



ARYABHATTA CENTRE FOR NANOSCIENCE AND NANOTECHNOLOGY
ARYABHATTA KNOWLEDGE UNIVERSITY, PATNA
ANNUAL REPORT: 2021-22



First cutting edge research centre in University of Bihar.

Reported By

Dr. Rakesh Kumar Singh, Head of the Center
Center for Nanoscience and Nanotechnology

Activity Category: 1- Research and Development Activities

1.1. Doctoral Research (Ph.D.) awarded/ submitted

The teachers of this centre are actively engaged in Doctoral research activities and producing a vibrant atmosphere of R & D in a state and outside too. In this context following scholars have completed their Doctoral work/ thesis submitted in academic year 2021-22.

Name of Research Scholar	Name of the Supervisor	Area of Doctoral Research	Awarded/ Submitted
1.Ms. Sweta Sinha	Dr. Rakesh Kumar Singh	Calcium based bhasma as nanomaterials and its applications	Awarded
2.Ms. Archana	Dr. Rakesh Kumar Singh	Food Nanomaterials and its applications	Awarded
3.Mr. Harendra Kr Satyapal	Dr. Rakesh Kumar Singh	Hexa Ferrite Magnetic nanomaterials	Submitted
4.Ms. Mugdha Rao	Dr. Anal Kant Jha	Nano Biotechnology	Awarded
5.Ms. Sabiha Zamini	Dr. Anal Kant Jha	Nano Biotechnology	Awarded

1.2. Doctoral Research (Ph.D.) completed their research work

Doctoral Research (Ph.D.) scholars of the academic session 2018-21 have submitted the final progress report to the Doctoral committee as per UGC guideline. The details of such Ph.D. scholars are following. Very soon they will submit Doctoral research thesis.

S. No	Name of Research Scholar	Name of the Supervisor	Field of Doctoral Research
1	Ms. Pallavi Singh	Dr. Rakesh Kr Singh	Functional Food Nanomaterials and its applications
2	Mr. Aniket Manas	Dr. Rakesh Kr Singh	Magnetic Nanomaterials for its applications in Hydroelectric Cell
3	Mr. Naman Nayak	Dr. Rakesh Kr Singh	Functional Food nanomaterials and its applications
4	Ms. Ritu Kumari	Dr. Rakesh Kr Singh	Functional Herbal based Nanomedicine and its applications
5	Mr. Vivek Kumar	Dr. Rakesh Kr Singh	Magnetic Nanomaterials for its applications in Hydroelectric Cell.
6	Mr. Bibhuti Bikramaditya	Dr. Rakesh Kr Singh	Garnet Materials for LED applications
7	Prof. Prabhat kr Dwivedi	Dr. Rakesh Kr Singh	Iron oxide based bhasma as nanomedicine

Activity Category: 1- Research and Development Activities

1.3. Doctoral Research (Ph.D.) in final stage of completaition

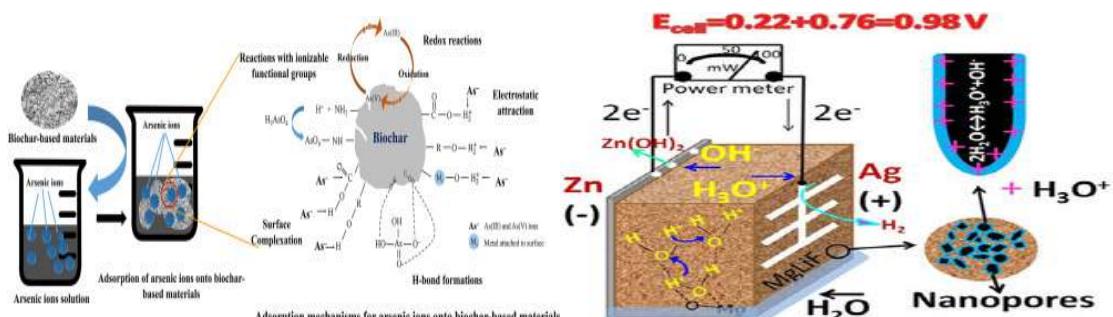
Four scholars of the academic session 2016-19 and 2017-20 are also working on their doctoral research. Their work is in progress and they have presented their 3rd progress in PGPR, Doctoral committee. The remaining 7 students of this session have completed their work and presented their pre-thesis submission presentation.

S. N	Name	Guide/ Supervisor	Research Area
1	Ms. Pushpa Sharma	Dr. Rakesh Kr. Singh	Biochar materials for purification of water
3	Naveen Kumar	Dr. Rakesh Kr Singh	Ceramic Nanomaterials
4	Vijay Kumar	Dr. Rakesh Kr Singh	Ceramic Nanomaterials

1.4. Doctoral Research scholar pursuing course work

In academic session 2021-24(Ph.D.) four Ph.D. students admitted for Ph.D. degree and engaged in course work of one year. The details of the students are following-

S.No	Name of students	Category
1	Rajaram Rajak	SC
2	Ashutosh Kumar	EBC
3	Singh Sonu Kumar	GEN
4	Shama Farozen	EBC



Research Activities on Purification of water through nanomaterial's and Hydroelectric Cell



Production of Ceramic magnetic nanomaterials and Nanosilica from rice husk

Research and Development Activities

Activity Category: 2- M. Tech Research Project(2 Semester)

2.1. M. Tech Research Project completed with Research publications

The M.Tech students of session 2018-20 are working on their Research Project. Ten students registered for their research projects, and all are working under the supervision of Dr. Rakesh Kr Singh. The experimental research project has completed after December 2020 (COVID-19). During lockdown/ COVID problem, they have worked on a chapter of this thesis with the help of the supervisor in online mode. More than 20 research papers related to M.Tech projects have been published/reported / being reported for publication in Scopus/SCI/WOS/SCI journal. The final research project thesis submitted and awarded degree in the month Jan 2022. The details of research area are following:

Sl.No.	Name of the Candidate	Name of the Supervisor	Area of Research project
1.	Ms. Om Priya	Dr. Rakesh Kr Singh	Magnetic nanomaterials
2.	Gaurav Kumar	Dr. Rakesh Kr Singh	Nanocomposite and nanoceramics
3.	Singh Sonu Kumar	Dr. Rakesh Kr Singh	Hexa ferrite Nanomaterials
4.	Shashank Bhushan Das	Dr. Rakesh Kr Singh	Magnetic Nanomaterials
5.	Anjali Kumari	Dr. Rakesh Kr Singh	Nano silica from Rice husk
6.	Shama Frozan	Dr. Rakesh Kr Singh	Multiferroic Materials
7.	Sazid Hussain	Dr. Rakesh Kr Singh	Nanosilica from Rice husk
8	Golu Kumar	Dr. Rakesh Kr Singh	Magnetic Nano composite
9.	Gokul Kumar	Dr. Rakesh Kr Singh	Magnetic Nanocomposite
10	Uday Shankar	Dr. Rakesh Kr Singh	Nanoscomposite



Research and Development Activities

Activity Category-3: Awards and Recognition

2.2. Awards/ Recognition of Faculty members of Nano science center, AKU.

Certificate of excellence is awarded to Dr. Rakesh Kr Singh, Head-Academic , Nano science and Technology center for his outstanding performance in the category of Best Young Teacher with research contributions in Modern field of Nano Science" as per recommendation of the selection committee constituted by Hon'ble Chancellor, Universities of Bihar. Dated 23 Nov 2021.

Chancellor's (Governor) Award for Best Young Teacher of Bihar with Research Congratulation in Modern Field of Nano Science



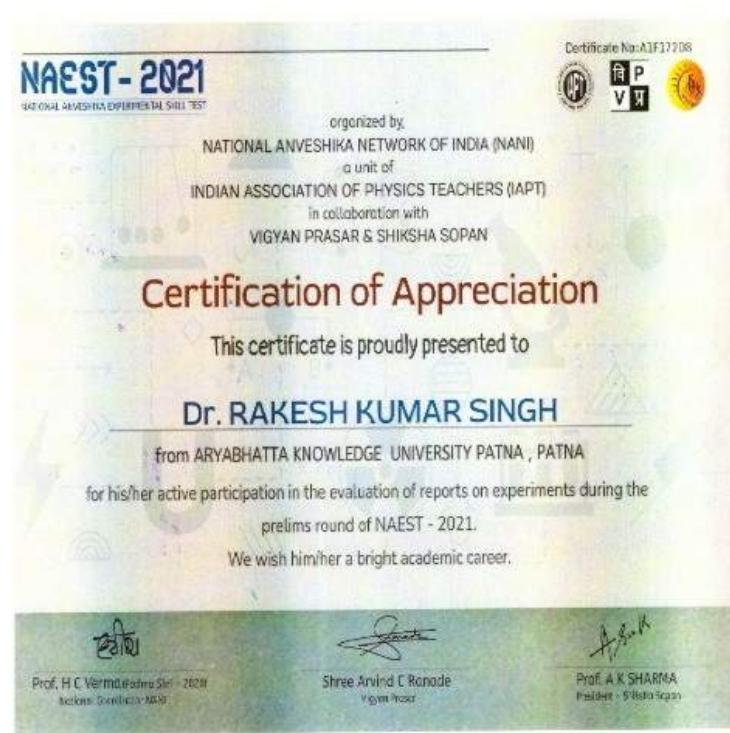
Activity Category-3: Awards and Recognition

2.3. National Anveshika Science Skill Test(NAEST)

Dr. Rakesh Kr Singh awarded a certificate of appreciation by eminent academician Padam Shree Prof. H C Verma, IIT Kanpur in recognition of valuable contributions to the online prelims of National Anveshika Experimental Skill Test-2021. This programme was coordinated by Siksha Sopan, IIT Kanpur and Vigyan Prasar, Govt. of India

National Science Skill Test- Brief introduction and Objective

Experiments are an integral part of science. History shows how careful observations and suitably designed experiments have changed the course of human development in all aspects. To promote these skills among students, National Anveshika Network of India (NANI), a unit of Indian Association of Physics Teachers, conducts a competition NAEST (National Anveshika Experimental Skill Test) based on Physics Experiments each year since 2014. This is probably the only test of its kind in India. There are 27 Anveshika across the country , coordinated by eminent academicians Prof. H C Verma, IIT Kanpur. Dr. Rakesh Kr Singh is coordinator of Patna Anveshika. The main objective of this Anveshika Centers to create experiment assisted science teaching. In the first round which is called Screening Round, 8 to 10 short videos of some innovative experiments will be shown to the students, and questions will be asked to test their observation skills and basic understanding of the subject. Selected students from the Screening round will be allowed in the Prelims round which will be conducted by the Anveshikas. This round focuses more on performing experiments and analyzing the data by the participants. In this programme about more than 50,000 students from class 9th to M.Sc form different academic institutions of India participated. Appreciation by Vigyan Prasar, DST-Govt. of India and NANI, Coordinated by Padam Sri Prof. H.C.Verma, IIT Kanpur ,



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Awards and Recognition (Research and Development activities)

2.4.1. M. Tech/Ph.D students won the best research presentation award/ other recognitions in an international / National/ University level Conference/ Activities

Gaurav Kr of M.Tech students won best oral presentation award in 5th International Conference on recent advances in Materials Chemistry, held at Kattankulathur, Tamil Nadu. He has worked on M.Tech research project on rare earth substituted Ceramics Magnetic nanomaterials under the supervision of Dr. Rakesh Kr Singh



2.4.2. On the occasion of World Earth day -2022 ” two Ph.D. students, Ms. Naman Kr Naik and Ms. Pallavi Singh, awarded 1st Position and 3rd Position in Essay competition on the topic “ The Ecological Processes involved in the soil system, their relationship with human and its protection organized by center for Geographical studies, Aryabhatta Knowledge University, Patna . Both Ph.D. scholars are working in the field of superfine nanoscale Food materials for its applications in Biomedical engineering, Pharmaceutical sector etc.



Pallavi Singh

Naman Naik

2.4.3. M.Tech Nanoscience and Nanotechnology Topper, Mr. Singh Sonu Kumar worked on research project thesis titled “Rare earth substituted ceramics Magnetic nanomaterials”. He has published/Reported about more than 15 publications in SCI/Scopus journals in the field of ceramic magnetic nanomaterials for its applications from Electronics to Nanomedicine.



Research and Development activities

2.5. Research Publications with affiliation of Nanoscience center of Aryabhatta Knowledge University

At present about 25 students of M.Tech and Ph.D. have been engaged in research activities for their M.Tech and Ph.D. degree under the supervision of Dr. Rakesh Kr Singh and one M.Tech scholar under Dr. Vijay Kr Ravi (Guest Assistant Professor- On contract). These students worked on materials research with the help of supervisor, presented papers in international conferences supported by international publisher Elsevier, Springer, IOP etc. Some of the research findings have been published/accepted in Scopus/WOS/SCI indexed journal. Altogether about 29 research papers have been published/Reported/being reported with affiliation of Nano science center of Aryabhatta Knowledge University Patna. The published papers are being read/cited by academicians/scientific communities of countries- Germany, Romania, Italy, etc. and some others. The research findings includes- Nanotechnology in Ayurveda Science, Electronics, Food, Magnetic materials and Agriculture. In the academic year 2021-22 Research Publications in SCI/ Scopus/ UGC care list/ Peer reviewed journal by Dr. Rakesh Kr Singh and his research group including M.Tech/Ph.D. scholar/Collaborator in multidisciplinary area of research, such as Nanotechnology in Electronics materials, Nanotechnology in Food & Agriculture, Nanotechnology in Ayurvedic Science as Nanomedicine and Physics education and related area. The details of publications are following-

1. Atul Jyoti, Rakesh Kr Singh, Nishant Kr, Abhay Kr Aman, Manoranjan Kar, Synthesis and properties of amorphous nanosilica from rice husk and its composites, Materials Science and Engineering B. 203(2021) 114871.
2. Nishant Kr, Rakesh Kr Singh, Sunil Kr, Prem Kr, Tuning in Optical, magnetic and Curie temperature behaviour of Nickel substitution of monovalent K^{1+} ion of $Ni_{0.8}K_{0.2}Fe_2O_4$ nanomaterials for multifunctional applications. Physica B: Physics of Condensed Matter 2021) <http://doi.org/10.1016/j.physb.2020.412797>.
3. Nishant Kr, Rakesh Kr Singh, Structural, optical, magnetic properties of nonstoichiometric lithium substituted magnesium ferrite nanoparticles for multifunctional applications, Journal of Materials Science: Materials in Electronics. Springer nature. <https://doi.org/10.1007/s10854-020-03454-z>.
4. Abhishek Kr, Rakesh Kr Singh, Harendra Kr Satyapal, Monalisa, Amit Kr, Saurabh Sharma, Lattice strain mediated structural, magnetic properties enhancement of Barium hexaferrite nanomaterials through control annealing. PhysicaB.600 (2021)2592.

Research Publications in SCI/ Scopus/ UGC care list/ Peer reviewed journal by Dr. Rakesh Kr Singh and his research group including M.Tech/Ph.D. scholar in multidisciplinary area of research, such as Nanotechnology in Electronics materials, Nanotechnology in Food & Agriculture, Nanotechnology in Ayurvedic Science as Nanomedicine and Physics education and related area

5. Harendra Kr Satyapal, Rakesh Kr Singh, Singh Sonu Kr, Shashank Bhushan Das, Tuning the structural, magnetic and multiferroic properties of Sm^{3+} substituted Barium hexaferrite nanoceramics. Elsevier J. Mater. Today proceeding. (2021) <http://doi.org/10.1016/jmatpr.2020.12.011>.
6. Singh Sonu Kr, Rakesh Kr Singh, Aniket Manus, Tuning of Structural, Elastic, Luminescence, Magnetic and Multiferroic properties of rare earth Ce^{+3} substituted strontium hexaferrite Ceramics Magnetic nanomaterials for its industrial applications, Applied Phy. A: Materials Science & Processing (2021). 127-754, doi:<https://doi.org/10.1007/s00339-021-04904-z>.
7. Shubhra, Rakesh Kumar Singh, Nishant Kumar, Vivek Kumar, Shashank Bhushan Das & Md. Muzzammil Haque Siddiqui, Impact of doping Gd^{3+} rare earth ion on structural, magnetic, and optical properties of cobalt and nickel ferrite nanomaterials, Applied Physics A volume 127, Article number: 861 (2021)
8. Nishant Kr, Rakesh Kr Singh, Vivek Kr, Shashank Bhushan Das, Gufran Ahmad, Shyam Narayan, Rekha Kumari, Physical properties of Pr-substituted Li/Ni ferrite magnetic materials at nanometric scale for its multifunctional applications in industrial/environment and their cytotoxicity, lymphocyte studies as Nanomedicine, Applied Nanoscience. (2021). <https://doi.org/10.1007/s13204-021-02198-4>.
9. Santosh Kr, Deepika, Raju Kr, Nishant Kr, Rakesh Kr Singh, Seema Sharma, Spin Polarized room temperature ferromagnetism in Co-doped ZnO, synthesized by Electrodeposition, Chinese Journal of Physics. (2021).<http://doi.org/10.1016/j.cjph.2021.08.12>.
10. Monalisa, Saurabh Sharma, Rakesh Kr Singh, H K Satyapal, Correlation between lattice strain and magnetic properties enhancement of nanocrystalline cobalt ferrite with controlled annealing, J. Material Science, Material in Electronics (2021). <https://doi.org/10.1007/s10854-021-06795-5..>
11. Rakesh Kr Singh, Anurag Kumar, Nishant Kr et al. Rice husk and Nanosilica magnetic composite, Springer nature in mechanical engineering, Advancement in Materials, Manufacturing and Energy engineering, Vol.1. (2021).
12. Rakesh Kr Singh et.al. Zn aluminates nanoparticles and their magnetic studies, Springer Lecture notes in mechanical engineering , Advancement in Materials, Manufacturing and Energy engineering, Vol.1.(2021). Doi.org/10.1007/978-981-16-5371-1.32.

