

CLIMATE CHANGE

"Global warming" is becoming a significant cause of global climate change. Human activity is highly dependent on earth's climate. Human adaptation and the climate pattern is responsible for the sustenance of human life on this earth. This adaptation to the seasonal and year to year pattern of temperature and rainfall shapes the social and economic characteristics of a society. Thus, enhanced green house effect and associated global warming leading to *climate change* can cause following potential effects.

a) Effects on Water Resources : Changes in precipitation and increased evaporation can significantly affect

- the quality and quantity of drinking water
- availability of water for irrigation, industrial use and electricity generation.
- the aquatic life.

b) Effects on Coastal Resources : Increased rainfall may cause more flooding. An estimated 50 cm rise in sea level by the year 2100, could inundate more than 5,000 miles of dry land.

c) Effects on Health : The changing pattern of precipitation and temperature may produce new breeding sites for pests leading to increase in the spread of infectious diseases fatal for human health and survival.

d) Effect on Sea Ice : Increased climate temperature tends to melt sea ice and results in increased absorption of solar energy by the ocean. Decrease in sea ice will lead to the movement of heat fluxes from the ocean to the atmosphere.

e) Effect on Global Climate : Climatic changes can have serious impact on the global climate. It is seen that the ocean currents of Atlantic act as heat conveyer of the planet and there by regulates the global climate. The release of large quantities of cold water due to the melting of glaciers if occur, then this heat conveyer will be interrupted and as a consequence the northern hemisphere could plunge into an ice age and the southern hemisphere will face severe droughts.

Thus, *global warming* is likely to make the *climate* more unpredictable in the coming years.

2.3 SOLID WASTE MANAGEMENT: BIO-DEGRADABLE AND NON BIO-DEGRADABLE WASTE

“The collection, treating and disposal of solid material that is discarded because it has served its purpose or is no longer useful can be defined as solid waste management.

Improper disposal of this solid waste can create unsanitary conditions leading to pollution of the environment resulting in the outbreaks of vector-borne (animals such as rats and insects) diseases.

The major sources of solid waste are;

1. Residential Solid Waste

Major sources of solid waste are the residences and homes where people live. “**Garbage**” from these places include food waste, paper, glass, plastics, leather, metals, electronic items, batteries, etc. from the residential solid waste.

2. Industrial Solid Waste

Industries are known to be one of the biggest contributors of solid waste. They include light and heavy manufacturing industries, power plants, chemical plants, construction sites, medical wastes etc.,

3. Commercial Solid Waste

Commercial facilities such as hotels, markets, restaurants, stores, offices, godowns etc., are yet another source of solid waste. Plastics, food wastes, metals, paper, glass, wood, cardboard materials, etc are the types of solid waste generated here

4. Institutional Solid Waste:

The solid waste produced by institutional centers like schools, colleges, governmental centers, prisons, military establishments, courts etc are referred as institutional solid waste. Some of the common solid waste generated from these places includes plastics, food items, wood, paper, metals, glass, rubber, electronics etc as well as various hazardous wastes.

2.3.1 BIODEGRADABLE WASTE

Biodegradable waste are the waste material which are and can be easily degraded by *natural factors* like microbes such as bacteria, fungi etc

& *abiotic components* like temperature, oxygen etc into water, methane, carbon dioxide and simple organic molecules. The micro-organisms (microbes) and other abiotic components work together and breakdown complex substances into simple organic matter that finally suspends and disappear into the soil. This entire process is natural, which can be fast or slow. As a result, the environmental issues and risks caused by biodegradable waste are minimal.

Bio degradable waste includes human waste, manure, sewage, biodegradable plastic etc.

Biodegradable Waste Management

Majority of the biodegradable Waste will decay to methane in the absence of oxygen by a process known as anaerobic digestion.

Now a days, the biodegradable waste is separated from the rest of the waste stream either by separate 'curb-side collection' or by 'waste sorting' after waste collection. At the point of collection, the separated biodegradable waste is called as 'green waste'. This green waste is then made to undergo process of decomposition in the presence of oxygen. This converts the green waste into compost.

