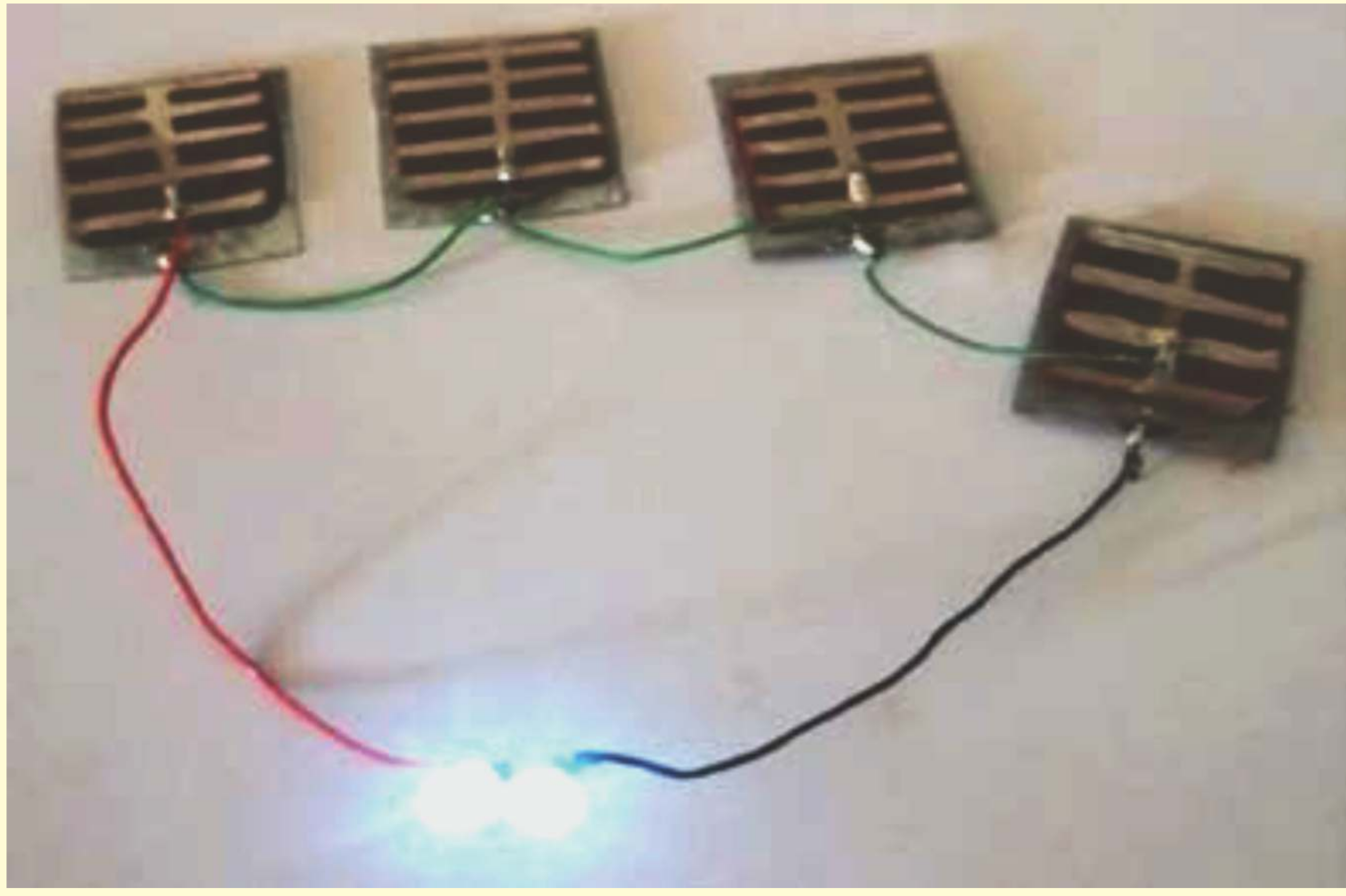


Prototype developed of four hydroelectric cells of magnesium ferrite Nanomaterials Connected in series with two LEDs for Low cost Green Energy Source



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

Summary of Research

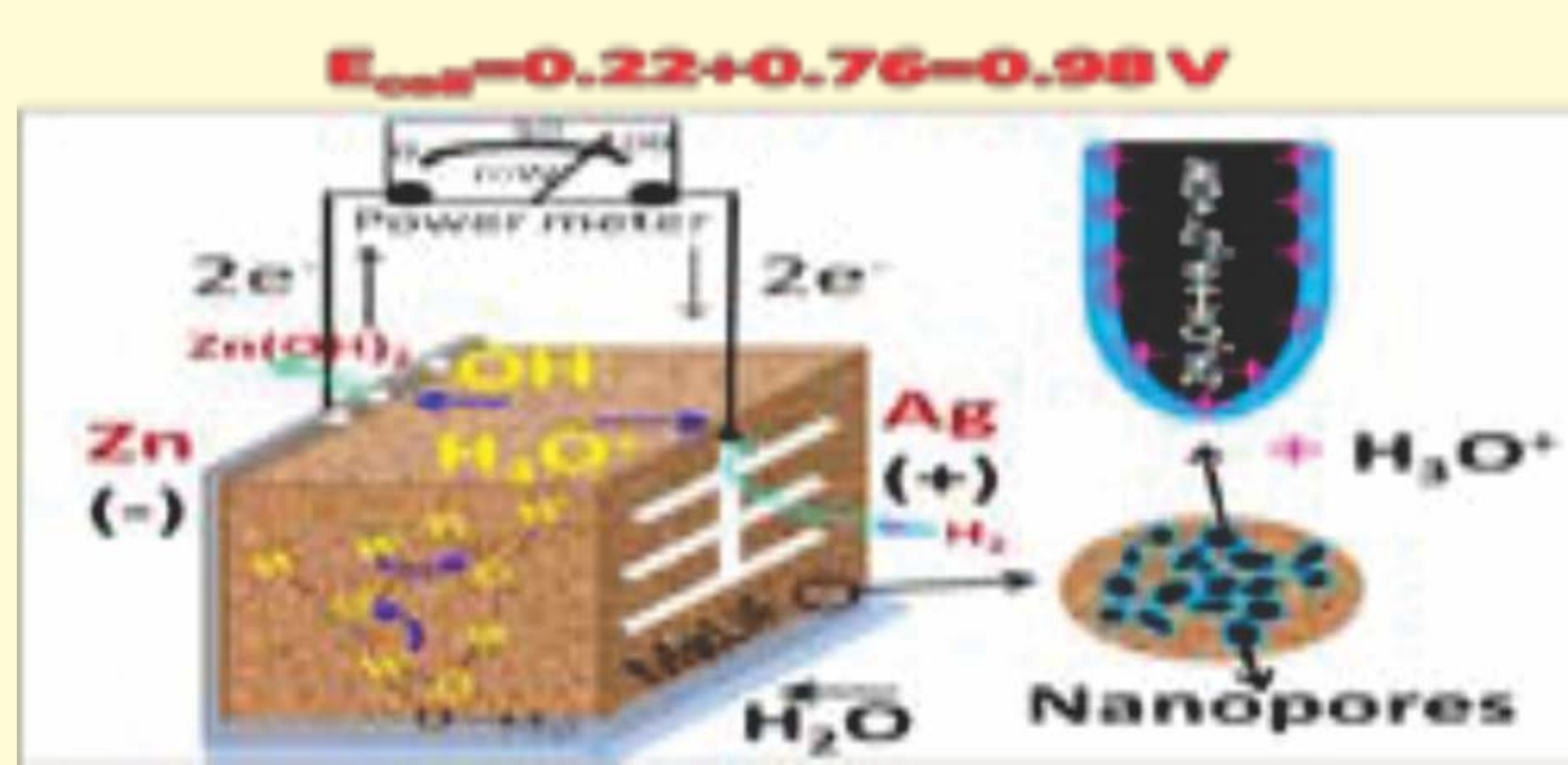
- Alkali metal substituted spinel magnesium ferrites Nanomaterials have been considered as potential materials for the fabrication of hydroelectric cells for the generation of green electricity without using any electrolyte. In this present research, the crystallite size and porosity of entire prepared samples $Mg_{1-x}K_xFe_2O_4$ ($x= 0.0-0.4$) were found in between 11.15-36.20 nm and 22-53%, respectively. The Scanning Electron Microscope(SEM) micrographs shows porosity in the synthesized sample, which causes 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. 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.

Plan to set up Hydroelectric Cell institute for Green energy source Require Industry partner and Collaboartors

- Pride of India: Path Breaking Invention from India
- Offers safe, clean, low cost, reliable power generation
- Useful by-products (H_2 gas as clean energy & $Zn(OH)_2$ nanoparticles for industries)
- Portable (Easy to carry)
- Uses few drops of water as fuel
- Environment friendly
- Safe for human health
- Green Energy Source Made in India

Applications

Table lamp or fan, Mobile charging, Torch, Video camera, Laptop charger, etc.



•US Patent Application No. **US 20160285121A1**,
•Indian Patent # 792/DEL/2015



Principle Research Team



Aniket Manus



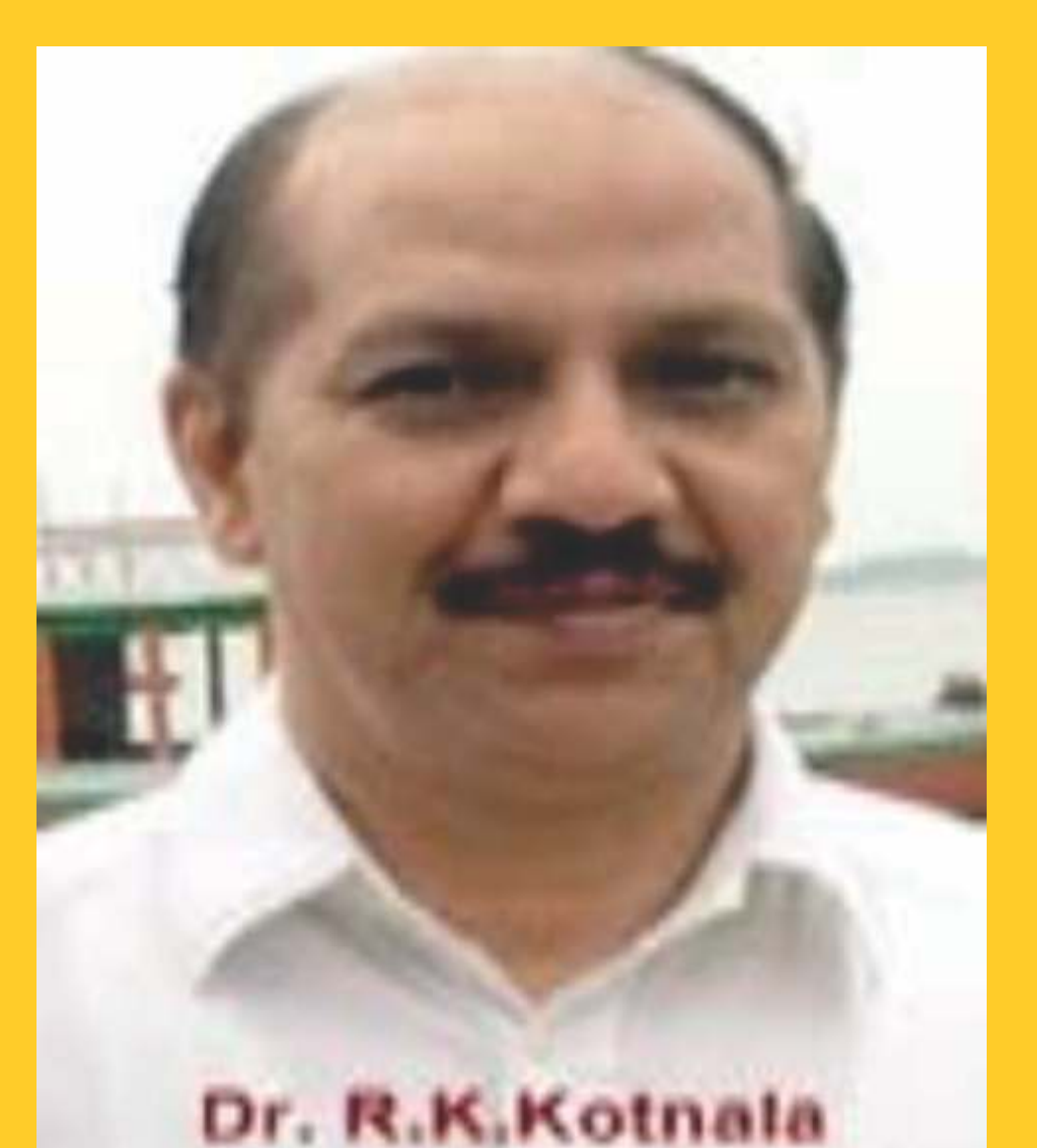
Rakesh Kr Singh



Mr. Nishant



Dr. Jyoti Shah



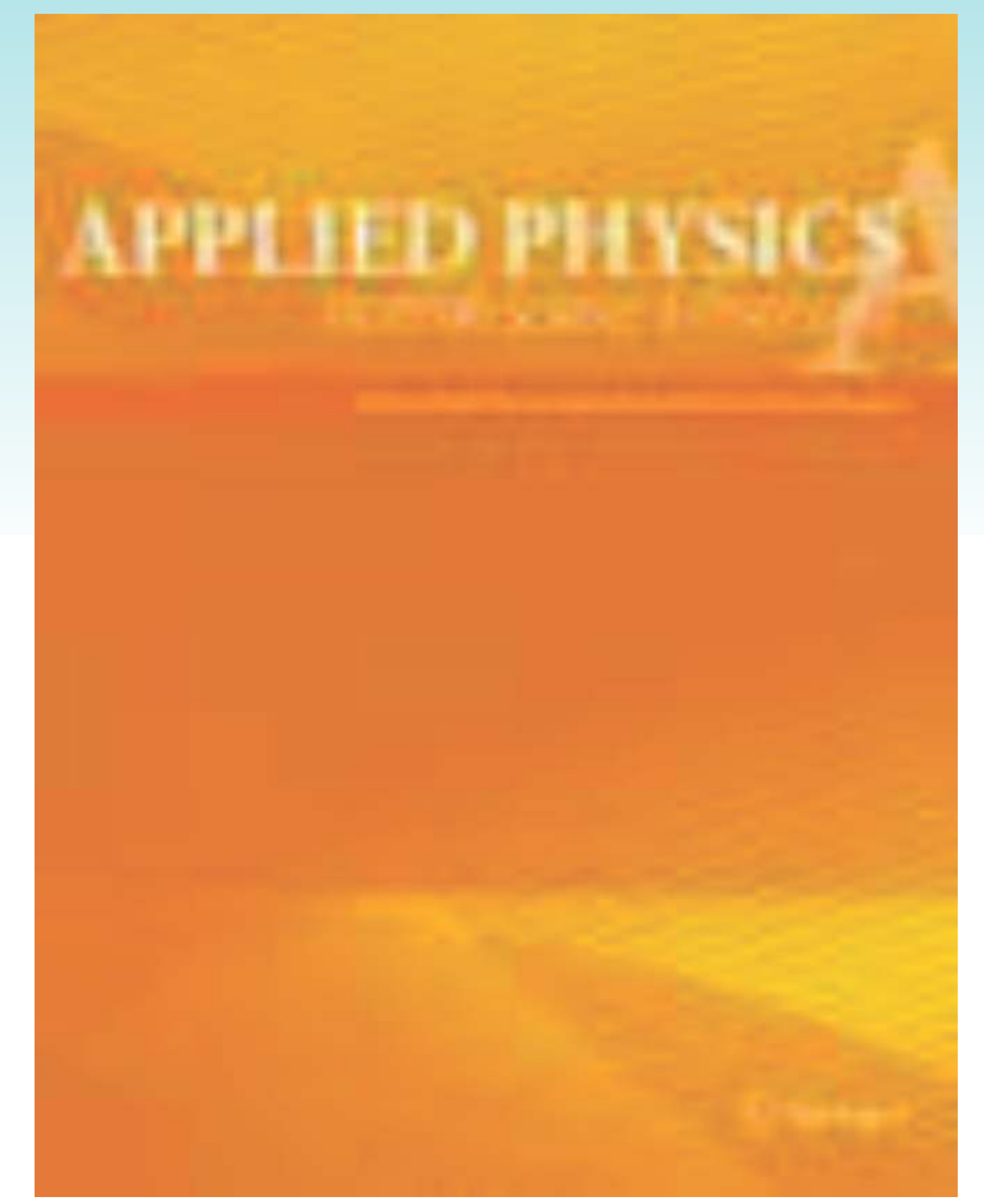
Prof. R K Kotnala

Acknowledgement: 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 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 nickelferrite nanomaterials