Research Publications in SCI/ Scopus/ UGC care list/ Peer reviewed journal by Dr. Rakesh Kr Singh and his research group including M.Tech/Ph.D. scholar in multidisciplinary area of research, such as Nanotechnology in Electronics materials, Nanotechnology in Food & Agriculture, Nanotechnology in Ayurvedic Science as Nanomedicine and Physics education and related area.

13. Rakesh Kr Singh et al. Structural, Optical and Magnetic properties of Cobalt ferrite nanoparticles, synthesized by a green technological approach using Lemon juice , Springer Nature Lecture notes, in mechanical engineering , Advancement in Materials, Manufacturing and Energy engineering, Vol.1.((2021)., doi-org/10.1007/978-981-16-5371-122.
14. Bibhuti Bikramaditya, Rakesh Kr Singh, Nishant Kr, R K Verma, Yttrium substituted Borate Nanomaterials for its LED applications, Elsevier Mat. Today Proceeding, Volume 49, (2022), Pages 2352-2359.
15. Bibhuti Bikramaditya, Rakesh Kr Singh, Nishant Kr, P K Verma, R K Verma, Low temperature synthesis of Yttrium borate nanomaterials and their optical studies, IOP. J of Physics, J. Phys.: Conf. Ser. 2070 (2021) 012067.
16. Dinesh Kumar, Shambhu Nath Guha, Rakesh Kr. Singh, Jitendra Kr Singh, Dineshwar Prasad, Shashank Bhushan Das, Nishant Kumar Effect of Radiation of Moon on the physical property of Jalkhumbhi (Water hyacinth) Bhasma as a functional nanomaterial for its applications as medicine and in other areas of Science & Technology. Journal of Physics: Conference Series 2070 (2021) 012082.
17. Rakesh Kumar, Rama Sinha, Pushpa Kumari Sharma, Prabhakar Sharma, Rakesh Kumar Singh, et al Bioaccumulation of Fluoride in Plants and Its Microbially Assisted Remediation: A Review of Biological Processes and Technological Performance, Processes 2021, 9, 2154. Doi: <https://doi.org/10.3390/pr9122154>
18. Nishant Kumar; Archana; Rakesh Kumar Singh; Vivek Kumar; Shashank Bhushan Das, Tuning in structural, optoelectronic, magnetic and ferroelectric properties of NiFe_2O_4 ceramics engineering nanomaterials by substitution of rare earth element, Pr^{3+} prepared by sol-gel method, Journal of Mater. Sc. Mat. Electronics. *Journal of Materials Science: Materials in Electronics* volume 33, pages6131–6149 (2022)
19. Anikat Manas, Rakesh Kr Singh, Harendra Satyapal, Gaurav Kumar, A review on Magnesium Ferrite nanostructure materials: Energy, environment, electronics and Biomedical applications, Krishpon, Advancing Science,DOI- <https://doi.org/10.5281/zenodo.5376568>, Vol-1, issue-5(2021).
20. Rakesh Kr Singh, Rakesh Kr Sing, Dinesh Rangappa , Nishant Kumar, R.K. Kotnalla, Jyoti Shah , Vivek Kumar, Tailoring the Structural, Optical and Magnetic Properties of Non-Molar Potassium Substituted Magnesium Ferrite Nanomaterials for its Application in Hydroelectric Cell and Other Electronic & Biomedical Science being submitted to Applied Physics A.

In addition to mentioned above research paper, 6 research papers are being reported in SCI/Scopus indexed international Journals.

27. Dr. Vijay Kr Ravi, Guest Assistant Professor (On contract) has been working on SERB-DST sponsored project on " Investigating the structured Oligometric Intermediates while aggregation of Disulfide bond dissected Lysozyme and its inhibition strategy"

2.6. Achievement (Research and Development activities)

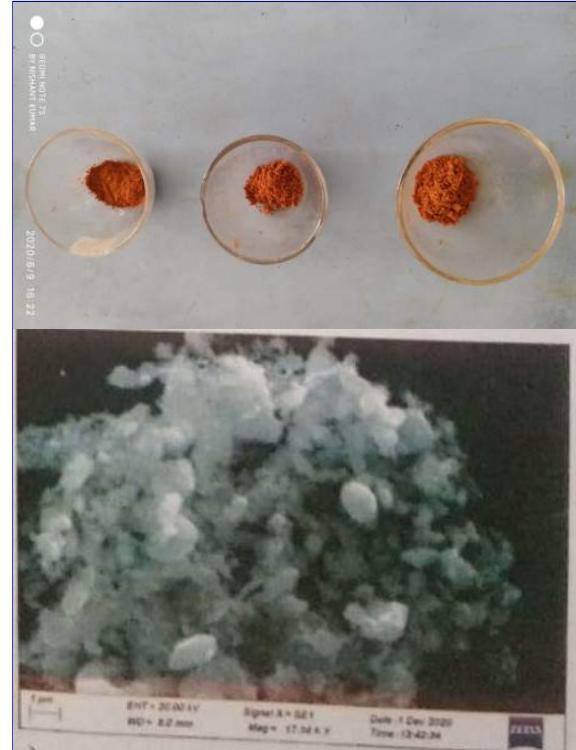
3 नए चुम्बकीय नैनोपदार्थ की संरचना की खोज, जो चुम्बकीय-प्रकाष, सेन्सर, हाइड्रोइलेक्ट्रिक सेल हेतु उपयोगी

1. **रिसर्च टीम**—आर्यभट्ट ज्ञान विष्वविद्यालय के नैनोटेक्नोलॉजी के विभागाध्यक्ष—सह—कुलसचिव डा० राकेष कुमार सिंह, तकनीकी स्टाफ श्री निषान्त कुमार एवं विष्वेसरया टेक्नोलॉजिकट विष्वविद्यालय बैंगलोर के नैनोटेक्नोलॉजी के विभागाध्यक्ष डॉ० दिनेष रंगप्पा द्वारा यह खोज को किया गया।
 2. यह रिसर्च मेट्रेयिल्स सायंस—प्रोसेसिंग (एफलाइड फिजिस्ट १), जो अंतर्राष्ट्रीय जर्नल है, प्रकाषित है। इस तरह के रिसर्च प्रकाषित होने के बाद जुलाई २०२१ में नए पदार्थ के खोज का सम्पादकीय टीम, पेनसाइलाइनया, यू.एस.ए. द्वारा रिसर्च डाटा का ओरिजनल डाटा की माँग डॉ० राकेष कुमार सिंह से किया गया। डॉ० राकेष के द्वारा समर्पित डाटा को प्ल्यू; प्लजमतदंजपवदंस ब्दजमत वित क्पाटिंबजपवद कंजंद्व के न्यैण्ण के अंतराष्ट्रीय टीम द्वारा जाँचा गया एवं जनवरी २०२२ में प्रधान सम्पादक डॉ० सूरया एन. काबेकोड द्वारा इसे नए पदार्थ के संरचना हेतु सही की सूचना दी गई, जिसे पाउडर डिफटेक्सन फाइल (वैज्ञानिक शब्द) के नाम से वैज्ञानिक जगत में जाना जाता है। इस तीन नए चुम्बकीय पदार्थ का फाइल नाम निम्नवत दिया गया है, जो सितंबर २०२२ में प्रकाषित होगा—

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3. चुम्बकीय पदार्थ का विवरण—मेगनेशियम लीथियम फेराइट चुम्बकीय पदार्थ को कम लागत वाले केमिकल मेथड से बनाया गया। 9 अत्याधुनिक उपकरणों, ज्वले ऊपर और ऊपर ज्वले ऊपर टैडे चर्च न्ट. नै. छप्ट्ट द्वारा इसके संरचना, चुम्बकीय, प्रकाष उत्सर्जन, इलेक्ट्रॉनिक्स इत्यादि गुणों का अध्ययन विस्तार से किया गया। इस वैज्ञानिक विष्लेषण के आधार पर तैयार नैनोपदार्थ का उपयोग चुम्बकीय—प्रकाषकीय सेनसर, हाइड्रोएलेक्ट्रीक हेतु जर्नल में रिसर्च को प्रकापित हुआ। पुनः इस पदार्थ की संरचना का नया माना गया। पूरी दुनिया में इस तरह के पदार्थ को भविष्य में बनाया जाएगा तो इस रिसर्च ग्रुप को संदर्भ देना होगा एवम् आर्यभट्ट ज्ञान विष्वविद्यालय का नाम पूरी दुनियाँ में होता रहेगा।

ज्ञात है कि डॉ० राकेश कुमार सिंह को नैनोसाइंस के विषेष योगदान हेतु बेस्ट युवा टीचर का अवार्ड महामहिम कुलाधिपति द्वारा दिया गया है एवम् माननीय मुख्यमंत्री द्वारा भी इसके प्रयोग को सराहा गया है। इनके द्वारा करीब 125 से ज्यादा रिसर्च पेपर अंतरराष्ट्रीय जर्नल में प्रकाशित हुआ है।



Dr. Rakesh Kumar Singh



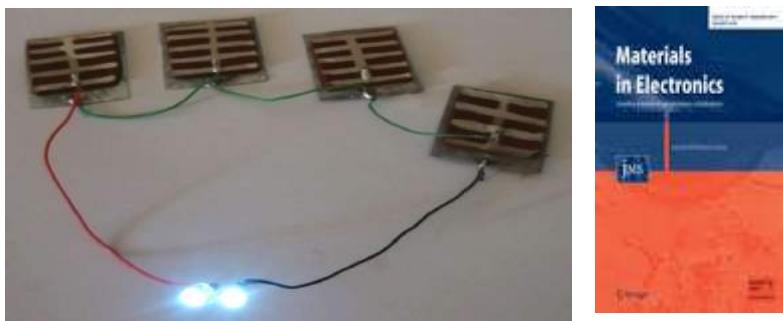
Mr. Nikhant Kumar



Prof. Dinesh Rangappa

Achievements (Research and Development activities)

2.7. Prototype of four hydroelectric cells of magnesium ferrite Nanomaterials Connected in series with two LEDs



SPRINGER
NATURE

Hydroelectric Cell with LED bulb prepared and Published by International Journal of Material Science & Materials in Electronics, Switzerland

Summary of Research- In recent years, alkali metal substituted spinel magnesium ferrites have been considered as potential materials for the fabrication of hydroelectric cells for the generation of green electricity without using any electrolyte. The purpose of potassium substitution was to observe the crystallite size variation, stretching molecular bonds, micro strain, porosity, defect centers, the surface morphology and HEC behavior of the prepared ferrites as monovalent potassium leads to occupy octahedral site of Fe and Mg which acts as reactive site for absorption and dissociation of water molecule. The crystallite size and porosity of entire samples $Mg_{1-x}K_xFe_2O_4$ ($x= 0.0-0.4$) were found using Scherer's equation between 11.15-36.20 nm and 22-53%, respectively in XRD analysis, which decreased with the increase in alkali metal content. The FTIR analysis revealed the shift of molecular bands towards lower wavenumbers with the increase in K^+ content. The SEM micrographs shows agglomeration in the material is observed and porosity in the synthesized sample and further we observe decrease in grain size from 1.264-0.79 μm . The porous structure enhances the chemidissociation of water molecules followed by physisorption to generate the electric current. The PL spectra showed the emission wavelength between 275-400 nm, which indicate the presence of oxygen vacancies, leading to the chemidissociation of water molecules. Nanoparticles of the compositions have been investigated for hydroelectric cell application. The voltage-current characteristics performance of all the compositions fabricated as hydroelectric cell reveals the offload current and open circuit voltage between 1.4-7.8 mA and 0.74-0.86 V. The prototype of hydroelectric cell prepared are shown of this present research.

Principle Research Team



Aniket Manus



Dr. Rakesh Kr Singh



Mr. Nishant



Dr. Jyoti Shah



Prof. R K Kotnala

Activity Category-3. Visitors of the Nano Science Center,

In year 2021-22, the faculty/research scholar of various institutions visited the Nanotechnology center and appreciated different academic activities carried out in the Nanoscience and Nanotechnology center of Aryabhatta Knowledge University, Patna. The name of some of the institutions are following

- Riken Research Institute, Japan
- Check Republic
- NIT Silchar, Assam
- Jabalpur University
- Labour Employment Ministry, New Delhi
- Central University of South Bihar
- Central university of Jharkhand
- RMRI,Patna
- IIT Patna
- NIT Patna
- Atal Incubation center, Patna
- D Y Patil International University
- Secretary Dept. of Education, Govt. of Bihar
- Director, Dept. of Education, Govt. of Bihar
- C V Raman University, Vaishali
- Indira Gandhi Institute of Medical Science(IGIMS)
- Vice Chancellor, Patliputra University, Patna
- Faculty members/principals/Students of various colleges/schools of Bihar (About more than 500)



Scientists/ Academicians from different academic Institutions visited Nanotechnology center and appreciated ongoing research activities.

Activity Category-4: International level activities

Talk/Lecture Delivered/ Research presentations by Faculty member in International Conferences as Resource Person/ Presenter(Online/Offline mode)

Dr. Rakesh Kr Singh, Head-Academic, University Center for Nanoscience & Nano Technology delivered an invited talk/ Research presentation in total of places across the country in various International conferences/ workshops/ seminars. The details of the place and events are followings.

S.No	Title of the Talk/ Research Presentations	Name of the Events details, date and Place
1	Structural Characterization of Ash as functional nanomaterials of Sri Athi Rudra homa (an ancient Indian Wisdom) using modern scientific tools for its various applications	International Conference on ' Role of Indian Science in freedom Movement', JNU, Delhi, 28 th Feb 2022
2	Structural, optical and magnetic properties of cobalt ferrite nanomaterials, synthesized by green technological approach using lemon juice	International Conference on Advancement in Materials, Manufacturing and Energy Engineering (2021), 18-20 Feb 2021 at NIT-Bhopal
3	Tailoring the structural, optical and multiferroic properties of low temperature synthesized cobalt ferrite nanomaterials, by citrate precursor method.	International Conference on Futuristic Trends in Material and Manufacturing. (2021) In Delhi Technological university, 7-8 th April 2021. Delhi Technological University
4	Investigating Structural, Magnetic and Multiferroic properties of Gadolinium substituted Strontium Hexaferrite ($\text{SrFe}_{12-X}\text{Gd}_X\text{O}_{19}$).	International Conference on Futuristic Trends in Material and Manufacturing. (2021), 07-08 th April 2021, Delhi Technological University
5	Magnesium ferrite nanostructure materials: Energy, Environment, Electronics and Biomedical application.	International Conference on Nanomaterial. (2021), 9 th -11 th April/ Mahatma Gandhi University,
6	Hydroelectric cell: A green energy source for sustainable development.	International Conference on Futuristic Trends in Material and Manufacturing. (2021), 07-08 th April 2021 and Delhi Technological University
7	Nanotechnology in ancient wisdom and Assets for Atma Nirbhar Bharat and Development of Society	International Conference on emerging Bioscience Research for Rural And Urban Development, Patna University, Patna, 21 st December 2021.



Activity category-5: Talk/Lecture Delivered/ Research presentations by Faculty member in National level Conferences/Seminars/Workshops as Resource Person/Presenter

Dr. Rakesh Kr Singh, Head-Academic, University Center for Nanoscience & Nano Technology delivered an invited in total of places across the country in various International conferences/ workshops/ seminars. The details of the place and events are followings.

S.No	Title of the Talk and date	Name of the Events details, and Place/ Organized by
1	In Programme Bihar Bihani talk on Converging Science and Emerging Technologies on 23 rd Aug 2021	In Programme Bihar Bihani talk on Converging Science and Emerging Technologies, Doordarshan, Patna.
2	Human Resource Development on 29 th September 2021	Azadi ka Amrit Mahotsav-Science, Technology and Innovation Ecosystem for AtmaNirbhar Bharat, organized by-DST, Govt. of Bihar
3	R & D Infrastructure for Sustainable Science On 30 th November 2021	Azadi ka Amrit Mahotsav-Science, Technology and Innovation Ecosystem for AtmaNirbhar Bharat, organized by-DST, Govt. of Bihar.
4	Science For Sustainable Living on 17 th December 2021	State Level Children's Science Congress- A Programme of DST-Govt. of India
5	Ayurvedic Nanomedicine on 25 th Sep 2021	World Pharmacist day-2021, Organized by- Shree Baidyanath Ayurveda and Indian Pharmaceutical society
6	Innovations for Technological advancement on 13 th September 2021.	Joint webinar organized by Nanoscience center and Atal Incubation Centre, Patna
7	Future of Ayurveda in the in the Light of Nano Science and Nanotechnology and 26 th Aug. 2021	Bihar State Ayurvedic Congress and and Govt. Ayurvedic College Hospital, Patna
8	Centre for Innovation, Research and Facilitation in Intellectual Property for Humanity and Development on 12 th July 2021.	National Intellectual Property Right Policy- 2016, Organized by Chankya Law University, Patna
9	Nanotechnology: A way towards new Development on 3 rd July 2021.	New Government Polytechnique Patna, DST- Govt. of Bihar
10	Science Education and Innovations for Global Recognition on 6 th March 2022	Satyam Shivam Sundaram Group of Institutions, Bihar
11	Learning Science through Low cost Experiment and New Education Policy on 27 th March 2022	T N Agrawal Teachers training College, Arah, Bihar
12	Ethics and Scientific temper for Scientific Society on 23 rd July 2021	Prasar Bharti, Patna, Bihar



Delivered Talk at MIT Muzaffarpur

Participation of faculty member Dr. Rakesh Kr Singh Resource persons in various activities

DEPARTMENT OF SCIENCE AND TECHNOLOGY
GOVERNMENT OF INDIA
Through State S&T Councils Network

STI Ecosystem for ATMANIRBHAR BHARAT

आजादी का अमृत महोत्सव 29th October 2021, 3:00 PM

VIGYAN UTSAV
Celebrates
विज्ञानोत्सव

HUMAN RESOURCE DEVELOPMENT IN BIHAR
STI Institutions in the State One Month One Theme Initiative

Dr. Anant Kumar
Project Director, BCST -cum-
Joint Director (Sc.), Dept. of Science & Technology
Govt. of Bihar

Speakers:

Prof. Arvind Choudhary
Director, ST, Bhagalpur

Prof. Sanjay Shrivastava
Director, MIFT, Patna

Prof. Jyoti Verma
Asstt. Prof., CIMP, Patna

Dr. Ashwani Aswani
Inspire Facility, ST, Patna

Dr. Rakesh Kumar Singh
Academic Head (SC),
AKU, Patna

Dr. Ravindra Kumar
Director Research, BABSU

Dr. Ujjwal Kumar
Director (A),
ICAR-RCR, Patna

Organized by
Bihar Council on Science & Technology
(Department of Science & Technology, Government of Bihar)
IGSC-Planetarium Complex, Adalatganj, Bailey Road, Patna-800001
www.bcst.org.in

STI Ecosystem for AtmaNirbhar Bharat organized by BCST-DST, Govt. of Bihar in which Director/Head of academic center/organization delivered a talk.