2.3.2 NON-BIODEGRADABLE WASTE

The Waste material which cannot be decomposed or degraded by the biological process is known as "*non-biodegradable waste*".

As non-biodegradable material cannot be broken down by natural organisms / processes, these become a source of pollution. They remain on earth for thousands of years without degradation or decomposition.

Plastics, metals, cans, chemicals used for agriculture & industries etc which are inorganic compounds in nature fall under the category of non-biodegradable waste.

Non-biodegradable Waste Management

Compared to the waste management of biodegradable waste, the non-biodegradable waste management is a complicated process.

Non-biodegradable wastes are further segregated into "*Recyclable Waste*" and "*Non-recyclable waste*."

Recyclable waste is recycled into substances of use and are used again, where as the non-recyclable waste separated are treated variously and are tried to dispose off.

2.4. SEGREGATION OF DOMESTIC WASTE AT SOURCE; IMPACT OF PLASTIC ON HUMAN AND ANIMAL HEALTH

2.4.1 SEGREGATION OF DOMESTIC WASTE AT SOURCE

Any material that is discarded can be called as “waste”.

Waste generated by individual activities is **domestic waste**. Like other living organisms humans also discharge waste substances to the environment that ends up entering into the environmental cycle. Human activities are closely associated with soil, water & air components of the ambient environment. This sustaining environment can be source of ill health to many people due to;

- Lack of clean water,
- Bad sanitation
- Inadequate housing
- Exposure to insects and animal disease causing agents.
- Accumulation and improper disposal of “Refuse” into the environment.

What is Refuse?

Refuse is the solid waste generated from the organic life of a community.

The general term “Refuse” includes the following kinds of solid waste;

- 1) Public refuse -- consisting of solid waste materials collected from cleaning of public streets comprising of leaves, street sweepings etc.,
- 2) Trade refuse -- the solid waste generated from commercial processes like factories & business establishment.
- 3) Stable refuse comprising of manure
- 4) House refuse comprising of garbage, rubbish & house ash from houses, stores, schools etc.,

- 5) Market refuse chiefly made up of **Garbage & Rubbish** & separately classified due to its special qualities.

What is Garbage?

Garbage is the organic waste matter of animal and vegetable source, generated from houses, kitchens, restaurants, hotels, markets etc. This garbage includes the natural content of animals and vegetable matter consisting of moisture.

What is Rubbish?

Rubbish consists of Wood, Paper, rags, straw, leather, rubber, old furniture, beddings, boxes, barrels etc.,

What is House ash?

House ash may be defined as residue from fires in houses, schools, stores, business establishments etc and it also includes the inorganic materials such as "glass, crockery, metallic substances, dirt, dust and bricks".

What is solid domestic waste?

Solid domestic waste is the waste generated by the living organisms including humans. It is composed of;

- Garbage
- Rubbish
- Toxic waste (old medicines, spray cans, bulbs, chemicals etc)
- Recyclable waste (Paper, glass, metals & Plastics) This solid domestic waste is also known as "Municipal Waste".

Unprecedented global levels of economic activity in the Twentieth century has witnessed a dramatic increase in the generation of solid domestic waste. Accumulation and improper disposal of this domestic waste can be lethal to;

- Environment and
- Health of organism including humans.

This makes it a necessity to segregate the domestic waste at source so that the environment and organism sustain each other.

The management of municipal solid waste in India has been a several problem due to the enormous quantities of waste generated every day. As per **Central Pollution Control Board (CPCB)** 2014-15, 31% of urban Indian population i.e about 377 million (census of India 2011) generates humongous 1,43,499 metric tonnes per day of municipal solid waste.

The SWM rules, 2016 (Solid Waste Management Rules, 2016) defines *segregation and separate storage of various components of solid waste* namely.

