rural Reconstruction), Tagore expresses the view that eco-ethical human living should be based on symbiosis between man and Nature, and between man and man. But manifestations of 'ripus' through limitless competition, consumerism and commercialism have undermined this symbiosis alarmingly in modern times, and unless the trend is reversed and objective conditions for eco-ethical human living restored, the consequences would be disastrous.

Tagore's concept of sustainable development of India is rooted deep in rural regeneration as majority of the population of India reside in villages. Tagore calls for revival of the spirit of the rural masses through education and formation of panchayats and cooperatives so that they could be self-sufficient for their economic development and empowerment. This is crucial for maintaining pluralism of the nation and socio-ethnic diversity in close consonance with ecological diversity with minimal interference from exogenous agencies that end to homogenize and destroy diversity in the guise of developmental aids.

The cultural overtones of a close relation between the human agency and biodiversity in form of the Upanishadic resonances are revealed in Tagore's essay "The Religion of the Forest"

"The forest entered into a close living relationship with their work and leisure, with their daily necessities and contemplations. They could not think of other surroundings as separate or inimical...They uttered their faith in these words: "Yadidam kinch sarvam prâna éjati nihsratam" (All that is vibrates with life, having come out from life). When we know this world as alien to us, then its mechanical aspect takes prominence in our mind; and then we set up our machines and our methods to deal with it and make as much profit as our knowledge of its mechanism allows us to do."^[3]

The "epistemic violence" done to indigenous knowledge today can be addressed through transformative pedagogic practices. Students must confront, get baffled, and try to work out the anomalies between the prevalent language of tight lipped educational norms, practised indiscriminately all over the nation and the indigenous subaltern polemics. The classroom space must be problematized to encourage reflective practices about interventions that only and only education can generate. Tagore prescribed a "choloman pothochari siksha" or mobile travelling education in which the pupils of his school in Shantiniketan were taken for regular visits to Sriniketan, and they were presented with the real life problems of the villages to be solved with the knowledge acquired in high schools. In his letter to Sri Tanayendronath Ghosh, dated 10th March, 1929, Tagore specifically mentions the importance of such an education

"You must make the students think and reflect on whatever they learn. We have to present numerous problems of our daily lives and they must be encouraged to critically analyse the cause and discuss the probable solutions...they go to Sriniketan, but they must not perceive it from outside only. Present the cardinal problems of Sriniketan to them and urge them to think and come up with probable solutions. See to it that they can truly reflect upon the bases of rural economy, co-operative system and its importance

in our economy, the exploitation inherent in the relation between landlords and subjects, the reasons behind death of our people in famines, droughts and epidemics, and how their education can be used to fight all these maladies".^[11]

Education thus must be emanated freely through new techniques that enable one to relate to and connect to the flow of real life problems, and a huge influx of myriad cultural, ethnic and ecological perspectives. In his Siksha,^[12] he had urged the development of schools where there would be dairy, poultry and some land for cultivation. He wanted students to participate in cultivation along with their studies to produce the necessary food for their residential institution and employ new scientific knowledge for that purpose. They would be engaged in gardening and engage in traditional art forms like "kantha shilpa" that would also be applied for tribal upliftment through proper educated intervention and marketing. Thus, the classes would be held everywhere- in the fields, in the village, in the dairy and poultry farms and in devising marketing strategies for developing the rural economy. Tagore envisioned new residential colleges and schools that provide a new glocal space of education like Nalanda or Taxila for a profound glocal inter-ethnic collaboration.

Tagore's vision can be extended through teacher and student exchange programs between various zones with a non-geographical redefinition of "zones" based on cultural and socio-economic paradigms. Internship of trainee teachers as well as medical students could be planned in a way that allows them to work in rural settings completely different from their immediate urban background. Policy and Frameworks may endeavour to identify the multiplicity of spaces in the nation on the basis of socio-economic and cultural commonality. The moment the inter-relation is worked out in full, the student can realize knowledge as a mechanism of fruitful change, progress, sustainable development and source of infinite possibilities. In his letter to Ajit Kumar Chakraborty dated 30th January, 1913, Tagore made an express statement of his vision

"those residing in India must be trained from early childhood so that they may draw the intrinsic resources from the deepest chamber of their heart. Every task must be life-oriented and our boys must not be given up to the mechanical demon".^[9]

UNESCO World Conference on Education for Sustainable Development, 2009 echoed this. Under the subheading "Education for sustainable development in the 21st century" it asserted that

"Education for Sustainable Development is based on values of justice, equity, tolerance, sufficiency and responsibility...Education for Sustainable Development is underpinned by principles that support sustainable living Environmental protection and restoration, natural resource conservation and sustainable use, addressing unsustainable production and consumption patterns, and the creation of just and peaceful societies are also important principles. Education for Sustainable Development emphasizes creative and critical approaches, long-term thinking, innovation and empowerment for dealing with uncertainty, and for solving complex problems, and highlights the interdependence of environment, economy, society, and cultural diversity from local to global levels, and takes account of past, present and future. Linked to different needs and the concrete living conditions of people, Education for Sustainable Development provides the skills to find solutions and draws on practices and knowledge embedded in local cultures as well as in new ideas and technologies".^[8]

CONCLUSION

The relevance of the vision of Tagore in realizing this definition is evident. The new era demands a redefinition of development in the globalized perspective - a development that can be sustained and can lead to long term benefits of the human race under threat today. Such development thrives on biodiversity and Tagore's vision synthesizes such diversity with modern developmental strategies. Education, if integrated with this approach, may perhaps achieve the desired level of growth and development today.

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Khana's sayings: lyrical lessons in environmental sustainability

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ABSTRACT

The investigation focuses on Khana who was popular for her verses on weather forecasting and environmental sustainability in early medieval Bengal. It attempts a contemporary assessment of Khana as an environmentalist, ecofeminist and communicator. Secondary sources like books, journal articles and internet resources were consulted. Opinions of knowledgeable persons were sought. Logical inferences were drawn. Khana's life remains an enigma. More research is needed to ascertain facts about her life. Khana emerged as a passionate campaigner for environmental sustainability. She seems to be an ecofeminist as she defied patriarchy, engaged with the subaltern, advocated subsistence agriculture and championed environmental conservation. Erstwhile popularity of her compositions testifies her success as a communicator. These verses combine Japanese Haiku-like simplicity with pragmatism. However Khana's sayings have waned in popularity in the information age. Revisiting Khana is needed in the wake of extensive environmental degradation. Her verses must be included in primary science curriculum. Academic discourses on her work should be encouraged. Extension workers must utilize audio-visual media to spread Khana's message of ecological sustainability among masses.

Key Words Khana's Verses, Environmental Sustainability, Ecofeminism, Communication

INTRODUCTION

Advent of the medieval period (sometime between 9th and 12th century AD) saw the rise of an extraordinary woman in the eastern region of the Indian subcontinent [10]. Her name was Khana. She was also referred to as Leelavati. It is believed that she could precisely predict weather conditions. She could also suggest when it was the best time to plant the seeds of a crop, when to plough, where to dig a pool and where to build an abode. She would sometimes dabble in astrology and advise people on how to flourish in life. However weather forecasting was her strong point. Her guidelines for agriculturists, cattle breeders and the populace were fashioned as short verses – couplets and quatrains. These verses credited to her became extremely popular as Khanar Bachan (the sayings of Khana). Her life is part myth and part history. Her early life is an enigma. Some say she was a local of Deuli village in Barasat in South Bengal. Another account claims that she was a native of East Bengal (now Bangladesh). A different folklore situates her in Pragjyotishpur on the border between Bengal and Assam. It is also claimed that she arrived from Sri Lanka. Nevertheless a hillock at Berachampa in South Bengal bears her and husband's names (Khana Mihirer Dhipi or the hillock of Khana and Mihira). This hillock seems to be a part of the fortified old settlement of Chandraketugarh, the remnants of which were excavated during an archaeological expedition in the 1950s. However archaeologists are uncertain whether Khana really resided there at some point during her life. This enhances the mystery surrounding Khana. So rigorous research is required to unravel facts about Khana. Although legends about her origin vary there is some concord in the belief that she wedded into the family of the celebrated astronomer / astrologer Varahamihira. Well-known historians mention that Varahamihira was among the "nine gems" at the court of King Chandra Gupta II Vikramaditya [4]. In all likelihood Khana was the wife of Varahamihira's son - Mihira. It appears that the milieu

of her conjugal home helped her develop her skills in astronomy and astrology. However there is no evidence to suggest that her father-in-law and husband actually trained her in these. It is plausible that Khana learned astronomy and astrology by watching the father-son pair at their job. But evidently she was not a mere mimic. Her compositions suggest that she must have been an ardent observer of nature from the very beginning. Her skills appear to have been innate. She charted her own course by veering from astrology per se. Khana successfully decoded astronomical and other natural signals to predict weather, avert disasters and preserve the environment [1, 7, 10].

AIMS & OBJECTIVES

The investigation attempts a contemporary assessment of Khana as an environmentalist, ecofeminist and communicator on the basis of information available about her and by analysing her sayings.

METHODOLOGY

It is a historical research employing qualitative analysis. Secondary sources like books, journal articles and internet resources were consulted to gather information about Khana and to compile Khana's verses. These compositions were studied carefully and critically. Logical inferences were drawn. For carrying out the qualitative analysis opinions of knowledgeable persons were sought. Information about Khana, her life and times aided the analysis.

RESULTS AND DISCUSSION

Being a qualitative study the word result may be bit of a misnomer. Khana's verses were analyzed to arrive at findings. Examples of Khanar Bachan (the sayings of Khana) demonstrate her capacity for interpreting signals from nature and her environmental concerns:-

- i) "Maathe giye aage karo dik nirupon
Purba dik hate hal karaha chalon
Khana bale mor katha shuno mahashay
Fashal falibe nahi shanshay"^[2]

Essence: The agriculturist should distinguish the directions before starting to plough. He / she must begin to till from the eastern side. If this advice is followed then the crop will not fail.

- ii) "Amabashya aar purnimate je baa dhare hal
Taar dukkho thake chirokal"^[2]

Essence: Tilling on days of no moon and full moon will not yield a good harvest.

- iii) "Pubे haansh paschime baansh
Uttare kala dakshine mela"^[1]

Essence: The place for ducks (i.e., pond) is on the eastern side. Bamboo grove should be on the west. Banana must be grown on the northern side and the place for fairs is to the south. In this verse Khana is suggesting the ideal plan of a village.

- iv) "Purba aashaarey dakhina boy
Shei batshar banna hoy"^[7]

Essence: The year the wind blows from southern direction in early part of the month of Aashaar (June), there is sure to be flood. It is said that this prediction is accurate ^[7].

- v) "Jadi barshe aaghane
Raja jaan maagane
Jadi barshe maagher shesh
Dhanna rajar punna desh"

Essence: If it rains in the month of Agrahayan (November – December) then the king goes begging. If there is

rain towards the end of the month of Maagh (February) then the King and his kingdom are blessed by abundant crop.

- vi) “*Kodaale kurule megher gaa
Madhye madhye dicche baa
Chaashare bal baandhte aal
Aaj naa habe to habe kaal*”

Essence: The shapes of the clouds are jagged. The wind is blowing sporadically. Tell the farmer to raise barriers around his / her plot. It will rain either today or tomorrow. In this couplet Khana tells the farmer how to prevent deluge of the field planted with crops.