Shubhra¹ - Rakesh Kumar Singh¹ - Nishant Kumar¹ - Vivek Kumar¹ - Shashank Bhushan Das¹
Md. Muzzammilul Haque Siddiqui¹

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



Shubhra



Dr. Rakesh Kr Singh



Nishant Kr



Vivek Kr



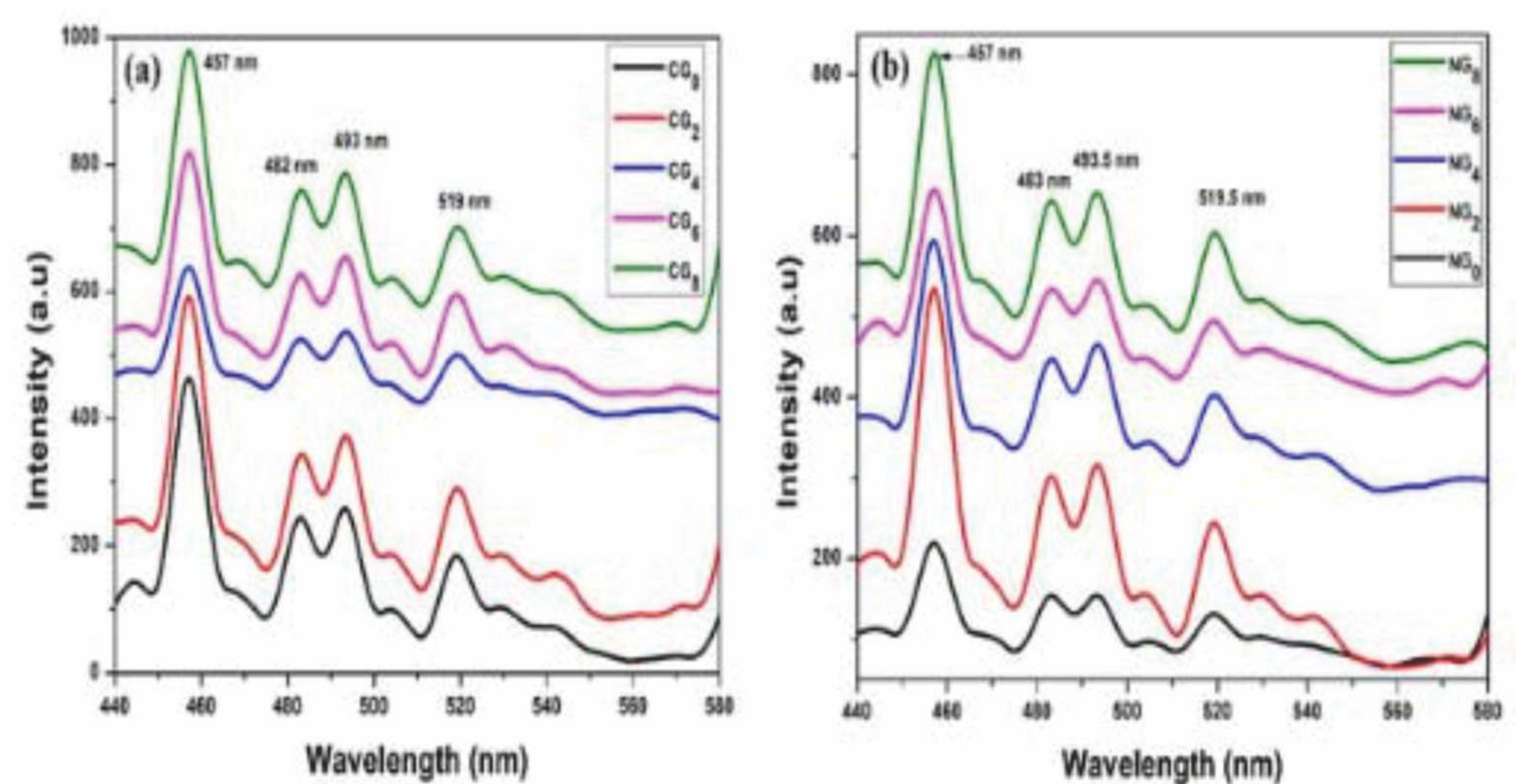
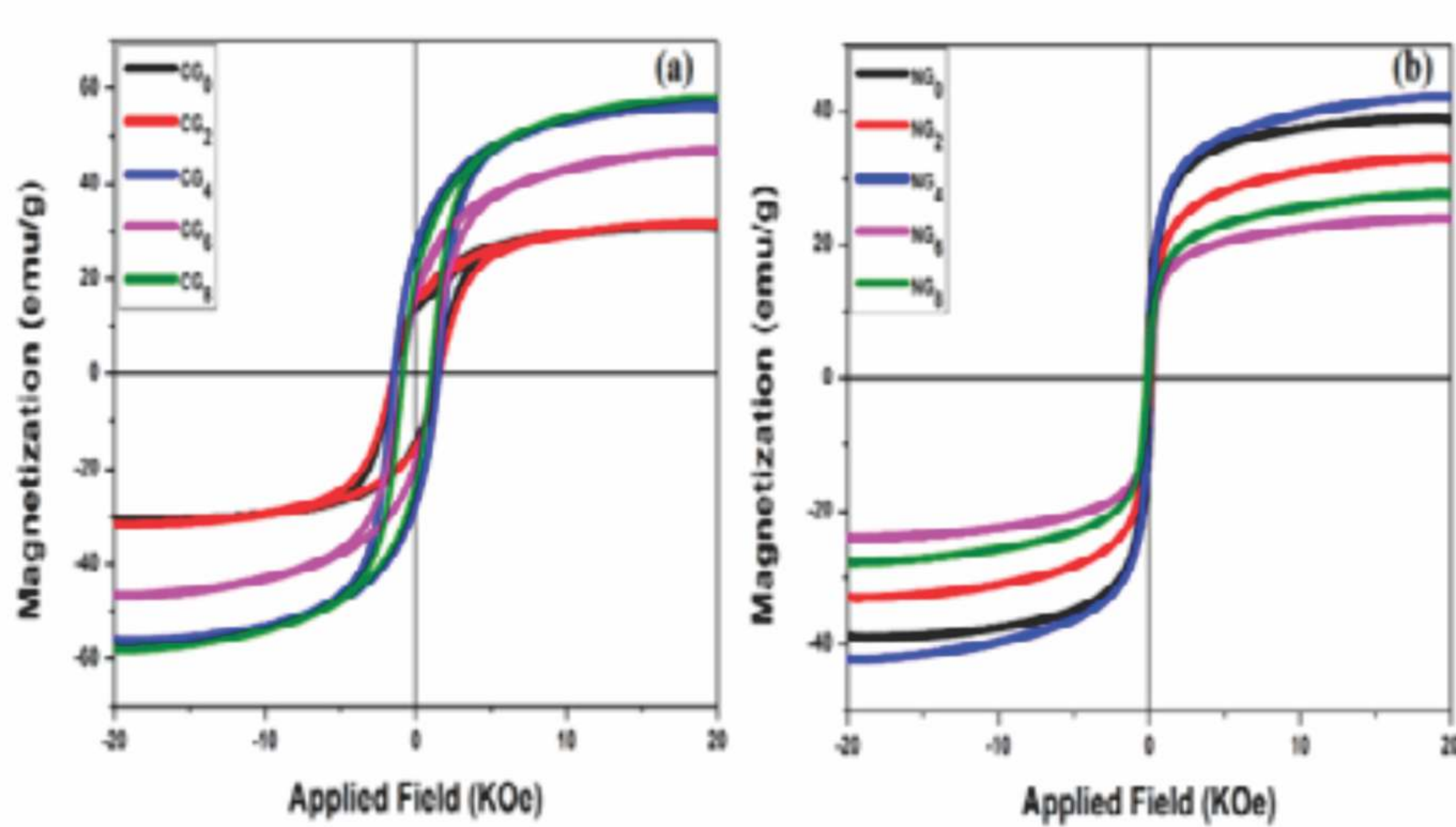
Shashank B Das



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 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



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. Observed properties may account for some interesting magneto-optical devices .

Acknowledgement: 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 Iron based Kasis Bhasma as Indian based Ayurvedic nanomedicine

Published in Scopus indexed Journal, United Kingdom.



Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr



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

Prabhat Kr Diwedi, Rakesh Kr. Singh, P. Kour, Nishant Kumar, Pawan Kumar, Manoranjan Kar



