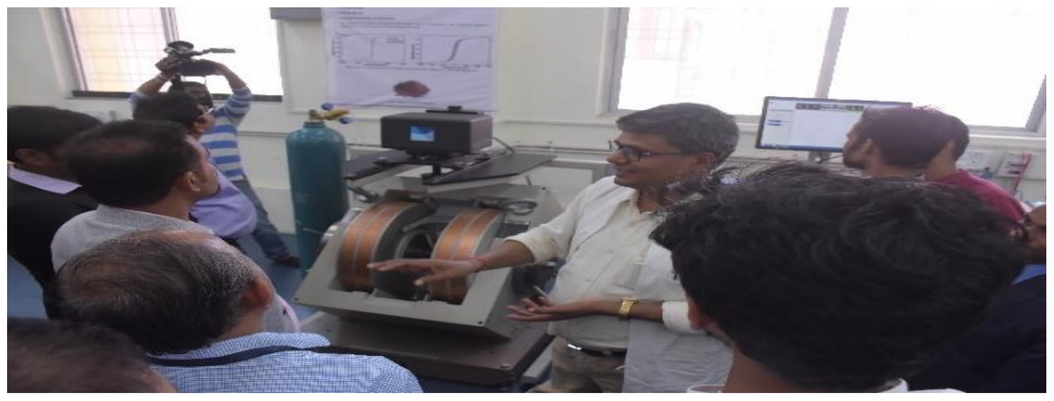
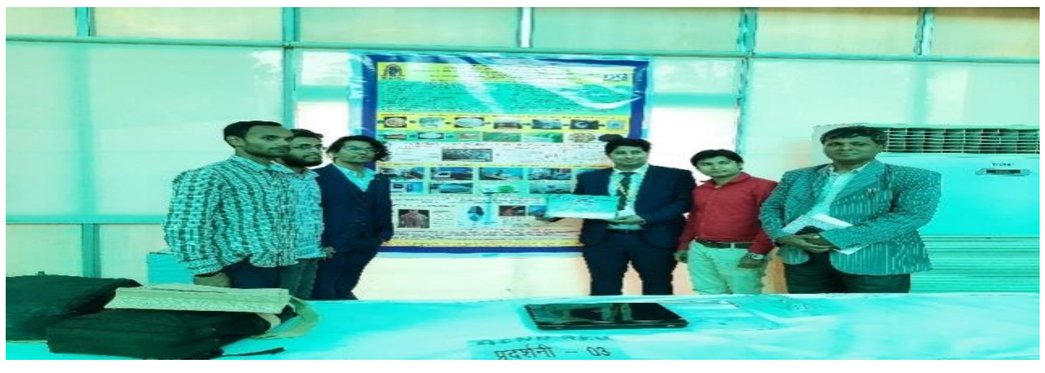
Aryabhatta Center for Nanoscience and Nanotechnology Aryabhatta Knowledge University, Patna - Achievements

Hon'ble CM, Sri Nitish Kr Ji and other eminent dignitaries visited and appreciated ongoing academic/research activities under the leadership of Dr. Rakesh Kr Singh. Dr. Rakesh Kumar Singh, has been coordinated in establishing this center as Head/Prof. incharge-Establishment/Academic-incharge from 1st April 2014. At present he is Registrar of this university (from 8th Jan 2022)

On 23rd November 2021, certificate of excellence is awarded to Dr. Rakesh Kr Singh, Faculty member of Nanotechnology center of Aryabhatta Knowledge University, Patna 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.



This Nanotechnology center well equipped with about 22 high-end research instruments such as Scanning Electron Microscope, Multiferroic system, Vibrating sample magnetometer etc. and its impact is being felt globally. Establishment of Simulation laboratory in nanomaterials research are also in progress under the coordination of Dr. Rakesh Kr Singh. More than 500 scholars/academicians from national/international level academic institutions have visited the Nanotechnology center of this university.