- vii) “*Thaakte balad na kare chaash
Taar dukkho baaro mash*”^[10]

Essence: life of the person who owns oxen but will not plough is full of wretchedness. Here Khana warns that lethargy is sure to bring financial ruin. It is all too evident from her verses that Khana advocated harmonious relation between human beings and nature. Her credo was never to upset the ecological balance. Khana’s compositions manifest deep understanding, empathy and even reverence for all things natural. She championed harnessing of environment in a sustainable fashion. She always suggested ways of preventing environmental degradation which might be brought about by natural calamities or by human ignorance and avarice. Khana observed with habitual keenness even the supposedly insignificant features of natural phenomena (e.g. jagged edges of clouds) and using inductive reasoning deciphered their hidden import. Judicious utilization of natural resources appears to be her motto. She seems to abhor laziness, callousness and abuse in human engagement with nature. Contemporary appraisal of Khana may raise the question whether she may be regarded as an ecofeminist. Ecofeminism is defined as a movement or theory that applies feminist principles and ideas to ecological issues^[5]. Ecofeminism is considered a social and political movement that combines environmentalism with feminism^[9]. Ecofeminist philosophy recognizes and analyzes linkages between behaviours that harm the environment and those that oppress women. It is also contended that both environmental and women’s liberation movements intend to bring about social transformation^[9]. Hallmarks of ecofeminism are denouncement of patriarchal-capitalist exploitation of nature and marginalized sections of society particularly women. Use of sophisticated and expensive technology is considered as masculine impositions which render women powerless and result in maldevelopment of environment^[6]. By these yardsticks Khana may be termed as ecofeminist as she unshackled herself (albeit temporarily) from the clutches of patriarchy, connected with the subaltern, recommended subsistence level agriculture and was passionate about environmental conservation. However in the end she reportedly had to pay a heavy price for disobeying patriarchy. Legend says that her jealous father-in-law and husband chopped off her tongue. That “silenced” Khana and patriarchy reasserted itself. If the legend is proved to be authentic then she could well be regarded as a martyr for ecofeminism centuries before the buzzword was coined.

In current idiom Khana could be described as an immensely successful science communicator. She had spread scientific literacy among the masses. Her verses addressed poor people in the simple language they promptly understood. Khana’s handy and catchy compositions were among the first in Bengali language. These were parts of the oral tradition^[7]. One reason for that is that these verses pre-date the introduction of the Bengali script. The verses attributed to Khana not only spoke the language of the underprivileged but also dealt with the problems they faced daily in eking out a living. Khana’s compositions may have been regarded as too functional, unsophisticated and lacking literary merits by some scholars^[9] but contemporary researchers^[11] value these for being living examples of cultural continuity. These verses appear to combine Japanese Haiku like austerity with practical purpose. However it has been pointed out that Khana may have articulated aspects of human cultural legacy which were already in existence^[7, 11]. But the present author feels that she not only made people aware of what existed in their collective unconscious but also constructed new knowledge. The knowledge she contributed became part of the collective unconscious of subsequent generations. It is no surprise then that her compositions have transcended geographical and temporal boundaries. Versions of her couplets exist even now in different states of eastern India viz. West Bengal, Bihar, Odisha, Assam, Tripura and neighbouring countries like Bangladesh and Nepal^[1, 7, 10].

CONCLUSION

Analysis of Khana's sayings reveals her roles of environmentalist, ecofeminist and communicator. But one has to confess that Khana's verses which were readily quoted by the public till a few decades ago have receded in popularity. Arrival of information society with its focus on capitalist and materialistic way of life has left Khana bereft of her pastoral context. Her compositions may appear outmoded in the world of satellite television, mobile phones and the internet. Nowadays weather forecasts and information about environmental conservation are not only published in newspapers but are readily accessible on countless television channels, mobile phones and the internet. But we have to admit that millions of people in our country are still steeped in poverty and illiteracy. There are isolated areas in our vast country which are out of reach of mass media. Natural disasters like floods, landslides, droughts etc. occur frequently and inflict devastation despite installation of sophisticated weather monitoring systems. The underprivileged rural people are the worst victims of these calamities often simply because the warnings do not reach them on time. Of course the government must ensure that such critical information travels as widely and as fast as possible. However a complementary approach would be to draw on our treasure trove of indigenous knowledge including Khana's verses.

RECOMMENDATIONS

Hence time has come to rediscover Khana's couplets as indeed other sources of indigenous knowledge. These come at practically no cost. Moreover, these are simple therefore easy to understand and in tandem with nature. Indigenous knowledge represents age-old tradition of benefiting from and at the same time preserving nature. Reviving indigenous knowledge is important in the present era of extensive ecological degradation. Khana's verses can thus find place in the school science curriculum especially at the primary level. Children will find these easy to learn by heart and recite. They will find it interesting if these are taught outside the confines of classrooms – on the playing field and on agricultural plots during excursions. They can be encouraged to actually identify the directions, observe the clouds and feel the wind. Children can follow Khana's sayings and foretell the weather. They may assess the accuracy of their forecasts later. In this way they can learn the rudiments of scientific experimentation. Rural children may relate to Khana's verses better and find more opportunities of utilizing these in their locale. But these verses will also make urban children more aware of nature and the necessity of environmental conservation. Besides Khana needs to figure more frequently in academic discourses on ecology, anthropology, history, women's studies, literature etc. Agricultural extension workers can regenerate Khana's popularity among farmers by printing and distributing pamphlets and posters featuring her couplets. Khana's compositions can be recited on radio. Short films on how these verses can help prevent natural catastrophes and conserve the environment can be telecast or shown on video to villagers. Puppet shows and *Jatras* (popular folk-theatre of Bengal) on Khana's life and work can certainly boost her sagging popularity.

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Role of Maharashtra Andhashradha Nirmulan Samiti for Community Engagement in Environmental Conservation

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ABSTRACT

Environmental issues have emerged as a major concern for the welfare of people. We celebrate our festivals as per the traditions and customs, which are not environment-friendly. Maharashtra Andhashraddha Nirmulan Samiti (MANS) is a voluntary organization working to promote scientific attitude. It also works for environment protection. A case study is done on the role of MANS for community engagement in environment conservation and based on the study, it can be said that MANS's focus on the above subject is mainly divided into following activities, namely; Eco-friendly holi, Snake science, Eco-friendly Ganeshotsav and Pollution-free Diwali. MANS has been promoting these activities in schools, colleges, society; mainly, youth. MANS suggests, promotes and works on community engagement in celebrating our festivals in an alternative way by causing minimum amount of harm to the environment. Lakhs of students, youth and women are widely and actively being participated in activities for environment protection.

Key Words Maharashtra Andhashraddha Nirmulan Samiti, Festivals, Environment-friendly celebration, Community engagement, Environment Conservation.

INTRODUCTION

At the beginning of the 21st century, environmental issues have emerged as a major concern for the welfare of people. In India, the concept of environment conservation has been evident since an early period.

We humans are social beings. We like to celebrate festivals together, among the families and in society. Indian culture gives more space for such celebrations. Especially in hindu religion, festivals are more in number and are being celebrated on a larger scale since a long time. Most of these festivals are not environment friendly. And it's a common excuse for us to celebrate all these festivals by saying that they reflect our heritage and have been in practice for a long time for us to question them.

Late Indian Prime Minister Pt. Jawaharlal Nehru has said, that "It is the duty of every Indian citizen to have scientific temperament, search for truth and humanism." Since environmental issues have emerged as a threat to us, it is the responsibility of every human being, community, Government Organizations, Non-Governmental Organizations, educational institutions, voluntary organizations^[1].

Maharashtra Andhashraddha Nirmoolan Samiti (MANS) or (Maharashtra Blind faith Eradication Committee) is a voluntary organization working through 230 branches in all districts in rural and urban Maharashtra, Belgaum in Karnataka and Goa. It does not receive foreign or government funding. It's a People's movement working solely on support of the people and for the people^[2].

Maharashtra has a long legacy of rationalist social reformers who always took an objective and informed stand against superstition. The constitution of India has stipulated adoption of scientific outlook as one of the responsibilities of every Indian and has included it as a value to be inculcated through education. MANS has

resolved to further this rational legacy through purposeful activities and programs. This work can be characterized as follows:

To cultivate scientific attitude, skepticism, humanism and critical thinking among the people.

- i) To oppose and agitate against harmful superstitions, rituals and suggest useful alternatives to some.
- ii) To encourage constructive analysis of religious traditions and customs.
- iii) To help and work with other social reform organizations to cultivate rational moral values and create a just society.

Along with the activities stated above, MANS upholds environment protection as a major priority and has been constantly encouraging people for their active participation in environment conservation and protection.

Hence, a case study has been done on the work of MANS for environment protection.

AIMS AND OBJECTIVES

- i) To study the work of Maharashtra Andhashraddha Nirmulan Samiti (MANS) for environment protection.
- ii) To analyze the role of MANS in community engagement for environment conservation.

METHODOLOGY

This data is collected from the records obtained from the MANS database and through personal experiences during MANS work and campaigns.

RESULTS AND DISCUSSION

From the case study done, it has been observed that the work of MANS regarding environment conservation has been focused on four major activities, as follows:

- i) Eco-friendly Holi
- ii) Snake science
- iii) Eco-friendly Ganesh festival
- iv) Pollution-free Diwali.

With respect of community engagement for environment protection, MANS has made schools, colleges, youth&women as its hub. All the above stated activities are strongly promoted in this ‘hub’. The promotion and execution of the above stated activities is widely done in the hub by creating awareness through speeches, lectures, demonstrations, poster exhibitions, etc.

Eco-friendly Holi

The traditional way of celebrating Holi (fire festival) involves burning a lot of precious wood heaving vulgar abuses, quite often, upon women. This certainly affronts our sense of civility as also responsibility towards environment. Samiti has been offering many alternative ways of celebrating Holi in a joyful but well-mannered and conscientious way, step by step. And it is encouraging that the society is accepting these alternatives gradually^[3]. The alternatives are as below:

- i) Cleaning the neighborhood and making a bon-fire of all the garbage that is collected, instead burning precious wood. This provides an occasion to clean up the surroundings.
- ii) Making an effigy representing all vices and naming its limbs as corruption, addictions, etc.; short speeches declaring resolve to remain aloof from all vices and then burning the effigy. Samiti has conducted many such programs which can be conducted in a public place or in schools.
- iii) In both the above alternatives some combustion is involved and that leads to pollution. Samiti, therefore invented another alternative, i.e., ‘making a bonfire of our own defects and vices’. Students are given a

pro forma on which they are expected to declare their resolve regarding which defects/ faults or vices they are going to ‘burn’/give up completely in the course of the new year, in consultation with their parents. The forms, signed by both the students and their parents are to be returned to the school. When a bonfire of the rubbish collected from the surroundings is lit, instead of hurling abuses at women, slogans praising women are shouted. This is quite in fitness of the things because Women’s day and death anniversary of Savitribai Phule fall in the same month, as the festival of Holi, i.e., March. Samiti gives a message of, “Holilahankara, polidaankara”, by organizing programs in schools, colleges, etc. in which thousands of students and teachers participate every year.

Colors used in Holi have chemicals in it which are harmful for health. So awareness is done on this issue along with demonstrations on preparation of natural colors using leaves, flowers, vegetables & fruits. Echo-clubs in schools play important role in this activity^[4].

Snake Science

MANS has established a statewide organization of ‘Sarpa Mitra’ (Friends of the Snakes) in Maharashtra which is the first of its kind. This has helped those friends of snakes who work within the framework of the law to overcome difficulties to an extent. Samiti, with the help of the Forest Department, organized a march ‘Sarpavidnyan Probodhan Yatra’ (making people aware of science of snakes) through the state. People were given detailed scientific information regarding snakes, snake bites, superstitions in connection with snakes and how the snakes and environment are linked up^[5]. Live snakes were used for demonstration. On the ‘Nagapanchami Festival’ Samiti arranges a week long programme for enlightenment of people regarding the science of snakes. This programme is executed mainly in schools. Lectures are arranged to convince the students that they should not kill the snakes nor should they offer milk to them but understand them scientifically and appreciate their importance in conserving the environment; they should not go to a snake enchanter or a witchdoctor in case of a snake bite but give appropriate first aid to the victim and immediately take him/her to the hospital for proper treatment. Lectures are supplemented with film strips, posters, etc. About 800 to 1000 such lectures are arranged every year during the Nagapanchami week.