Prof. Prabhat Kr Dwvedi



Dr. Rakesh K Singh,



Dr. Paramji Kaur,



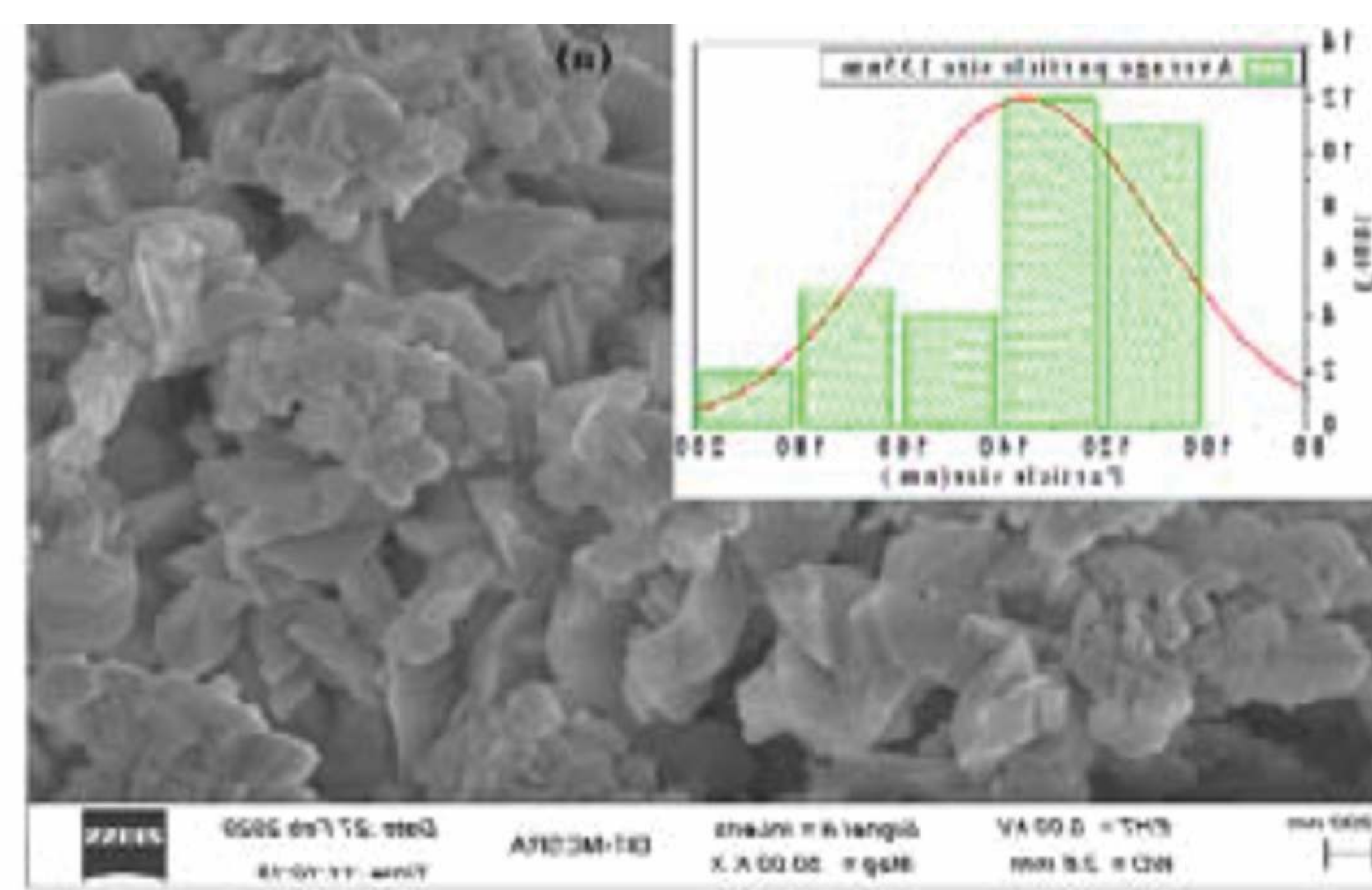
Nishant Kr



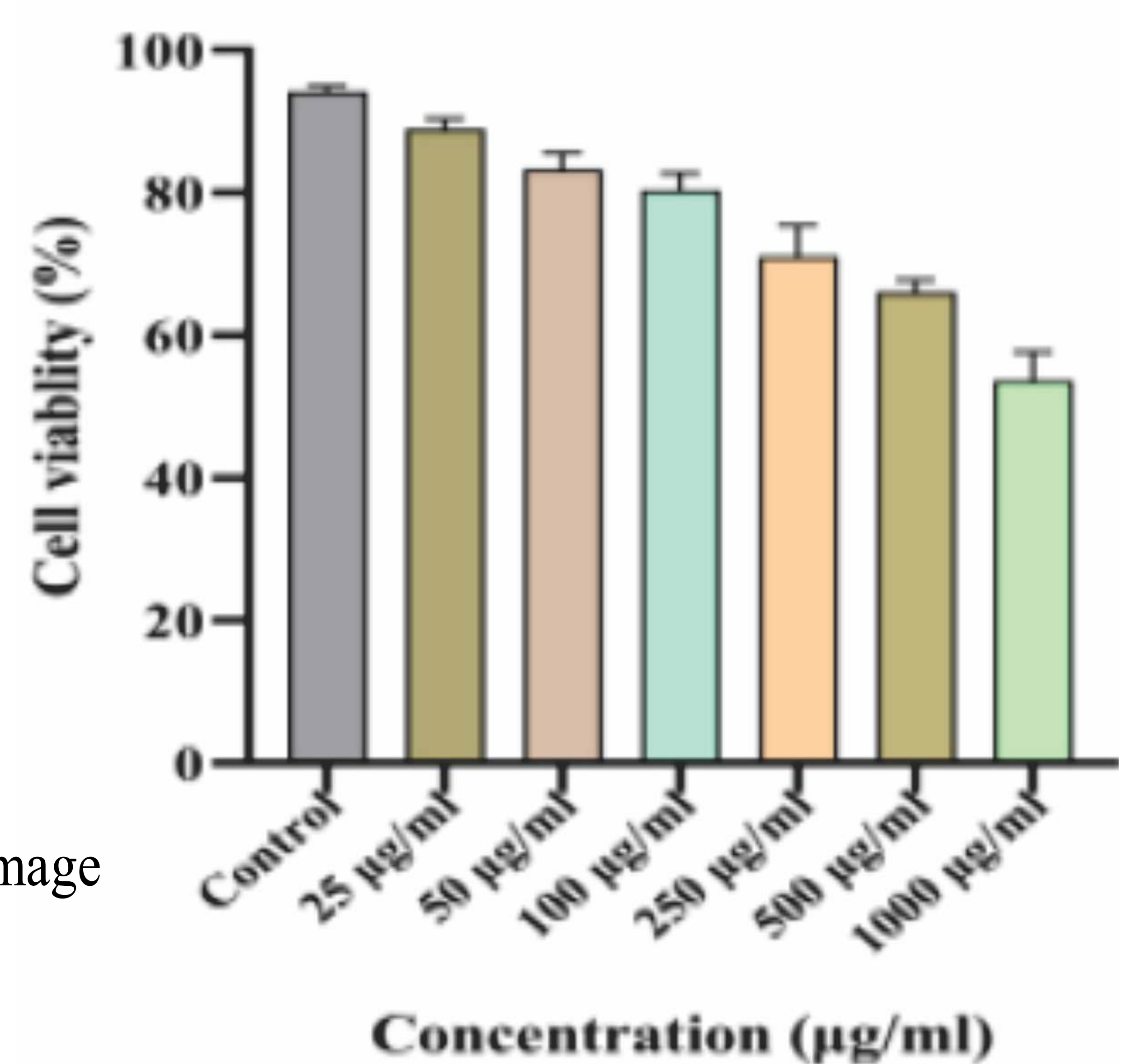
Dr. Manoranjan Kar



Bhasma as nanomaterial



Electron Microscopy Image



Research Findings: Highlights

- The average crystallite size of these Bhasma found below 65 nm confirmed by XRD, FE-SEM. Harmful elements are not traced in the EDX spectrum.
- Luminescence Peaks in the visible region support its uses in other area of science and technology. The only difference in luminescence property of such natural based iron oxide nanomaterials is that materials are prepared using green approach and low cost. While other iron oxide based luminescent materials are prepared chemically. Therefore such research explore the possibilities of new window of using natural based product as luminescence based product
- Cytotoxicity of this Bhasma on the cell showed with an increase in temperature the decrease in size shows better a negligible effect on the cells. So Mandoor Bhasma as nanomaterials has good biocompatibility. Hence, the present experimental results on kasis Bhasma prepared can help ayurvedic doctors in the treatment of different diseases.

Acknowledgement: 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.

Preparation of Superfine bael leaf nanopowder, Physical properties measurement and its anti-microbial activities.

Accepted: European Chemical Bulletin (Scopus Indexed)



Ritu Kumari



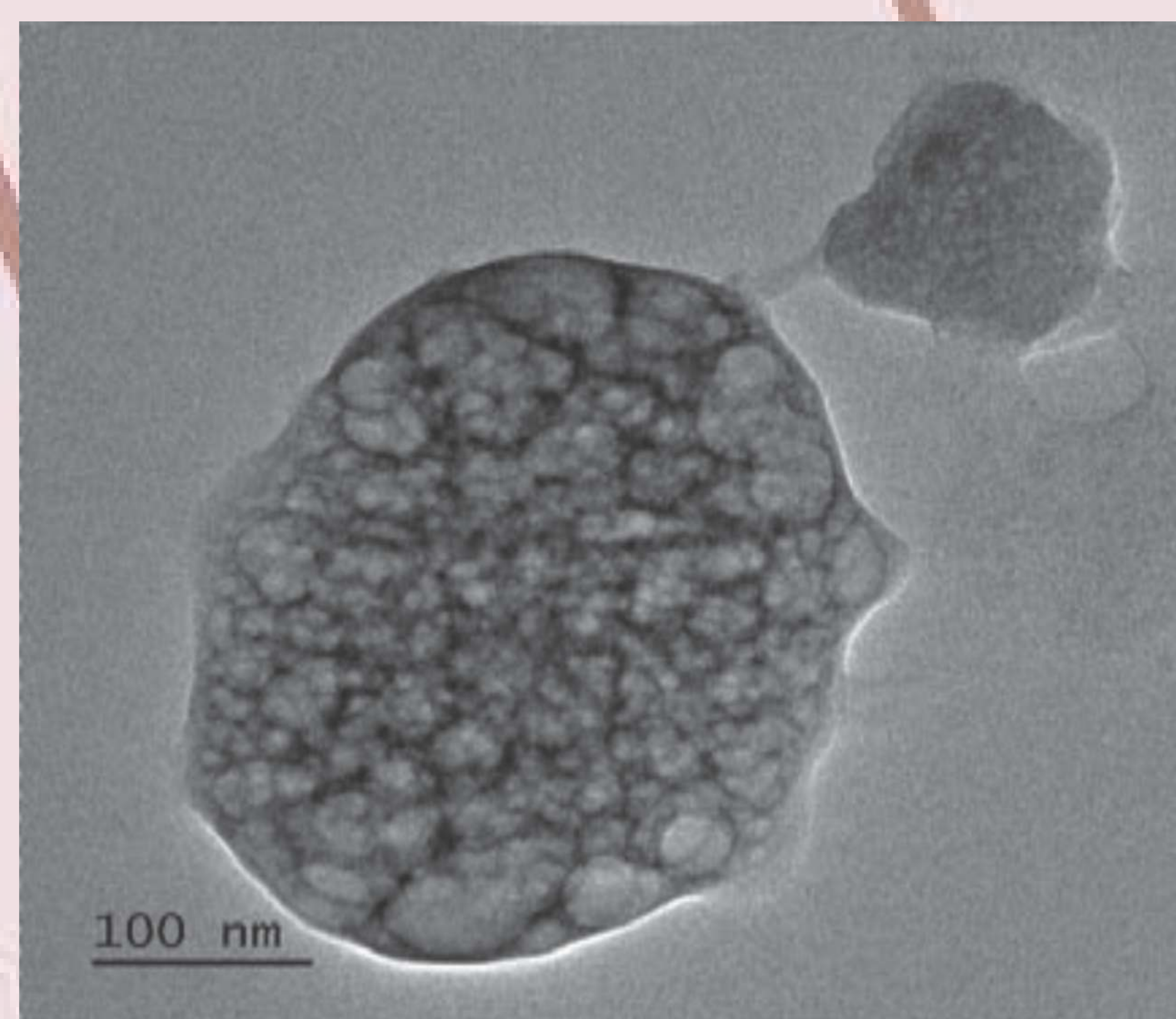
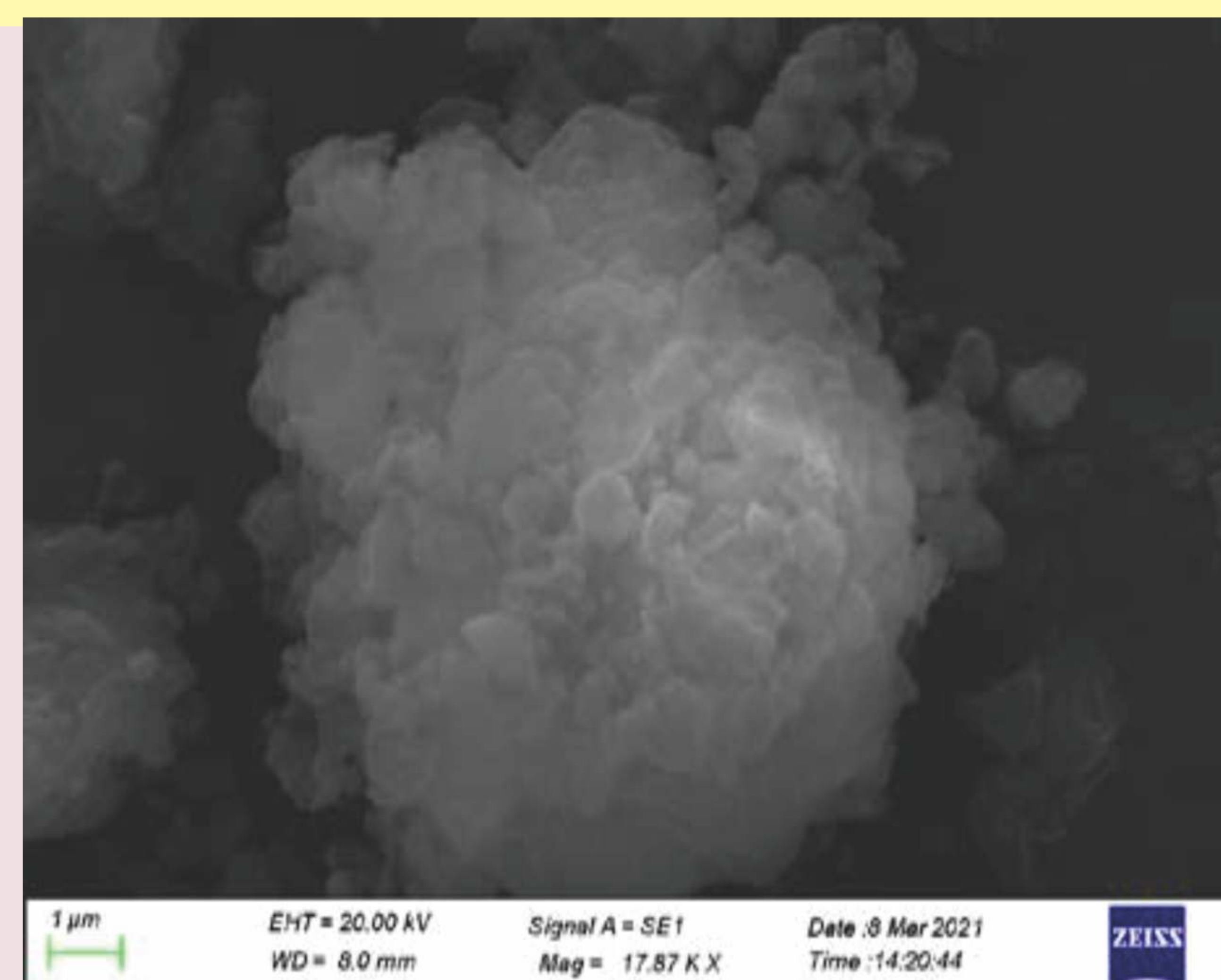
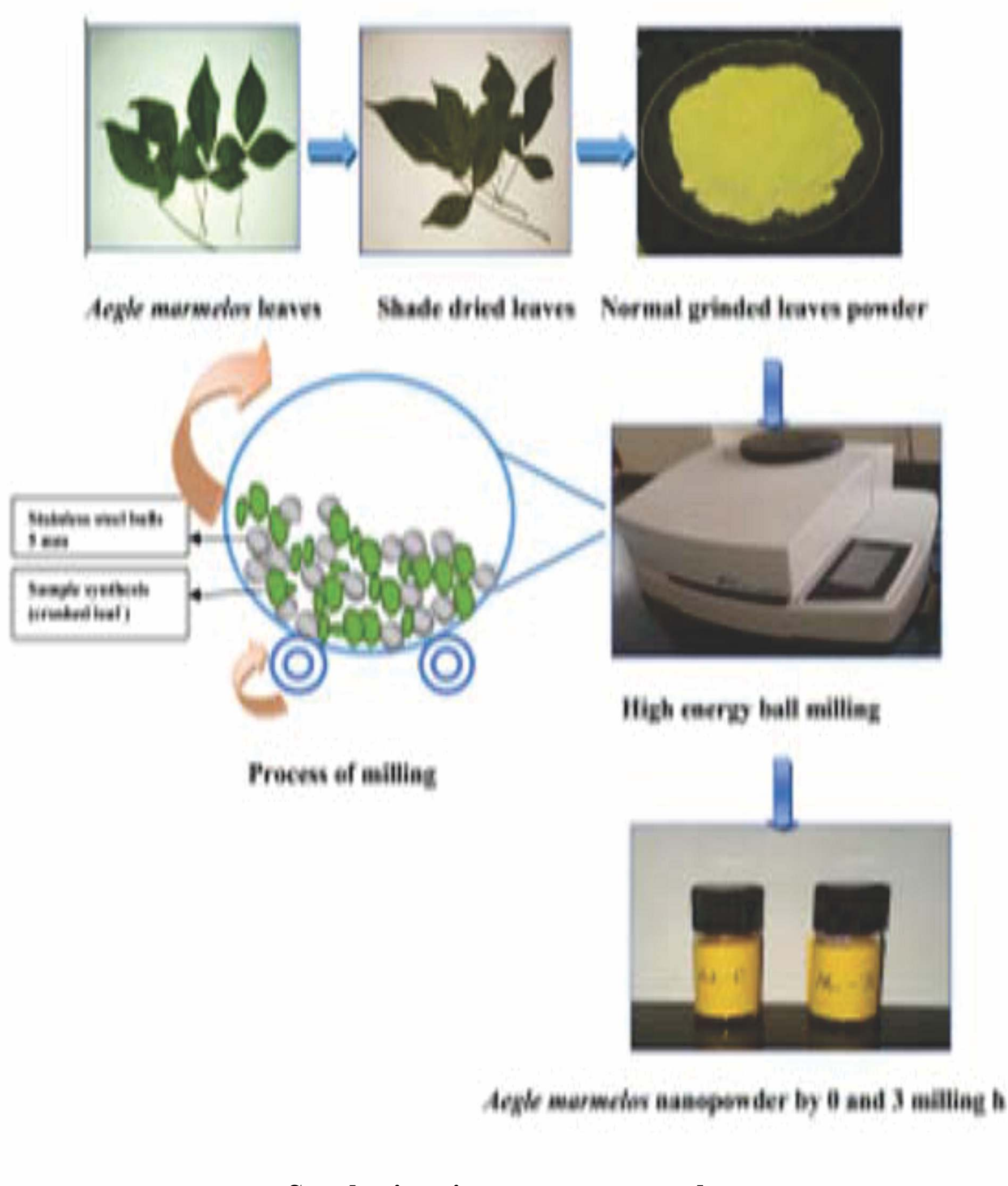
Dr. Rakesh K. Singh



Nishant Kumar



Dr. Rekha Kumari



Electron Microscope Image & TEM

Research Summary:

- The recent advent of nanoscience and nanotechnology as a cutting-edge science has created opportunities for novel and creative uses as herbal nanomedicine. In this present research, Ball milling was used to produce the superfine nanoparticles from shade-dried *Aegle marmelos* leaves. The particle size was evaluated using TEM analysis and found to be 19.89 nm.
- Absorption bands in UV spectra at 508, 541, and 607 nm, indicates the presence of the pheophytin fraction in the prepared superfine nanoparticles. The Zeta potential found to increase with milling hour from -15.56 mV to -22.57 mV, showing the stability of material increases with milling hours. Despite the nanoparticles' size changes as a result of milling time, and their crystallinity remained unchanged. Studies of milled sample antimicrobial activities were performed.
- Herbal nanoparticles against Gram-negative *E. coli*, *E.aerogenes*, and Gram-positive *S.aureus*, *B.cereus* Streptomycin were investigated. The longer the milling times, the more superfine behaviour, which enhances the antibacterial action. The result supports the superfine behaviour have potential against antibacterial action on specific microorganism.
- The understanding of how particle size affects antibacterial activities that have been demonstrated would aid in maximizing the creation of prospective nanoparticles for various biological applications.