- Biodegradable waste (Agriculture & Dairy Waste), and
- Non-biodegradable waste consisting of
 - * Recyclable waste
 - * Non-recyclable combustible waste.
 - * Sanitary waste
 - * Non-recyclable inert waste.
 - * Domestic hazardous waste &
 - * Construction and demolition waste

As per SWM Rules 2016,

Every waste generator shall –

- a) Segregate and store the waste generated by them in three separate streams namely;
 - i) Bio-degradable
 - ii) Non-biodegradable and
 - iii) Domestic hazardous wastes in suitable bins and handover the segregated waste to the concerned authorities from time to time.
- b) Wrap securely *used sanitary waste* like diapers and sanitary pads etc in suitable wrapping material as instructed by the local authorities and place then in the bin meant for dry waste or non-biodegradable waste.
- c) Construction and demolition waste should be stored separately in the own premises and it should be disposed off as per the Construction and Demolition. Waste Management Rules 2016.

- d) Horticulture waste and garden waste generated from the premises should be stored separately in the own premises and disposed off from time to time as per directions of the local authorities.
- e) The waste generator shall not throw, burn or burry the solid waste generated by him on the streets, throw it in open public places outside his premises or in the drain or into water bodies.

The procedure of segregation of domestic waste comprises of following methodology:

Each household will segregate the generated domestic waste in 2 dustbins – **Green dustbin** and **Blue dustbin**.

- **Green dustbin should be used for Segregating Wet Waste**

The contents of the Green bin as described by the MSW Rules 2016 are;

- ❖ Food Wastes of all kinds – cooked and uncooked, including eggshells and bones.
- ❖ Flower & fruit waste including juice.
- ❖ Household garden waste / plant waste
- ❖ Soiled paper comprising of used toilet paper, paper towels etc.,



- **Blue dust bin should be used for Segregating Dry Waste**

As per the MSW-Rules 2016, the contents of the Blue bin are described as follows:

- ❖ All types of papers (Newspaper, notebook etc.)
- ❖ Cardboards & Cartons
- ❖ Containers & Packaging of all kinds excluding those containing hazardous materials.
- ❖ Compound packaging materials such as tetra packs.
- ❖ Plastics.

An inspirational pioneering social initiative was undertaken by Ramakrishna Math, Mangalore. It launched a compain "*Clean Mangaluru*"

in 2015 and focussed on weekly cleanliness drives and other programmes to create awareness. A team of volunteers from this campaign went on to launch a startup to manage wet waste generated by households of Mangalore.

Mr. Dilraj Alva, Director of Mangala Resource Management Institute (MRMI) and volunteers with the Math's *Clean Mangaluru Campaign* runs this startup initiated and guided by **Swami Ekagamyana** of Ramakrishna Math Mangalore.

In this start up, promotion of *pot-composting* method of wet waste generated in each home / apartment is done so that easily residents can convert the wet waste into manure. The Ramakrishna Math Mangaluru has supplied to pots to around 2800 households in the city & around 2,500 of them still to follow the process.

Ease of use of this pot-composition method is making many citizens use this initiative of segregating their own wet waste and converting it into fertilizer.

2.4(ii) Impact of Plastic on Human and Animal Health

What is Plastic?

Plastic is a loose term used to describe materials that are formed and moulded using polymers under heat and pressure.¹

20th and 21st centuries have been dubbed as "Age of Plastic". The world's first ever man-made plastic was introduced in 1862 by Alexander Parkes at the London International Exhibition. It was marketed as an alternative to ivory and horn. It was called as "Parkesine" and Parkes discovered this material while trying to develop a synthetic substitute for shellac for waterproofing.²

In 1907 Leo Baekeland invented the first fully synthetic plastic called "Bakelite". In the last six decades, plastic has become an indispensable and versatile product due to its wide range of properties product due to *its wide range of properties, chemical composition* and applications. This is due to its property of "Plasticity" where you can mold or shape plastic polymer into;

1. **Polymer:** Polymers are the chemical class of materials consisting of chain of repeating smaller molecules known as monomers.
2. **Shellac:** Shellac is a resin secreted by the female Lac bug on the trees in the forests of India and Thailand. It is used as natural electrical insulator.