- (a) Felicitated by Chairman Baidyanath-Ayurveda in seminar and delivered a talk on Ayurvedic Nanomedicine
- (b) Principal Kurzi Holi Family in covocation address on theme Scientific values for Scientific society.



Delivered a talk a Resoucer person on nature assisted Science teaching learning in traing programme of District Education Officer (DEO) of different district of Bihar, organized by SCERT-Dept. of Education, Govt. of Bihar.

Delivered a Talk by Dr. Rakesh Kr Singh as Resource Person Workshops/Seminar



Delivered a Talk on Impact of Learning Science through Experiment in National Seminar as Resource Person



Delivered talk at Govt. Ayurveda College on Nanomedicine and Frontiers Science for Atma Nirbhar Bharat and in DD-Bihar Channel

Einstein Nobel Prize Centenary Year Celebration
The Story of Photoelectric effect
 10 July 2021, 4:30 PM – 6:00 PM
<https://youtu.be/RAanXsbhwUM>

Welcome address by
 Sri Sanjeev Kumar, IAS
 Director, Science and Technology
 Govt of Bihar

Main Speaker
 Padam Sri, Prof. H C Verma
 Ex-Prof. IIT Kanpur and National
 Coordinator (NANI)

Vote of Thanks
 Dr. Anant Kumar
 Project Director, BCST-DST
 Govt of Bihar

Session Conducted by
 Dr. Rakesh Kr. Singh
 Head-Academic, Nanotechnology Center
 Aryabhatta Knowledge University, Patna

Organized by
 Bihar Council on Science and Technology, Dept. of Sc. and Technology, Govt. of Bihar
 &
 National Anveshika Network of India (NANI), Unit of IAPT

As directed all the Students/Faculty member/Principal of Engineering Colleges, Polytechnic Colleges including Women Polytechnic are welcome to participate

Activity category-6: Faculty member worked as Editorial member of various International/ National Journals and academic council member/ Research board/ related activities.

Dr. Rakesh Kumar Singh, worked as peer review member of following International Journals

1. The Journal of superconductivity and Novel magnetism(Elsevier, Germany)
2. The Journal of Material Science and materials in Electronics(NewYork)
3. Journals of Inorganic Polymers and Materials(Springer- New York)
4. J Materials Today Proceeding(Elsevier, United Kingdom)
5. J. Thermal analysis and calorimetry(Springer-Netherland)
6. The J of Environmental Science and Pollution Research(Elsevier, Germany)
7. Journal Explore and IRIS-J of Young Scientists(NAAC-A Grade and Potential for Excellence Institute- Patna Women's College, Patna University)
8. Journal of Basic and Applied Sciences(USA)
9. Organizing committee member of various International/National/ State level conferences/workshops/ Seminars/ Academic Institutions

Activity category -6: Achievement

Awards/ Recognition/ Appreciation/ Research highlighted or cited of Faculty members of Nanoscience center, Aryabhatta Knowledge University.

Dr. Rakesh Kr Singh, has been working as Head/ Professor-in charge-Establishment/ Academic-in charge / Coordinator of Nanoscience center of AKU from the day of foundation of Aryabhatta Knowledge University, Patna. Till date, Dr. Rakesh and his research group published more than 150 research publications in the field of Nanotechnology in Agriculture, Food, Electronics, Magnetic materials, and Physics education with the affiliation of AKU, Patna. In this academic year Research Publications of Dr, Rakesh Kr Singh and his group was being cited by the following world class Institutions:

1. University of California, LOS
2. Adma Science and technology University, Ethiopia
3. Hankuk university of foreign studies Korea
4. Nankai University, China
5. University of Electronics Science and Technology of China
6. University Hussain Omn, Malaysia
7. National research Mordovia University, Russia
8. Nisantasi University, Turkey
9. National Central University Taiwan
10. Bandung Institute of Technology, Indonesia
11. Research Institute of Analytical Instrumentation, Romania
12. Zagazig university, Egypt
13. Federal do Rio Grande Do Norte, Brazil and many more

In addition to cited the research of AKU faculty members by global scientific communities, Dr. Rakesh was invited more than 20 various academic institutions to deliver a lecture in seminars/training programme. In this process, he has interacted with more than 500 faculty and 5000 students across the globe. He was also invited by scientific communities of countries, Japan, Canada, Singapur, China, Korea, Paris(France) California, and some others countries to deliver a **talk on a research topic on which research work was carried out at Nanoscience center of Aryabhatta Knowledge University, Patna.**

Activity Category 7.1. Contribution to Corporate Life and Management of the Department and Institution through participation in academic and Administrative Committees and responsibilities (Dr. Rakesh Kr Singh)

In addition to his engagement in teaching, research, research supervision, professional development activities, **Dr. Rakesh Kr Singh** engaged in following corporate life and management of the university and department. He has been authorized for following administrative, Establishment and academic related work in academic year 2021-22.

Detail of the events/Work	Responsible Committee Member
1. Aryabhatta Centre for Nanoscience and Technology, Aryabhatta Knowledge University, Patna,	In charge-Academic (Responsible for Teaching, Research-Laboratories, admission, Examination, attendance and related administrative and Establishment work (Head of the center responsibilities)
2. Proctor of the University, from dated- 17 th June 2021 3. Registrar of the University, from dated- 8 th January 2022 4. Doctoral Committee, Post-Graduate Programme in Research, Aryabhatta center for Nanoscience and Nanotechnology 5. Simulation Laboratory Establishment at Nanoscience center, AKU	Convener /Coordinator/ Nodal Officer/ Secretary
As member of different committee such as 10. University Vision documents preparation committee 11. Framing draft for rules and regulation for scholar hostel of AKU 12. Statute Committee Member 13. National Institutional Ranking of Framework (NIRF) -TEQIP 14. Purchase and Sales Committee- Special invitee 15. Revision of M.Tech-Nanoscience syllabus for credit transfer 16. TEQIP sponsored academic activities 17. Inspection committee member of AKU, affiliated Colleges 18. Under Member of Statute Regarding Governing Body of AKU, participated as university representative of higher education institute of AKU 19. DPR for center for Astronomy and Stem Cell Technology 20. Inspection/NOC committee member of Academic Institutions under Aryabhatta Knowledge University, Patna 21. Post metric scholarship of students 22. Technical Committee member of Simulation lab of nanoscience center 23. Member of ordinance Preparation committee, Center for Geographical Studies	Committee Member/ Special Invitee member/ Member Secretary

Activity category 7.2- Dr. Vijay kr Ravi, Guest Assistant Professor (On contract) have been working as chairman of diploma pharmacy examination Controller, Dept. of health, Govt. of Bihar.

Contribution to Corporate Life and Management of the Aryabhatta Knowledge University as Registrar (i/c)

Dr. Rakesh Kumar Joined as Registrar(i/c) of Aryabhatta Knowledge University, Patna on 8th Jan 2022. Apart from his daily routine work, he initiated/executed various academic/administrative plan of Aryabhatta Knowledge university with the guidance/support of Hon'ble Vice Chancellor, Executive council and submitted proposals to Government. The some of the important proposals submitted to the Government are – Post sanctioned of teaching & Nonteaching positions of 12 different academic centers e.g, School of Astronomy, Stem cell Science, Geographical studies, Philosophical studies, Journalism and Mass communication, Patliputra school of Economics and some administrative positions of the university. Apart from theses, Ph.D. in Nanoscience, Medical science, Social science, No objection certificate for new courses in all 38 Engineering colleges of Bihar, regular monitoring of academic council progress, new teaching programme, induction of some academicians in the development of different affairs of progress of university are properly monitored. In addition to these he has been also discharging his duties as law officer, Public Information officer (PIO), Head-Academic of university center for nanoscience and nanotechnology and proctor of the university.



Participation in various administrative/academic programme as registrar

Activity Category-8.

Details of the Conferences/Workshops/Seminars organized for Nanoscience Students(Online/ Physical mode)

In addition to Classes organized by the faculty member, from April 2021 to March 2022(Academic Year), we have organized more than 15 Seminars/Symposiums for the interdisciplinary learning of subjects for the M.Tech and Ph.D. students of Nanoscience and Nanotechnology. In this regard more than 45 eminent researchers/ scientists delivered a lecture related to Material science and Nanotechnology in online and offline mode.

8.1. Participation of Nanoscience center in Bihar Divas

On the occasion of Bihar divas, Dept. of Education organized 3 days academic programme at S K memorial hall. In this Programme, Nanoscience center was invited to present the frontiers related research activities, carried out by M.Tech and Ph.D. students. About 23 research finding related to Nanotechnology in Agriculture & Food, Ceramics Magnetic nanomaterials, Ayurvedic nanomedicine and learning science through low cost experiment have shown in the form of poster. Research exhibition was visited and appreciated by Hon'ble Education minister Sri Vijay Kr Choudhary, Additional Chief secretary Dept. Of Education Sri Sanjay Kumar, Director-higher education and Officers of education department and mass people of Bihar. 25 M.Tech/Ph.D. students participated in this exhibition. On this occasion Hon'ble Vice Chancellor Patna University, Patliputra University Prof. Girish Choudhary and Prof. R K Singh, Advisor higher education Dr. N K Agrawal and many more academicians/ People of Bihar also appreciated such frontiers related research exhibition.



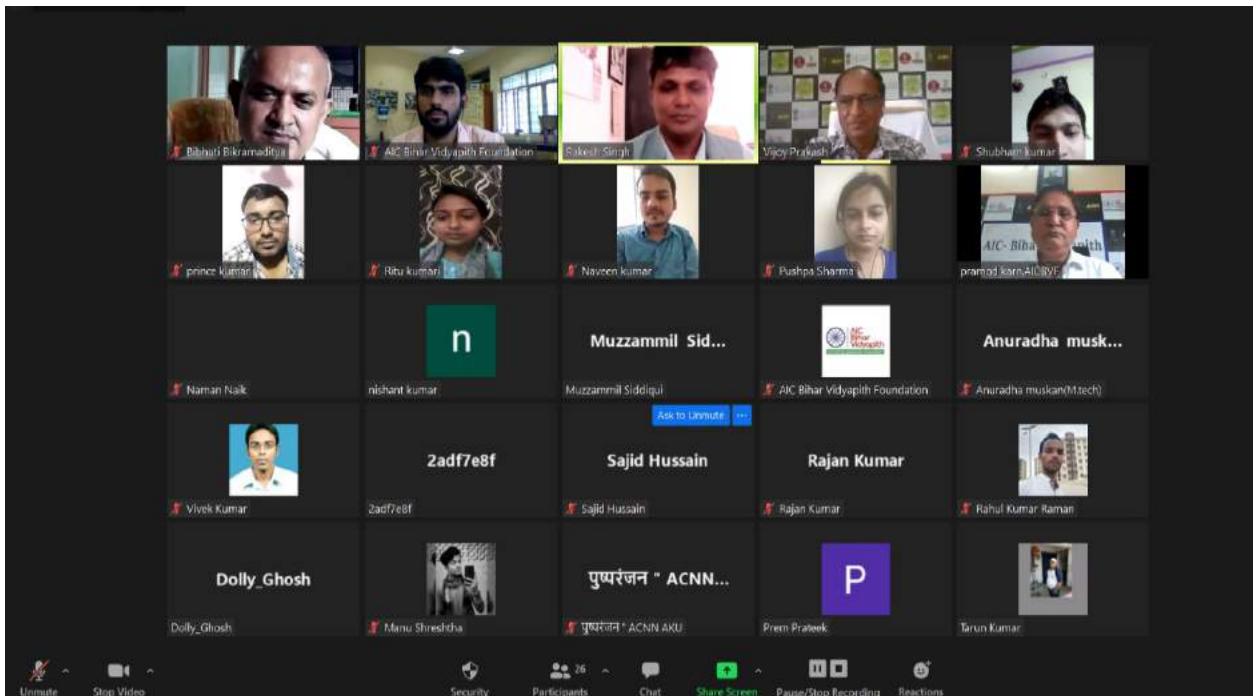
On The Occasion of Bihar Divas, 23 Research Related to Nanotechnology in Food, Agriculture, Ayurveda And Physics Presented And Appreciated By Hon'ble Education Minister; Additional Chief Secretary; Director Higher Education, Vice Chancellor of Patna University, Patliputra University And Mass People of Bihar.

8.2. Seminar on Nanotechnology in Environment



Seminar held on nanotechnology in Environment on 12th Feb 2021 The main speaker of this seminar was Dr. Prabhakar Sharma of Nalanda University Rajgir. Research scholar (M.Tech Research project) and Ph.D. with Resource persons, Dr. Prabhakar Sharma, Nalanda university, Rajgir

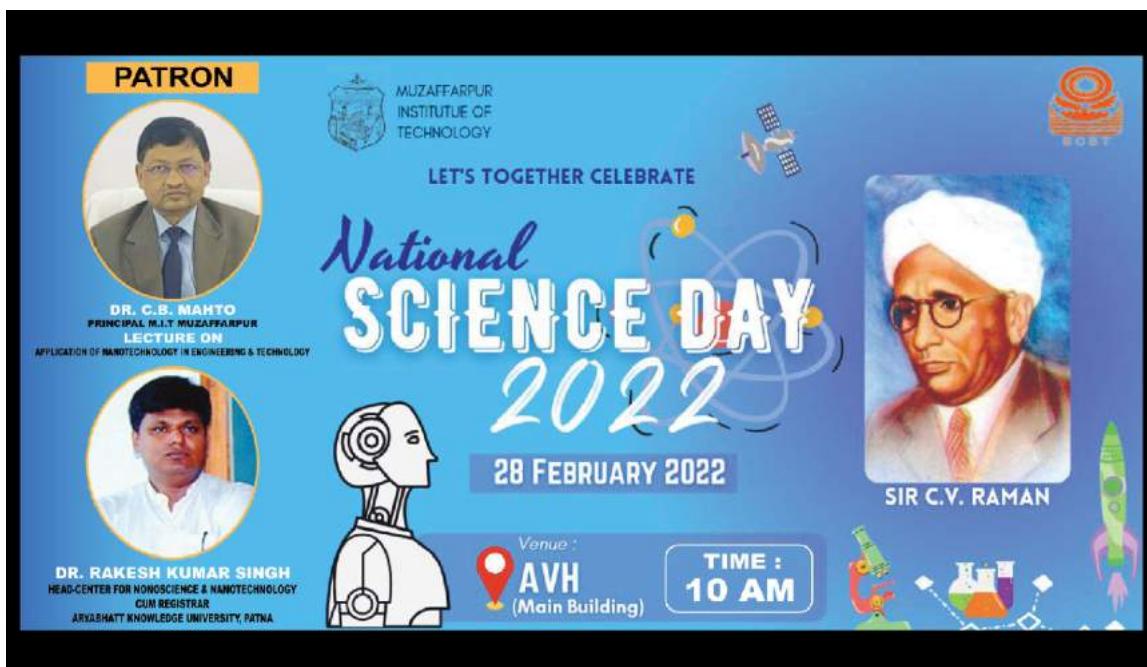
8.3. Seminar on Startup stages & Eco system-seminar, organized by Nanoscience and center and Atal incubation center on 13/9/21



8.4. Nanoscience scholars and Faculty members participated in Seminar, organized by Atal Incubation center and Nanotechnology Center of Aryabhata Knowledge University, Patna. This seminar was organized on the occasion of Azadi ka Amrit mahotsav.

In addition to these above seminars organized for students, following workshops/Seminars/ Conferences organized/ made available online/offline for the students

5. A Seminar on Hydroelectric Cell- Invention of 21st century on the occasion of national Science day- 28 Feb 2022. The main speaker of this Seminar was Prof. R K Kotnala, Chairman, NABL, Delhi
6. A Seminar on Technology vision-2035-potential vision and startups, by Prof. Prabhat Ranjan Vice Chancellor of D Y Patil university on 2/3/22
7. National Seminar on “ The present past and future of education in India” The main speaker of this seminar was Director of AICTE , dated- 27/2/22
8. International Conference on Nano engineering, organized by Asian Polymer Association, Dept. of textile engineering, IIT Delhi on 10/1/22
9. International symposium on application of thermal analysis and calorimetry, 21-22 Dec 2021, Organized by International Association of thermal Analysis and calorimetry and Dept. of Chemistry , Magadh University . Prof. R K Verma, founder Vice Chancellor, Munger University was convener of this international symposium.
10. National workshops on Emerging trends to heal the earth and environment on 18/9/21, organized by Save the environment society and school of interdisciplinary and trans-disciplinary studies IGOU, Delhi.
11. National webinar organized “Einstein Nobel Prize centenary Year(2021) or the discovery of Photoelectric effect” 10/7/21, orgized by BCST-DST, Govt. of Bihar, National Anveshika Network of India .In this seminar more than 42,000/ students participated.
12. National Symposium on Microscopy for Energy Materials Research and Advanced Battery Characterization on 1st February 2022, organized by Nanotechnology center, Aryabhatta Knowledge University Patna and Call Zeiss Microscopy Pvt. Ltd



Activity Category-9: Research and Development activities

Research presentations by M.Tech/Ph.D. scholars and Staff member (Technical).