Acknowledgement: 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.

Research finding related with purification of water published with affiliation of Nanotechnology Center, Aryabhata Knowledge University, Patna in collaboration of China Agriculture university, IIT Patna and Nalanda university Rajgir



Groundwater for Sustainable Development

Available online 3 June 2022, 100796

In Press, Journal Pre-proof



Research Paper

Single-step synthesis of activated magnetic biochar derived from rice husk for hexavalent chromium adsorption: Equilibrium mechanism, kinetics and thermodynamics analysis

Rama Sinha^{a,1}, Rakesh Kumar^{a,1}, Kumar Abhishek^{a,b}, Jianying Shang^c, Sayan Bhattacharya^d, Shubhalakshmi Sengupta^d, Nishant Kumar^e, Rakesh Kumar Singh^e, Jyotirekha Mallick^f, Manoranjan Kar^f, Prabhakar Sharma^g

Publication Details: Groundwater for Sustainable Development, SCI/Scopus, Netherland

International Journal Editor in chief- Dr. Prosun Bhattacharya, Australia



Dr. Rakesh Kr Singh



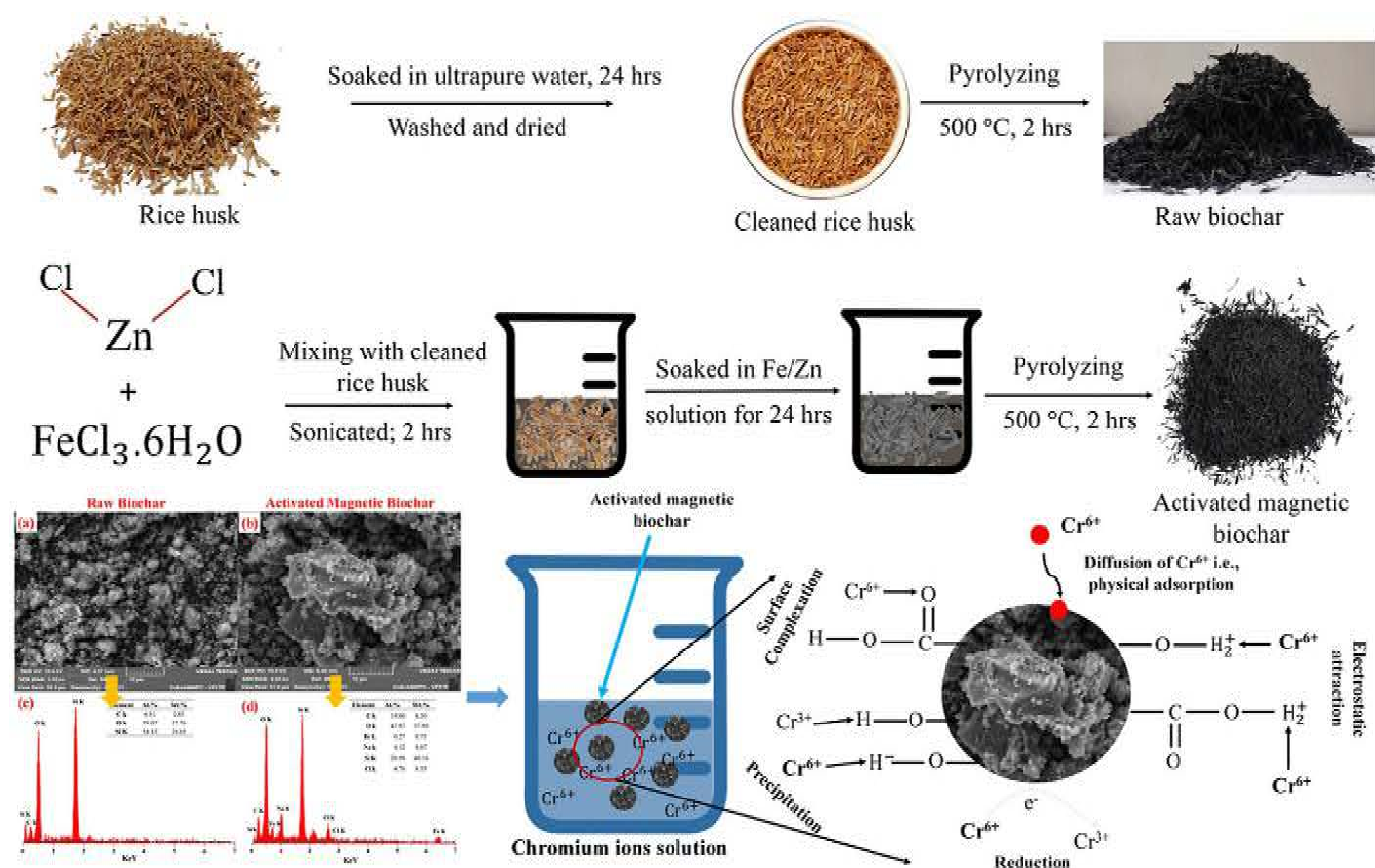
Nishant Kumar



Rakesh Kumar



Dr. P. Sharma



Research Summary

- Prepared activated magnetic biochar using a single-step approach and explore solute-solvent mechanisms for removing hexavalent chromium [Cr (VI)] from the aqueous solution. Agricultural waste rice husk was pre-treated in iron chloride and zinc chloride Obtained
- In contrast, the negative value of thermodynamical parameter ΔG° (-15855.3 kJ/mol) at 351 K shows that adsorption was spontaneous. Overall, the activated magnetic biochar synthesized from rice husk was more efficient than raw biochar in removing Cr(VI) ions from the aqueous solution.

Acknowledgement: 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.

Eco-friendly produced superfine Black pepper food powder and its characteristic effect on its structural, morphological and toxicity for varied applications as new functional nanomaterials



Mrs. Pallavi Singh



Dr. Rakesh K Singh



Mr. Naman Naik



Mr. Nishant kr

Research Summary:

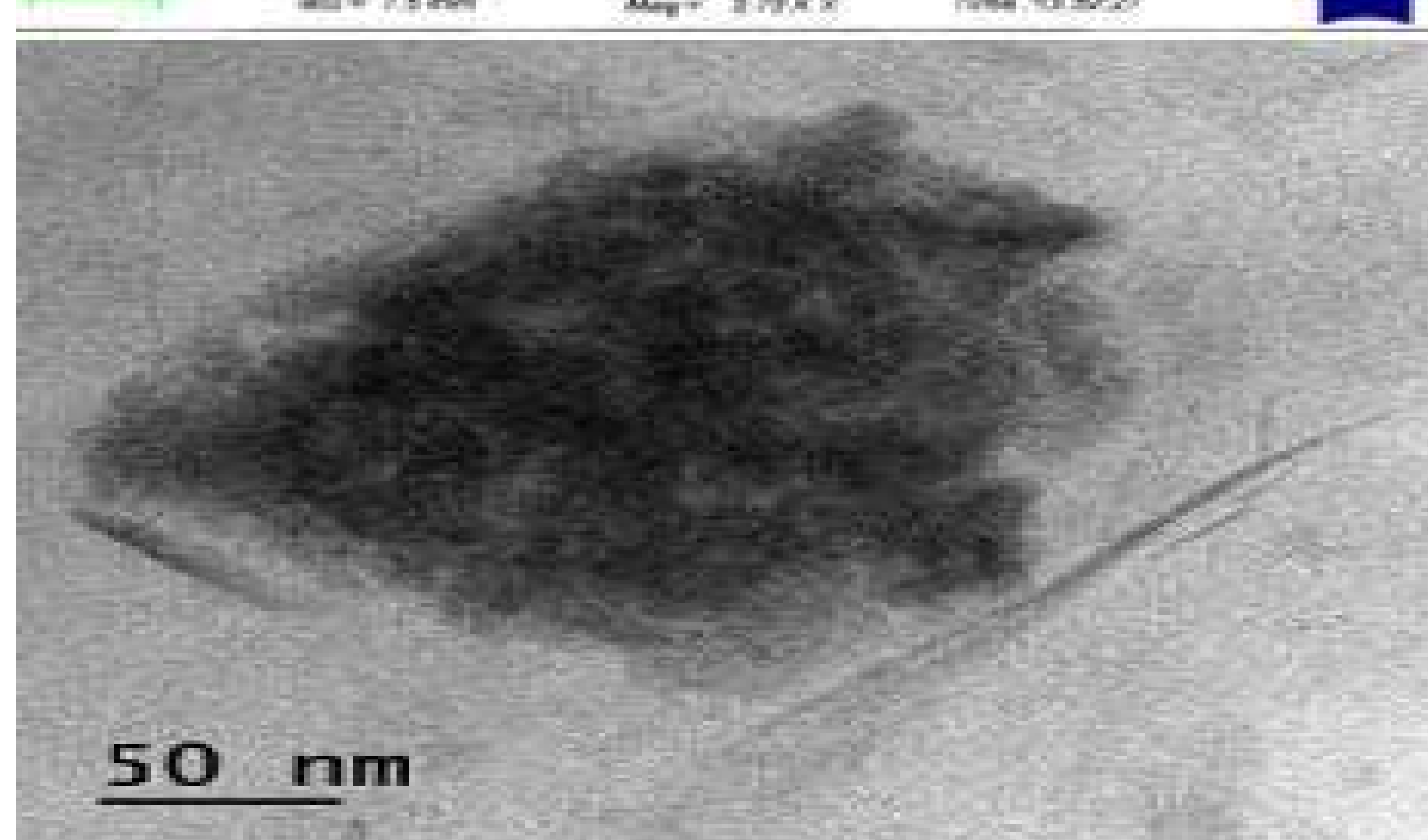
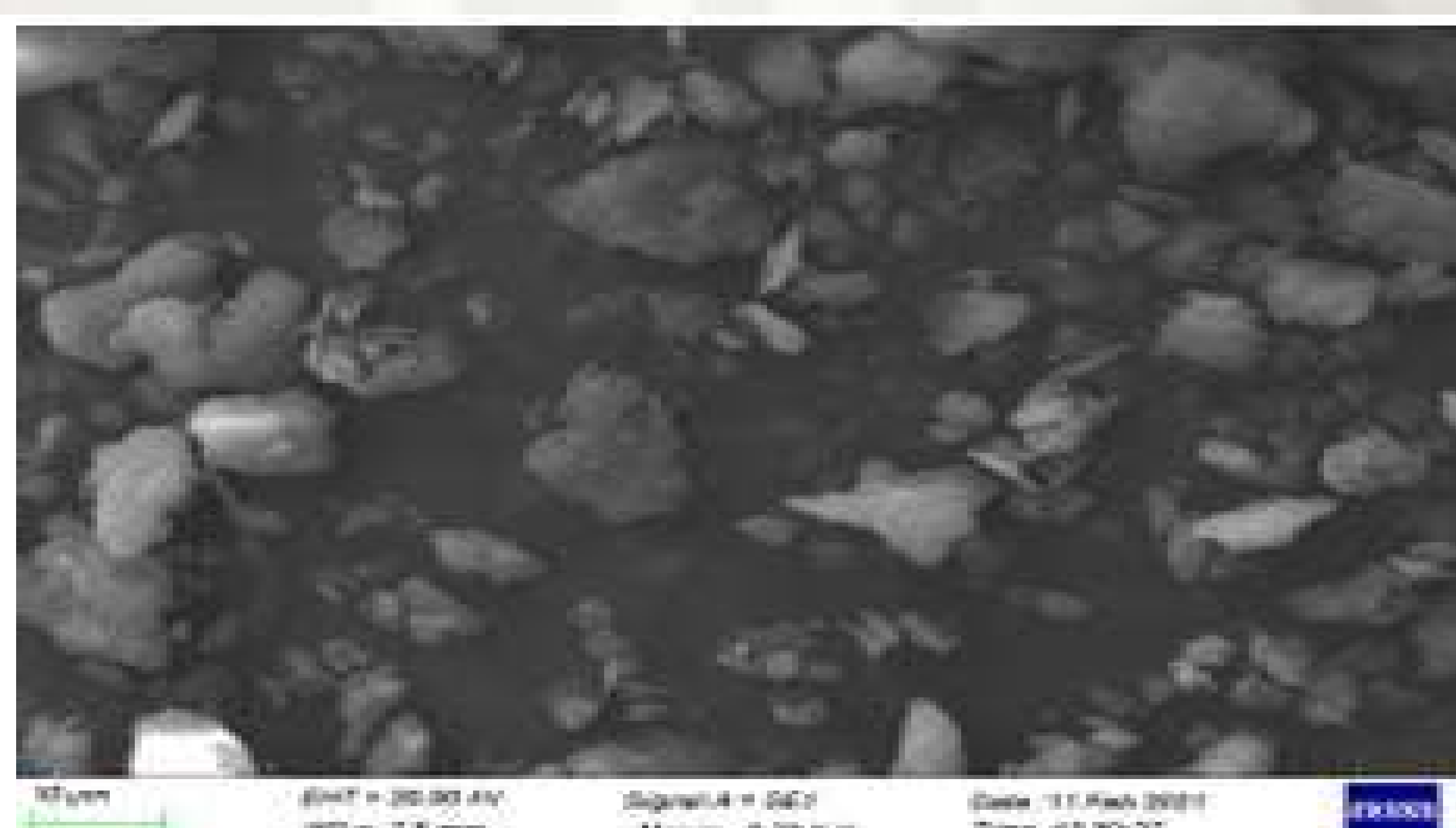
- The superfine powder of black pepper at nanometric scale was synthesized using High Energy Ball Milling equipment. The Electron microscopy studies revealed that the superfine Nano powder is less than 50 nm in size and surface structure was found to change.
- The optical properties were highlighted by the observed changes in the colour which has changed from dark brown to light brown confirming the changes in properties in pretext to the crystal structure of the synthesized black pepper nano powder. The result of the assay showcase reduced cell toxicity and increased cell viability due to change in crystal structure of superfine powder.
- The present research reveals that nanometric food particles can remarkably enhance the physicochemical properties, which are useful for its applications in agriculture, food, Biomedical science as new functional food materials



(a) 0 hr



(a) 2.5 hr



(a) 5 hr



(a) 7.5 hr

Optical Images of Black pepper superfine Nanoparticles and Electron microscope Image

Acknowledgement: 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.