Eco-friendly Ganesh Festival

There are about 1.8 crore families residing in Maharashtra and out of them about 1 crore families install the Ganesh Idol during the Ganeshotsav. After 10 days of worship, the idol is immersed in water as per the religious tradition of the Hindus. The average weight of these idols made of plaster of Paris is about a kilo and a half. They do not dissolve in water, but on the contrary, settle like rocks at the bottom, depositing thick mire and clogging the springs in the wells, rivers, ponds and lakes. In addition the poisonous chemicals used for painting the idols severely pollute the water. Approximately ten million kilos of flowers and other materials used in the worship and immersed in water along with the idol too pollute the water every year. Being a religious tradition, people are very touchy about it and this makes it very difficult to take any step to avoid this pollution. However ANS decided to take the initiative that was overdue.

In 1993, ANS started collecting separately the flowers and other offerings and instead of immersing it along with the idol, used it for making compost manure in Kolhapur. Later many municipalities and municipal corporations, students of National Service Corps, Environmental organizations jumped into this movement. In 1998, ANS initiated another move inviting people to donate their Ganesh Idols to the ANS, instead of immersing them into water. It argued that since at the end of tenth day after the Uttarpooja (worship and dismissal of the divinity at the close of a ceremony) the idol loses its sanctity as a god, and is therefore immersed in water; the devotees may, as well, donate the idols (that are no more pious) to the ANS instead and the ANS in turn will immerse the idols in such water storage, that can avoid pollution of clean sources of water. Every village has a quarry from where big boulders and stones are mined and the huge pits left behind at the site get filled with unusable water. Since the bottom of the pit also is rocky, this water does not seep down. ANS started immersing idols in these abandoned mines and avoided pollution of all other sources. This activity quickly grew into a

people's movement and soon ANS started collecting about 70 thousand Ganesh Idols for immersion without pollution, every year, from over 15 districts of Maharashtra.

ANS offered another alternative solution to the problem. Permanent durable idols of metal or earthen and paper mash idols can be made which can be immersed after a regular Uttarapooja, in a bucket of water at home. The water can then be used for the plants in the house or garden and return to nature what was taken away from it. This movement was largely welcome by the society but some Hindutvavadi organizations vehemently opposed it. They gathered at the place of immersion and insisted that the idols be immersed only in a live source of water, creating a law and order problem. To solve this problem ANS appealed to the division bench of the Aurangabad High Court in 2004. The court ordered that use of chemical colours to paint the idol be banned and the idols may chiefly be made of earth. Taking this into consideration, capacity building was done in many schools by teaching the students to make ganesh idols out of soil. Students across the state last year made more than 5000 ganesh idols and installed them in their homes and later, bid adieu to their dear 'ganpatibappa' by immersing the idols in water buckets at their homes itself. This year, ANS aims at involving nearly 2 crore school children from about 20,000 schools to make about a million earthen ganesh idols. This is to be done in association with the state education department.

Another useful judgment was from the Supreme Court Monitoring Committee, which made it clear that polluting water for any reason, whatsoever is a criminal offence and all Indian States should clearly notify their citizens accordingly. The State Pollution Control Committee in its turn notified the local governing bodies, municipalities, corporations, etc. This created an important means of stopping water pollution; however the local governing bodies do not care to implement the order. ANS has to increasingly pressurize the government to get the local bodies to obey the order. Hence, Commissioners, Collectors, Social Forestry Department and Municipal Corporations are frequently issued letters to prioritize and act towards ensuring an environment-friendly Ganeshotsav. Despite all the opposition ANS is continuing its constructive action of religious criticism through mass community engagement.

Pollution-free Diwali

Diwali is a religious festival and the crackers and the fireworks during this festival have a kind of religious sanction. But this literally burns your money and causes noise and atmospheric pollution. It also involves risks of accidents and setting fires. Children are recruited in the workshops to produce crackers. Samiti organized a broad movement of making Diwali a pollution free festival. The students' declaration on a pollution free Diwali (prepared by the Samiti) was signed by Dr. JayantNarlikar, Dr. NarendraJadhav, Dr. PrakashAmte, Nana Patekar and Sachin Tendulkar. Students were expected to mention in this declaration form a.-the amount of reduction in their spending on crackers and instead buy sweets, books and toys worth that amount thus saved and b.-in what way they intend to help the poor. This scheme got a tremendous response in the recent years. The total money saved by lakhs of students by not buying crackers amounted to Rs. 20 crores, 25crores& 30 crores in last 3 years. Maharashtra pollution control board, Central pollution control board, Eco-clubs in schools and other organizations supported this activity. Films, documentaries, students rally, posters, banners, lectures are used for community involvement against air & sound pollution due to crackers. This activity is tremendously accepted & appreciated by parents& other people in community.

CONCLUSION

- i) There is an urgent need to build capacities of government agencies, communities, NGOs and the judiciary with regard to the implementation of necessary steps for environment conservation.
- ii) Lack of information, along with some of our traditions are great hindrances for people's participation and monitoring and do not allow people to think and act scientifically.
- iii) But MANS is playing a crucial role for people's participation by creating scientific awareness and by giving alternative ways for celebrating our festivals in an environment-friendly way.

- iv) The work of MANS has created a very good impact in rural as well as urban areas of Maharashtra. People are now coming forward and accepting these alternatives cautiously for environment protection, conservation and development.

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Sustainability: Rethinking Human Development in Indian Context

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ABSTRACT

The rapidly growing population is not only hindrance to the developmental process but also confronts the problems of sustainability due to usage of natural resources to the large extent. The purpose of development is not only to enhancing the economic position /income of the people but to lead a long and healthy life and also to enjoy a decent standard of living in a sustainable manner. Sustainable development is a process of change in which the exploitation of resources, the direction of investment, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. Ancient Indian mythological stories and religious teachings have advocated the path of sustainable development but, the modern generation is responsible for not following it and putting themselves into a temporarily rich and permanently poor condition. In the myopia of western development India has forgotten the thoughts of 'Kautilya', its own ancient thinker, who had given Sustainable Developmental Models for every sphere of public life in Indian context and has proved their effectiveness. It should never be forgotten that the 25 years Chandragupta Mourya's period of Indian history is remembered as the 'Golden Age' because of the success of Kautilya's models. This paper aims to address the issue of sustainable human development.

Key Words Development, Sustainable, India, Kautilya, Golden Age.

INTRODUCTION

Sustainable Development

'Sustainable development', an all-inclusive, somewhat ambiguous concept basically means economic and social development that endures over the long-term and its core ethic is intergenerational equity. It is a process of change in which the exploitation of resources, the direction of investment, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. Sustainable economic development ensures the well-being of individual by integrating social development, economic development, agriculture and industrial production through environmental conservation and protection.

Human Development

People are the real assets and resources of the country. Hence human development is the primary objective of any developmental policy. This approach of development puts people at the centre in development process by enlarging people's choice and improving the standard of living and ensuring social-political-economic well being [2].

Access to basic needs, education, health care, social protection, business opportunities equality, poverty eradication, and healthy environment are the different aspect of human development [2].

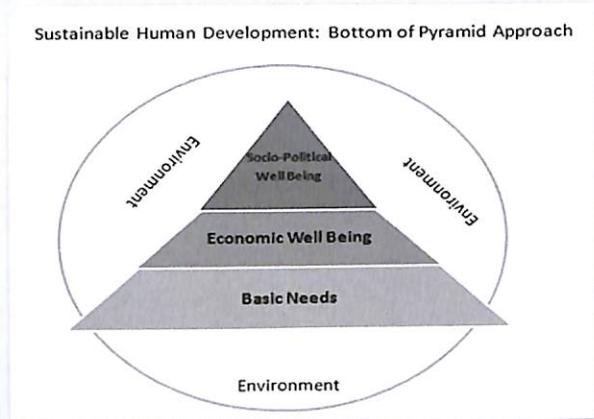
Nutritious Food, Clean Drinking Water and Fresh Air

The 21st century is characterized by unprecedented challenges and opportunities for the survival of human being on the earth, arising from rising population, Usage of natural resources, Environmental degradation and climate change, the desire for inclusive and sustainable development and the imperatives of climate change are all matters of immense concern.

The challenges are to ensure availability of sufficient stock of food, so that needs of everyone be fulfilled. Further, nutritious food is the absolute minimum resource necessary for long-term physical well being. The issue is how - should we ensure availability of food. We need to boost agricultural productivity to both improve the availability of food and reduce poverty. Storage and transportation of food from place of abundance to place of scarcity is also an equally important method of dealing with food availability.

Clean water and sanitation can make or break human development. Access to clean drinking water is critical determinant of health; hence ensuring reach ability of filtered clean drinking water to every person in the country is a major challenge for government [1].

Another issue is fresh environment for the healthy life of human being. Unregulated human activities accelerated unsustainable use of natural resources and increased pollution level. This obviously impacts the health of the people. Hence we must take into account the true environmental cost for many reasons, including government subsidies, lack of knowledge about environmental impacts and the ill effects of pollution.



AIMS AND OBJECTIVES

This paper aims to address the issue of sustainable human development.

METHODOLOGY

The present proposal is based on a composite of past proposals, material based on ancient Indian mythological stories and religious teachings and other relevant information gathered which gives an idea about past conditions and reflects the present condition.

RESULTS AND DISCUSSION

The Indian Context

The Indian culture is based on the above stated philosophy, which should be every Indian's approach towards his life. This approach advocates sustainable development. Indians are basically the preachers of sustainable development. Ancient Indian mythological stories and religious teachings have always advocated the path of sustainable development but, it the modern generation, who is responsible for not walking on the right path and putting ourselves into a temporarily rich and permanently poor condition.

The entire edifice of Indian economy is traditionally based on Agriculture. In fact, Indians have adopted it as a way of life, which still happens to be the most powerful strength of Indian economy [4]. Though the recent

results do not, favor this statement, but the fact remains that agriculture is the only area of Indian economy which, if nurtured properly can bring not only prosperity but also provide us the necessary economic direction for sustainable development. Agriculture and rural set-up go hand-in-hand and therefore it is pertinent to think about rural development when we think about agricultural development.

The rural life style is woven around an individual's minimal needs and has a strong social and environmental bonding. This combination itself speaks about sustainable development. The concept of sustainable development is directly associated with the needs of human being. More the needs more will be the exploitation of resources and more the exploitation lesser will be the sustenance of development. It is therefore necessary for India to review its development policy in totality and to rethink on the measures of development they apply. Is it GDP? Is it per capita income? Is it industrial growth? Is it standard of living? The fact remains that the real measure of development of any country is- good eco-psycho-socio quality of life of the poorest of the poor citizen. Until the quality of life of the poorest is not brought up to the satisfactory level, one cannot claim success on developmental front.

If this should be the focus of Indian economy then, are the present economic changes piloting in this direction? The answer is definitely "NO". At present the world is clearly divided into two parts: sellers and buyers. The sellers are in fact buying the savings of the buyers as a result of growing consumerism.

The other point concerning India is, that it is still not successful in providing its people with the basic needs of livelihood? The scrutiny of affairs points towards number of things including the Governance Model, policy implementation, beaucratic set up, political will, etc.