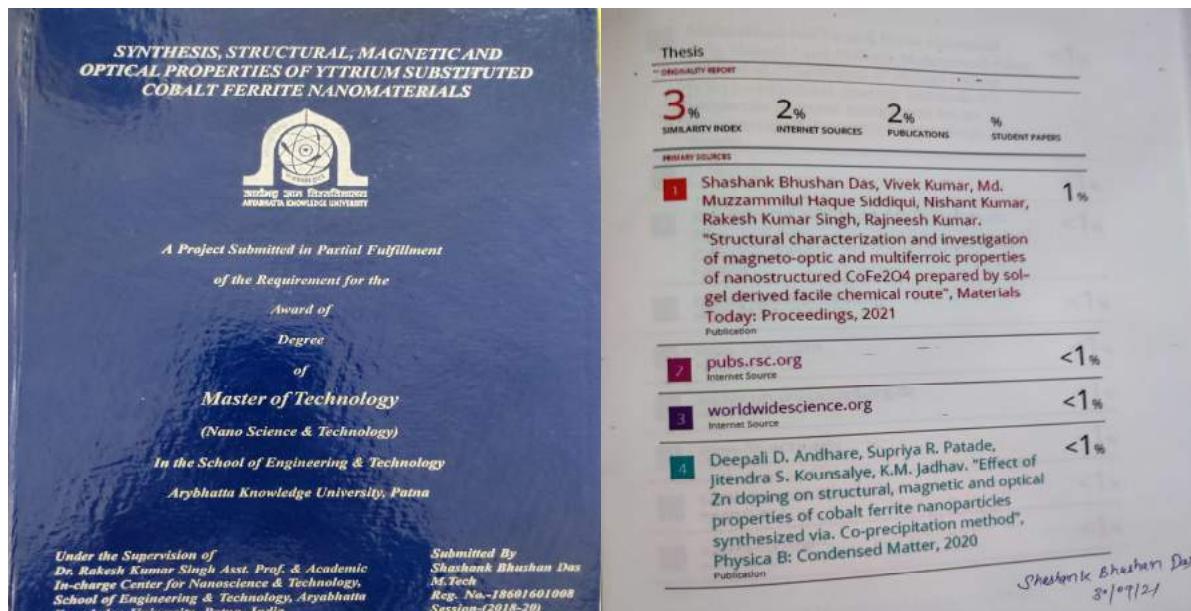
17 research papers have been presented in international conference organized through online/offline mode. These conferences are organized by different academic institutions of national and International repute. The importance of such conferences are that presented research findings were reviewed by peer team nominated by world leading research article publisher-Elsevier, Springer, IOP, AIP, etc.

Serial No	Research Group (M.Tech/PhD students/ Staff)	Name of the Supervisor	Title of the Research	Name of Conference	Date/Organized by
1	Singh Sonu Kumar, Gaurav Kumar, Uday Shankar	Dr. Rakesh Kr. Singh	Structural, Elastic and Multiferroic property of strontium ferrite nanoceramic prepared by sol-gel derived citrate precursor method.	International Conference on Materials, Manufacturing and Modelling-2021	19-21 March/ VIT, Vellore
2	Singh Sonu Kumar, Aniket Manash, Gaurav Kumar	Dr. Rakesh Kr. Singh	Investigating Structural, Magnetic and Multiferroic properties of Gadolinium substituted Strontium Hexaferrite ($\text{SrFe}_{12-x}\text{Gd}_x\text{O}_{19}$).	International Conference on Futuristic Trends in Materials and Manufacturing-2021	7 th -8 th April 2021 /Delhi Technological university
4	Gaurav Kumar, Singh Sonu Kumar, Aniket Manash	Dr. Rakesh Kr. Singh	Refinement in structural and magnetic properties of citrate precursor sol-gel derived nanocrystalline cobalt ferrite doped with Cerium ($\text{CoFe}_{2-x}\text{Ce}_x\text{O}_4$)	International Conference on Recent Advances in Material Chemistry-2021	18 th -20 th Feb 2021/ SRM Kattankulathur
5	Aniket Manash, Singh Sonu Kumar, Gaurav Kumar, Uday Shankar,	Dr. Rakesh Kr. Singh	A Comprehensive review on hydroelectric cell:A green energy source for sustainable development.	International Conference on Futuristic Trends in Materials and Manufacturing-2021	7 th -8 th April 2021 /Delhi Technological university
6	Aniket Manash, Singh Sonu Kumar, Gaurav Kumar	Dr. Rakesh Kr. Singh	A review on Magnesium ferrite nanostructure materials: Energy, Environment, Electronics and Biomedical application.	International Conference on Nano Materials - 2021	9 th -11 th April/ Mahatma Gandhi University
7	Harendra Kr. Satyapal, Singh Sonu Kumar, Shashank Bhushan Das,	Dr. Rakesh Kr. Singh	<i>Structural, Magnetic and Multiferroic Properties of Sm³⁺ Substituted Barium Hexaferrites BaFe_{12-x}Sm_xO₁₉ Nanoceramics</i>	International Conference on Materials Processing and Characterisation-2020	15 th -17 th Dec 2020 /IIT Indore
8	Shama Faroza, Harendar K Satyapal, Singh Sonu Kumar	Dr. Rakesh Kr. Singh	Effect of La ³⁺ Substitution on Structural and Multiferroic Properties of Sol-gel derived Bismuth Ferrite ($\text{Bi}_{1-x}\text{La}_x\text{FeO}_3$) Nanoceramics	International conference On Computational & experimental methods in mechanical engineering	11th - 13th February, 2021 G.L. Bajaj Institute of Technology & Management
9	Saurav Sharma, Singh Sonu Kumar, Harendar K Satyapal, Aniket Manash, Raj Aryan	Dr. Rakesh Kr. Singh	Effect of Gd ³⁺ Substitution on the Structural and Magnetic Properties of Barium Hexaferrite Nanomaterials	International Conference on Futuristic Trends in Materials and Manufacturing-2021	7 th -8 th April 2021 /Delhi Technological university
10	A. Manash, Singh Sonu Kumar, H. Satyapal, G. Kumar	Dr. Rakesh Kr. Singh	A Comprehensive Review of Different Synthesis Processes Involved for the Preparation of Magnesium Ferrite	National Conference on Emerging Trends in Engineering & Research	JIS College of Engineering. Kalyani 2021

Serial No	Research Group (M.Tech/PhD students/ Staff)	Name of the Supervisor	Title of the Research	Name of Conference	Date/Organized by
14	Anjalee Prabha, Rakesh Kumar Singh, Singh Sonu Kumar , Gaurav Kumar, Nishant Kumar	Dr. Rakesh Kr. Singh	Extraction of Crystalline Nano Silica from Agro-Waste rice husk and its Composite with magnetic nanomaterials (NiFe_2O_4) and evaluation of its Physical behaviour for its applications	International Symposium on Applications of Thermal Analysis and Calorimetry	University Department of Chemistry, Magadh University, Bodh Gaya, India, Dec 2021
15	Harendar K Satyapal, Shama Faroza, Saurabh Sharma, Utpal Singh	Dr. Rakesh Kr. Singh	High temperature magnetic behaviour of $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Fe}_{12}\text{O}_{19}$ nanoceramics for high density recording media application	International Conference on Multifunctional Nanomaterials	Manipal University Jaipur 21 st Jan 2021
17	Shashank B Das, Vivek Kumar, Nishant Kumar Muzzammilul Haque Siddiqui,	Dr. Rakesh Kr. Singh	Structural characterization and investigation of Magneto-Optics and multiferroic properties of nanostructured CoFe_2O_4 , prepared by sol-gel derived chemical route.	Global Conference on Recent Advancements in Sustainable Materials-2021	A J Institute of Engineering and Technology, Mangalore, Karnataka, 29-30 th July 2021

Plagiarism free M.Tech Research Thesis-

In this academic center 2 year M.Tech course of 4 semester, in which 1 year of research project work is to be completed by students. Final thesis are evaluated outside institute and finally degree awarded after Viva-voce examination conducted like Ph.D. The level of similarity(plagiarism) followed as per UGC regulation is maximum 10%.



Students and faculty members in Scientific activities session

Activity Category 10: Novelties of the Research finding in academic year 2021-22

Scientific Studies on Marine based Shankha Bhasma as Nanomedicine: Highlights

Nanotechnology in Ayurveda Science.

Research finding on Animal Origin Calcium based Shankh Bhasma as Nanomedicine



**Journal of
NATURAL REMEDIES**
Volume 16, Issues 3-4, Winter 2018

IMPROVEMENTS



JOURNAL OF NATURAL REMEDIES
DOI: 10.18211/jnr/2021/26225

RESEARCH ARTICLE

Preparation and Exploration of Physical Properties of Calcium based Indian Origin Ayurvedic Medicine-Shankh Bhasma (Marine Drug) as Nanomaterials for its Applications

Sweta Sinha¹, Rakesh Kr. Singh^{1*}, Nishant Kumar¹, Subhash Pd. Singh², Prabhat Kr. Dwivedi¹ and Rekha Kumari³

¹Aryabhatta Centre for Nano Science and Nanotechnology, School of Engineering and Technology, Aryabhatta Knowledge University, Patna – 800001, Bihar, India; rakeshkrhpu@gmail.com

²Department of Chemistry, AN College, Patna, Patliputra University, Patna – 800001, Bihar, India

³Department of Zoology, AN College, Patna and Department of Education, Govt. of Bihar, Patna – 800001, Bihar, India



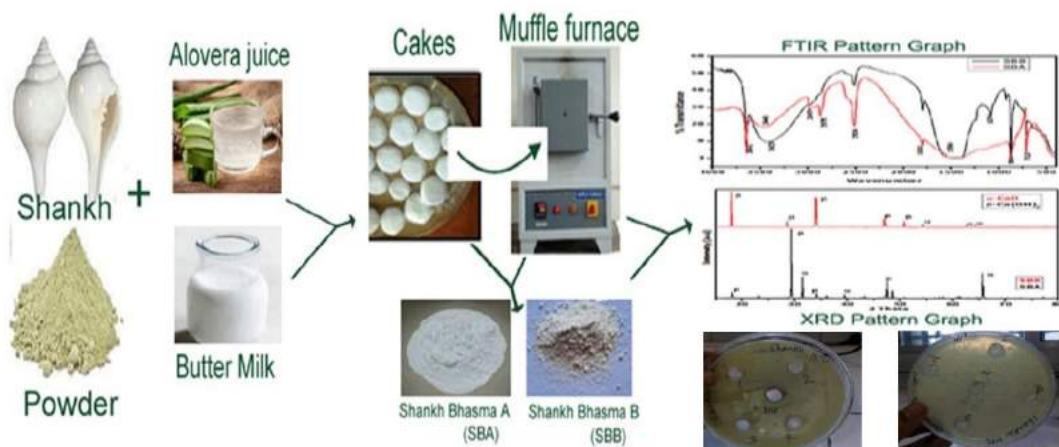
Dr. Sweta Sinha

Dr. Rakesh Kumar Singh

Prof. Rekha Kumari

Prabhat Kr. Dwivedi

Nishant Kumar



Novelties of Research:

- The objective of the present research is to explore the Physical properties of a marine origin Indian Ayurvedic medicine (Shankh Bhasma) as nanomaterials for its applications. Shankh Bhasma has been prepared by using the method as mentioned in Ayurvedic text, Aloe vera and buttermilk as ingredient.
- The preparation method was ecofriendly and no hazard chemicals are used or emitted during preparation. X-ray diffraction measurement and Scanning electron microscopy analysis showed that Bhasma is in agglomerated Nano crystalline materials.
- The photoluminescence measurement shows a broad spectrum in UV region and one prominent emission peak in the visible region at 405nm. Prepared shankh bhasma was examined on *E. coli* and there is no effect on *E. coli* was observed.
- In this present research, physical property measurement of shankh bhasma using state of the art techniques of 21st century not only support a foundation for the development of low cost ayurvedic natural marine based materials as Nano medicine and its uses in other sectors of science and technology.

Acknowledgements :

The authors are extremely thankful to Department of Education, Govt. of Bihar and Aryabhatta Knowledge University, Patna for frontiers research establishment, support and functioning of the Nanoscience and Nanotechnology center.



Netherlands

Nanotechnology for purification of water



Groundwater for Sustainable Development

Volume 17, May 2022, 100740



Review on arsenic removal using biochar-based materials

Pushpa Kumari Sharma ^{a, 1}, Rakesh Kumar ^{b, 2}, Rakesh Kumar Singh ^{a, 3}, Prabhakar Sharma ^{b, 3}, Ashok Ghosh ^{a, 4, 5}

^a Aryabhata Centre for Nanoscience & Nanotechnology, Aryabhata Knowledge University, Patna, 800001, Bihar, India

^b School of Ecology and Environment Studies, Nalanda University, Rajgir, Bihar, 803116, India

^c Mahavir Cancer Sansthan and Research Centre, Phulwari Sharif, Patna, 801505, Bihar, India

^d Bihar Pollution Control Board, Patna, 800010, Bihar, India

Research Team



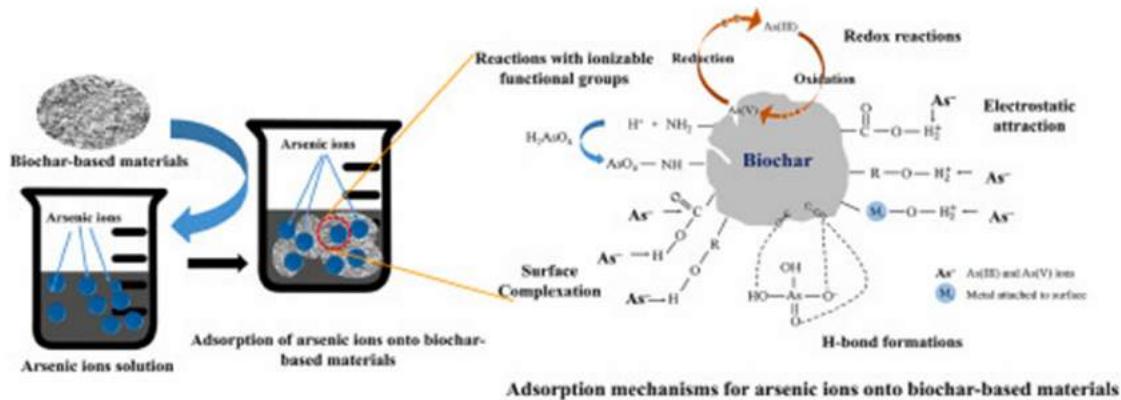
Pushpa Kumari
Sharma

Rakesh Kumar

Dr. Rakesh Kumar Singh

Dr. Prabhakar Sharma

Dr. Ashok Ghosh



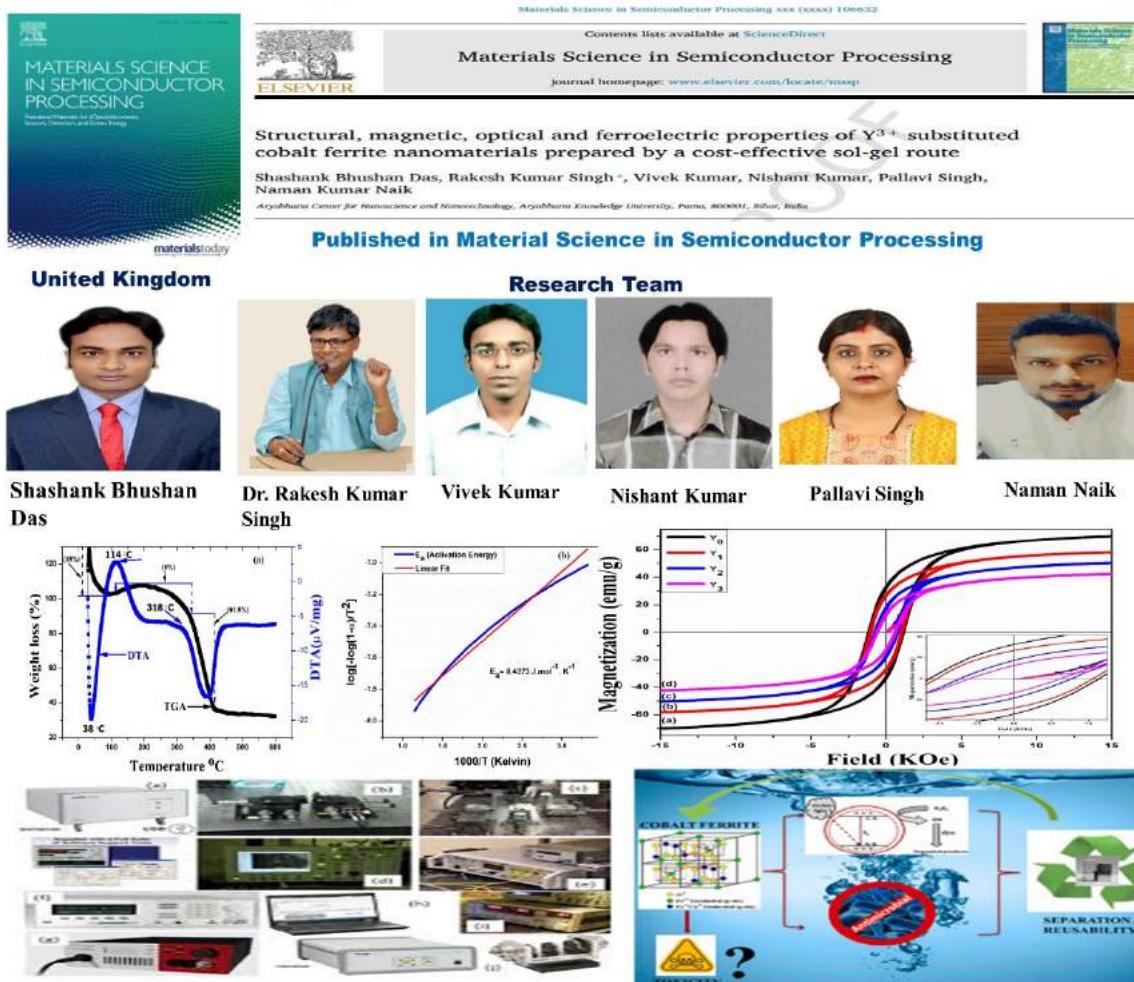
Research Summary:

- This review work significantly summarized the current state of knowledge for arsenic-contaminated water treatment.
- Firstly, this paper insight a brief understanding of arsenic speciation, toxicity, and accumulation in the food chain, and secondly, explains the adsorption techniques for as remediation from the contaminated water.
- Thirdly, this review discusses various factors, such as acidic pH, initial concentration, biochar dose, co-existing ions, and temperature, including regeneration and reusability of biochar-based sorbents.
- Lastly, mechanistic understanding for arsenic adsorption onto biochar materials has been discussed, considering equilibrium adsorption isotherms, kinetics, and thermodynamics analysis. In conclusion, this review also highlighted major challenges and future scope relevant for implications of biochar sorbents in continuous flow systems to scale up for commercial and industrial purpose

Acknowledgements :

The authors are extremely thankful to Department of Education, Govt. of Bihar and Aryabhata Knowledge University, Patna for frontiers research establishment, support and functioning of the Nanoscience and Nanotechnology center.