- a) tough and light weight beverage bottles,
- b) flexible garden pipes,
- c) heat insulating food containers
- d) shatter proof window glasses etc.

Many of the chemical names of polymers used as plastics are very well known to consumers through their abbreviations /trade names.

2.4(ii)(a) Following is an brief account of various polymers used as plastic, its common use and its impact on human health:-

1) Poly vinyl chloride (3PVC)

It is commonly used in

- a) Food packaging
- b) Plastic wraps
- c) Containers for toiletries
- d) Cosmetics
- e) Floor tiles
- f) Shower curtains
- g) Toys
- h) Water pipes & Garden hoses
- i) Auto upholstery
- j) Inflatable swimming pools etc.

Adverse Impact on human health consists of;

- i) Chronic bronchitis
- ii) Skin diseases
- iii) Birth defects
- iv) Deafness
- v) Vision failure
- vi) Liver dysfunction
- vii) Genetic changes
- viii) Cancer etc.

2) Phthalates (DEHP, DNP and other)

Phthalates in combination with softened vinyl products are used to manufacture

- Emulsion paints
- Vinyl clothing
- Foot wears
- Printing inks
- Toys
- Surgical components like gloves, breathing tubes, inhalation masks & other medical devices
- General purpose lab ware etc

Adverse effects of Phthalates on human health comprises of;

- Developmental and reproductive effects
- Endocrine disruption
- Asthma
- Incineration of medical waste with PVC and phthalates causes adverse effect on health.

3) Poly carbonates with Bisphenol A

Poly carbonates with Bisphenol A is used to produce tough, non breakable water bottles.

Adverse effects of poly carbonates with Bisphenol A;

Research has found out that exposure to even low doses of bisphenol A leads to production of;

- Cancer
- Improper immune function
- Obesity
- Early onset of puberty
- Diabetes etc.

4) Polystyrene

Polystyrene is used to produce

- a) Food containers for meals, fish, cheese, yogurt
- b) Foam and clear clam shell containers
- c) Rigid plates
- d) Clear bakery containers etc

Impact of Polystyrene on human health produces;

- a) Irritation to eyes, nose & throat
- b) Dizziness and unconsciousness
- c) Polystyrene can migrate into food and store in body fat
- d) Can lead to elevated rates of cancers related to lymphatic system and blood cancer is people working in polystyrene industry.

5) Poly Ethylene (PET)

Poly Ethylene is used in the production of;

- a) Water bottles & soda bottles
- b) Drinking Glasses
- c) Chewing gums
- d) Food containers and wrappers
- e) Heat sealed plastic packaging materials
- f) Squeeze bottles
- g) Plastic bags
- h) Kitchenware etc

Impact of PET on human health;

PET is suspected to be one of the component of human carcinogens leading to the production of cancer in humans.¹

6) Polyester

Polyester is mainly used in the production of;

- a) Clothing
- b) Bedding
- c) Disposable diapers
- d) Food packaging materials
- e) Upholstery etc

Adverse Impact of Polyester in human causes;

- a) Eye and respiratory tract infection and
- b) Acute skin rashes

1. Carcinogens are cancer causing substances.

7) Urea-Formaldehyde

Urea formaldehyde finds its use in production of;

- a) Particle board
- b) Plywood
- c) Building insulation materials
- d) Fabric finishes etc

Impact of urea formaldehyde on human health is as follows;

- 1) Formaldehyde is a suspected carcinogen.¹ **It causes cancer in humans.**
- 2) It has shown to cause birth defects and genetic changes.
- 3) Inhaling formaldehyde can cause cough, swelling of throat, watery eyes, breathing problems, headache, rashes etc.