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

materialstoday:
PROCEEDINGS

Available online 27 January 2023

In Press, Corrected Proof  What's this? >



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



Naman Naik



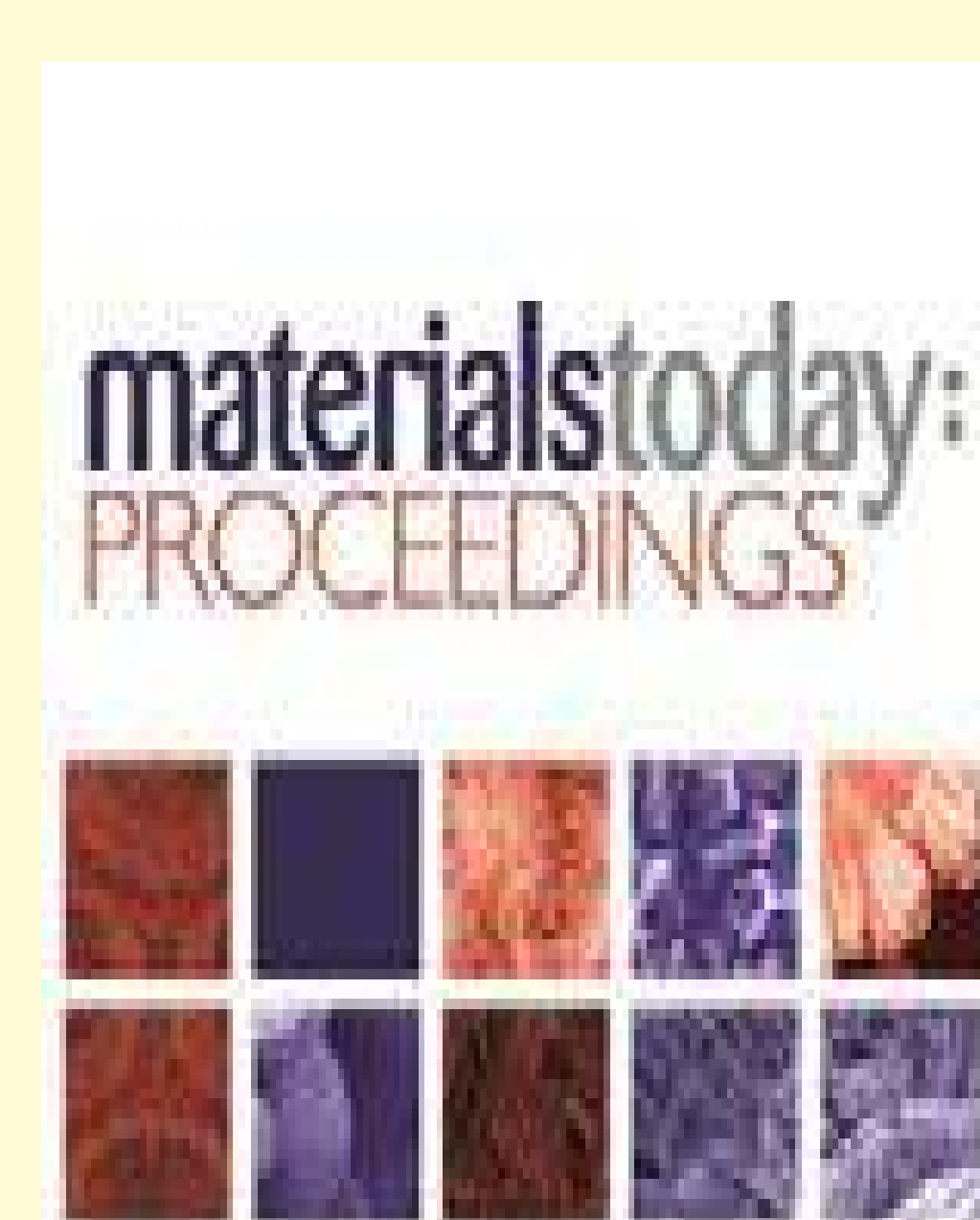
Dr. Rakesh K Singh



Pallavi Singh



Nishant Kumar



Published by Elsevier-UK

Research Summary:

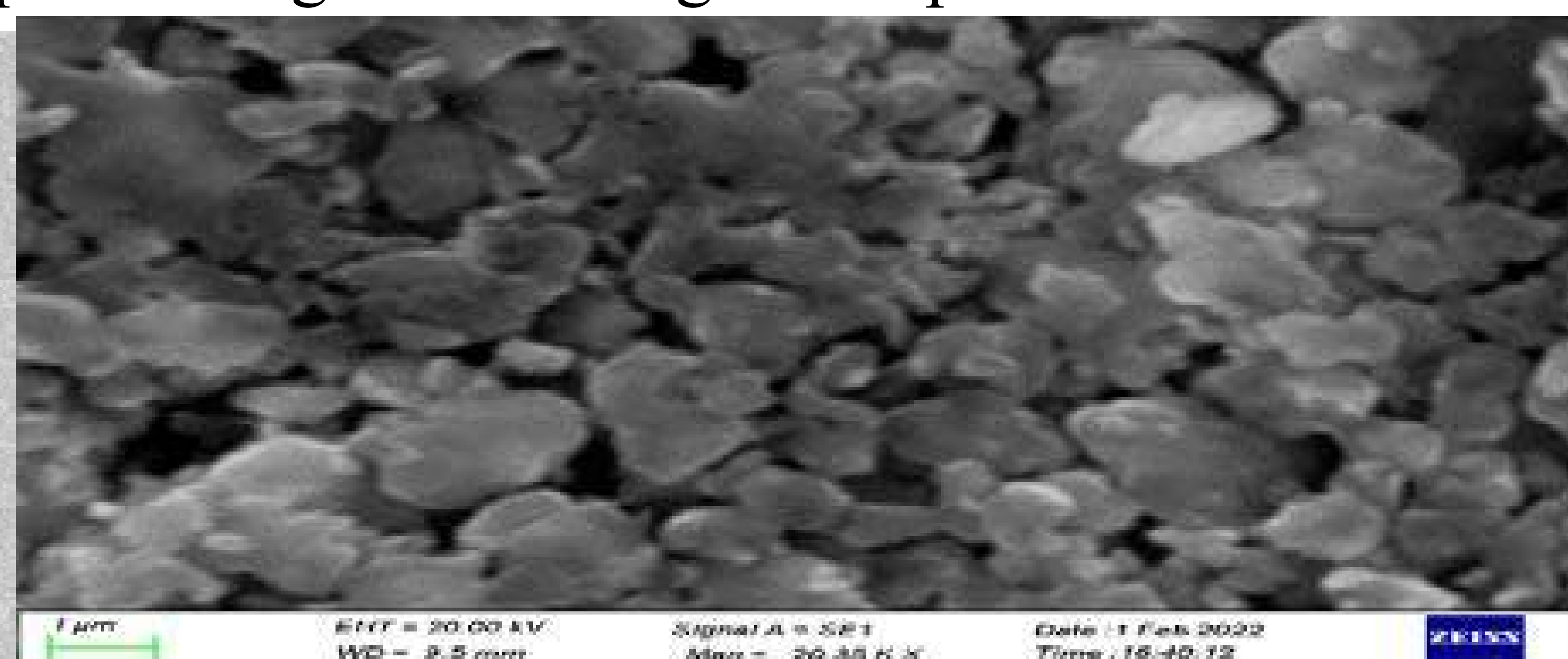
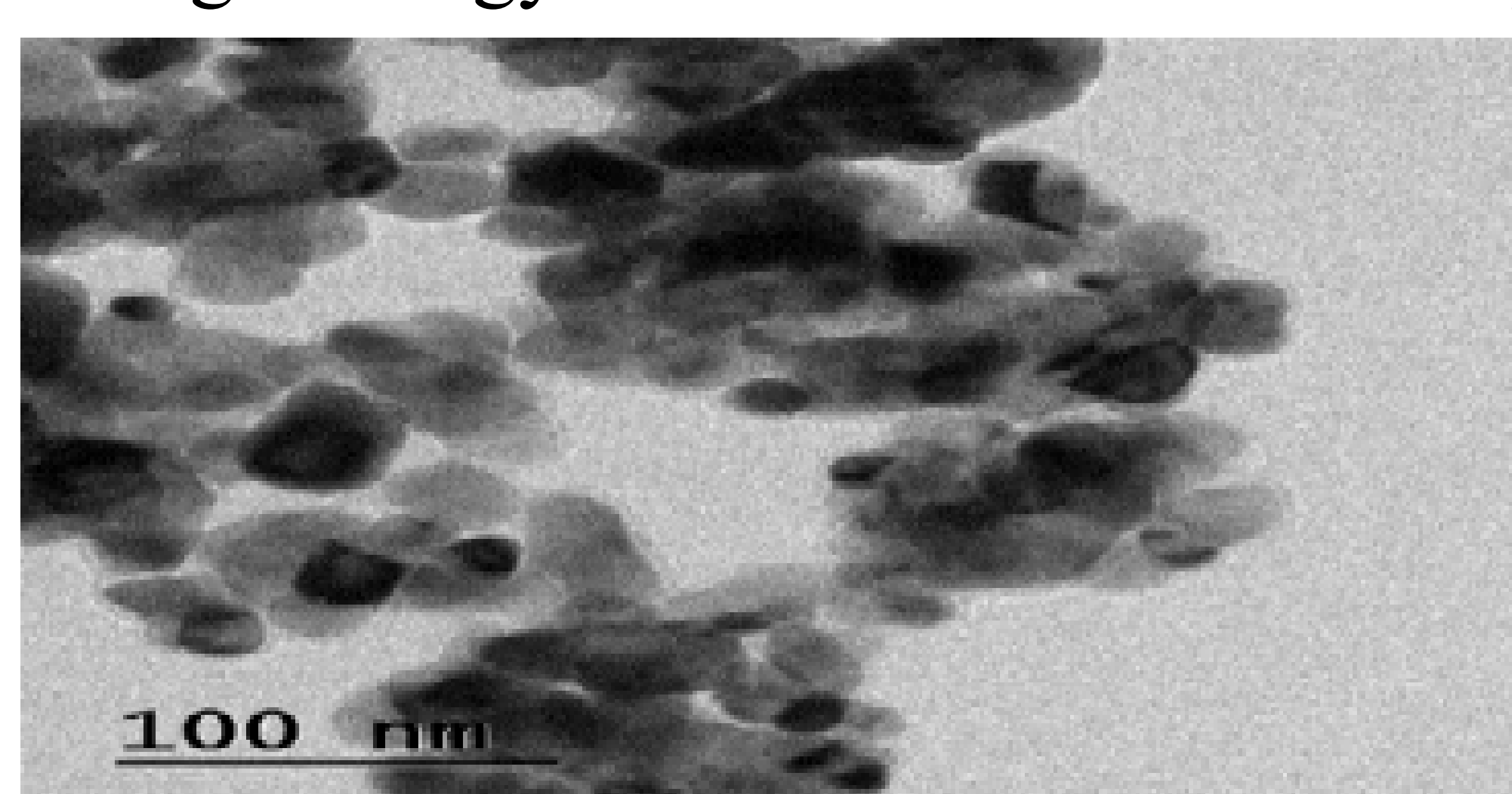
- The present study investigates the characteristic changes brought in the structural and morphological properties of the Moringa oleifera leaf nano powder prepared by High Energy Ball Milling equipment and characterizing by using modern scientific tool.
- Transmission Electron Microscopy studies showed that the size of milled moringa oleifera powder are less than 50nm.
- 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



High Energy Ball Mill



Optical Images of Moringa Nanopowder



Transmission Electron microscopy and Scanning Electron Microscopy of *Moringa oleifera* nanoscale sample.

Acknowledgement: 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.