Nanotechnology in electronic industry and Environmental sector.



Research Summary:

- Ferrite nanomaterials are known as popular magnetic materials for their applications in the electronics industry, energy storage and environmental monitoring. Yttrium substituted Co_{Yx}Fe_{2-x}O₄ nanomaterials, were synthesized at 750°C by a sol-gel process.
- The surface morphology of CoFe₂O₄ and CoY_{0.3}Fe_{1.7}O₄ samples revealed agglomerated and porous structures with an average grain size of 1.24 and 2.50 μm, respectively, using SEM. HRTEM confirmed particle size of Co_{Yx}Fe_{2-x}O₄ (where, x = 0.0 and 0.3) near 30.40 and 10.92 nm, respectively.
- The increase in Y³⁺ content has increased the direct band gap from 3.39 to 3.91 eV. The room temperature PL spectroscopy of the prepared samples indicated a predominant blue emission between 457-493 nm and a weak green emission between 493-520 nm using 350 nm excitation. The magnetic parameters like the coercivity (H_c), saturation magnetization (M_s), retentivity (M_r) and magnetocrystalline anisotropy constant (K) exhibited a continuous decrease from 1173 to 666 Oe, 69.95 to 42.38 emu/g, 33.24 to 13.45 emu/g and 7.73 10⁵ to 3.01 10⁵ erg/cm³, respectively at room temperature with the increase in Y³⁺ content. The multiferroic analysis between 3-5 KV has shown the largest P-E loop area of the pure CoFe₂O₄ materials, which considerably decreased with Y³⁺ substitution.
- The structural, magnetic, optical and multiferroic properties could make it useful as multifunctional materials in opto-electronic and environmental applications.

Acknowledgements :

The authors are extremely thankful to Department of Education, Govt. of Bihar and Aryabhatta Knowledge University, Patna for frontiers research establishment, support and functioning of the Nanoscience and Nanotechnology center.

Scientific studies on Ceramics Magnetic materials for Magneto-Optical devices and piezoelectric material, may open a new window for mass production of Ceramics Materials.

J Mater Sci: Mater Electron (2022) 33:6131–6149



Tuning in structural, optoelectronic, magnetic and ferroelectric properties of NiFe_2O_4 ceramics engineering nanomaterials by substitution of rare earth element, Pr^{3+} prepared by sol–gel method

Nishant Kumar¹, Archana¹, Rakesh Kr. Singh^{1,*}, Vivek Kumar¹, and Shashank Bhushan Das¹

¹ Aryabhatta Center for Nanoscience and Technology, School of Engineering and Technology, Aryabhatta Knowledge University, Patna 800001, India

Research Team



**Nishant Kr
Das**



Dr. Archana



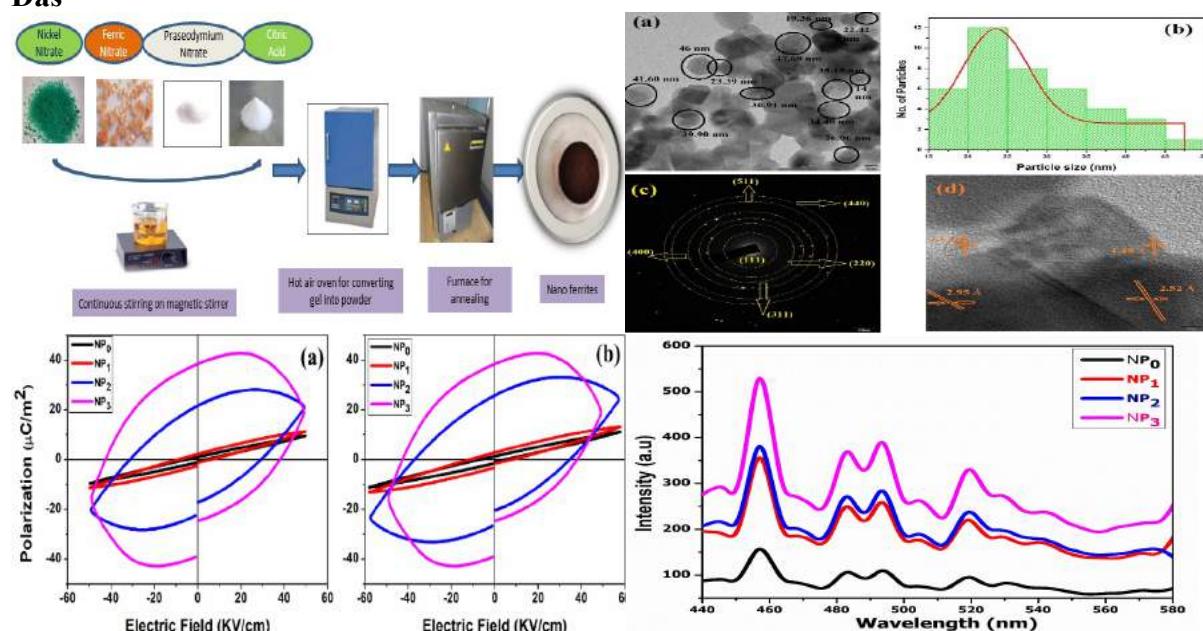
Dr. Rakesh Kr Singh



Vivek Kr



**Shashank Bhushan
Das**



Research Summary:

- The optical, magnetic, structural and polarization–electric field properties maybe useful in future photocatalytic devices, electronics, photo degradation, hyperthermia and environment applications as functional nanomaterials
- The Ceramics magnetic materials are prepared using low cost based chemical method, which are also one of the important feature of this present research for mass production and research and development activities.

Correlation between lattice strain and magnetic properties enhancement of nanocrystalline cobalt ferrite with controlled annealing

Monalisa¹, Saurabh Sharma¹, Harendra Kumar Satyapal^{1,*} and Rakesh Kumar Singh¹

¹Present address: Aryabhatta Centre for Nanoscience and Nanotechnology, Aryabhatta Knowledge University, Patna 800001, India

Research Team



Monalisa



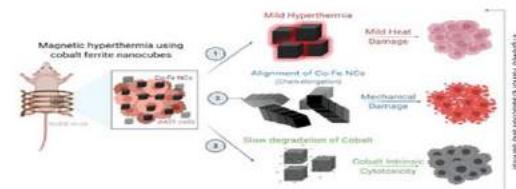
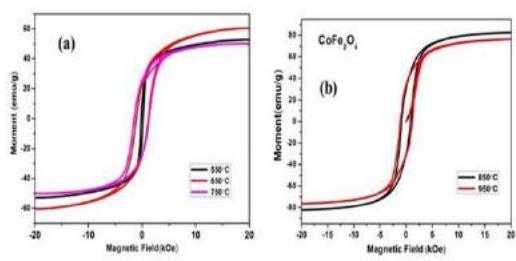
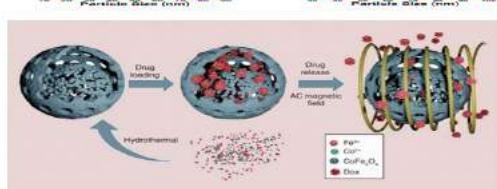
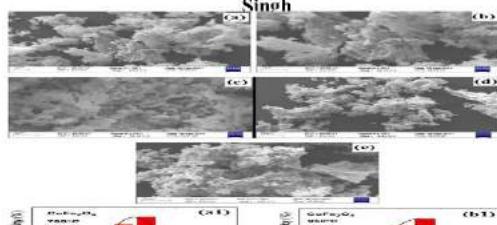
Dr. Rakesh Kumar Singh



Saurabh Sharma



Harendra Kumar Satyapal



Research Summary:

- Spinel cobalt ferrite (CoFe_2O_4) has been prepared using the citrate precursor sol–gel method. The synthesized samples have been controlled annealing at 550 °C, 650 °C, 750 °C, 850 °C, and 950 °C for 2 h.
- The average crystallite size for samples is found to be 54.32 nm, which increases with an increase in annealing temperature. The lattice strain reaches a maximum value of 2.95×10^{-3} for CoFe_2O_4 annealed at 950 °C. W–H plots calculation is supported by SEM morphological analysis. Lattice parameter (a) is calculated using Fullprof Rietveld refinement of XRD patterns, which show noticeable increments due to induced lattice strains in samples.
- FTIR spectrum is analyzed to find out tetrahedral and octahedral metal–oxygen bond lengths. EDX analysis justifies elemental composition.
- The ‘Law of Approach to saturation’ is employed to quantify magnetic properties like magnetization (M_s), anisotropy field (B_1), and magnetocrystalline anisotropy (k_1). These magnetic properties show improvement due to the annealing effect, with M_s ranging from 24.60 to 77.68 emu/g and retentivity (M_r) 5.12–47.08 emu/g. The coercivity (H_c) shows an appreciable increment from 175 to 1402 Gauss. The anisotropy (k_1) ranges from 2.22 to 11.68×10^6 erg/cm³. These remarkable improvements in magnetic properties motivated us to explore the correlation between induced lattice strain and magnetic response of CoFe_2O_4 nanomaterials at different annealing temperatures.

Acknowledgements :

The authors are extremely thankful to Department of Education, Govt. of Bihar and Aryabhatta Knowledge University, Patna for frontiers research establishment, support and functioning of the Nanoscience and Nanotechnology center.



Structural, optical, and magnetic properties of Yttrium aluminium BORATE (YAB) nanomaterial, prepared by low cost sol-gel chemical method

Bibhuti Bikramaditya ^a, Rakesh Kumar Singh ^{a, b}, Nishant Kumar ^a, R.K. Verma ^b

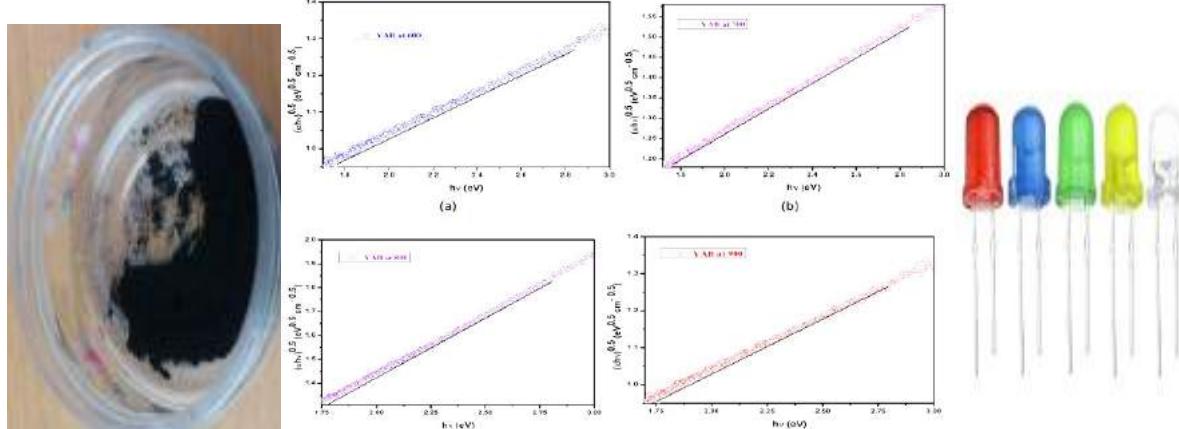


Research Team

Bibhuti Bikramaditya Dr. Rakesh K Singh Mr. Nishant Kumar

Research Summary:

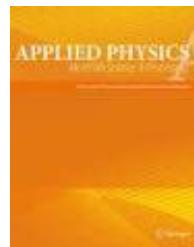
- ✓ In this research, we present synthesis, structural optical and magnetic analysis, of the Yttrium Aluminium Borate (YAB) nanomaterials, size ranging between 16 nm to 26 nm.
- ✓ Photoluminescence property shows that YAB gives intense blue light emission in the visible region. Further energy band gap of the were investigated using Tauc plot which was found to be decreased from 1.782 eV to 1.748 eV respectively with increasing annealing temperature from 800°C to 900°C keeping annealing time constant for 2 hrs. This result shows that the band gap is a function of crystallite size and it is very close to energy band gap of GaAs nanomaterial used in the **Light Emitting Diode (LED)** application, having band energy gap 1.441 eV.
- ✓ Vibrating Sample Magnetometer (VSM) shows the paramagnetic nature of the prepared sample. Coercivity increases while Magnetization and retentivity decreases for YAB nanomaterials for the temperature above 800 degree Celsius. The prepared YAB nanomaterials may be potential candidate for LED and other related application.



Scientific studies on Ceramics Magnetic materials for Magneto-Optical devices and Low cost Preparation method, may open a new window for mass production of Ceramics Materials.

Applied Physics A (2021) 127:861
https://doi.org/10.1007/s00339-021-05011-9

Applied Physics A
Materials Science & Processing



Impact of doping Gd³⁺rare earth ion on structural, magnetic, and optical properties of cobalt and nickel ferrite nanomaterials

Shubhra¹ · Rakesh Kumar Singh¹ · Nishant Kumar¹ · Vivek Kumar¹ · Shashank Bhushan Das¹ · Md. Muzzamilul Haque Siddiqui¹

Applied Physics A: Materials Science & Processing, Springer Nature Switzerland



, Siddique photo

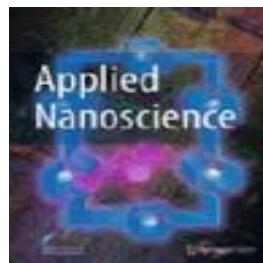
Research Team

Shubhra, Dr. Rakesh Kr Singh, Nishant Kr, Vivek Kr, Shashank B Das, Md. M Siddique

Novelties of Research

- The rare earth element Gd³⁺ substituted CoFe₂O₄ and NiFe₂O₄ nanomaterials were prepared at annealing temperature 700°C using the citrate precursor method. The crystallite size of annealed samples of Gd³⁺ substituted CoFe₂O₄ and NiFe₂O₄ was found between 15.61-23.49 nm and 12.01-30.95 nm, respectively.
- The direct band gap (E_g) of CoFe₂O₄ and NiFe₂O₄ samples were found between 1.628-2.406 eV and 1.643-1.661 eV, respectively using Uv-Vis spectroscopy. The room temperature PL studies reveal broad and strong emissions between 457-520 nm with 200 nm excitation, indicating a dominant blue emission and a weak green emission.
- The microstructural analysis using HRTEM confirmed the approximate particle size of 34 nm and 41.58 nm for pure cobalt and nickel ferrite materials, respectively. From the magnetic measurements using VSM, the coercivity of pure CoFe₂O₄ and NiFe₂O₄ was found to be 1452.41 and 191.49 Oe, respectively.
- The coercivity has displayed an initial increase and then decrease in the prepared cobalt ferrite with the increase in the amount of Gd³⁺ substitution whereas the nickel ferrite materials have exhibited a continuous decrease in coercivity. The saturation magnetization (M_s) was noticed between 30.59-57.84 emu/g for CoFe₂O₄ and 23.99-42.11 emu/g for NiFe₂O₄ samples.
- The substitution of Gd³⁺ in crystal sites may result in significant strain within the crystal structure and the related properties may account for some interesting magneto-optic properties.

Scientific Studies on ceramic magnetic Nanomaterial for its applications as electronics materials to Nano medicine.



Springer Nature Switzerland

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NATURE

Applied Nanoscience
<https://doi.org/10.1007/s13204-021-02198-4>

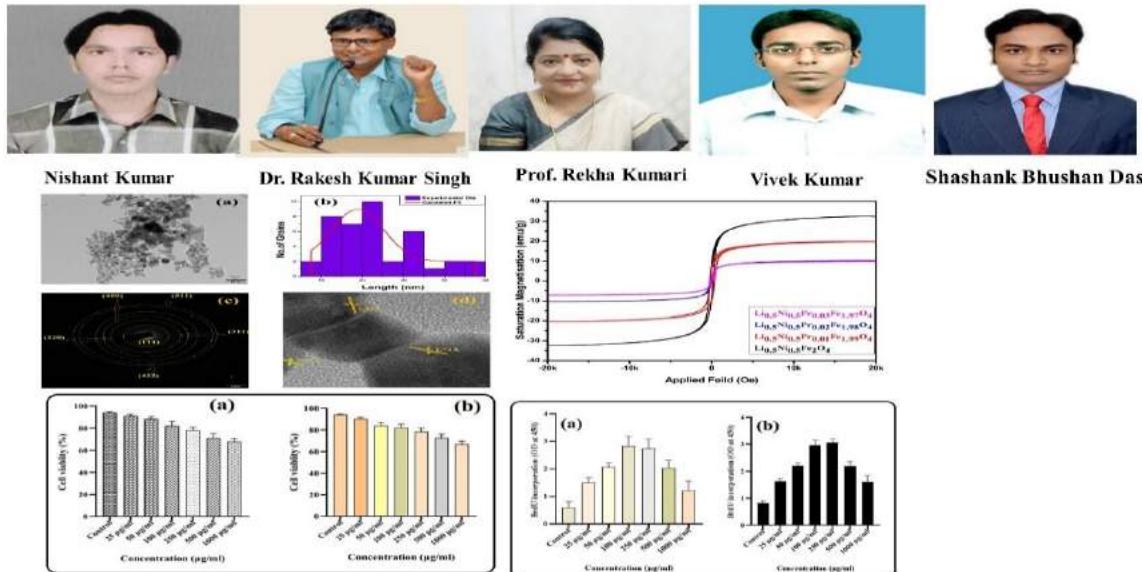
ORIGINAL ARTICLE



Physical properties of Pr-substituted Li/Ni ferrite magnetic materials at nanometric scale for its multifunctional applications in industries/environment and their cytotoxicity, lymphocyte studies as nanomedicine

Nishant Kumar¹ · Rakesh Kumar Singh¹ · Vivek Kumar¹ · Shashank Bhushan Das¹ · Gufran Ahmed² · Shyam Narayan² · Rekha Kumari³

Research Team



Research Summary:

- $\text{Li}_{0.5}\text{Ni}_{0.5}\text{Pr}_x\text{Fe}_{2-x}\text{O}_4$ ($x=0, 0.01, 0.02$ and 0.03) prepared using cost-effective citrate precursor method. The ferrite magnetic materials are iron oxide-based materials and at nanometric scale very promising for its multifunctional applications in Electronics industries, Purification of water and as Nanomedicine. In this present research, structural, surface morphology, optical, electronic, and magnetic properties together with cytotoxicity and lymphoproliferation on murine spleen cells have been investigated.
- The indirect band gap energies were improved with the substitution of rare-earth ion. The saturation magnetization value was found between 33.5 and 6.73 emu/g for $\text{Li}_{0.5}\text{Ni}_{0.5}\text{Pr}_x\text{Fe}_{2-x}\text{O}_4$ ferrites.
- The coercivity was estimated in between 185.24–98.78 Oe for Li-Ni-nanoferrite system. In addition, the observed in-vitro cytotoxicity and lymphoproliferative results appeared to be biocompatible and concentrations dependent as studied by MTT and BrdU assays.
- The present research results indicate that Pr-substituted ferrite might be applied in transformer cores because of reduced coercivity in opto-electronic instruments owing to improved optical properties and iron- oxide based bio-nanomaterials for its uses in health and medical science sector.