The most important amongst these are the political will and rampant corruption in the system which is why India has failed to utilize the resources for development purpose. It would be very apt to quote from an article by our Hon'ble Finance Minister Shri P. Chidambaram that, "If we look at our Post Independence budget allocations towards developmental areas like roads, power, education etc. then it will be clear to us, the way we misused our scarce resources". If one is not, faithful to one self than why should one expect others to be so towards oneself?

There are pockets in India which can be treated as models of development and that too sustainable one, like agro-industrial combination of sugar factories in Western Maharashtra, but these are exceptions. Therefore, if India wishes to keep its developmental cycle in motion then, it has to not only frame appropriate policies but also take care of their implementation. The present methods of implementing developmental policies have failed to deliver and there are number of reasons that can be attributed to it like, delayed and fractured law enforcement, fallen moral standards, eroded ethical norms and absence of social concern^[3]. This is not the time when India should be discussing the tragedies of its developmental failures, but it is high time it should endorse them, because unreasonable underperformance has taken its toll on sustainable development, and this occurrence has to be thoroughly probed.

Indians were never the 'Prairsers of Poverty', they were always the 'Practitioners of Prosperity' but in the recent times they have overlooked this fact. Due to this, poverty in India has been glorified in the Post Independence period which has actually affected the philosophy of Indian developmental thought. We study the Economics of Smith, Marshall and Robinson and in the process have forgotten the thoughts of 'Kautilya', the Great Indian thinker, who had given Sustainable Developmental Models for every sphere of public life in Indian context and has proved their effectiveness. It should never be forgotten that the 25 years Chandragupta Mourya's period of Indian history is remembered as the 'Golden Age'. Out of these 25 years, 12 years were of insufficient rains, which was most essential for the economy based on agriculture. This underlines the strength in the Developmental Models and sincerity in their application.

In the shadow of Globalization, lots of economic issues are coming up for discussion and one of them is sustainable development^[2]. But in Indian context the effects of globalization has cast its shadow from the advent of East India Company, which later on became the holding company of India Inc. The Britishers simply exploited Indian economy for their economic development through a Governance system, which is still being

continued in India in the disguise of democracy and civil services [1].

Therefore, in order to improve on sustainable development fronts it is necessary to channelize economic resources through the psychological transformation of public thinking, creating political will amongst political leaders, enforcing strict laws, encouraging public participation and decentralizing the power honestly and speedily.

CONCLUSION

The key drivers and principles of human development begin when it becomes central to growth process. This needs strong dedication to human development and social welfare, and openness to trade and innovation.

While developing a policy of development of a country, it should address to developmental approach of a country as a Unit of the earth. Human development should not be restricted to a particular class of masses; everyone is a partner in the developmental process. The major challenge is to facilitate this: enhancing equity, enabling voice and participation, confronting environmental challenges and managing demographic change, there is a greater need to focus on the ensuring development from bottom of pyramid through inclusive and sustainable growth strategy. There is co-existence of human being and earth, environment and sustainability, therefore no development process can afford to neglect the environmental consequences of economic activity, or allow unsustainable depletion and deterioration of natural resources.

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Industrialization: Its Impact on the Society and the Environment

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ABSTRACT

Environmental pollution is now a global problem in today's society and is likely to influence the total ecosystem of our country including the health and human population and also the plants and animals (both on the marine and land surface). This paper gives a total view of the positive and negative effects that the industrialization on the environment from the different perspectives of air, water, noise, land and solid wastes pollution and also the diseases caused to the human beings, plants and animals. It also gives an insight to some controlling measures for controlling the pollution and usage of less polluting technology which will keep our environment healthy and safe from all kinds of pollution related hazards. Thus, the negative impacts on health could be avoided. The paper mainly focuses on the impact of industrialization on the society and the environment. Moreover, it also discusses about the initiation of the industrialization in the developed economies in the 18th and the 19th century followed by a wide description of the initiation of the industrialization in the state of Qatar. Finally it ends up with a conclusion of all possible steps to overcome the limitations of industrialization.

INTRODUCTION

The natural environment in which we are surrounded consists of atmosphere, earth, water and space. Without pollution it remains clean and healthy to live in. The various activities of man lead to the degradation of the environment. These activities include industrialization, construction, transportation and many others which are although essential for the human development and welfare. On the other hand, these activities lead to the generation and release of toxic materials which are hazardous to the environment. Environmental pollution now-a-days is a wider social issue since pollution has that potential to destroy the human lives as well as the communities. Pollution is the effect of the changes which are undesirable in our surrounding causing harmful effects on the plants, animals and human beings.

Both the industrialization and the technological growth are not only essential but are helpful for the measurement of a developed nation. A well and proper balance needs to be maintained between the industrial activities and also the government including the local bodies so that the pollution can be controlled in an efficient manner in order make our environment friendly and safe to live in.

AIMS AND OBJECTIVES

Our main aim is to keep our environment clean and pollution free. The rapid growth of the industrialization in India compared to that of the world cannot be restricted in quicker times to control the pollution. So, by explaining the merits and demerits of industrialization on the environment in order to eradicate the pollution some industrial processes needs to be selected which would lower the level of pollution to a minimum or at a zero level. Further, it is necessary to take some pollution control measures by the government so as to keep our environment as clean as possible.

The Industrial Revolution brought improvement in agriculture lowering the cost of food. This meant that families could get food cheaper and since most of their money was spent on food, many families had extra money to spend. Another major reason for the cause of the Industrial Revolution was Britain's rising textile industry. Britain's competition with India's cotton textile industry made Britain create tariffs on Indian cotton, thus giving Britain an advantage. Britain also had a number of inventions that made cotton textiles cheaper and faster to produce. At the same time, steam engines were also being produced to help spread industrialization and trade. This Industrial Revolution grew and spread changing the politics, economics, and social aspects of the world.

Industrialization or the industrial revolution will be defined as the following: a transformation in the way people live and work; a transition from an agricultural/craft based society to one based on industry; a shift to wage based, division of labor factories founded on mechanization; a move to mass production; and a movement from rural to urban living.

Although industrialization began in Great Britain in the 18th century and then spread to America, the industrial revolution as it occurred in the United States will be the primary focus of this article.

The standard of living for workers in the early Industrial Revolution was certainly horrible, but it did improve in the course of the nineteenth century. Two types of statistics tell us this. First of all, the overall population of Europe rose dramatically from some 187,000,000 in 1800 to 466,000,000 by 1914. Add to that another 60,000,000 who immigrated to other continents and one gets the distinct impression that the overall standard of living in Europe was getting better.

Another figure telling a similar story of progress is the average life expectancy of Europeans during this time. In 1800, most people could expect to live around 30 years or less, depending on their social class. By 1900, the average life expectancy had risen about fifty per cent to 45 years. Better living conditions and nutrition, public sanitation, and great advances in medical science were all responsible for this jump. However, the price those early generations of factory workers paid for this progress and our own comfortable life styles was a terrible one indeed.

Agriculture, steam, factories, and the government contributed to how the people were affected by industrialization in the 19th century. With Agriculture beginning to use machinery, Steam becoming a very important part of everyday life, and factories being able to put in new machinery there was an increase in the position of the government. Change did not always mean progress; with change there came a number of setbacks as well as advances for the people. With agriculture beginning to use new machinery the market for food increased. They began to use machinery rather than animals and people. A farmer and his sons would be able to run a whole farm on their own without hired help. They were able to get work that would normally take weeks, done in a shorter period of time. They were then able to get food from places that were not close to them.

Although the nuclear family had generally replaced the extended family in European society since the Black Death (largely in order to keep from splitting up family lands), there was still a network of close friends and relatives in the villages providing each other mutual support. However, as individual families moved to the city, they left behind the support network of the villages, often living in isolation and having little or no support from their neighbors.

The growing numbers of people left helpless and destitute by the rapid changes of industrialization did not go unnoticed, and reform movements arose from three directions. Some reformers were genuinely concerned industrialists such as Robert Owen and W. H. Lever, who built model communities in which their workers could live and work. Other reformers were liberal politicians trying to alleviate the sufferings of the masses or conservative politicians trying to avert social revolution caused by such misery. Together such politicians enacted legislation that gradually eased the plight of the working class, such as the Factory Act of 1833, which limited the

use of child labor, and the Factory Act of 1850, which limited women and children to workdays of ten and a half hours.

However, many workers felt that for real progress to be made, they would have to work for it themselves. That involved organizing into trade unions, the very existence of which was illegal until 1824. Even then, they could only exist as mutual aid societies to provide their members with insurance against sickness and injury. Not until 1871 could British unions represent their members' grievances and actively work for reforms. The struggle for those reforms was a long, hard, and often violent one. However, by the end of the nineteenth century, trade unions had made substantial progress toward improving the living and working conditions that industrial workers had to endure.

A Case Study

The state of Qatar is a small peninsula just over 11000 sq.km. with 900 km coastline off the Arabian Peninsula and connected in the south to Saudi Arabia. Increasing industrialization creates many threats to the environment. These are associated with large-scale energy production and metallurgy with the advent of more scientific technology. Qatar has become one of the richest countries in the world in the recent years and their population has also increased due to the increasing industrialization. The annual population growth for the Non-Qataris is 6.5% and for the Qataris it has been 2.2% between 1997 and 2004 (World Bank, 2005). Discovery of oil made Qatar's GDP increase to 18% between 1999 and 2004. Crude oil and gas consists of 62% of the Qatar's GDP. Qatar's marine and terrestrial resources consist of a large number of species including reptiles, birds, fishes, plants. Environmental risks covers in a large-scale basis from regional to international. One of the most important matters associated with the increasing industrialization is the availability of water. About 96% of the domestic water in Qatar provided by desalination whereas ground water supplies are largely used for the small agricultural industry. Over-use of ground water resulted in the destruction of many springs in the Arabian Peninsula. 15 desalinated plants are located in the Gulf region which releases gases, treatment chemicals and other elements. Increase in the number of desalinated plants will lead to the devastation of the environment. In case of the marine environment, coastal development took place including dredging, land reclamation for the projects such as, residential areas, industry, fishing ports, airports etc. These activities increases silt and sedimentation and water turbidity which prohibits photosynthesis of the plants. It also affects the life of the fishes by clogging their gills and also destroys the sea grasses and the coral region. Sewage of approximately 20-30% was discharged into the Gulf water which is not fully treated. In 1999, Qatar developed 13 sewage treatment plants where this sewage was fully treated and this treated water is then used for irrigation of fodder crops and also for other purposes. In order to protect the environment from all these hazards The National Biodiversity Strategy and Action Plan (NBSAP) implemented in October 2004 with the goal of reducing the environmental loss. It consists of a large number of strategies and plans and various control measures to protect the natural ecosystem including the humans from the negative effects of industrialization.

Impact of Industrialisation on the Society

Industrialization, though it has some ill-effects on the environment, yet it has some favorable effects on the society. The public has been much more aware of the advantages of the industrialization than of its negative effects. The story of industrialization contains a mixed bag of pros and cons and lasting impact.

Industrialization has allowed individuals to own items that would never have been imagined prior to Industrial Revolution, and in many instances it has brought speed, increased productivity, ease of use, power and wealth.

With the process of industrialization, the standard of living of the people improves. People enjoy fruits of modernization in the form of a variety of goods and services available in the urban centers. It promotes social welfare as well.

Industrialization means the transformation of the country's population from being predominantly rural to being predominantly urban. As per Lewis Model, we know that a particular economy has two sectors-a traditional rural agricultural sector and an advanced urban industrial sector. In the agricultural sector, there prevails disguised unemployment due to unlimited labor supply and hence, wage rate is at its subsistence. The industrial sector can

be made advanced if the excess labor in the rural sector gets migrated to the urban sector. In that situation, the disguised unemployment gets reduced. After a certain level of labor absorption in the industrial sector, the wage rate rises above the subsistence level. Thus, with the industrialization not only the industrial sector improves but this makes a positive impact on the agricultural sector as well.