Green Synthesis and Physical properties of Crystalline silica engineering nanomaterial from Rice husk (Agriculture waste)



Ms. Archana



Dr. Rakesh K Singh



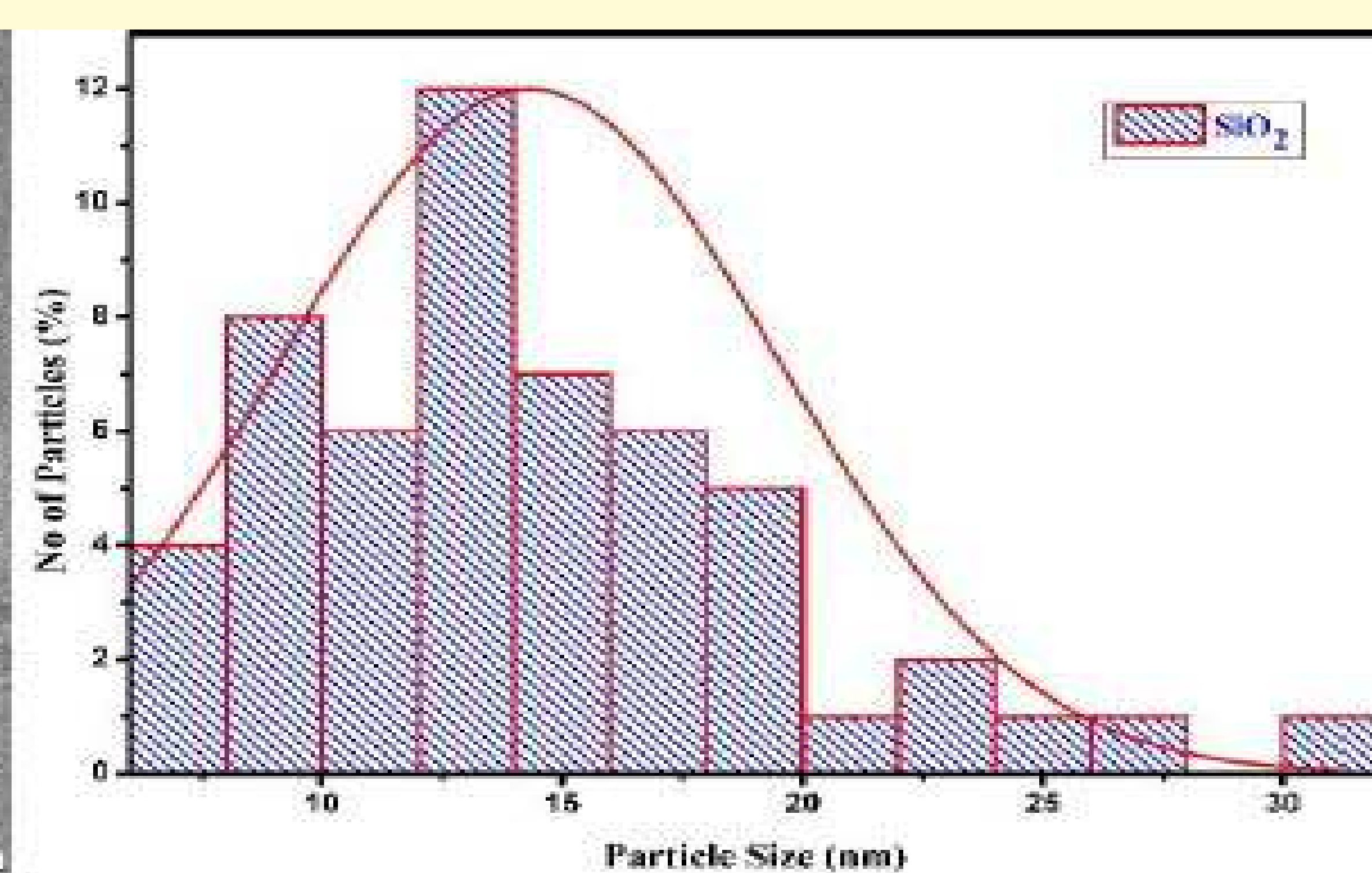
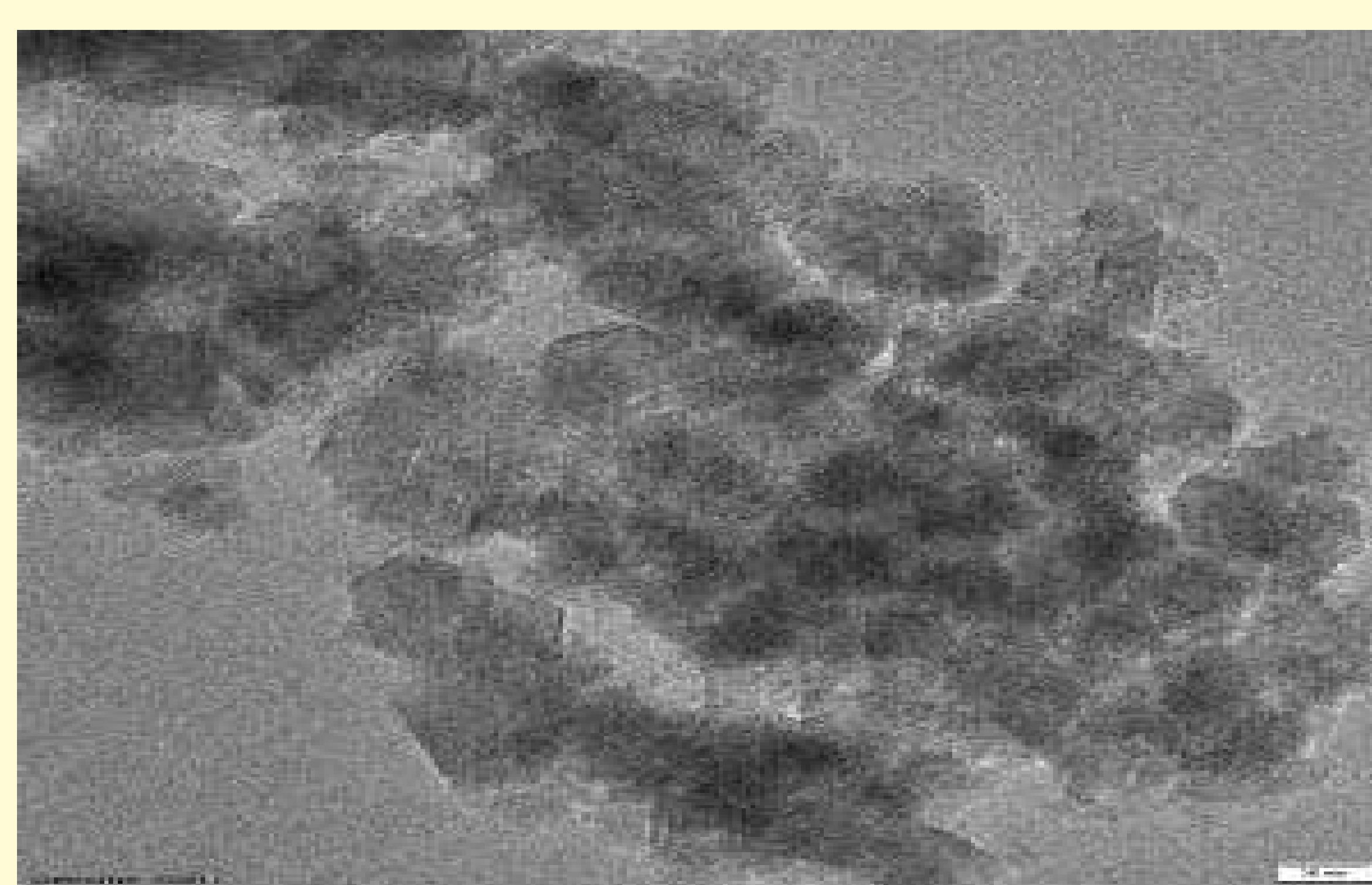
Nishant Kumar



Monalisa



Saurabh Sharma



- Crystalline Nano silica (SiO_2) was synthesized using a cost-effective eco-friendly method from agricultural waste material like rice husk and Polymer nanocomposite has been prepared using the sol-gel technique from crystalline Nano silica using PVA as a polymer binder.
- The X-ray diffraction tools analysis shows the crystalline nature of silica is revealed to have characteristic peaks of SiO_2 and found to be in the range of 21-31 nm. FTIR measurement shows the presence of O-Si-O (silane) bond formation. The PL measurement shows broad excitation prominently in the visible region.
- SEM provides information on homogeneous distribution. This could be beneficial in terms of higher mechanical qualities as well as multifunctional properties.
- Stability of materials are confirmed by Zeta Potential and DLS. In the photoluminescence property of SiO_2 -PVA crystalline Nano silica powder is excited using a radiation wavelength of 200nm. The indirect bandgap was determined to be 4.28 eV. Such materials may be used as a semiconductor material obtained from direct natural source, rice husk.
- Thus in present research structural, physical and optical properties of crystalline nano silica and its polymer composite are explored, which leads us to prepare technological grade material from agricultural waste for varied applications including Agriculture to medical science.

Acknowledgement: 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.

Physico-chemico and Biomedical behaviour of superfine nanoscale Potato (*Solanum tuberosum*) food powder for its various applications, prepared via eco-friendly approach.

Publication Details: European Chemistry Bulletin



Mrs. Pallavi Singh



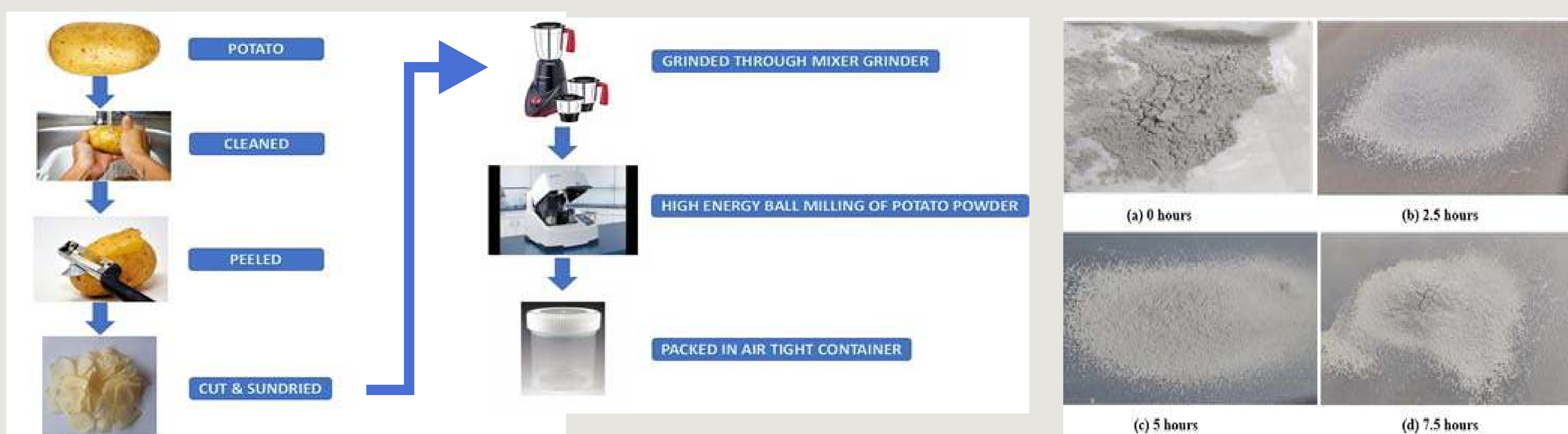
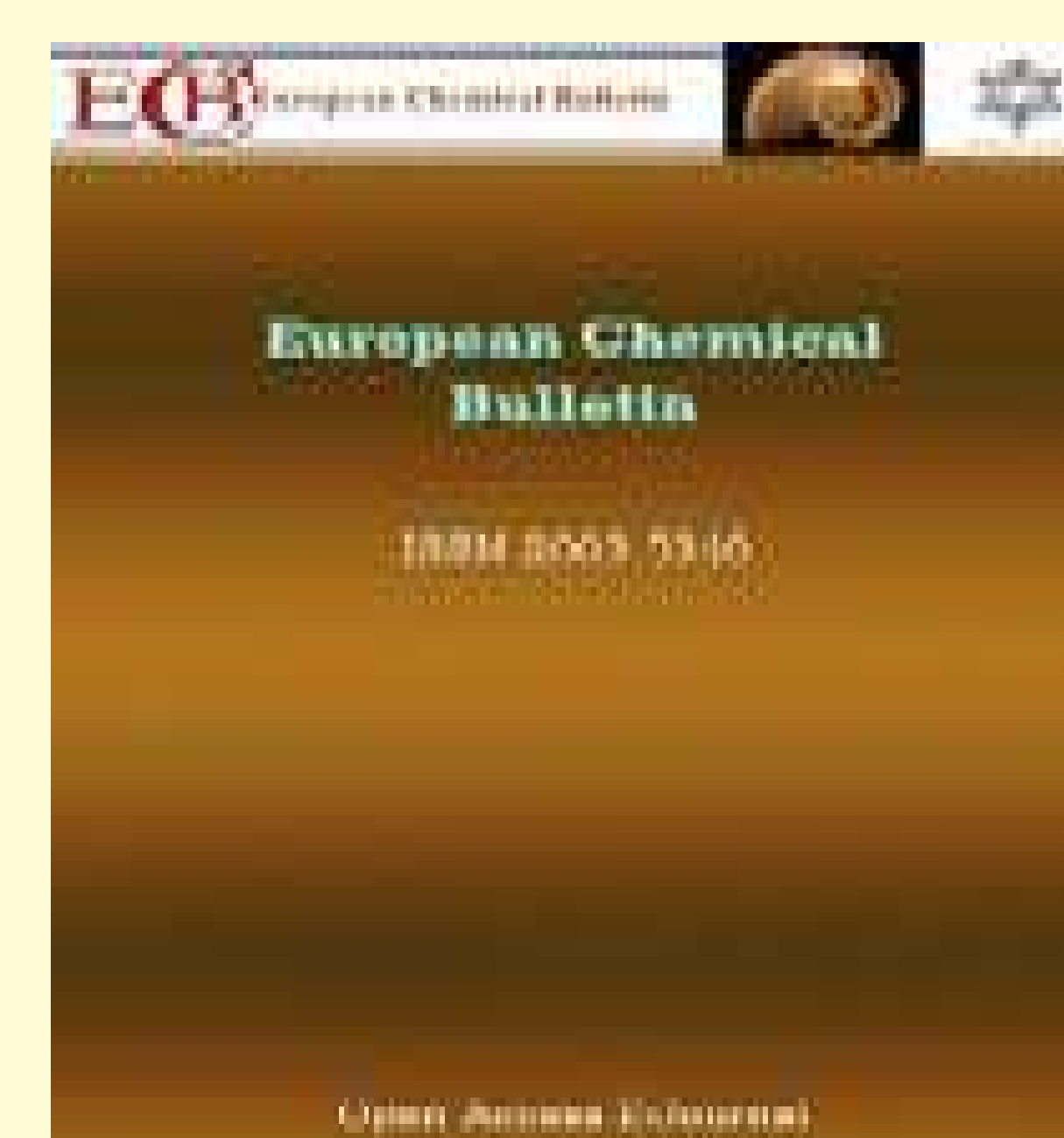
Dr. Rakesh K Singh