Acknowledgements :

The authors are extremely thankful to Department of Education, Govt. of Bihar and Aryabhatta Knowledge University, Patna for frontiers research laboratory establishment, support and functioning of the Nanoscience and Nanotechnology center.

Scientific Studies on Effect of radiation of Moon on Properties of Jalkhumbhi bhasma and formation of Nanomedicine.

Nanotechnology in ancient wisdom/Ayurveda

ICAPSM 2021
Journal of Physics: Conference Series

IOP Publishing
2070 (2021) 012082 doi:10.1088/1742-6596/2070/1/012082



Published from United Kingdom

Effect of Radiation of Moon on the physical property of Jalkhumbhi (Water hyacinth) Bhasma as a functional nanomaterials for its applications as medicine and in other areas of Science & Technology.

Dinesh Kumar¹, Shambhu Nath Guha², Rakesh Kr. Singh^{3*}, Jitendra Kr Singh⁴,
Dineshwar Prasad², Shashank Bhushan Das⁵, Nishant Kumar³

Research Team



Dr. Dinesh Kr

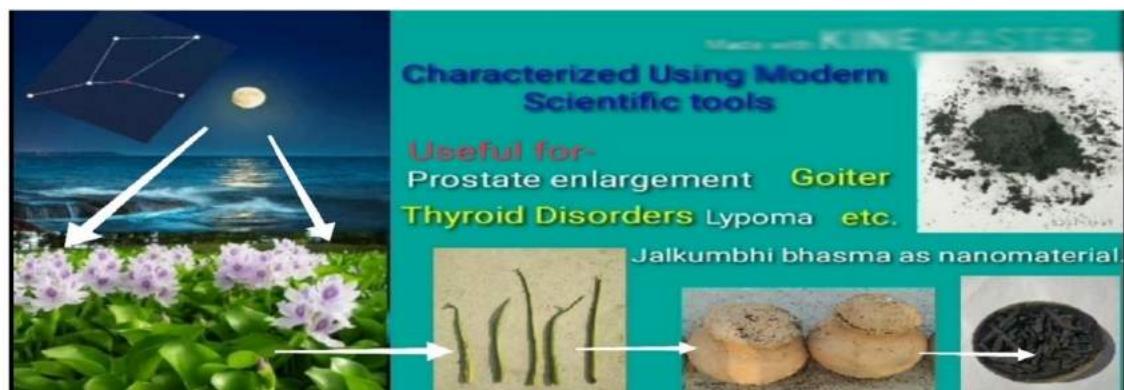
Dr. Rakesh Kr Singh

Prof. S.N. Guha

Nishant Kumar

Dr. Jitendra Kr Singh

Shashank B Das



• Jalkhumbhi Bhasma as Nanomaterials are prepared using ecofriendly green approach in Pushya nakshtra and Rohini nakshtra. The crystal structure was evaluated, using modern scientific tools. X-ray diffraction measurement shows that crystalline size and lattice constant of Jalkhumbhi bhasma prepared in Push and Rohini nakshtra were found, 26.62 nm and 54.55 nm and lattice constant 6.312A, 6.301A and respectively. This reveal effect of radiation of moon alters the crystal structure and formation of nanocrystalline materials.

• The Fourier transform infrared spectroscopy (FTIR) measurement shows functional group present in the materials are of compound of K, Cl, C-Cl, NH₂, C-O-C, C=O, Ca and Ca(OH)₂ respectively. The magnitude of force constant for are 2.51307 N/cm, 4.16005 N/cm and 2.61932 N/cm, 4.20074 N/cm respectively and this measure the interatomic strength. The photoluminescence spectra (PL) reveals that the broad spectrum from both the materials lies in the visible region showing broad blue emission. The energy band gap value for the most significant intense peak corresponding to 481 nm (2.55 eV) corresponding to 350 nm excitation and 501 nm (2.475 eV) for 370 nm. The optical property shows that prepared jalkhambhi bhasma may be useful as semiconductor electronics nanomaterials, which was prepared using eco-friendly. This may open a new window for pharmaceutical industries for production of such materials for electronics-based industries in addition to use as drug.

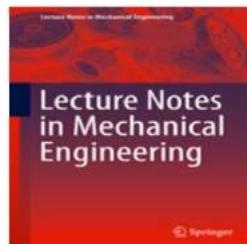
Acknowledgements :

The authors are extremely thankful to Department of Education, Govt. of Bihar and Aryabhatta Knowledge University, Patna for frontiers research establishment, support and functioning of the Nanoscience and Nanotechnology center.

Magnetic Electronic nanomaterial prepared using Lemon

Title of research- Structural, optical and magnetic properties of Cobalt Ferrite nanomaterials, synthesized by green technological approach using Lemon Juice.

Journal details- Springer Lectures notes in Mechanical Engineering, (Scopus Indexed) (Status: Accepted in Production)



California

Research Team



Shashank Bhushan Das



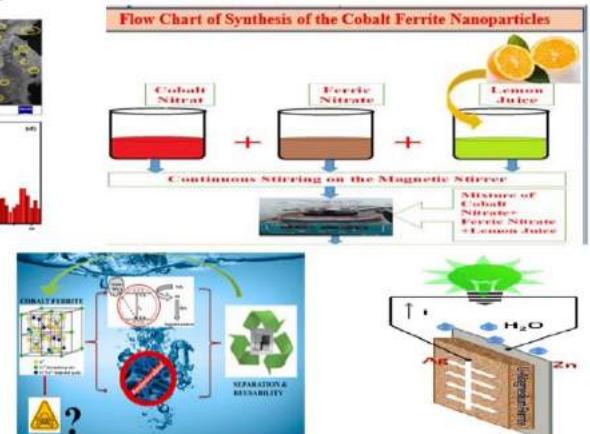
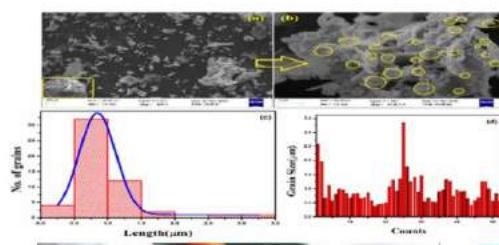
Dr. Rakesh Kumar Singh



Vivek Kumar



Nishant Kumar



• Research Summary:

- Green synthesis of nanomaterials is considered to be cost-effective and eco-friendly methods of synthesis. With this intention to use green synthesis approach, CoFe_2O_4 nanoparticles were successfully prepared using lemon juice and metal nitrates as a precursor material.
- FTIR spectroscopic analysis was performed for investigating various molecular vibrations of prepared ceramics. The existence of Fe-O , Co-O etc. vibration bands also clarify the phase formation of CoFe_2O_4 . Besides these, optical properties were inspected using photoluminescence and UV-VIS spectroscopy.
- Direct band gap was evaluated using Uv-vis spectroscopy where it was measured equal to 3.65 eV using Tauc equation A broad and strong emissions between 457-493 nm (predominantly blue emission) was observed during photoluminescence studies. The magnetic parameters like coercivity displayed systematic increase with rise in annealing temperature.
- The saturation magnetisation (M_s) had significant improvement with annealing temperature.
- The present research studies open a new window that large production of Cobalt ferrite nanomaterial's using green approach can be produced for various applications such as in Electronics industry, Purification of water, Hydroelectric shell etc.

Acknowledgements :

The authors are extremely thankful to Department of Education, Govt. of Bihar and Aryabhatta Knowledge University, Patna for frontiers research establishment, support and functioning of the Nanoscience and Nanotechnology center.

Scientific studies on effect of annealing temperature on Aluminate materials: Highlights

Title of research- Investigating the effect of annealing temperature on structural, Luminescent and magnetic properties of Nickel and Zinc Aluminate nanomaterials, prepared by Sol-gel method.

Research team- Sampurnanad, Nishant Kumar, Dr. Rakesh Kumar Singh

Journal details- Springer Lectures notes in Mechanical Engineering. (Scopus Indexed)



Published from California



Sampoornanand



Dr. Rakesh Kr Singh



Nishant Kr



Novelties of Research

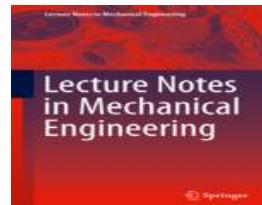
- ZnAl_2O_4 and NiAl_2O_4 powders were synthesized by citrate precursor method and annealing at 650°C , 750°C and 850°C . The formation of metal aluminates nanoparticles and their particle size was found to depend upon the annealing temperature.
- The XRD patterns reveal that the formation of single phase cubic spinal ZnAl_2O_4 and NiAl_2O_4 nanoparticles.
- The M-H curves of aluminates nanoparticles reveal that NiAl_2O_4 is paramagnetic at room temperature and their coercivity and retentivity increase with increasing annealing temperature otherwise ZnAl_2O_4 diamagnetic in nature and their saturation magnetization increases with increasing annealing temperature. The maximum coercivity was found 909.86 G at 850° for Nickel aluminates.
- The PL spectra reveal that both aluminate nanoparticles annealed at different temperatures are in the visible range. Both materials were prepared at the same thermodynamic parameters and utilizing same chemical based citrate precursor method.

Scientific studies production of Silica nanomaterials from Rice husk (Agriculture waste) for its applications:

Title of research- Physical properties of Amorphous Nano silica materials from Rice husk (Agriculture waste) and its PVA composite, prepared using green approach for its applications.

Research team- Anurag Kumar, Nishant Kumar, Dr. Rakesh Kumar Singh

Journal details- Springer Lectures notes in Mechanical Engineering (Scopus Indexed)



Published from California



Anurag

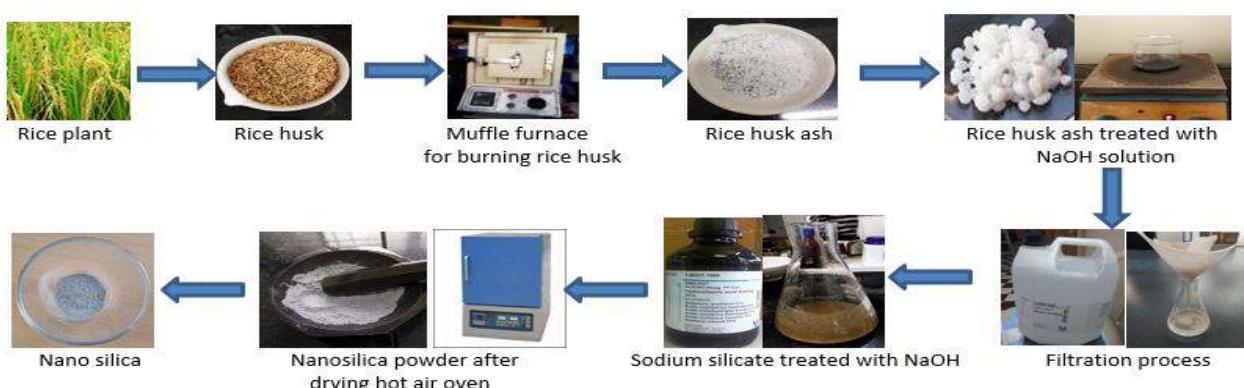


Dr. Rakesh Kr Singh



Research Team

Nishant Kr



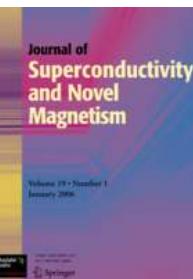
Novelties of Research

- The small size amorphous Nanoscale silica materials from rice husk were prepared using low-cost ecofriendly approach.
- Surface morphology measurement of silica depends on temperature and shows agglomerated porous structure. Photoluminescence, measurement represents wide emission in UV region. PVA/SiO₂ composite was also prepared ecofriendly using low-cost chemical method. Functional group of silica and its composite was measured using FTIR and show the presence of hydrogen bonded silanol group that increases the densification of composite.
- The luminescence emissions of radiations in composite materials are also in UV range but intensity height decreases considerably.
- Physical properties measurement of present research opens a new window for electronics, cement, medicine industries and its use as raw materials or composite materials.

Scientific Studies on variation in Energy Band gap with addition of silver (Ag^+) for its applications as Semiconductor Nanomaterials

Journal of Superconductivity and Novel Magnetism
<https://doi.org/10.1007/s10948-022-06220-w>

ORIGINAL PAPER



Studies on the Structural Properties and Band Gap Engineering of Ag^+ -Modified MgFe_2O_4 Nanomaterials Prepared by Low-Cost Sol-Gel Method for Multifunctional Application

Uday Shankar¹ · Rakesh Kumar Singh¹ · Shashank Bhushan Das¹ · Vivek Kumar¹ · Nishant Kumar¹ · Rakesh Kumar² · Prabhakar Sharma²

Research Team



Uday Shankar



Dr. Rakesh Kumar Singh



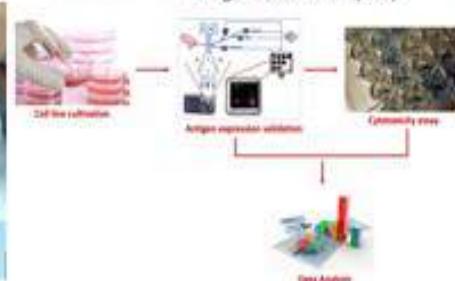
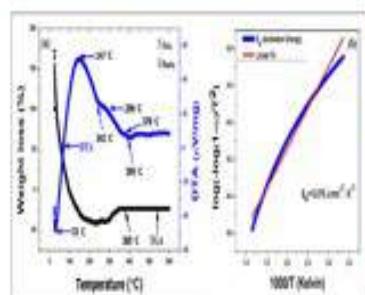
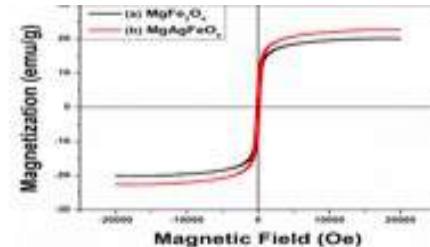
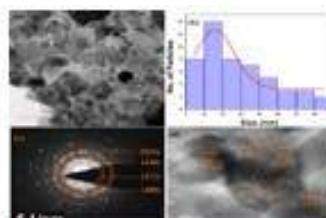
Shashank Bhushan Das



Vivek Kumar

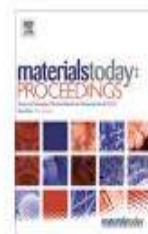


Nishant Kumar



Research Findings: highlights

- Silver (Ag^+) substituted MgFe_2O_4 nanomaterials were successfully prepared by a citrate precursor method
- The Electron microscopy micrographs have shown porous structures in the prepared samples,
- The increase in Ag^+ content has resulted in the increase of the direct and indirect band gaps of prepared materials. The average particle size was approximately measured to be 19.23 nm and 12.76 nm for MgFe_2O_4 and MgAgFeO_4 , respectively by Transmission Electron Microscope.
- Magnetic measurements revealed that the coercivity (H_c) decreased, but saturation magnetization (M_s) and retentivity (M_r) increased with the increase in Ag^+ content.
- The material thus prepared may exhibit excellent properties for its applications in antimicrobial activity, biomedicine and electronics industry as semiconductor materials.