An increase in labor employment in the industrial sector leads to the increase in the purchasing power of the people which further induces the aggregate demand in the economy to rise. Hence the economy grows with the advancement of the industrial sector.

With the growth of industry, the severity of unemployment gets reduced. Most of the manufacturing goods have the income elasticity greater than one and the primary goods have income elasticity less than one. Hence, with the rise in income, the demand for the manufacturing goods rises and that of traditional goods falls. Thus, as the economy grows the demand for industrial products rises. This leads to the rise in employment of labor in the sector that leads further to rise in industrial production.

Industrialization brings social transformation, social equality, more equitable distribution of income and balanced regional development. It improves the economic condition of the backward regions of the country. With the setting up of the industries in those regions, the people get engaged in productive works leading to the improvement in the standard of living.

Industrialization leads to production in bulk. Hence, it brings returns to scale/economies of scale that leads to a fall in average cost.

Most of the less developed countries (LDCs) begin their industrial development to supply fertilizers, farm machinery and other inputs so as to increase the efficiency of the farm. With the technical progress, the production rises.

Most of the LDCs depend on the DCs for the import of sophisticated techniques of production prior to industrialization. However, industrialization reduces this dependence. This improves the trade balance of the country.

Impact of Industrialisation on Environment

Apart from the positive effects of industrialization, there are also certain impacts which are negative in nature and act as a threat for the environment. By the introduction of newer and newer technology and scientific methods and processes, industries are growing in numbers day by day in order to fulfill the demands of the consumers compared to the 18th century, thus generating pollution for the environment. This rapid industrial growth not only took place in the developed countries but the developing countries have also widely shown various industrial developments. Due to such pace of industrial growth degradation of environment is taking place which includes air pollution, water pollution, noise pollution and land pollution. Apart from these pollutions the major threat in today's recent environment and society is of Global Warming. The emission of the green house gases from the industries leads to the rise of the global temperature which gives a threat to the world.

The machines which are used in the industries like boilers, diesel generating sets release lots of fumes and poisonous gases, smog and oil aerosols which causes air pollution. The smog contains nitric oxides, sulphur oxides, carbon monoxide, hydrogen sulphide which reacts photochemically producing nitric, sulphuric and carbonic acids. These acids fall in the form of acid rain causing severe destruction of the living beings. These pollutants on the other hand create various respiratory problems like asthma, bronchitis and lung cancer. Changes in the ozone layer have serious impacts on mankind. Sunburn, cataract, aging of skin and skin cancer are caused by the increased ultra-violet radiation. It weakens the immunity system of the human body by lowering their resistance power and thus they suffer from various infections like chicken pox and other viral diseases. Ultra-violet radiation also affects the plants and animals in wider scale. The plants' ability to capture the sunlight during the time of photosynthesis gets reduced due to this radiation. It also reduces the growth of the plants and animals. The breeding period of the animals reduces due to the radiation.

The industrial wastes and the oily substances which are emitted from the industries gets mixed with the waters of the rivers, lakes and the oceans polluting and suffocating the aquatic system including fishes, crabs etc. Due to the oily coating in the water surface it prevents sunlight from entering into the water which ultimately stops photosynthesis of the plants and the planktons. Industries produce lots of sounds and it specially affects those people who stay near to the industry area. Different types of sounds of mixing the materials, extraction, compressing and heating by the powerful electric equipment create loud noise and vibrations. Birds and animals migrate to other places while the human beings suffer from serious diseases such as insomnia, hypertension, irritation, physiological stress and partial deafness. Land degradation also happens due to the disposal of solid and liquid wastes. The disposed oil hardens the soil surface preventing the efficient penetration of the air, water and decomposed organic matter into the soil. It further destroys some of the nitrogen-fixing bacteria and organisms which are helpful for the growth of the plants. The natural color of the soil gets lost due to these oily wastes.

Sanitation was virtually non-existent, making clean water a luxury reserved for the rich. Open sewers ran down streets carrying water fouled with industrial and human waste. Diseases such as cholera, typhoid, typhus, and tuberculosis often reached epidemic proportions.

These are in short the negative sides of the effects which are caused due to the industrialization on the environment. Proper environmental measures need to be introduced as soon as possible in order to save the global economy and also the society. Thus, industrial process plays a major and significant role in the degradation of the global environment.

CONCLUSION

Although we started the industrialization in Europe with the industrial revolution, we now have to provide a long-term solution for all people around the world, especially in underdeveloped countries. We are facing major challenges in the near future; therefore, we should start with humanitarian efforts to make the earth a place where all humans can comfortably live.

New efficient and inherently safe nuclear power plants must be built. We have to realize that fossil fuel reserves are limited, whereas nuclear fuels will almost be available for an unlimited time and not restricted to be uranium or plutonium only. Renewable energy supply systems should also be applied and any power supply and power using system should be designed to be as efficient and clean as possible. The advances in computer technology provide us with the best possible control of power generation and power using systems.

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Degradation of Environment: Issues and Challenges

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ABSTRACT

Environment must be carefully nurtured and protected not only for the present but also for the future. Global warming, depletion of ozone layer, environmental pollution, climatic changes are some of the major issues of environmental degradation. Industrialization and its subsequent fast population growth are the chief contributors in both developed and developing countries. Urbanization, industrialization, extension of agricultural areas etc and has created environmental imbalances. Increasing use of polythene, increasing number of automobile vehicles , unplanned sewerages , use of pesticide to combat pests and insects in agricultural fields have threatened the lives and bio- diversities challenging the very existence of biotic and abiotic phenomenon.

To combat the situation related to environment degradation government and scientists have also taken wide measures for management and monitoring of environmental problems. There is need for technological innovations involving production of environment friendly materials and new techniques. The time is right for action and it must be taken quickly.

Green Human Resources: An Effort towards Environment Sustainability

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ABSTRACT

There is a growing need for strategic Green HRM – the integration of environmental management into HRM Sustainable development which means meeting the needs of people today without compromising the needs of future generations. From a business perspective, sustainability is a company's ability to achieve its business goals and increase long-term shareholder value by integrating economic, environmental and social opportunities into its business strategies. Green human resources refer to using every employee interface to promote sustainable practices and increase employee awareness and commitments on issues of sustainability. This is done by E-HRM which employs continuous and directed support by full use of web-technology-based channels and networks as a HR strategy and practice. Today over 40% of the Fortune 100 companies issue corporate social responsibility reports based on environmental and sustainability considerations. The present study is an explorative research and uses secondary data source to analyze social and environmental reporting practices of Indian companies including how responsibly companies in India are responding to their social and environmental obligations and how the facts are getting reported in their annual reports. It aims to understand, review and judge the Corporate Social Responsibility initiatives of relatively large companies in India and draw lessons for future.

INTRODUCTION

The term ‘sustainability’ evolved during the first years of the 21st century as one of the most cited key words and one of the biggest challenges for businesses and for the community [23]. The implementation of a sustainable corporate strategy requires strong leadership and a concrete process [13]. While many scholars still dispute the impact of sustainability on the financial bottom-line, the implementation in firms has already been going on for years [15,13].

Facing the need of incorporating ‘green’ into the corporate strategy, the topic of sustainability is moving up on the agenda of most business leaders and management boards, whereas it generally stays off the radar screen and awareness of most practitioners in the HR environment. Within the world of business the main responsibility of corporations has historically been to make money and increase shareholder value. But, now in an era of globalization corporations put their emphasis on contributing to a better society and cleaner environment. With increased media attention, pressures from non-governmental organization there is surging demand from civil society consumers, governments and others for corporations to conduct sustainable business practice. The corporate response has often meant an adoption of a new consciousnesses and this has been known as Corporate Social Responsibility (CSR) since 1970s. Corporate Social Responsibility is a form of corporate self regulation integrated into a business model. Baker, 2007 [2] defined that CSR is about how companies manage the business processes to produce an overall positive impact on society. The World Business Council for Sustainable Development, states that “Corporate Social Responsibility is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large”

Among other countries India has one of the richest traditions of CSR. Much has been done in recent years to make Indian Entrepreneurs aware of social responsibility as an important segment of their business activity but CSR in India is yet to receive widespread recognition. The history of CSR in India has its four phases. In the first phase charity and philanthropy were the main drivers of CSR. In the pre-industrialization period, which lasted till 1850, wealthy merchants shared a part of their wealth with the wider society by way of setting up temples for a religious cause. With the arrival of colonial rule in India from 1850 onwards, the approach towards CSR has changed. In the second phase, during the independence movement, Indian industries focused on the progress of the society. Gandhi's influence put pressure on various industrialists to put an emphasis on the socio-economic development of the nation. In the third phase (1960-80) there was an emergence of the public sector. During this period the private sector was forced to take a backseat. The public sector was seen as the prime mover of development. They were set up by the state to ensure suitable distribution of resources (wealth, food etc.) to the needy. In the fourth phase (1980 until the present) Indian companies started abandoning their traditional engagement with CSR and integrated it into a sustainable business strategy. Increased growth momentum of the economy helped Indian companies grow rapidly and this made them more willing and able to contribute towards social cause.

For large multinational companies or small local businesses, the topic of sustainability has become important simply because the public's perception of this issue has changed. Today, consumers are educating themselves on both green and social issues and are considering sustainability when selecting goods and services. Green human resources refer to using every employee interface to promote sustainable practices and increase employee awareness and commitments on the issues of sustainability. It involves undertaking environment-friendly HR initiatives resulting in greater efficiencies, lower costs and better employee engagement and retention which in turn, help organizations to reduce employee carbon footprints by the likes of electronic filing, car-sharing, job-sharing, teleconferencing and virtual interviews, recycling, tele-commuting, online training, energy-efficient office spaces etc. In this green world the green HR or people management function has sustainability at its core as part of its people management and talent management focus and organizations engage with the society by aligning their agendas with it. Communities, customers and contractors all become equal stakeholders along with employees and shareholders.

Literature Review

A great deal of CSR literature is concerned with the perceived dichotomy of the normative and instrumental approaches. Much of the literature promotes the 'business case' for CSR with many claiming that "ethics can be good for business". It is argued that CSR needs to be made relevant to the concerns of business people by emphasizing and focusing on this 'instrumental' approach. It is argued that "CSR needs to be reconstructed in an instrumental linguistic praxis to be meaningful to managers in their day-to-day pursuits of organizational goals and objectives"^[1]. However, those who take a normative approach express the concern that an instrumentalist approach diminishes the underpinning ethical principles of CSR. Many HR advocates proposed that corporations should protect human rights because it is the right thing to do, whether it is profitable or not. It is argued that an instrumental approach would only involve acting ethically as long as it was profitable to do so, whereas a normative approach suggests a more consistent ethical performance^[14]. Research demonstrates that the driving force for corporations to adopt CSR values is often catalyzed by particular events.

A series of experiments conducted by The University of Western Ontario's Ivey School of Business revealed that it pays companies to invest in social responsibility. Fombrun and Van, 2004^[12] observed that once a company hits certain socially responsible thresholds, they will have measured to some reputation levels. In return, consumers will reward it by paying higher prices, recommending other stakeholders and customers to the company etc. However, works of Birch, 2003^[5] observed that good corporate social responsibility does not require outside approval, nor should it necessarily be a measure of how 'good' or 'ethical' a company is. He emphasized that it's essential that corporate social responsibility is made a part of all decision making in the company. It is well known that 'charity begins at home' so is the case with CSR. It is the first step towards CSR.