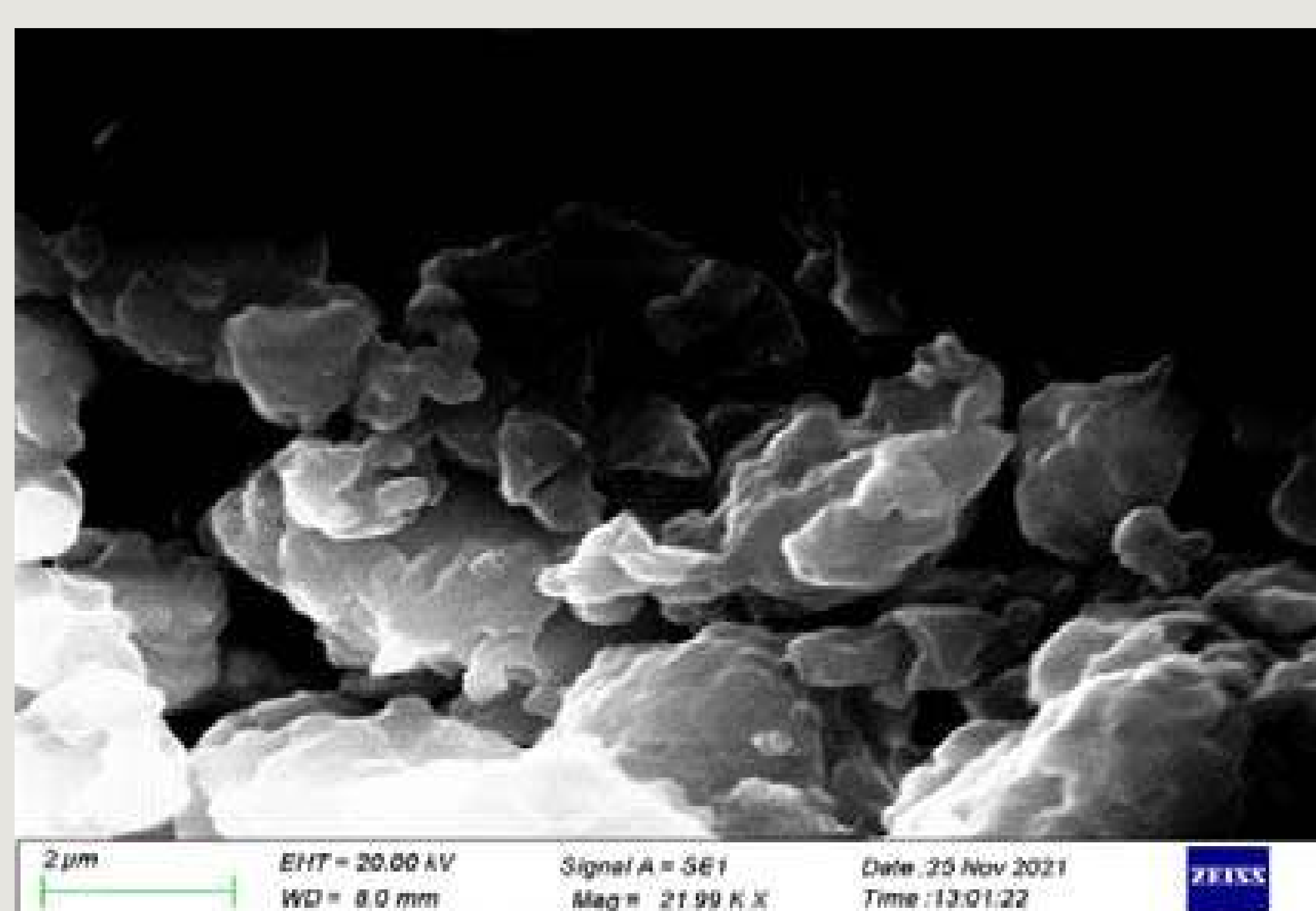
Mr. N. Naik



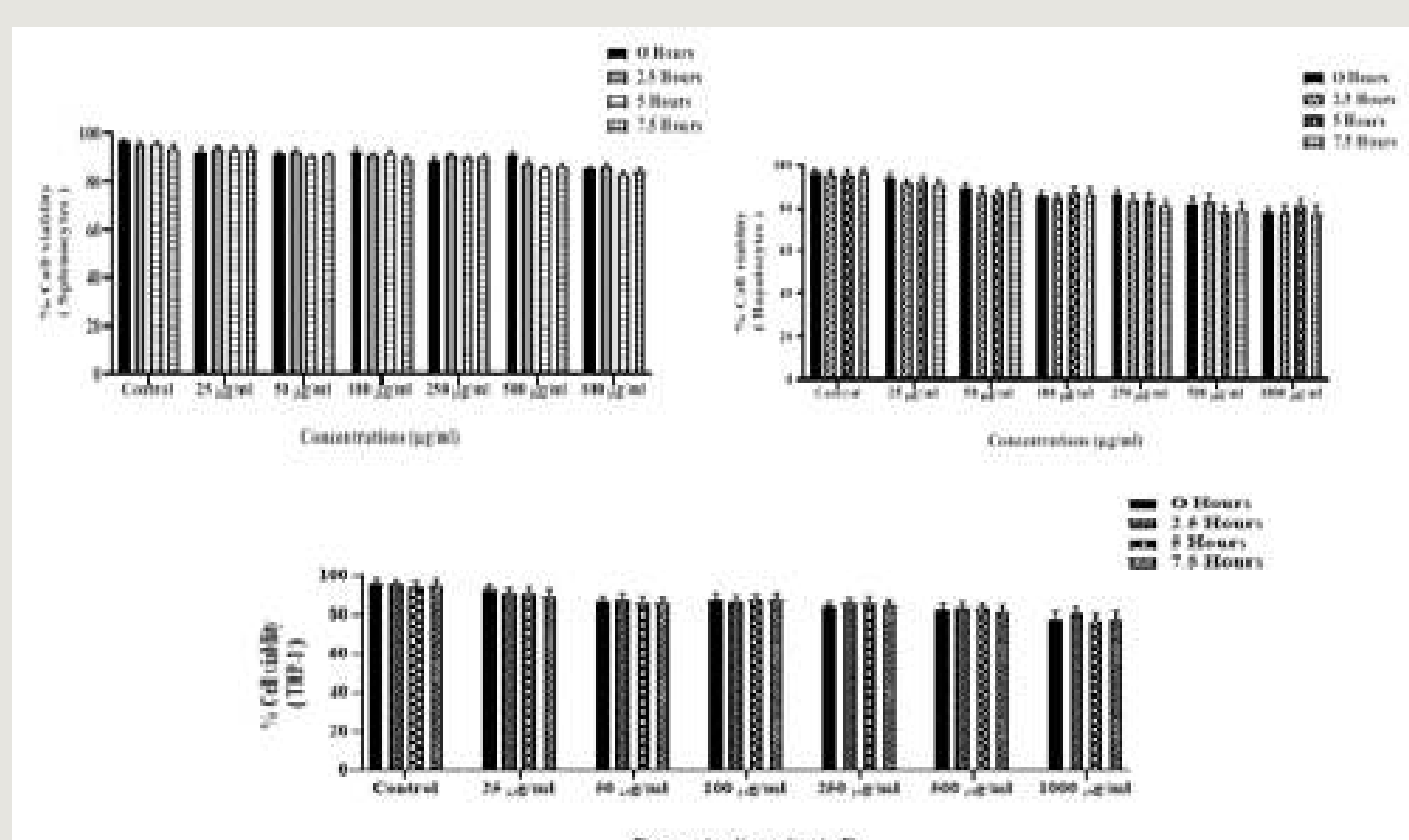
Mr. Nishant Kr.



Synthesis approach and optical images of superfine potato powder



Electron microscopy image



Cell Viability/ Toxicity studies

Research Summary:

- Superfine nanometric potato food powder was extensively prepared by using high energy ball milling equipment. Some part of the aforesaid grinded powder was taken and labelled as 0 hr and thereafter the potato nano powder was extensively milled for 2.5 hrs, 5hrs and 7.5 hrs respectively in high Energy Ball Milling equipment.
- The X-ray Diffractometer, Scanning Electron Microscopy measurements, Transmission electron microscopy results showed increased surface reactivity and the crystallite size is in nanometric range.
- Optical properties of potato nanopowder includes changes in the colour from dark grey to lightest grey which is due to characteristic changes in physical properties and crystal structure.
- The experiments were performed to evaluate its biocompatibility against murine-derived (hepatocytes and splenocytes) and human-derived (THP-1) cells of in-house prepared super fine potato nano-particles using MTT assay and Trypan blue exclusion assays, which found dependent on crystalline structures and superfine behaviour. In this approach, eco-friendly and physical method was used to produce superfine potato nanopowder with novel and potential characteristic properties after superfine grinding for its applications in food, Biomedical and other related sectors.

Acknowledgement: 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.

SYNTHESIS AND EXPLORATION OF PHYSICAL PROPERTIES OF NANOBIOCHAR FROM RICE STRAW FOR ITS APPLICATIONS IN ARSENIC REMEDIATION FROM WATER.

Journal Name: Elsevier- Journal of Material Today Proceeding (U.K) : Scopus Indexed



Pushpa K Sharma



Rakesh Kumar



Dr. Rakesh K Singh



Dr. Prabhakar Sharma



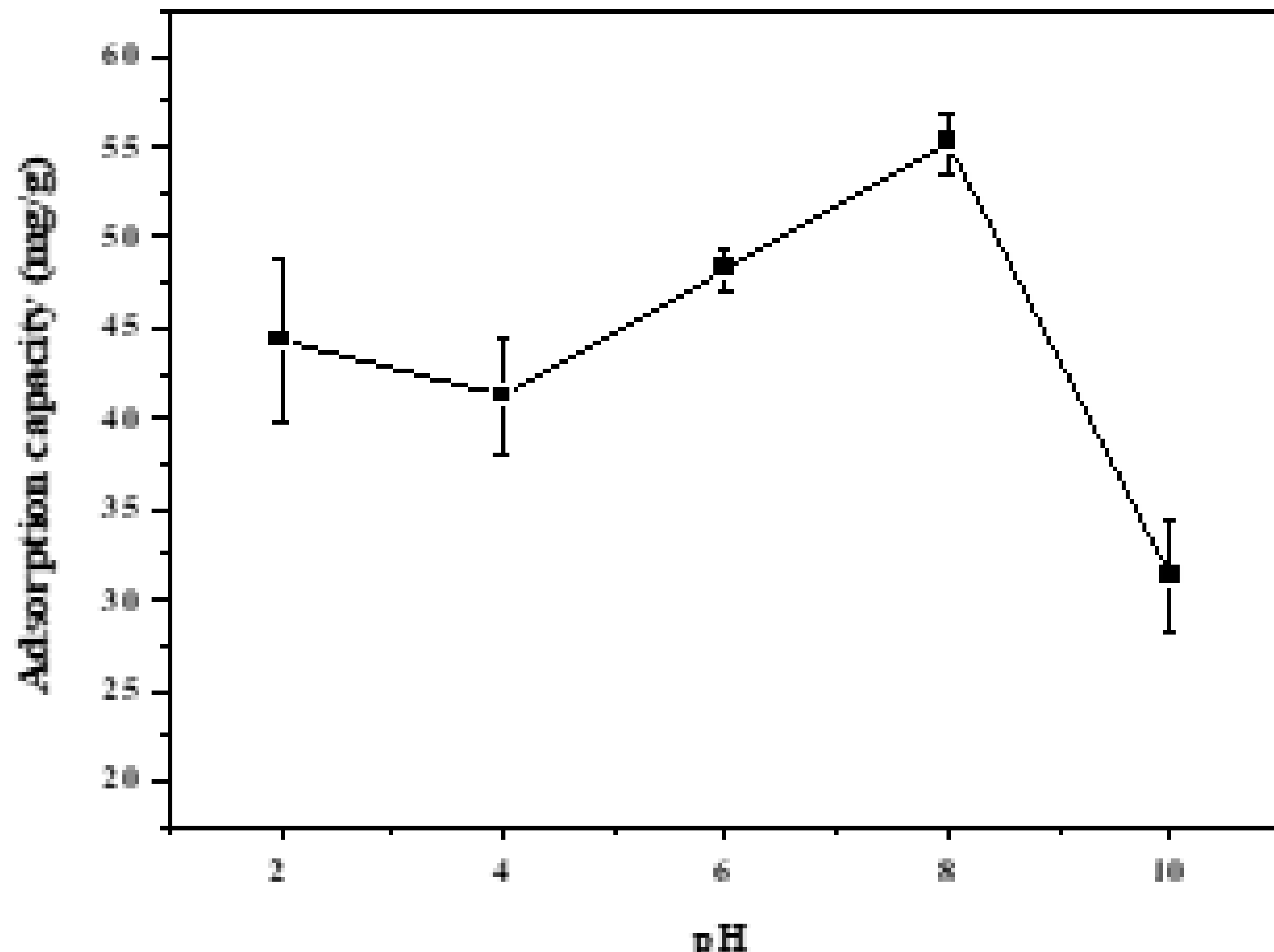
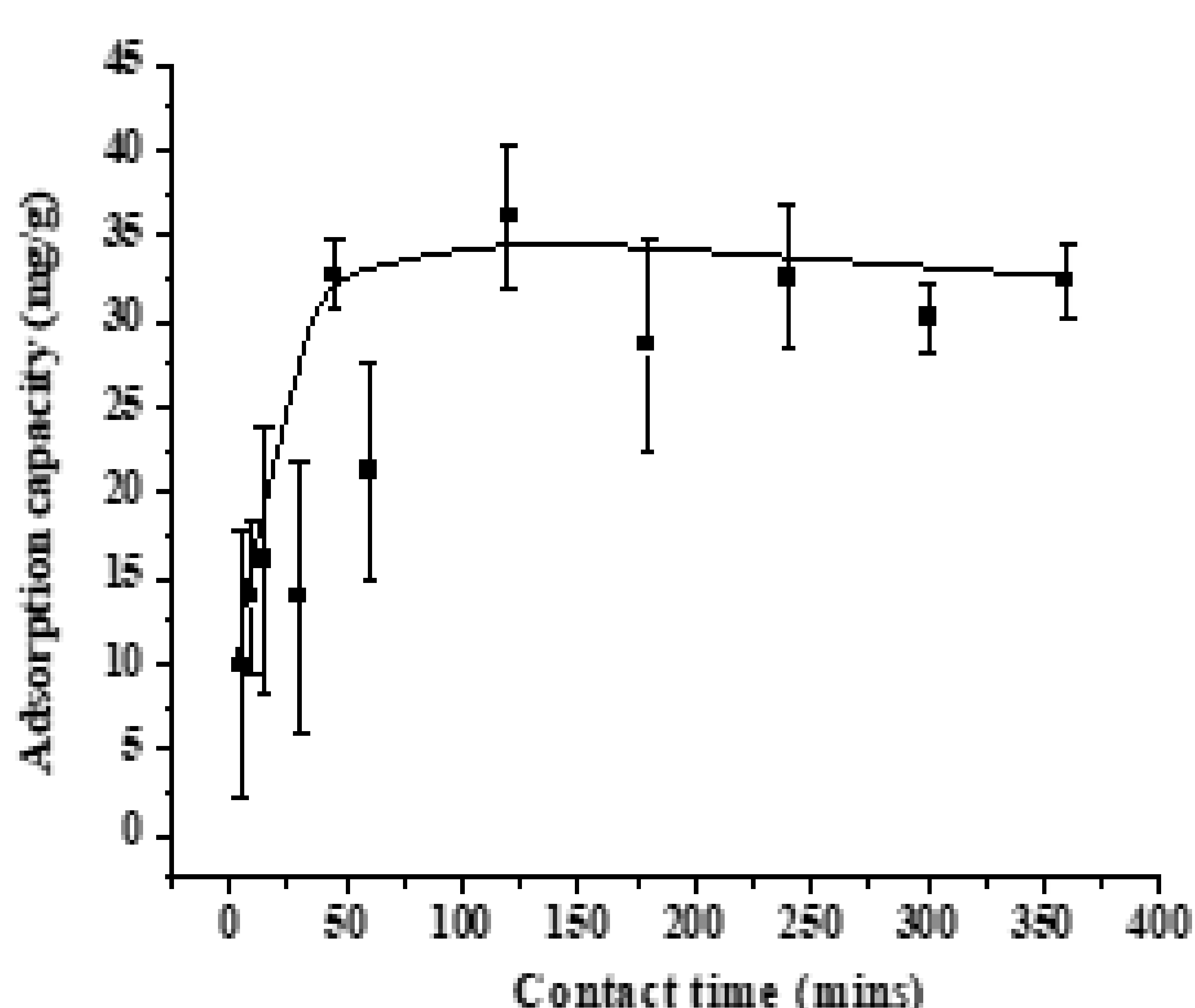
Dr. Ashok Ghosh



Nishant Kumar

Research Highlights:

- Arsenic (As) is a widespread carcinogenic element that emerges due to geogenic and anthropogenic processes and poses a significant threat to the world. The level of exposure, the degree of arsenic exposure, and the exposed person's nutritional status all have a major effect on the detrimental consequences of arsenic on public health. Biochar is a carbonaceous, renewable, and sustainable material synthesized under low or absent oxygen.
- The present study explores the application of biochar obtained via pyrolysis at 500°C for 2 hrs, followed by ball milling for 3 hrs at 500 rpm to obtain nanobiochar materials. Different functional groups, including hydroxyl, carboxyl, and alkene, are observable using Fourier Transform Infrared Spectroscopy, contributing to arsenic removal from water.
- Scanning Electron Microscope analysis shows the porous nature of nanobiochar, which also contributes to remediation. TEM analysis shows an average particle size of nearly 28.12 nm. The arsenic removal efficiency was obtained with an adsorption capacity of 36 mg/g.
- The possible adsorption mechanism of arsenic species on biochar surfaces are attractive forces, surface chemical bonding, ion exchange, and precipitation. Future research will concentrate on decontaminating natural groundwater samples containing various emerging contaminants for safe and clean drinking water.