Students of Nanoscience center, working in the area of "production of nanosilica from rice husk", under the supervision of Dr. Rakesh Kr Singh, receiving 1st prize at Rajbhawan Patna in a state level programme" Innovations and Entrepreneurship in Science Education and Research.

Faculty member and M.Tech / Ph.D. scholar of this research center have published more than 200 papers in peer reviewed/ Impact factor/ Indexed Journals. Thrust areas of research are- Nanotechnology in Food & Agriculture, Nanotechnology in Ayurvedic Science, Nano Electronics Magnetic nanomaterial's, Nano medicine, Nano-Biotechnology, Nanosilica from Rice husk(Agriculture waste) etc. In last 3 year about more than 100 research papers presented in international/national conferences with nanoscience center affiliation. At present about 25 research project/activities are being carried out by faculty members and scholar of Nanotechnology center.


2 महासंग्राम पटना। मंगलवार • 25 अगस्त • 2020

DY. CM BIHAR

सोमवार को राजधानी पटना में वीडियो कॉन्फ्रेंसिंग के जरिए उच्च माध्यमिक विद्यालयवलिहीन 3304 पंचायतों में शैक्षिक सत्र 2020-21 से नौवीं कक्षा का शुभारंभ करते मुख्यमंत्री नीतीश कुमार। साथ में हैं उपमुख्यमंत्री सुशील कुमार मोदी ।

मुख्यमंत्री ने आर्यभट्ट की प्रतिमा का वीडियो कॉन्फ्रेंसिंग के माध्यम से किया अनावरण

पटना (एसएनबी)। मुख्यमंत्री नीतीश कुमार ने वीडियो कॉन्फ्रेंसिंग के माध्यम से आर्यभट्ट ज्ञान विश्वविद्यालय भवन परिसर में महान गणितज्ञ, खगोलशास्त्री आर्यभट्ट की आदमकद प्रतिमा का अनावरण किया। मुख्यमंत्री ने आर्यभट्ट के नाम से इस विश्वविद्यालय की स्थापना तथा नाम में ज्ञान शब्द जोड़े जाने के मुख्य उद्देश्य का स्मरण कराते हुए विश्वविद्यालय द्वारा किए गए कार्यों की सराहना की। मुख्यमंत्री द्वारा यह भी बताया गया कि यह विश्वविद्यालय अन्य

नीतीश कुमार ने की विभि द्वारा किये गए कार्यों की सराहना की

विश्वविद्यालयों से अलग है। मुख्यमंत्री द्वारा विश्वविद्यालय अंतर्गत तौणिक केन्द्र आर्यभट्ट नैनी विज्ञान एवं नैनी प्रौद्योगिकी द्वारा किए जा रहे शोध की सराहना करते हुए अन्य नए शैक्षणिक केन्द्रों को खोले जाने के लिए परामर्श दिया गया। इस मौके पर विश्वविद्यालय परिसर में कुलपति डॉ. (प्रो) अरुण कुमार अग्रवाल, प्रतिकुलपति प्रो. एस एम करीम, कुलसचिव सह परीक्षा नियंत्रक ई. राजीव रंजन, उप कुलसचिव डॉ. कुमारी अंजना, उच्च शिक्षा विभाग की निदेशक डॉ. रेखा कुमारी तथा विभि पदाधिकारी एवं कर्मचारी उपस्थित थे।

Hon'ble Chief minister Sri Nitish Kr Ji, specially appreciated research activities of Nanoscience and Nanotechnology center of Aryabhatta Knowledge University, Patna, during his video conference program of establishment of statue of Aryabhatta in campus.

Awards/ Recognitions for Contributions to Knowledge in the area of Nanotechnology in Ayurvedic Science, at Stockholm, Sweden. European Advanced Materials Congress-2016, Stockholm, Sweden

Honored to Dr. Rakesh Kr Singh of Nanotechnology center of Aryabhatta Knowledge University, Patna by Executive Chairs of European Advanced Material Congress-2016, at Sweden (Prof. Hisatosi Kobayashi (Left), National Institute for Material Science, Tsukuba, Japan cum President-International Association of Advanced Materials (IAAM) Sweden).