On another note, Visser, 2005 [24] noted that CSR may be associated with a series of bottom-line benefits. For example, socially responsible companies have enhanced brand image and reputation. That is, consumers and stakeholders are often drawn to brands and companies with good records in CSR related issues. A company regarded as socially responsible can also benefit from its reputation within the business community by having increased ability to attract capital and trading partners. Overlooking negative social and environmental externalities when valuing a company might be equal to ignoring significant risks. Companies that adopt the CSR principles are more transparent and have less risk of bribery and corruption. Nkiko and Katamba, 2010 [20] observed that CSR oriented companies may implement stricter and, thus, more costly quality and environmental controls, but they run less risk of having to recall defective product lines and pay heavy fines for excessive polluting. They also have less risk of negative social events which damage their reputation and may cost millions of dollars in information and advertising campaigns. Companies perceived to have a strong CSR commitment often have an increased ability to attract and retain employees which leads to reduced turnover, recruitment and training costs.

Chahoud, et. al, 2007 [9], opines that Indian CSRT is not well balanced between internal and external stakeholders. Indian companies tend to aim their CSR engagement at external stakeholders. However, the long tradition of CSR in India indicates that CSR in India has considerable potential for improving corporate, environmental and social conduct.

AIMS AND OBJECTIVES

This study is focused on social and environmental reporting practices of Indian companies. In this study an attempt has been made to examine how responsibly companies in India are responding to their social and environmental obligations and how the facts are getting reported in their annual reports. The objective of the present study was to understand, review and judge the Corporate Social Responsibility initiatives of relatively large companies in India, with a view to understand their current thinking on the subject and draw lessons for future. The study might help other small and medium sized companies, to actualize their CSR interventions. It is believed that by undertaking a comprehensive study on CSR reporting in India a modest contribution could be made. To realize these objectives the following procedures can be adopted:

- a) to survey the published annual reports of companies in India
- b) to understand the present scenario of corporate social responsibility of public and private sector enterprises
- c) to make an evaluation of the adequacy or otherwise of the measures taken by the companies in order to mitigate damages and
- d) to suggest measures for improvement.

METHODOLOGY

The proposed study had been both exploratory and empirical in nature. The study involved several conceptual issues. These issues dealt with an analytical approach. The information to be used for this study was collected from both primary and secondary sources. For theoretical and conceptual study we mainly depended on literature available on this field in the forms of books, journals, published articles and websites. This study was based on information available from companies in India. Moreover, information in this context were available from published annual reports of the company, from auditing companies who are into social auditing and websites which were taken into consideration for this study as secondary source. For studying the perceptions of managers, a questionnaire was prepared, managers' interviews were taken and responses were analyzed by applying suitable statistical tools. We intended to confine our analysis to 20 randomly selected private and public sector companies of India. And after that we analyzed the recent trends of those companies. Also few parts of our study will be based on analytical research which generally deals with conceptual issues.

RESULTS AND DISCUSSION

A structured questionnaire specially designed for the study, was administered on private and public sector

organizations in India. It has been observed that despite rigorous, consistent and close follow up with the companies through courier, telephone, e-mail and at times through personal visits the response to the questionnaire has not been encouraging at all in case of private sector in comparison to that of public sector enterprises in India. Among several private sector companies only Tata Group of companies was good at responding. According to the literature review Corporate Social Responsibility in private corporate sector though not new to India, is still at a nascent stage. Big business houses like TATA, AMBUJA, BIRLA and AMBANI have already contributed to the society at large by setting up educational institutions, super specialty hospitals, infrastructure projects, temples etc. In this context several steps were taken to promote CSR by various India companies.

Reliance industries and two Tata group firms- Tata Motors and Tata Steel took initiatives to promote Corporate Social Responsibility. Tata Steel has adopted the Corporate Citizenship Index, Tata Business Excellence Model and the Tata Index for Sustainable Development. Tata Steel spends 5-7 per cent of its profit after tax on several CSR initiatives.

Over 500 self-help groups are currently operating under various poverty alleviation programs; out of which over 200 are engaged in activities of income generation thorough micro enterprises. Women empowerment programs through Self-Help Groups have been extended to 700 villages. From the year 2003 to 2006, the maternal and infant survival project had a coverage area of 42 villages in Gamharia block in Seraikela Kharsawa and a replication project was taken up in Rajnagar block. For providing portable water to rural communities 2,600 tube wells have been installed for the benefit of over four lakh people.

Tata Steel has hosted 12 Lifeline Expresses in association with the Ministry of Railways, Impact India Foundation and the Government of Jharkhand. Hospitals have been set up in Gobardhanpur, Sukinda, Joda, Belpahar, Belipada and Bamnipal. Tata Employees at Pune have been encouraged to make various industrial co-operatives engaged in productive activities like re-cycling of scrap wood into furniture, welding, steel scrap baling, battery cable assembly etc. The Tata Motors Grihini Social Welfare Society assists employees' women dependents; they make a variety of products, ranging from pickles to electrical cable harnesses etc; thereby making these women financially secure. Tata Motors has planted 80,000 trees in the works and the township and more than 2.4 million trees have been planted in Jamshedpur region. Through a scholarship program Vidyadhanam, the company supports 211 students. Out of these students 132 students are from the marginalized sections of the society. Tata Tea has been working hard since the 1980s to fulfill the needs of specially-abled people. It has set up the Srishti Welfare Centre at Munnar, Kerala; its various programs provide education, training and rehabilitation of children and young adults with special needs.

TCS aims at the Tata group's philosophy of building strong sustainable businesses community abroad too. In 2010-11, TCS supported its local communities in the United States: supported the victims of the 2010 Chilean earthquake, conducted IT educational programs for high school students in Cincinnati, raised support and awareness for diabetes prevention through a series of marathon sponsorships. Tata Consultancy Services also runs an adult literacy program. IBM has joined hands with the Tribal Development Department of Gujarat for a development project that aimed development of the tribal groups in the Sasan area of Gir forest. Coal India Limited (CIL) has invested US\$ 67.5 million in 2010-11 on social and environmental causes. Coal India Limited also provided facilities to meet the specific needs of the tribal community that allow them to maintain their unique cultural identity. Tribal affected families are given one-time financial assistance of 500 days for loss of customary right or usage of forest produce loss. CIL also provides at the resettlement site, schools, and roads with street lights, pucca drains, and pond dug wells, tube wells for drinking water supply, community centre, place of worship, dispensary, grazing land for cattle and play ground etc.

Public sector aluminium company NALCO has contributed US\$ 3.23 million for development work in Orissa's Koraput district as a part of its Corporate Social Responsibility. Some of their special projects at Angul Sector include permanent water supply projects for 11 villages through rural water supply and they have developed tourist spots in Deomali, Gupteshwar and also a stadium at Koraput. Other special projects include building 100 men Police Barrack at Bhubaneswar and setting up of schools in Angul and Damanjodi. Some of their major relief measures include contributions to National Defence Fund during Kargil War (1999), funds for relief

during Gujarat earthquake (2001), funds for Orissa flood victims (2003, 2008), funds for Tsunami (2005) etc. The Jindal Steel Works Foundation selected Vaddu to develop as a model village; the village had around 1,700 households in June 2008. Divided into two phases, the first phase focused on development of roads and pathways, drainage system up-gradation, construction of public toilets, garbage management, street lights and tree plantation. Around 450 m of drainage work and 1,930 m of road work along with a community toilet was developed. Efforts by companies such as HSBC India, Max New York Life and Standard Chartered Bank have ensured that the green movement has kept its momentum by asking their customers to shift to e-statements and e-receipts.

Challenges for CSR

1. There is a lack of interest of the local community in participating and contributing to CSR activities of companies. There exists little or no knowledge about CSR within the local communities. There is also lack of communication between company and community at the grassroots.
2. It is also reported that there is non-availability of well organized non-governmental organizations in remote and rural areas that can assess and identify real needs of the community and work along with companies to ensure successful implementation of CSR activities.
3. There are no clear cut statutory guidelines or policy directives to give a definitive direction to CSR initiatives of companies which is a major challenge of CSR. There is a lack of consensus amongst local agencies regarding CSR projects. This lack of consensus often results in duplication of activities by corporate houses in areas of their intervention. This results in a competitive spirit between local implementing agencies rather than building collaborative approaches on issues.
4. There is a need for capacity building of the local non-governmental organizations as there is serious dearth of trained and efficient organizations that can effectively contribute to the ongoing CSR activities initiated by companies.

RECOMENDATION

Companies can set a network of activities to tackle major environmental issues. Everyone in the organization should realize the necessity of promoting CSR. Companies should provide wider professional development activities. Training, conferences and seminars is a good way to disseminate and generate new knowledge and information in this sector. A strong budgetary support would definitely help to grow this sector and Government regulations which are supporting in this direction could attract more response from organizations. All this would also lead to benchmark CSR activities.

Companies need to involve their stakeholders in order to build meaningful and long term partnerships which would lead to creating a strong image and brand identity. More and more partnerships with NGOs would suffice this. It is also suggested to review existing policies in order to develop more meaningful visions for the companies and broaden their contributions to reach to local communities.

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Community Supported Agriculture (CSA) as a Strategy for Sustainable Living

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ABSTRACT

Our present life style is anything but sustainable as we are over producing and over consuming causing irreparable damage to the natural environment hastening climate change and untold miseries to human civilization. Fortunately there is a very desirable shift from the 20th century hyper consumption to 21st century age of collaborative consumption. This essential approach to consumption is the cornerstone of sustainable living. Adoption to sustainable life style depends on the human activities like consuming, living, moving and health and society. Marrakech Process (2003) set up task forces for implementation of the policy of sustainable consumption and production (SCP). One of such task force projects was on community development with the objective of creating best practices on grassroots social innovations for sustainable urban living in Europe and developing countries like Brazil, China and India. Community supported agriculture, a strategy for sustainable living, was pursued by the environmentally conscious citizens to make food production and consumption sustainable. One fledgling CSA farm is Smell of the Earth developed by a few members, inspired by sustainable farming. Situated in the outskirt of the city of Kolkata it is sincerely engaged in spreading the idea of biodynamic method of farming and community living.

Key Words: Community supported agriculture, Sustainable living, Smell of the Earth and Sustainable Lifestyle.

INTRODUCTION

Our present life style is anything but sustainable as we are over producing and over consuming causing irreparable damage to the natural environment hastening climate change and untold miseries to human civilization. Truly we are living beyond our means as the Earth has almost reached its carrying capacity. Moreover, the mindless economic growth and globalization has resulted in shift in power from nation states to multinational corporations which push their ‘brands’ in the markets at the cost local production. More unfortunately this ‘economic fetish’ has bypassed the poor sections of the society and the economic development has failed to be shared equally [8].

However, it is also to be noted that situation is not as bleak as there is an indication of social resiliency. As *Rachel Botsman*, author and founder of Collaborative consumption (SPREAD Project Advisor) pointed out that a big shift from the 20th century hyper consumption to 21st century age of collaborative consumption is under way. She further elaborated that convergence of social technology, a renewed belief in the importance of community, pressing environmental consciousness are moving us away from old form of consumerism towards one of sharing, aggregation, openness and cooperation. This desirable change in consumers’ outlook has renewed faith in adoption of sustainable lifestyle.

Sustainability and sustainable life style has been defined in various ways. The idea has its root in the UN Stockholm Conference on the Environment (1972). Later on the Brundtland report ‘Our Common Future’ [9] pointed out the connection between development and environmental limits leading to the idea of sustainability. The oft quoted definition of sustainability was coined by Brundtland report which says development meeting the

needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable Lifestyle

SPREAD Project has identified life style areas which are implicated in sustainable life style. These areas of human activities which may be the sources of sustainable or unsustainable life styles are

- a) Consuming
- b) Living
- c) Moving
- d) Health and society.