Study of structural, optical, and toxicity of iron-based nano particle Kasis bhasma

Prabhat Kr Diwedi^a, Rakesh Kr. Singh^a, P. Kour^{b,*}, Nishant Kumar^a, Pawan Kumar^c, Manoranjan Kar^d



Prof. Prabhat Kr Diwedi



Rakesh Kr. Singh



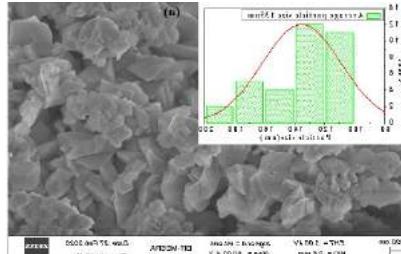
Paramji Kaur

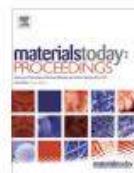


Nishant Kumar



Manoranjan Kar





Physical properties of quantum dot cadmium sulphide nanomaterials for its applications, prepared by low cost chemical method

Rohit Raj ^a, N. Kumari ^a, Monalisa ^b, B.C. Rai ^{a,*}, N.A. Karimi ^c, Rakesh Kr. Singh ^b, Nishant Kr ^b

^aDept of Physics, College of Commerce, Arts and Science, Patliputra University, Patna, India

^bNanoscience and Nanotechnology Center, Aryabhatta Knowledge University, Patna, India

^cDepartment of Physics, B.N. College, Patna University, Patna, India



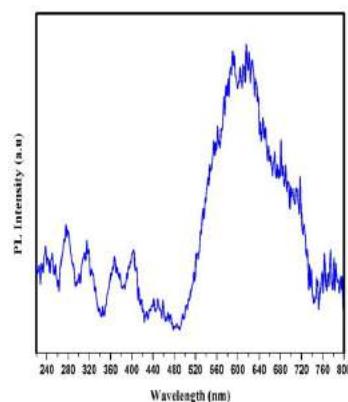
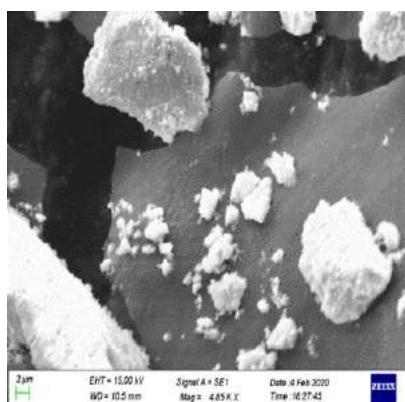
Dr. Rakesh Kr Singh



Mr. Nishant Kr



Ms. Monalisa



Novelties of Research

- Quantum dot cadmium sulphide nanomaterials synthesized in a green chemical way using aqueous solutions of hydrated cadmium sulfate, sodium sulphide and EDTA-disodium salt and thermolysis at a temperature of 170°C, is reported.
- XRD spectrum confirmed a cubic unit cell of lattice parameter 0.594 nm. A spherical morphology was observed with large mass lumps of nanoparticles in SEM, indicating highly reactive surfaces.
- FTIR spectrum confirmed the formation of CdS by exhibiting absorption band centered at 623.17 cm⁻¹, along with other functional bands.
- The photoluminescence spectrum of the sample shows peaks around 590 nm (intense peaks at 590.17 nm and 616.82 nm) suitable for photo-emissive devices. Numerical calculations using Effective Mass Approach supported a blue shift observed in PL due to quantum confinement.

High energy ball milling equipment and Scientific studies of Nanoscale Moringa for its industrial applications

Title of research- Eco-friendly produced superfine Moringa oleifera nanometric food powder and its characteristic effect on its structural, morphological and toxicity for varied applications as new functional nanomaterials

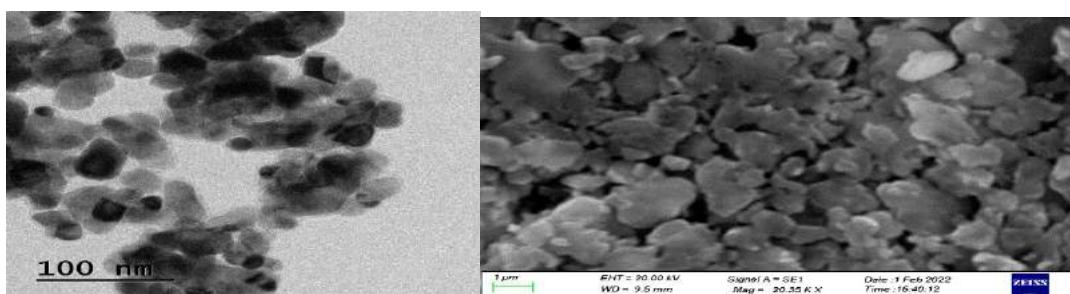


Mr. Naman Naik Dr. Rakesh Kr Singh, Pallavi Singh and Nishant Kr

Elsevier-Pub

Research Summary:

- The present study investigates the characteristic changes brought in the structural and morphological properties of the Moringa oleifera leaf nano powder prepared by High Energy Ball Milling equipment and characterizing by using modern scientific tool..
- The XRD studies showed that the size of milled moringa oleifera powder was between 1nm to 100nm.
- There was considerable change in wave number but no change in functional group was witnessed in FTIR at different milling time. Biomedical assay was performed in order to check the cell viability and cytotoxicity.
- The test which was used was and the results indicated that by increasing the milling hours the cell viability also increases. Dosage of 25 μ g/ml seems to be optimal for maintaining the cell viability. The present research reveals that nanometres food particles can remarkably enhance the physicochemical properties, which are useful for its applications in agriculture, food, Biomedical science as new functional food materials



Optical and Electron microscopy images of *Moringa oleifera* nanoscale sample

Scientific Studies on Rare earth substituted ceramics Magnetic materials for its industrial applications

Applied Physics A: Materials Science & Processing, Springer Nature Switzerland

SPRINGER NATURE

Applied Physics A (2021) 127:754
https://doi.org/10.1007/s00339-021-04904-z

Applied Physics A
Materials Science & Processing

Tuning of structural, elastic, luminescence, magnetic, and multiferroic properties of rare earth Ce^{3+} substituted strontium hexaferrite Ceramic magnetic nanomaterials for its industrial applications

Singh Sonu Kumar¹ · Rakesh Kumar Singh¹ · Aniket Manash¹

Received: 15 July 2021 / Accepted: 2 September 2021

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Singh Sonu Kumar



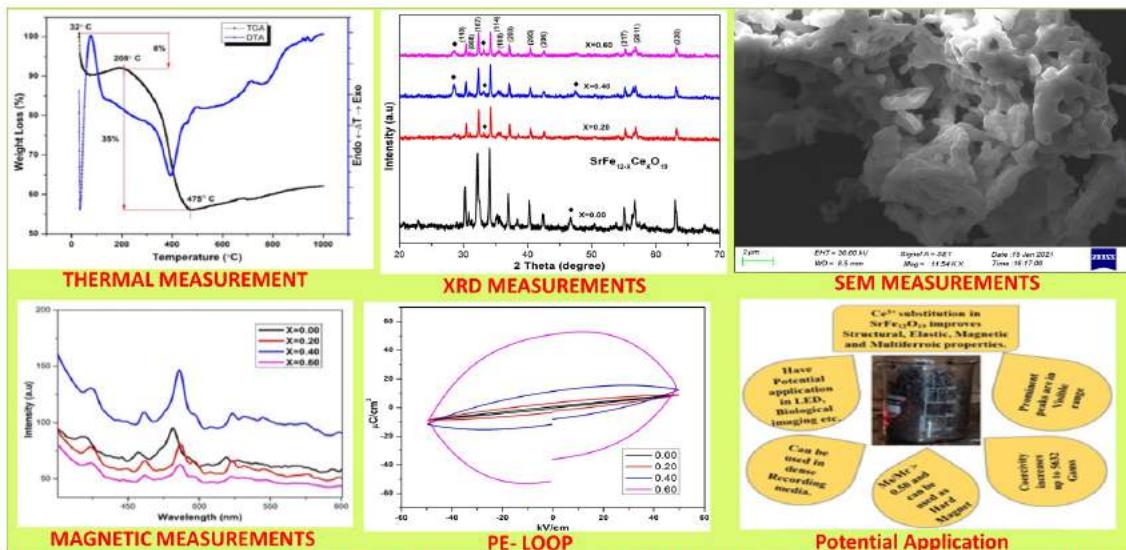
Dr. Rakesh Kumar Singh



Aniket Manash



Flowchart of Preparation of Ferrite Magnetic Materials Tree in the Lab



Advanced Research Technique used for Probing, Analyzing and Co-relating the Potential Application of Preaped Nanoceramic Material.

Research Highlights and Possible Applications

- Systematic decrease in crystalline size (79.64–66.02 nm) and strain value for the sample $\text{SrFe}_{12-x}\text{Ce}_x\text{O}_{19}$ is seen with increment in Ce^{3+} ($x = 0.0, 0.20, 0.40, 0.60$).
- Prominent peaks are found to be in the visible range, which is one of the features for its applications in LED, Biological imaging, etc
- The coercive value of the order 5632 Oersted indicates its application in dense recording media. The squareness ratio (Ms/Mr) is found to be >0.50 for all compositions suggesting that $\text{SrFe}_{12-x}\text{Ce}_x\text{O}_{19}$ can be used as a permanent magnet.
- Thus P-E loop measurement supports the functional properties of rare-earth substituted hexaferrite magnetic nanomaterials for its various applications in Electronics, Electrical, and Environmental applications.

Acknowledgement:- Author are thankful to Dept. of Education, Govt. of Bihar and Aryabhatta Knowledge university, Patna, for frontiers research establishment, support and functioning of the Nanoscience & Nanotechnology center.

Scientific Studies on Rare earth substituted ceramics Magnetic materials for its industrial applications: Novelties of Research



Published from United Kingdom

IOP Conference Series: Materials Science and Engineering

PAPER • OPEN ACCESS

Investigating structural, magnetic and multiferroic properties of gadolinium substituted strontium hexaferrite ($\text{SrFe}_{12-x}\text{Gd}_x\text{O}_{19}$)

Singh S Kumar¹, Rakesh K Singh^{1,*}, Aniket Manash¹, Gaurav Kumar¹,



Singh Sonu Kumar



Dr. Rakesh Kumar Singh



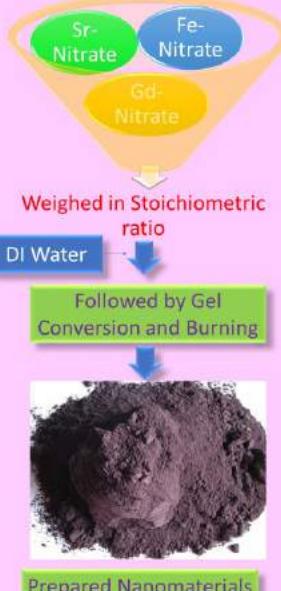
Aniket Manash



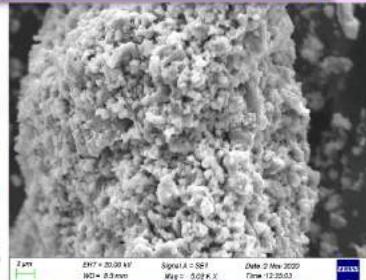
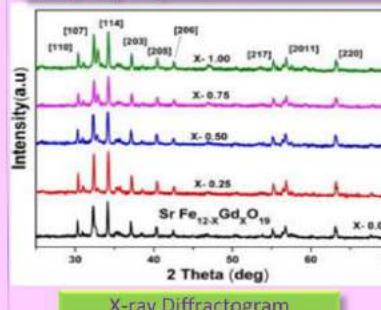
Gaurav Kumar

Nanomaterials for Electronics and Environmental applications

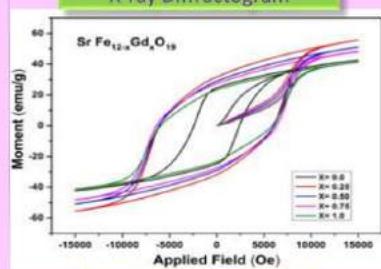
Flowchart of Synthesis Process



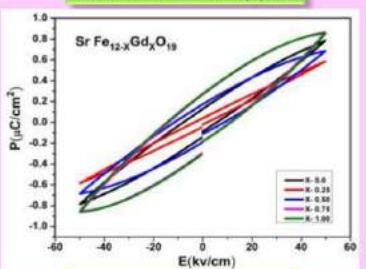
Analyzing Prepared Nanomaterials using Different Characterization tools



X-ray Diffractogram



Electron Microscopy es



Magnetization Curves

P-E Loop Measurement

Possible Application of Sr based Nanomaterials



Highlights of Research Finding

- Sol-gel technique is employed to synthesize monodispersed samples of strontium hexaferrite $\text{SrFe}_{12-x}\text{Gd}_x\text{O}_{19}$ for $x = (0.25 - 1.00)$.
- The particle size and crystal strain in samples amplified with an increasing Gd^{3+} content in lattice.
- The coercive field of order 6310 Gauss is recorded for $\text{SrFe}_{12}\text{O}_{19}$ doped with 0.75 mole Gd.
- Also, occupancy of Gd^{3+} ions in $\text{SrFe}_{12-x}\text{Gd}_x\text{O}_{19}$ crystals successfully enhanced electrical polarization by prohibiting electrical leakages.
- These tuned physical properties of $\text{SrFe}_{12}\text{O}_{19}$, due to lattice strain mediated by Gd^{3+} substitution suggests its futuristic technological applications in Electronics and Environmental Sector.

Acknowledgement:- Author are thankful to Dept. of Education, Govt. of Bihar and Aryabhatta Knowledge university, Patna, for frontiers research establishment, support and functioning of the Nanoscience & Nanotechnology center.



Gaurav Kumar



Dr. Rakesh Kumar Singh



Singh Sonu Kumar

APPLICATION OF PREPARED NANO MATERIALS(IMAGE SOURCES:GOOGLE)

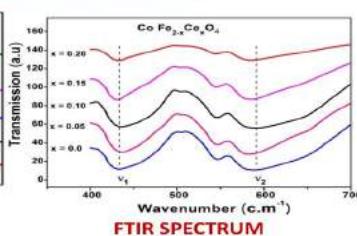
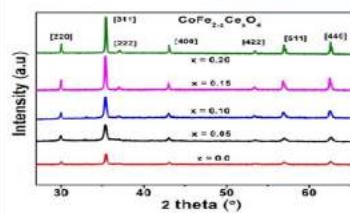


PREPARED FERRITE NANOMATERIALS IN LAB

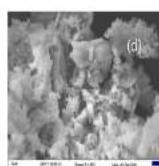
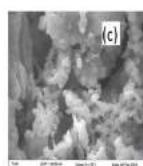
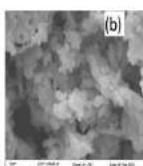
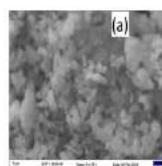
BIO-SENSORS

Electrical And Electronics Materials

STRUCTURAL MEASUREMENTS

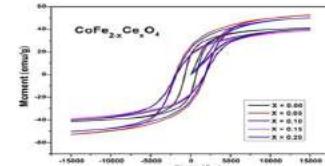


FTIR SPECTRUM

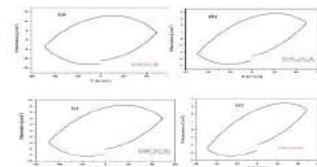


SEM ANALYSIS

MAGNETIC MEASUREMENTS



HYSTERESIS LOOP



FERRO ELECTRIC LOOP

Novelties of research

- Rare earth Ce substituted $\text{CoFe}_{2-x}\text{Ce}_x\text{O}_4$ was synthesized using an economical sol-gel method, and annealed at 500°C for 3 h.
- XRD analysis confirms that all samples have spinel structure having systematic increase in the lattice constants and crystalline size were noticed with Ce^{3+} substitution.
- The magnetization is maximum for cobalt ferrites with Ce^{3+} ions ($x = 0.20$) of the order of 57.68 emu/g. Further coercive field are also highest for cobalt ferrites ($x = 0.20$) with an order of 1912 Gauss. The improved magnetic parameters are guided by an increase in super-exchange interactions among Fe^{3+} ions.
- The present article opens a perspective for tuning in structural and magnetic properties of Ce^{3+} doped CoFe_2O_4 nanomaterials using crystal mediated lattice strain for its applications in Electronics to Environmental Sciences.

Media Response and Picture Gallery

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नवनियुक्त पदाधिकारियों के प्रशिक्षण कार्यक्रम में विशेषज्ञ रूपी शिरकत करेंगे डॉ राकेश

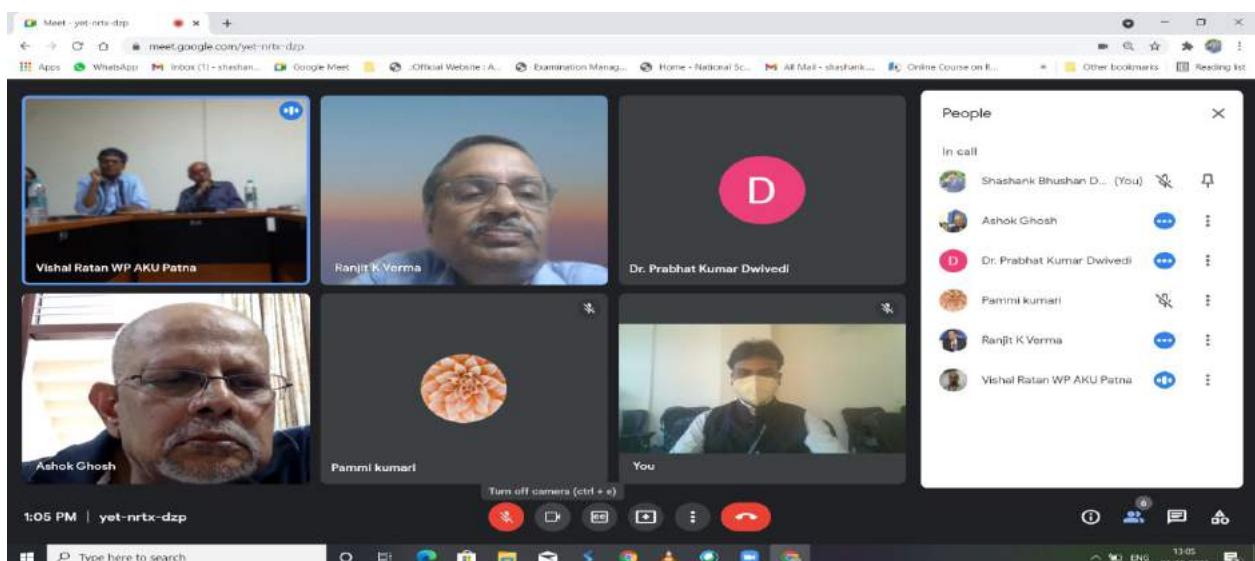
निदेशक ने पत्र प्रेषित कर कार्यक्रम में शामिल होने का किया अनुरोध