8) Polyurethane foam

Polyurethane foam is used in the production of

- Cushions
- Mattresses
- Pillows

It is observed that polyurethane foam usage produces following health ailments in humans. They are;

- Bronchitis, coughing, skin and eye problems
- Polyurethane foam sometime can release toluene di isocyanate. This compound released can produce several lungs problem.

9) Acrylic

It is used to produces following products;

- 1) The Acrylic fibres are used in clothing, blankets, carpets etc
- 2) Disposable diapers and napkins
- 3) Paints and Adhesives
- 4) Floor waxes
- 5) Dentures
- 6) Contact lenses etc.

1. Carcinogen is cancer causing agent.

Use of Acrylic in Humans can cause;

- 1) Breathing difficulties
- 2) Nausea and vomiting
- 3) Weakness and fatigue etc

10) Tetrafluoro ethylene

Tetrafluoro ethylene is used in

- a) Non-stick cookware as Non-stick coating
- b) Ironing board covers
- c) Plumbing tools etc

Impact of Tetrafluoro ethylene on human health is as follows;

- a) It can cause breathing difficulties
- b) It can cause irritation to eye, nose and throat.

2.4(ii)(b) Impact of Plastic on Animal Health

Tons of garbage generated by the human is getting dumped into the oceans as it appears as one of the simplest method to dispose off the garbage. But it is creating devastating effect on the environment and flora and fauna as plastic being one of the main component of garbage is non-biodegradable and takes thousands of years to decay. As a result, the fish and other wild life is becoming intoxicated. Further the toxins are entering into the food chain causing danger to human life as well. In many polluted places in the oceans, the mass of plastic exceeds the amount of phytoplankton six time over.¹

This floating mass of plastic garbage mass has lead to the formation of *plastic Islands*.

One of the largest among them is known as "*The Great Pacific Garbage Patch*".

The Great pacific Garbage Patch is a gyre found in the central North Pacific Ocean located roughly from 135°W to 155°W and 35°N to 42°N.²

1. Phytoplankton are microscopic plant bodies responsible for release of major quantity of oxygen into the environment.

2. Gyres are large systems of ocean currents in the form of slow moving whirlpools.

Thousands of animals from fishes to blue whales suffer by consuming the plastic debris and die grisly death. Plastic debris comprises of fragments of plastic micro particles found in the water. These enter along with water & microscopic food particles. And as these are non biodegradable, accumulate in the body parts such as stomach.

The impact of plastics on animal health can be summarised as below;

1) Impact on the Fishes

- It is estimated that is about 12,000 to 24,000 tons of plastic are ingested by the fishes.
- This leads to accumulation of non biodegradable plastic in the fishes body. This bio magnification leads to the transfer of plastic up the food chain to bigger fish, marine mammal and ultimately to human sea food eaters.
- Ingestion of plastic into fish can also cause intestinal injury and death of fishes.

2) Impact on Marine Animal

The marine animals can mistake the floating plastic garbage for food. On eating, they can choke, sustain internal injury and die.

Turtles are widely affected by this and the widespread plastic pollution on many beaches is affecting the turtles' reproduction.

3) Impact on Sea Bird

Sea birds ingest the food that is contaminated with plastic. This plastic ingestion reduces the storage volume of the stomach and causes starvation. This leads to death of sea birds. Dead Sea birds are often found with stomach full of plastic. This is indicative of amount of garbage in our oceans.

4) Impact on marine mammals

The marine mammals ingest and die due to accumulation of plastic debris in the various parts of their systems.

Along with that, these mammals get entangled in the vast amount of plastic debris found in their habitat. These entangled animals either get

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critically injured or die. This entanglement in plastic debris has led to injury and death of many endangered mammals such as sea lions. Dead whales have been found with their stomach filled with plastic.

Above are the effects/ impact of plastics on marine animals where predominantly plastic gets dumped.

Along with that we have observed the death of various terrestrial animals such as cows, bull and other domesticated animals meeting an gory end on consuming plastic covers which is thrown in garbage with food items in it.