Johannesburg Declaration on Sustainable Development and subsequent the Johannesburg Plan of Implementation called for the development of 10 year framework of programmes and asked the regional and national governments to take initiative to accelerate the shift towards sustainable consumption and production (SCP). In pursuance to this declaration Marrakech Process ^[7] was launched to promote 10 year framework on sustainable consumption and production at the global and regional level. One of such task force projects was on creative community. Its objective was to identify policy recommendations to create best practices on grassroots social innovations for sustainable urban living in Europe and developing countries like Brazil, China and India. Eight common areas of community led sustainable living were identified

- a) Developing cooperative purchasing groups where people will directly buy in bulk from the producers
- b) Local trading exchanges where people will exchange services and skills.
- c) Children's centre for the children to play with their parents.
- d) Car pooling
- e) Community agriculture exchange which will connect urban and rural areas.
- f) Elderly community care.
- g) Urban vegetable gardens
- h) Community nurseries which will run small nurseries by the mothers.

From the above discussion it may be concluded that one of the strategies of promoting sustainable life style is developing creative community. Generating feelings of community relationship and network where people develop sense of localness and sense of place would lead to sustainability and positive environmental attitude and behaviour. Small scale projects initiated at local level will be greener and reflect holistic vision of environmentalism.

Among the various areas of the community development programmes one of the most important aspect of sustainable development is food consumption, its production, food waste management. Food is the fundamental human right but it is also a fact that food in average household is considered to have number one impact on climate change. It is accounted for one third of climate impact (DEFRA) The whole process of food production to consumption adversely affect the environment causing soil erosion, producing waste and emitting green house gases ^[5]. The research done by *Krystallis et.al (2008)* ^[3] showed that intensiveness of food production method and meat consumption are among the most significant activities causing land degradation and endangering animal welfare.

Community Supported Agriculture

But people have also realized the importance of sustainable consumption and production of food and agriculture. One such endeavour is community supported agriculture or CSA. The concept of CSA is based on the partnership of mutual trust, openness, shared risk and shared rewards between the producers and consumers. Dissatisfied with the imbalance of power associated with super market culture, CSA is organized with desires to reinforce and create community cohesion and to produce and eat food with a lower environmental negative impact. It is about man's yearning to reconnect with one's own spiritual roots.

CSA as Subscription Farming is Based on the Following Interwoven Ideas

CSA is about community. It is a community of individuals, supportive of a farm operation and the members are the shareholders. The community activities include volunteering on the farm, social and cultural activities, work

and play including organizing picnic and celebrating changes in natural cycles.

CSA is concerned with health. It seeks to provide its members with clean healthy life giving food having natural taste and nutrition with the aim of reducing the ill effects of herbicides, pesticides and chemically treated packaged and processed foods.

CSA is all about ecology. The modern methods of agriculture are highly unsustainable and likely to cause long term damage to the earth's ecosystem. The modern agricultural expansion increases the amount of nitrogen and phosphorous in the eco system. The impact of monocultures and highly fertilized soil will adversely affect fresh water and marine ecology with loss of biodiversity and outbreak of nuisance species (*Tilman, 2013*). The small locally based community farming like CSA came into existence as a protest against chemically intensive food production, single crop farms and industrialization of agriculture. These farms typically use biodynamic farming methods which have minimum harmful effect on ecology.

CSA is about families and fun. It is more than eating vegetables. It is where families meet, have fun and children come in close contact with nature. CSA offers a sanctuary where people come to reduce stress amidst natural surroundings. It helps to reconnect people with the rhythm of nature thereby providing with spiritual nourishment.

CSA also offers learning opportunities. The members have the opportunities for hands on training in farming and develop farming skills and management.

Above all CSA is about seasons. Social gatherings are arranged to celebrate seasonal changes. The members share recipes and menus.

The principle of social inclusion is upheld by CSA system. The open days organized by the farms encourage the marginalized and economically disadvantaged groups to participate CSA activities.

Evidently CSA can truly serve as a strategy for sustainable living.

History of CSA

The history of CSA can be traced when Japanese Teikei System was launched as putting farmers' face on food. The concept originated in 1960s when a group of Japanese women gathered together to buy fresh milk. The Teikei is a dynamic philosophy with the objective being giving more control to consumers over the food they eat. Although Teikei movement did not directly influence other countries but community based agriculture started to gain ground in the USA and other European countries along with demand for organic foods. The concept of community supported agriculture in India has also taken off but there is a long way to go. In our country there is an urgent need to create anxiety over food conditions and use of industrial pesticides. Besides entry of multinational companies peddling genetically modified seeds can only be resisted by strong public opinion as the political leaders and bureaucrats are bent towing the unscrupulous corporate lines. CSA in India should have twin objectives of providing not only safe food and ecological balance, but also developing quality relationship between producers and consumers. Thus it emphasizes on developing and utilizing social capital on the basis of localizing food network. A new term 'food democracy' has been coined in this respect by *Hassanein (2003)* implying people's power to determine agro food policies by providing citizenship consumer education.

Smell of the Earth

The inspiration to set up the Smell of the Earth came from the CSA movement in the USA where during the last eight years there had been a spurt in community living and community based organic farming. But in the context of development of agriculture in India, the food bowl may have grown but at tremendous cost. It has hurt the ecology, perhaps irreparably and food distribution system and plight of the farmers are far from satisfactory. The middle class consumers are also taken for a ride. It seems India is going in the reverse direction when the consciousness of citizens in developed countries had started putting pressure on the government to adopt sustainable policies. The Smell of the Earth is one such CSA farm situated in the outskirt of the city of Kolkata (*Thakurpukur, P.S.*) with the objective raising conscious among middle class people about community farming and adopting sustainable life style.

While developing this farm, the following factors were taken into consideration. The site was rented as the farm was not in a position to own the land required for production. The area of the land is some eleven bighas with a pond within the boundary of the site. The land was borrowed through land share arrangement. The organization has twenty six members who pay Rs2000/ for the upkeep of the land and get organic vegetables every week.

As far as access is concerned, it is some 20 kilometers from central part of Kolkata. The road to the farm is not in ideal condition yet it is motor able. Climate of the area is tropical savannah with five main seasons namely spring, summer, rainy season, short autumn and winter. The Smell of the Earth like other typical agricultural lands in West Bengal is fertile. It is blessed with prime agricultural soil. The first harvest of the farm started coming from January 2013. The vegetables are delivered once a week.

The farm adopts low technology, low energy and low input policy. The farm practices try to disturb the ecology to the smallest extent possible. The method of intercropping is applied in the farm to avoid disturbing the ecological balance. In future the farm proposes to harness solar energy. Instead of ground water it uses the pond water. The use of chemical pesticides is strictly forbidden and even natural pesticides are used sparingly.

The Smell of the Earth is a partnership between farmer and consumers where responsibilities and risks are shared. It is built on the partnership of mutual trust, openness, shared risk and shared rewards.

CONCLUSION

The Smell of the Earth is still now in its very early stage of development. There are number of obstacles and risks that constantly confront it. The organizers do not want to focus on profit rather want the idea of sustainable community farming to grow among the middle class people. The objective is to make people realize the importance of adopting sustainable life style and to develop and tap the social capital of a particular community. It is much more than being merely environmentally knowledgeable, it is environmental awareness in action. Through our involvement with CSA, it is possible to renew our spirit while we get intimate with living landscape. CSA is mode of social innovation seeking to unveil the power of social actors who can collectively develop new ways of sustainable living. The future administrative policies are to focus on community empowerment. The communities are to take responsibility for local development and to function as self sufficient, aware and resilient in terms of resource competency and as pillars of sustainable society (Mont et. al, 2012).

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**FOOD & NUTRITION,
HUMAN DEVELOPMENT, FAMILY & SOCIETY,
TEXTILES, CLOTHING & FASHION**
(Posters)

Production, Characterization and Immobilization of α -Galactosidase from *Enterobacter Cloacae*

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ABSTRACT

The objective is to develop an immobilized α -galactosidase system. A large portion of global population cannot digest milk lactose because they lack α -galactosidase enzyme and the result is gastrointestinal upset, diarrhea, abdominal flatulence. Whether the deficiency of lactose is a genetic disorder is not clear but it is mainly widespread in the third world. Unfortunately, over the past 50 years, half of the world's production of lactose has not been transformed into sub products but wasted directly in aqueous habitats. This situation creates both major environmental issues and the new strategies for the recovery of sub-products and for the creation of energy. High BOD value of whey lactose must be reduced to permissible limit before discharging into sewage system. The main objective is to remove lactose from milk without affecting its nutritional and physical characteristics. Fermentative production of intracellular enzyme from natural source was carried out. Optimization of production parameters and purification and Immobilization of enzyme were done. Use of continuous column reactor for production of low-lactose milk was carried out. The immobilized enzyme can hydrolyze milk lactose upto 52% in a continuous packed-bed column reactor. α -galactosidase finds immense applications in dairy industry for production of lactose-hydrolyzed milk and in fermentation industry, it is also utilized to hydrolyze lactose in whey for production of Baker's yeast.

Nutritional Status of Beneficiaries of Mid Day Meal Programme – An Impact on Society

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ABSTRACT

A study was carried out to assess the nutrient adequacy of Mid Day Meal Programme in Kolkata. A total of 200 children (100 girls and 100 boys) of 7-9 years of age were selected from 6 Low Income Group schools in Kolkata. Data of three day dietary survey of Mid Day Meal as well as the whole day's nutrient intake, and anthropometric measurements of the children were taken. Almost 70% of the children had normal height, weight, mid upper arm circumference for age where as near about 30% children were suffering from malnutrition. Fruits, vegetables and dairy products consumption were less than the normal requirement. Roadside food consumption increased the risk of diarrhea and led to malnutrition.

Clinical deficiencies like easy to pluck hair; white spots on nails and rough skin were observed in most of the children. The statistical analysis of each nutrient by 't' test for whole day as well as for Mid Day Meal revealed that the mean macronutrient intake was deficient in children as compared to their RDA requirement. Clinical symptoms were prevalent in Mid Day Meal beneficiaries due to micronutrient deficiencies. No nutrient requirements were met other than that of the protein through Mid Day Meal which indicated that Mid Day Meal was not nutritionally adequate. Thus, environmental factors like poor sanitation and repeated diarrhoeal infections along with composition of Mid Day Meal need to be improved in order to overcome child malnutrition in India.

• Category: FOOD AND NUTRITION • Code: (FNP3)

A Study on the Fortification of Whole Wheat Flour Using Mushrooms Enriched with Vitamin-D through Exposure to Sunlight

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ABSTRACT

Mushrooms when exposed to sunlight could be a potential source of Vitamin D majorly benefiting the vegetarian group. A fortified product was prepared using sun exposed mushrooms as a source of Vitamin D to reduce the incidence of this micronutrient deficiency. The results obtained showed us that fortification of whole wheat flour with Vitamin D enriched mushrooms could be carried out by a simple technique i.e. addition of the sun exposed mushroom powder to the flour. Results obtained showed that mushrooms when exposed to sunlight for 7 hours showed maximum Vitamin D content as compared to longer hours since there was a decrease in the organoleptic properties and also Vitamin-D content on over-exposure i.e., more than nine hours. Paratha as the product developed was more accepted in comparison to the phulka prepared on the basis of sensory evaluation. There was no significant difference in the levels of calcium and phosphorus in comparison to the fresh, exposed mushrooms or the product developed. But the levels of Vitamin D depleted in the product developed which could be due to the interaction with other nutrients or maybe due to its heat instability properties.