SPRINGER NATURE

Applied Physics A (2021) 127:183
https://doi.org/10.1007/s00339-020-04233-7

Applied Physics A
Materials Science & Processing

Synthesis and characterization of non-molar lithium–magnesium nanoferrite material for its applications

Rakesh Kr. Singh[1] · Nishant Kumar[1] · Dinesh Rangappa[2]

Received: 20 October 2020 / Accepted: 21 December 2020 / Published online: 13 February 2021

Dr. Rakesh Kumar Singh

Mr. Nishant Kumar

Prof. Dinesh Rangappa

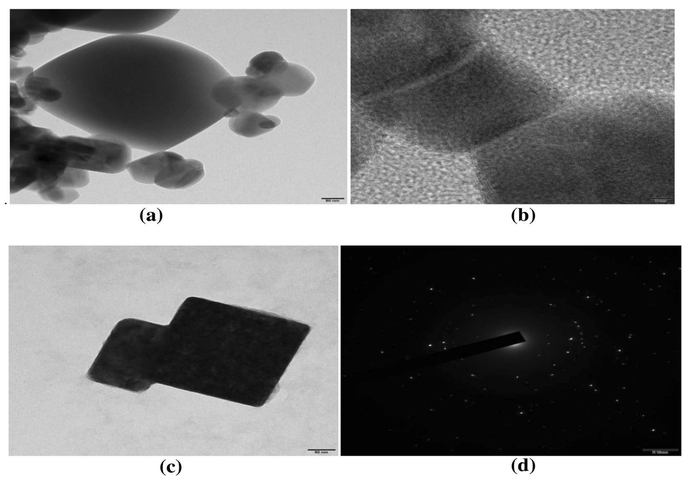
POSSIBLE APPLICATION OF PREPARED NANO MATERIALS

PREPARED FERRITE NANOMATERIALS IN LAB

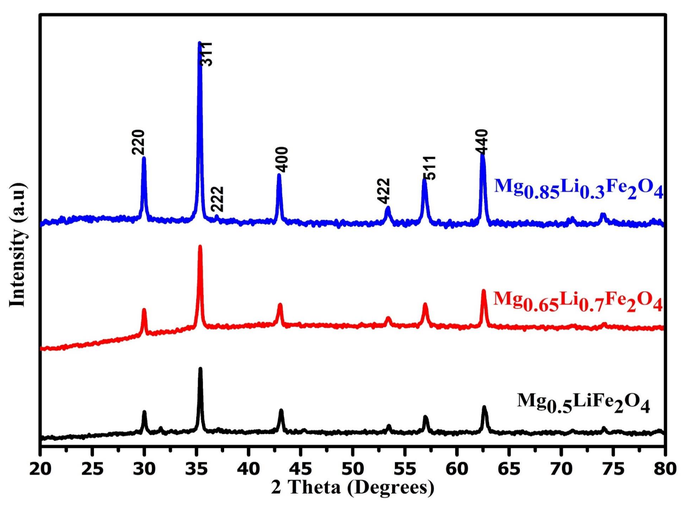
OPTOELECTRONIC DEVICES

MAGNETIC INDUSTRY

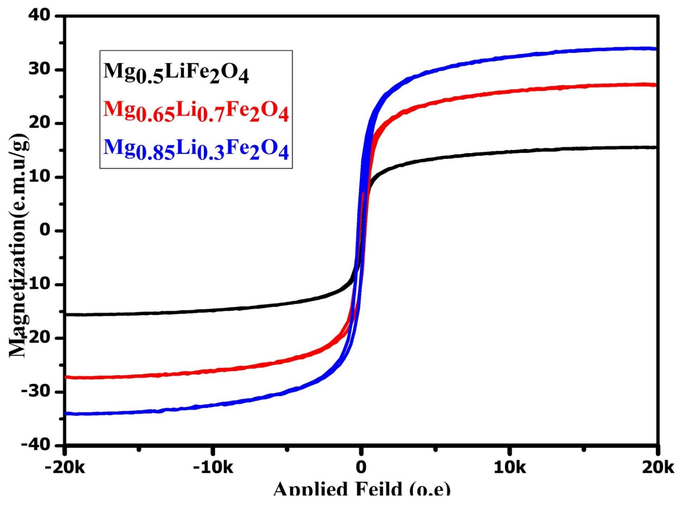
TEM ANALYSIS



STRUCTURAL MEASUREMENTS



MAGNETIC MEASUREMENTS



Research Summary:

- Non-stoichiometric ferrite magnetic nanoparticles $Mg_{0.5+x}Li_{1-2x}Fe_2O_4$ (x = 0, 0.15, 0.35) were prepared using low-cost sol–gel method and annealed at temperature 700 °C.
- Thermal analysis measurement confirms that there is a decrease in weight with an increase in temperature which becomes thermally stable till 600 °C.
- XRD study confirms that prepared nanoparticles are a cubic spinel structure having Fd3m space group. The crystallite size lies in the range of 26.41–31 nm.