आर्यवर्त समाचार पटना

पटना। राज्य शिक्षा शोध एवं प्रशिक्षण परिषद के निदेशक सज्जन आर ने पत्र प्रेषित कर आर्यभट्ट ज्ञान विश्वविद्यालय पटना के कुलसचिव सह नैनो विज्ञान व नैनो प्रौद्योगिकी केंद्र के शैक्षणिक प्रभारी डॉ राकेश सिंह का प्रशिक्षण कार्यक्रम में शामिल होने का अनुरोध किया है। राज्य शिक्षा शोध एवं प्रशिक्षण के निदेशक सज्जन आर ने प्रेषित पत्र में स्पष्ट किया है कि विहार शिक्षा सेवा के नवनियुक्त पदाधिकारियों का संस्थागत प्रशिक्षण कार्यक्रम का आयोजन 12 मई से ही परिषद में आयोजित है। जिसकी लेकर उक्त प्रशिक्षण कार्यक्रम में शैक्षणिक प्रभारी डॉ राकेश सिंह को विशेषज्ञ के रूप में आमंत्रित किया गया है। बता दें



कि आगामी 23 मई 2022 को आत्मनिर्भर समाज के लिए 21वीं सदी के प्रांतियर विषय के रूप में नैनो टेक्नोलॉजी की भूमिका एवं लागत/निःशुल्क प्रयोगों के माध्यम से विज्ञान सीखने की प्राकृतिक प्रक्रिया से सन्दर्भित विषय पर विशेषज्ञ के रूप में डॉ सिंह अपने विचारों को रखेंगे। मालूम हो कि 21वीं सदी के जिस मुकाम पर आज भारत है, पूरी दुनिया की नजरें भारतवासियों पर टिकी हुई हैं। कोविड ने जो परिस्थितियां पैदा की हैं, उसमें एक नया वर्ल्ड ऑर्डर (वैश्विक व्यवस्था) उभर रहा है। इस नए वर्ल्ड ऑर्डर में भारत की अपनी भूमिका बढ़ानी है और तेज गति से अपना विकास भी करना है। ऐसे में भारत का सबसे बड़ा लक्ष्य “आत्मनिर्भर भारत” और “आशुनिक भारत” का है।



Doctoral Committee Member, Nanoscience centre meeting in online mode

राकेश कुमार सिंह को रजिस्ट्रार का प्रभार

पटना। आर्यभट्ट ज्ञान विश्वविद्यालय, पटना के नैनोविज्ञान व नैनोप्रौद्योगिकी केंद्र के शैक्षणिक प्रभारी सह-कुलानुशासक डॉ राकेश कुमार सिंह को कार्यकारी कुलसचिव का प्रभार दिया गया है। उन्होंने अपना कार्यभार ग्रहण कर लिया है। वे नये नियमित रजिस्ट्रार की नियुक्ति अथवा डॉ पीके वर्मा के उपलब्ध होने तक प्रभार में रहेंगे। डॉ राकेश कुमार सिंह द्वारा लगभग 125 अंतर्राष्ट्रीय रिसर्च पेपर 21वीं शताब्दी के अंग्रेणी विलय से संबंधित प्रकाशित किया गया है। इन्होंने अपने कॅरियर की शुरुआत वर्ष 2004 में पटना वीमेंस कॉलेज से की थी।

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गई थी जिसे 12 दिन पूरा

नैनो विज्ञान, प्रौद्योगिकी के सतत विकास विषय पर सेमिनार आयोजित



आर्यवर्त समागम विश्वविद्यालय संबोधिता
आर्यभट्ट ज्ञान विश्वविद्यालय कैप्पस
स्थित एसीएनएन समागार में
'नैनो विज्ञान एवं प्रौद्योगिकी के सतत विकास' संदर्भित विषय पर आयोजित सेमिनार का आयोजन संस्थान के शैक्षणिक प्रभारी डॉ राकेश सिंह के अध्यक्षता में आयोजित किया गया।

आयोजित ऊक्त सेमिनार में शिरकत करने पहुंचे नालंदा विश्वविद्यालय के पारिस्थितिक एवं पर्यावरण अध्ययन के शिक्षाविद डॉ प्रभाकर शर्मा

को शोधार्थी पुष्पा शर्मा ने गुलदस्ता भेंट कर कार्यक्रम की शुरुआत की। वहीं शुरुआत कार्यक्रम के क्रम में शैक्षणिक प्रभारी डॉ सिंह ने डॉ शर्मा को आर्यभट्ट की प्रतिमा समर्पित कर संबोधन की कार्रवाई को शुरुआत करने हेतु आमंत्रित किया।

इसी क्रम में शैक्षणिक प्रभारी डॉ राकेश सिंह ने नैनो साइंस की उत्पत्ति को रेखांकित करते हुए कहा कि पिछले 20 वर्षों में नैनो विज्ञान और प्रौद्योगिकी के क्षेत्र में बुनियादी ढाँचे और मानव संसाधन का खासे निर्माण किया गया है। उन्होंने मौजूद छात्रों व शोधार्थियों से कुछ हटकर सोचने एवं भारत में कुछ विशिष्ट करने के लिए प्रोत्साहित किया।

ताकि अगले पांच वर्षों में भारत न केवल नैनो विज्ञान ही नहीं बल्कि सभी विज्ञानों में विश्व में सर्वोपरिहो। वहीं मुख्य वक्ता के रूप में डॉ शर्मा ने कहा कि नैनो विज्ञान का विभिन्न क्षेत्रों में शानदार अनुप्रयोग है। उन्होंने नैनो-चिकित्सा, कृषि, पर्यावरण और ऊर्जा जैसे क्षेत्रों में इसकी सफलता की कहानियों पर भी प्रकाश डाला। कार्यक्रम के समापन पूर्व काव्य भावों में अपने संबोधन को सहायक प्राध्यापक डॉ विजय कुमार ने धन्यवाद ज्ञापन की कार्रवाई को रूप दिया।

नैनोसाइंस व नैनोटेक्नोलॉजी में एमटेक और पीएचडी कर पायें रोजगार के अवसर



SAMARTH BIHAR

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By

PROF. RAKESH KUMAR SINGH

**HOD, NANOSCIENCE AND
NANOTECHNOLOGY CENTRE
ARYABHATTA KNOWLEDGE UNIVERSITY,
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9:00 PM ONWARDS**



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मंत्री नितिन नवीन ने आईएसएम छात्रों से कहा
परिवर्तन के एजेंट बनें, बिहार के
समग्र विकास के लिए काम करें।



प्रत्यक्ष नियन्त्रण संकेत निवारन नवीनी ने इंटर्नेशनल स्कूल आणि मिनेसोटा के छात्रों से पायक के सम्पर्क विळास के लिए, काम करके अवलंबन के एजेंट बनाने का आवाहन किया। आईएसएम परिवर्तन में 110 लाख दिवस सम्पादन में अपने संचारामन से छात्रों से कहा कि समाज से प्रति अपने कलानियों और विभिन्नताओं को निपन्न और चिका किन्नी जा या प्रकाशन के बारे में को कांसल्पणी ले। आपको नियन्त्रण संकेत निवारन के रूपांतर संकेत कुण्डर सिंह

ने अपने संचारामन में सांस्कृतिक विवरण से संक्षण के लिए नीतिकूल पूर्णो पर जो दिया। इससे पूर्व आईएसएम के निवेशकों पर आपके द्वारा अतिविरोध का दबावामन किया। कामकाज की गई शुरुआत मध्यम एकायु एकायु रजस्टर्ड, आईएसएम अपनी संपर्क रूप से, अपना रूपांतर, नियन्त्रण प्रो. आपके सिंह और संजय सिंह द्वारा आपको दीपे प्रगतिशीलता कर की गई। संचारामन शिल्पी कलिता ने किंचना जाकिंच नवनं रंगन विनाश का आपार माना।



पटाना, डॉकटरों के साथ फार्मासीस्टिट भी मरीजों की बीमारी दूर करने में सहयोगी हैं, कोरोना मलामारी और अब डेंगू के मरीजों को पांचे पर लिखी दिवांगों को देकर मरीजों की जान बचा रहे हैं, विकासक्षय टीम के एक प्रमुख साथी हैं फार्मासीस्ट, यह कहना है कि आयर्म्हू यूनिवर्सिटी के नैनो टेक्नोलॉजी सेंटर के हेड डॉ रामेश कुमार रिटायरमेंट विद्यालय पर शनिवार को बैजनाथ भवन रोड स्थित श्री बैजनाथ आर्योदय भवन में प्रतियोगिता सह सेमिनार का आयोग हुआ, इसका आयोजित ईंडियन प्रोफेसर्सिटी सह सायर्सएसएन का नियमा किया आयोजित संस्थान राय और सचिव आर बंद्योपाध्याय ने बताया कि कार्यक्रम में 85 से अधिक फार्मासिस्ट हुए, और छात्र-छात्राएं शामिल हुए, कार्यक्रम के बाद फार्मेसी पर प्रतियोगिता हुई, जिसमें पटाना जीपीआई व मुजफ्फरपुर एम आईटी कालिंज के विजेता 18 छात्र-छात्राओं को पुरस्करण दिया गया।



Chancellor Award for Outstanding Performance/Contributions



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हिन्दुस्तान एवसवलूसिव

पटना | चंदन दिवेंद्री

भारतीय संस्कृत और आयुर्वेद में ग्रहण और नक्षत्रों का बड़ा महत्व है। इनके भिन्न-भिन्न तरह के प्रभाव होते हैं। चंद्रमा की किरणें भी अलग-अलग नक्षत्रों में अलग-अलग यातायानिक प्रभाव लेती हैं। विहार के वैज्ञानिकों की ओर नैनोसाइंस के जरिए ताजा अध्ययन इसे पूर्ण कर रहा है। विहार के तीन वैज्ञानिकों और उनकी टीम के जलकुंभी भस्म पर विवेच गए हालिया अध्ययन में कई चीजोंना वाले खुलासे हुए हैं। वही

नैनी जलकुंभी भस्म प्रोटोटेट कैंसर के इलाज में प्रभावी साबित होगा। रिसर्च में यह बात सामने आई कि पृथ्वी नक्षत्र में चांदमा के प्रभाव में जलकुंभी भस्म का आकार सूक्ष्म से भी अल्ट्रास्कॉप 26 नैनोसाइंस तक हो जाता है। वही गोहिणी नक्षत्र में इस जलकुंभी भस्म का आकार लगभग 55 नैनोसाइंट हो जाता है। यानी चांदमा के किरणों का अलग-अलग नक्षत्र में जलकुंभी भस्म पर अलग-अलग प्रभाव होता है। इस अध्ययन में यह बात भी सामने आई कि इस भस्म का उभय इलेक्ट्रोनिक्स मैट्रीक्यल जैसा है और इसे प्रकाश का उत्सर्जन भी होता है। पहली बार जलकुंभी भस्म में प्रकाश के तत्व की मौजूदगी का दावा किया गया है।

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डॉ. निर्मल कुमार सिंह

नैनीमीटर जलकुंभी भस्म का आकार हो जाता है पृथ्वी नक्षत्र में

55 नैनीमीटर आकार बदलकर हो जाता है रोहिणी नक्षत्र में



डॉ. राकेश कुमार सिंह

पेटेट और उद्योग विकासित करने की दिया गे काम एकपूर्व के डॉ. राकेश कुमार सिंह ने बताया कि इसे पेटेट करने के साथ-साथ जलकुंभी भस्म आपारिंग उद्योग विकासित करने की दिया गे जल्द काम शुरू होगा। इस शोध को 12 अगस्त को यूनाइटेड किंगडम के आयरिंग साइंस कॉम्पैनीस में प्रस्तुत किया जा चुका है। यह जल्द ही यूनाइटेड किंगडम के जनरल और फिजियस में प्रकाशित होने वाला है।

इलेक्ट्रोनिक्स क्षेत्र में उपयोग की बढ़ी सम्भावनाएं

इस शोध का सबसे बड़ा फायदा विकिलस क्षेत्र को होगा। पृथ्वी तथ्य है कि नैनोसाइंकल का आकार जिनमा छाता होता है, उसमें विकिलस क्षेत्र में मात्रक क्षमता उठनी ही होती है। भस्म के सुखतम रूप से अब प्रोटोटेट कैंसर के लिए बेंद फ्रेमों द्वारा की निर्माण हो रहा है। इनका नाम साइड लाइट भी जारी है। भस्म में प्रकाश और अलग-अलग जैसी के लिए भी जारी होता है। उसकी विकिलस क्षेत्र की रकम बड़ी जैसी है और इसके लिए बेंद फ्रेम के लिए बड़ी जैसी इस्ट्रेचर जैसा इस्ट्रेचर किया जा सकता है। शोध में अहम भूमिका निभाने वाले डॉ. राकेश बातें हैं कि यह अपनी तरह का पहला अध्ययन है।

कुलपति एसएन गुहा, डॉ. निर्मल के निर्देशन में शोध विवर्ण एक्यू संस्थापक गुरुत्वात् पांडित गुहा व नवाचार कैंसर सम्बन्ध के पूर्व निदेशक जिलेंद्र कुमार सिंह के निर्देश में हुआ है। बैरसराय के अध्यवेदिक लोकेज के डॉ. दिनेश प्रसाद और पटना राजकीय आयुर्वेदिक कॉलेज के पूर्व प्राचारिक डॉ. दिनेश्वर प्रसाद की बदल से जलकुंभी भस्म तैयार हुई। डॉ. राकेश ने वैज्ञानिक अध्ययन किया। विभाग के एमटेक के छात्र नियात कुमार और शाराक भूषण ने भी सहायता दिया।



Team work research activities

आर्यभट्ट नॉलोज यूनिवर्सिटी के नैनो टेक्नोलॉजी विभाग की छात्रा की खोज दालचीनी और अदरक के नैनो फाइन पाउडर से कम होगा डायबिटीज व मोटापा

■ नैनो टेक्नोलॉजी डिपार्टमेंट डा० रिसर्च को बाजार का स्वरूप देने की तैयारी कर रहा

जूही दिवसा > पटना

दालचीनी, अदरक के नैनो फाइन पाउडर से डायबिटीज और मोटापा कम होगा, इस संबंध में आर्यभट्ट नॉलोज यूनिवर्सिटी के नैनो टेक्नोलॉजी विभाग से लिखले साल दिवसर के पौर्णचंडी कर चुकी अर्चना के रिसर्च अवसरल इंटरनेशनल जनरल में प्रकाशित हुआ है। इस रिसर्च को करने के लिए डॉ. राकेश और डॉ. अर्चना ने छह अस्थायूनिक उपकरणों का उपयोग भौतिक गुणों के बारे में जानने के लिए किया। डॉ. अर्चना ने बताया कि दालचीनी व अदरक के नैनो पाउडर बनाना चाहिए है, जो डायबिटीज, मोटापा के साथ-साथ टेक्नान को भी कम करता है।



कामी गुणकाटी है दालचीनी : दालचीनी कई गंभीर रोगों से बचाने के साथ-साथ एटी ऑक्सीडेट (एटी-वैक्टिविल, एटी-फैगल और एटी-वायरल) गुण होता है, अदरक के पाउडर के सेवन से शरीर के मेटाबॉलिजम पर

सोधा असर पड़ता है, जिससे हमारा बजन घटता है, यह पाचन तंत्र को नियोन्नत करता है, दालचीनी असरके फैट को कम नहीं करता है, अल्ट्रिक वे आपके शरीर में ज्यादा फैट को बढ़ने से रोकता है, अदरक पाउडर का उपयोग भी बजन घटाने के लिए किया जा सकता है, दोनों के मिश्रण से तैयार नैनो पाउडर डायबिटीज को भी कंट्रोल में रखता है।

बाजार में लाने की तैयारी : अर्चना ने बताया कि सी-एलिंगेस एक मॉडल अग्निनिम है, इसी पर शोध किया गया है, नैनो टेक्नोलॉजी डिपार्टमेंट रिसर्च को बाजार का स्वरूप देने का काम भी भीर-भीर कर रहा है, पौर्णचंडी नैनी टेक्नोलॉजी के हेड डॉ. राकेश कुमार सिंह कहते हैं, अर्चना का काम काफी बेंद है, इसे बाजार में लाने की बहुत ज़करत है, शोध पत्र रिसर्च जनरल में प्रकाशित हो गया है।

Library

Aryabhatta Centre for Nanoscience & Nanotechnology

Aryabhatta Centre for Nanoscience & Nanotechnology Department has a rich collection of valuable latest information sources such as text books, reference books, ready reference sources, annual reports, research publications etc., related to frontier research like Nanoscience & Nanotechnology. Books and other documents are catalogued and subject wise properly arranged in book shelves.

SI. No.	Document Type	No. of Collection
1.	Reference Books	112
2.	Issuable Books	50
3.	Dictionaries	08
4.	Encyclopaedia	04
5.	Research publications	More than 200
6.	Annual Reports	08
7.	Ph.D.Thesis & M.Tech, Research Project	63



Aryabhatta centre for Nanoscience & Nanotechnology is a research-based centre, it provides a healthy environment of research, its library has collection of Ph.D. Thesis and M.Tech. Project Reports submitted by the Ph.D. & M.Tech. research scholars. All thesis and project reports are catalogued and properly arranged in book case. New arrivals displayed in the display unit of library for readers and visitors.4 Newspapers are being procured since year 2013. Newspapers are date and month wise properly arranged and kept in racks in the Newspaper section of library for research scholars, faculty members & for visitors. Library has a good collection of Mid-term & End-Term exams question papers of M.Tech. & Ph.D. (Nanoscience & Nanotechnology) since 2013.

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Library Automation/e-granthalaya ver.4.0



Print out & Photocopy facility

Aryabhatta Centre for Nanoscience & Nanotechnology library is automated using e-granthalaya library software version 4.0 through cloud computing since 2015 to automate the library. The current version of software is version 4.0 - web based, enterprises edition with a centralized database option for many libraries under one organization.

It is a user friendly software and were distributed to all kinds of libraries in the country at free of cost. Reading room of Aryabhatta Centre for Nanoscience & Nanotechnology library is well settled. It has enough space for readers. Arrangement of light and air is sufficient. Library provides a cool environment to its readers for study.