Acknowledgement: 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.

Structural, optical and electrical behaviour of sodium-substituted magnesium nanoferrite for hydroelectric cell applications

Vivek Kumar, Rakesh Kumar Singh , Aniket Manash, Shashank Bhushan Das, Jyoti Shah & R. K. Kotnala

Applied Nanoscience (2022) | [Cite this article](#)

Structural, optical and electrical behaviour of sodium-substituted magnesium nanoferrite for hydroelectric cell applications

Journal Details- J Applied Nanoscience (Switzerland): SCI & Scopus Indexed



Vivek Kumar

Rakesh Kumar

Aniket Manash,

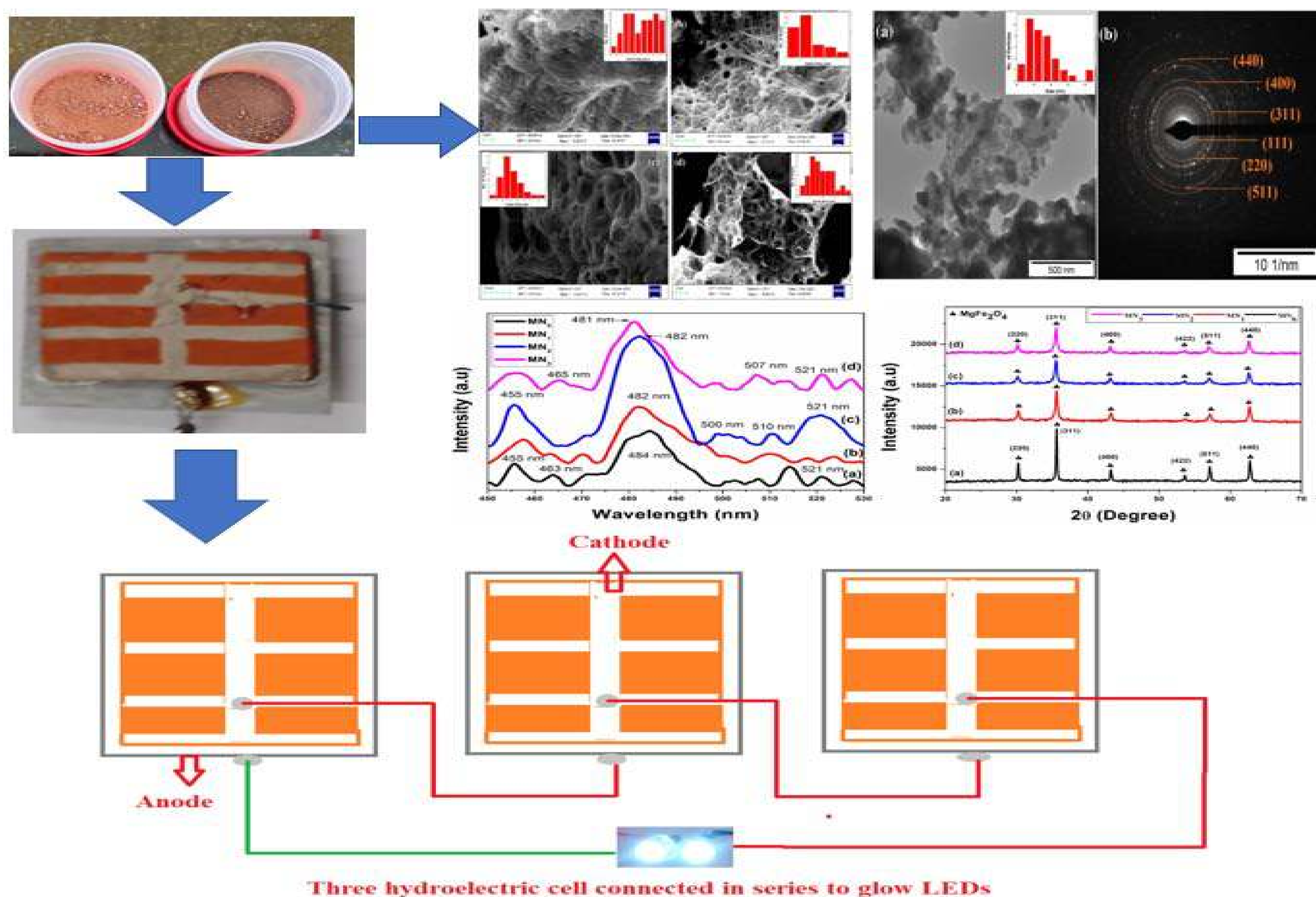
S. B. Das

Jyoti Shah

R K Kotnala

Research Summary:

- In this research, magnetic nanoparticles of $Mg_{1-x}Na_xFe_2O_4$ ($x = 0.0 - 0.3$) have been prepared by sol-gel technique to fabricate Hydroelectric Cell (HEC) to generate green electricity. The crystallite size of the prepared materials decreased from 33 to 16 nm by the increasing Na^+ content in magnesium ferrite, confirmed by XRD and TEM analyses.
- The photoluminescence emission wavelengths ranging from 455 to 581 nm, corresponding to the defect states and oxygen voids, confirms sodium increased the defects in magnesium ferrite. The defects and nanopores created by sodium substituted magnesium ferrite enhanced the water dissociation and generated electricity by redox reaction at electrodes (Zn and Ag) in the fabricated hydroelectric cell.
- HEC of $x = 0.2$ sodium substituted magnesium ferrite exhibited the highest offload current (mA) of 15 mA, maximum power of 14.19 mW and current density of 2.4 mA/cm^2 .



Prepared nanomaterial, Electron Microscope Image, Luminescent, XRD Spectra for Hydroelectric Cell.

Acknowledgement: 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.

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

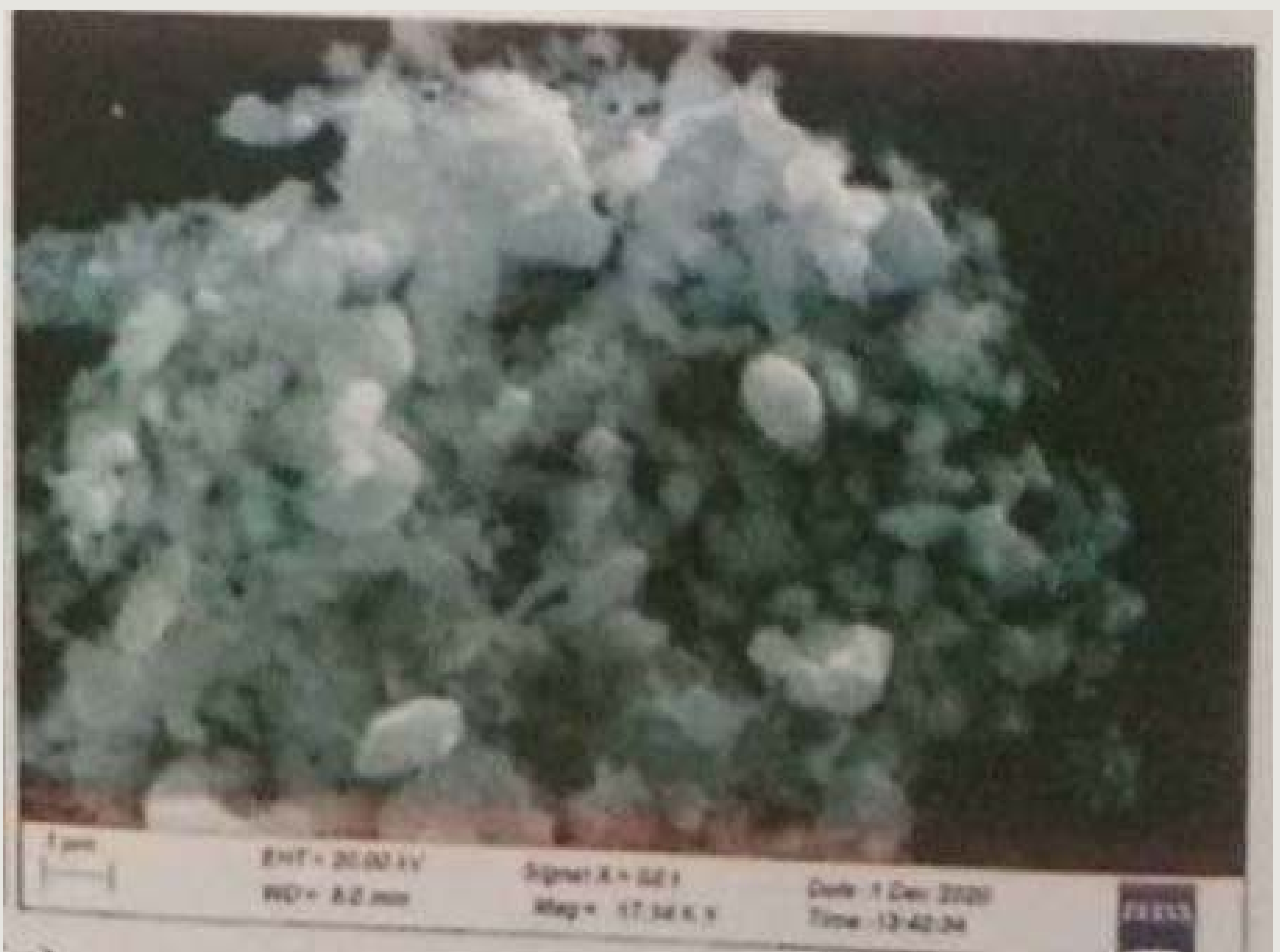
✳ रिसर्च टीम—आर्यभट्ट ज्ञान विश्वविद्यालय के नैनोटेक्नोलॉजी के विभागाध्यक्ष—सह—कुलसचिव डा० राकेश कुमार सिंह, तकनीकी स्टाफ श्री निशान्त कुमार एवम् विश्वेसरया टेक्नोलॉजिकल विश्वविद्यालय बेंगलोर के नैनोटेक्नोलॉजी के विभागाध्यक्ष डॉ० दिनेश रंगप्पा द्वारा यह खोज को किया गया।

✳ यह रिसर्च मेटेरेयिल्स सायंस—प्रोसेसिंग (एफलाइड फिजिस्ट), जो अंतर्राष्ट्रीय जर्नल है, प्रकाशित है। इस तरह के रिसर्च प्रकाशित होने के बाद जुलाई 2021 में नए पदार्थ के खोज का सम्पादकीय टीम, पेनसाइलाइनया, यू.एस.ए. द्वारा रिसर्च डाटा का ओरिजनल डाटा की माँग डॉ० राकेश कुमार सिंह से किया गया। डॉ० राकेश के द्वारा समर्पित डाटा को ICDD (International Center for Diffraction data) के U.S.A. के अंतर्राष्ट्रीय टीम द्वारा जाँचा गया एवम् जनवरी 2022 में प्रधान सम्पादक डॉ० सूरया एन. काबेकोड द्वारा इसे नए पदार्थ के संरचना हेतु सही की सूचना दी गई, जिसे पाउडर डिफटेकसन फाइल (वैज्ञानिक शब्द) के नाम से वैज्ञानिक जगत में जाना जाता है। इस तीन नए चुम्बकीय पदार्थ का फाइल नाम निम्नवत दिया गया है —



✳ PDF 00-072-0747, PDF, 00-072-0748, 00-072-0749

✳ चुम्बकीय पदार्थ का विवरण—मेगनेशियम लीथियम फेराइट चुम्बकीय पदार्थ को कम लागत वाले केमिकल मेथड से बनाया गया। 9 अत्याधुनिक उपकरणों (XRD, FTIR, SEM, TEM, EDS, VSM, PL, UV-UIS-NIR) द्वारा इसके संरचना, चुम्बकीय, प्रकाश उत्सर्जन, इलेक्ट्रॉनिक्स इत्यादि गुणों का अध्ययन विस्तार से किया गया। इस वैज्ञानिक विश्लेषण के आधार पर तैयार नैनोपदार्थ का



उपयोग चुम्बकीय—प्रकाशकीय सेन्सर, हाइड्रोइलेक्ट्रिक हेतु जर्नल में रिसर्च को प्रकाशित 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 विश्वविद्यालय का नाम पूरी दुनियाँ में होता रहेगा।



✳ ज्ञात है कि डॉ० राकेश कुमार सिंह को नैनोसाइंस के विशेष

योगदान हेतु बेस्ट युवा टीचर का अवार्ड महामहिम कुलाधिपति द्वारा दिया गया है एवम् माननीय मुख्यमंत्री द्वारा भी इसके प्रयास को सराहा गया है। इनके द्वारा करीब 125 से ज्यादा रिसर्च पेपर अंतरराष्ट्रीय जर्नल में प्रकाशित हुआ है।



Rakesh Kumar

Nishant Kumar

Prof. Dinesh Rangappa