• Category: FOOD AND NUTRITION • Code: (FNP4)

Tannase Production from Agro Waste and its Effect on Tea

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ABSTRACT

The present study aims to produce tannase enzyme from agricultural waste and application of that

enzyme for quality enhancement of tea. An extracellular tannase was extracted from the agricultural waste (red gram husk) using Aspergillus niger by solid state fermentation. It was purified by ammonium sulphate precipitation followed by DEAE cellulose chromatography. The purified enzyme (193.1 U/ml) was treated to tea samples at room temperature for 2hrs and then subjected to chemical and sensory analysis. The enzyme was purified 9.21 fold and the yield was 28%. Tannase treatment resulted in approximately 56% degradation of tannin, 85% increase in total polyphenol, 46% increase in total sugar level and 128% increase in anti-oxidant activity. Protein-tannin aggregation, which negatively affects the quality of tea, decreases about 58% and tea-cream formation also reduces by 85% after tannase treatment. Through sensory evaluation, the acceptability of the tannase treated tea was also established. Industrial technique to reduce the tannin content are laborious, time consuming and expensive. After completion of the present study it can be concluded that there is clearly much scope of tannase produced from agricultural waste in enhancing the quality of tannin rich beverage and food materials, commercially at a low capital investment.

• Category: FOOD AND NUTRITION • Code: (FNP5)

Development and Sensory Evaluation of Fermented Tea using Yeast and Sunlight as a source of Vitamin D

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ABSTRACT

Micronutrient malnutrition is widespread in industrialized and developed nations. From a public health point of view MNM is a risk factor contributing to high rates of morbidity and mortality. The control of vitamin and mineral deficiencies is an essential part of the overall effort to fight hunger and malnutrition. The prevalence of vitamin D deficiency is fairly common among infants, young children and the elderly. To overcome this issue a tea beverage was prepared using baker's yeast as a source of vitamin D to reduce the incidence of this deficiency. The results obtained show that enrichment of vitamin D could be carried out by fermentation. Yeast when exposed to UV and sunlight, a renewable resource and a potential domestic household source of vitamin D. Yeast after exposure to sunlight showed Vitamin D content. A reduction in total residual sugar and increase in yield of ethanol was observed which confirmed the fermentation process. Black and Earl Grey tea was well accepted as a fermented beverage. Total phenolic content greatly varied with normal tea followed by the fermented beverages. The phenolic content decreased with time of fermentation. This makes tea less bitter and more consumable. The antioxidant and antimicrobial activity of the beverages were found to be promising.

Climate Change Affecting Mother-Child Health-Nutrition Outcomes in Poor Communities of West Bengal

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ABSTRACT

Fact finding and scope probable climate change related impacts on women and children in urban slum (Ward No. 66) of Kolkata and in Kamarpol Gram Panchayat of Diamond Harbour 400 Households (stratified sampling). Vulnerability assessment, focus group discussions and observations. Common diseases among children were diarrhea, malaria and respiratory illness. Women suffered from heat stress, dehydration and tuberculosis. Only 3% drank purified water. Both areas wood, charcoal, kerosene and residues were used as fuel for cooking. Open chulla and stove were mainly used in rural areas. Kerosene lanterns (95%) were used in most houses in rural. Solid Waste Management - at household level and community level was severely lacking in these areas. All had polythene/plastic and paper as garbage. 90% disposed waste in nearby proximity of the house. Climate change is cross cutting agenda in development planning and actions; thus needs an integrated response. Focus has to be on community participation and ownership.

Influence of Household Determinants and Environmental Factors on the incidence of Malnutrition in Children of Low Income Group (1-5 Years)

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ABSTRACT

In the present study an attempt has been made to assess the grades of malnutrition in children of low income group with the help of anthropometric measurements, visible clinical features and a 3-day dietary recall. A sample of 160 children between the age group of 1-5 years belonging to the low income group was selected along with their mothers, in the slums of Kolkata. The probable causes of malnutrition were also taken into account through the mothers' BMI, awareness, knowledge and practices using a questionnaire. It was seen that 53.7% of the children were underweight, 34.3% were wasted and 77.8% were stunted and showed distinct clinical symptoms of malnutrition. Among 49% of the children who were born with normal birth weight, 18% were found to be suffering from different grades of malnutrition. Mothers' nutritional status during pregnancy, breast feeding, weaning and dietary practices, knowledge

of proper health care, sanitation and hygiene were found to be the probable causes of malnutrition in the children apart from other factors that could be directly related to malnutrition such as diseases and infections suffered by the children, poverty and other environmental factors. The children suffered from frequent bouts of infections and diseases due to unsafe water supply, inadequate sanitation, cramped homes and unhealthy household environment.

• Category: FOOD AND NUTRITION • Code: (FNP8)

Analysis of Microbial Contaminants, Nutritive and Sensory Quality of Milk Based Indian Sweets from Renowned Retail Outlets of Kolkata

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ABSTRACT

Illness caused by the consumption of contaminated foods has a detrimental impact on public health worldwide. The foods most commonly involved in food-borne disease include milk and milk products. Contamination of these products is largely due to unhygienic environmental conditions. Escherichia coli are a frequently contaminating organism and a reliable indicator of faecal pollution generally in unsanitary environmental conditions. Therefore, it is important to determine the quality of various milk products. The present study was done on a total of 30 samples of milk based Indian sweets including 15 samples of Sandesh and 15 samples of Pedha collected from 5 renowned retail outlets of Kolkata. The milk based sweets were examined for microbial quality that includes enumeration of Total Plate Count, Escherichia coli, Klebsiella, Mucor, Aspergillus sp. and Penicillium sp. The results revealed that all samples had high Total Plate Counts and E.coli counts. All samples also showed the presence of Klebsiella, Mucor and Aspergillus sp. Chemical analysis of samples revealed that all samples were high in nutritive value due to their content of fat, protein, sugar, calcium and phosphorus although they were poor sources of iron. Tests for permissible food colour in Pedha samples showed that colour was present in all samples above permissible limits. Sensory evaluation of the samples revealed that all sweets were highly acceptable. The present study concluded that milk based Indian sweets from renowned retail outlets of Kolkata are acceptable in terms of nutritive and sensory qualities but they were inferior in microbiological quality. It is therefore essential for the public health authorities to take necessary steps in strictly enforcing the hygienic concept, which is lacking, so as to avoid environmental contamination at various stages of processing, storage and handling.

Identifying the Physical and Behavioural symptoms of Stress among nurses working in Shifts in Private hospitals of Kolkata

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ABSTRACT

Stress is thought to be the principal cause of physical illness and millions of working days every year are believed to be lost as a consequence of this. Stress levels in various occupations are known to differ. Nursing is repeatedly referred to in the literature as an inherently taxing profession. The investigator conducted the study in three private hospitals of Kolkata to identify physical and behavioural symptoms of stress, if any among nurses working in shifts. The study was conducted on ninety nurses, thirty from each hospital through questionnaire method and an informal interaction. Quantitative analysis was done through percentages and cross tabulations. The study revealed that some form of physical and behavioural stress was experienced by a huge percentage of nurses. For physical stress, Fortis hospital and for behavioural stress, Mercy hospital was the least variable. Back pain and often feeling fatigue besides normal working hours were identified as the most common physical symptoms of stress. Symptoms like disturbance in sleep pattern, non adaptation to the frequency of changes in the shifts and lack of appetite were mostly seen in night shift nurses. Age, number of years in nursing profession, marital status of nurses and their area of professional specialization also contributed to experiencing stress to a high degree. The study revealed that married nurses and those working in night shifts were stressed more, in the above private hospitals in Kolkata metropolis.

A Study on Acceptability of Lined Jackets Made From Jute Blend and Union Fabrics

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ABSTRACT

The study 'Acceptability of lined jackets made from jute blended and union fabrics' was undertaken with an objective to provide diversification for the jute fibre. An attempt was made to study various factors influencing the buying behavior of jackets. A good response towards jackets made out of jute blended and union fabrics with lining was found through a preliminary study. Jackets were worn by young adults the most and black was found as the most popular colour for jackets. The sketches and the fabrics for construction of jackets were selected by a panel of judges. Construction details of jackets and preference towards the constructed jackets was assessed through a structured questionnaire for a purposive random sample of 75 females. The data collected was analyzed by percentage, ranking and two way Anova tests. Jacket with halter neckline and black jute-cotton blend fabric was most preferred. Overall appeal and colour were found as the important factors affecting the preference for the constructed jackets while garment and lining fabric was not considered as an important factor. There was an appreciation for such kind of attempt towards diversification for jute fibre in the segment of fashion apparels such as jackets.

A Study on Printing of Cotton Fabric Using Natural Dyes by Batik Method

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ABSTRACT

The present study is an endeavour to make the process of batik printing eco-friendly by replacing the conventionally used azo dyes with natural dyes. An attempt is also made to reduce water consumption and use of fuel by using the cold batch process of dyeing that uses very little water. Thus, cotton waxed fabric samples were dyed with aqueous extract of marigold and manjistha individually as well as in combination. After dyeing their fastness properties were assessed. It has been found that batik samples dyed with marigold gives best results in terms of surface colour strength and fastness properties.

A Study on the Application of Mixture of Natural Dyes on Silk Fabric and its Different Characteristics

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ABSTRACT

Degummed and 25% owf $Al_2(SO_4)_3 \cdot 16H_2O$ pre-mordanted crepe silk fabric was dyed using aqueous extract of eucalyptus bark and leaves. The effect of varying conditions of extraction and dyeing process variables (time, temperature, pH, MLR and dye concentration) on surface colour strength and colour related parameters apart from fastness (light, wash, rub and perspiration) was optimized. Temperature, pH and dye concentration are the predominating dyeing parameters for eucalyptus bark as indicated by the widely dispersed CDI values. Pre-mordanted silk fabric has also been dyed with different proportions of the binary mixture of purified extracts of red sandalwood and eucalyptus. High K/S values were obtained with higher proportion of red sandalwood in the mixture. Samples dyed with the mixture of dyes show poor wash fastness with respect to change in the depth of colour, which improves slightly on treatment with CTAB, a cationic dye fixing agent. Both the methods of assessing compatibility of the mixture of dyes, eucalyptus bark and red sandalwood i.e the traditional qualitative method based on plots of K/S vs ΔL and ΔC vs ΔL and the relatively newer quantitative method based on calculation of closeness of CDI values shows that there is no appreciable synergistic interaction between the two dyes and the RCR was found to be 2. Thus, the two dyes are only fairly compatible.

Dyeing of Silk Fabric with Waste Material Using Unconventional Methods

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ABSTRACT

The present study is an endeavor to make the process of dyeing with natural dyes cost effective and improve its light and wash fastness of natural dyes from onion peel. Thus, degummed and aluminium sulphate (10% owf) pre-mordanted crepe silk fabric has been dyed with aqueous extract of onion peel natural dye. The effect of varying extraction condition and dyeing process variables (time, temperature, pH, MLR and dye concentration) on the surface colour strength and related colour parameters and colour fastness (light, wash, rub and perspiration fastness) have been assessed and optimized value established. It is reported that in case of onion peel, dyeing variables like pH, temperature and dye

concentration shows a wide dispersion of CDI values indicating that these are the predominating dyeing parameters for dyeing silk fabric with onion peel. There is an $\frac{1}{2}$ - 1 grade improvement in the light fastness ratings on after-treatment of silk dyed with aqueous extract of the dye with 2% UV-absorbers (benztriazole, benzophenone and MEK) are applied by the pad-dry method. Also, 2% dye fixing agents agents (Tinifix WS Conc., cetrimide and CTAB) show higher degree of improvement in wash fastness of dyed silk when applied by the pad-dry process than the exhaust process. Further with an objective to economize on the water consumption and use of fuel / energy, the effect of much simpler method of dyeing on the surface colour and fastness properties have also been explored, through the pad-batch-dry method. Pre-mordanted silk gives better K/S values good surface colour when dyed with purified extract of onion peel by the pad-batch-dry method of dyeing.