- HRTEM and SEM image confirms the cubic spinel structure and porosity in the material. The indirect energy band gap was found to be 2.25, 1.89 and 2.03 eV respectively for x = 0, 0.15 and 0.35. The energy band gap was found function of crystallite size. Strong luminescence was observed in the visible range of 580–610 nm.
- The non-molar ratio of Li = 0, 0.15 and 0.35 mol leads to a systematic increase in all the magnetic parameters.
- Hence, materials may be potential candidate for magneto-optical device, humidity sensor, hydroelectric cell applications and some other related fields.

STRUCTURAL PROPERTIES

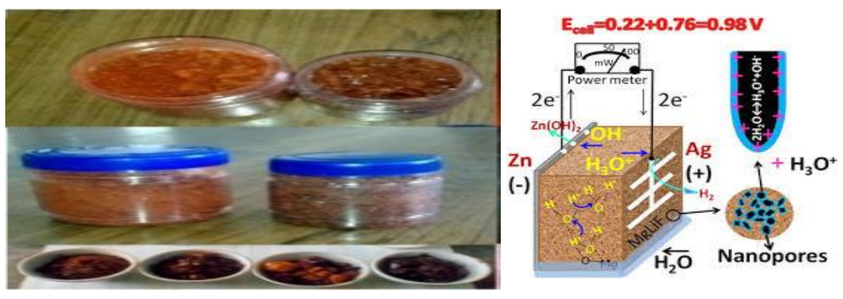
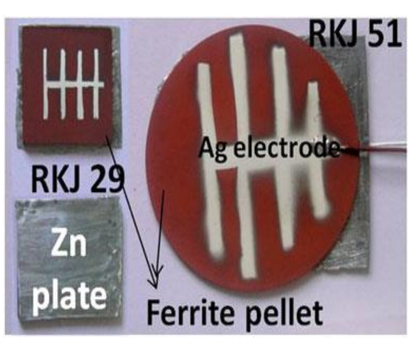
Materials	d-spacing (Å)	Angular Position (2Θ)in degree	Lattice constant (Å)	Cell Volume(cm^3)	Molecular Weight (g/mol)	d_x (gm/cc)
$Mg_{0.5}LiFe_2O_4$	2.535	35.369	8.410	594.850	194.779	4.349
$Mg_{0.65}Li_{0.7}Fe_2O_4$	2.537	35.343	8.416	596.118	196.342	4.374
$Mg_{0.85}Li_{0.3}Fe_2O_4$	2.539	35.319	8.421	597.266	198.427	4.412

MAGNETIC PROPERTIES

Parameter	x=0	x= 0.15	x= 0.35
Magnetization (Ms)(emu/gm)	15.53	27.20	33.75
Coercivity (Hc)/Oe	116.56	143.35	161.37
Retentivity (Mr)(emu/gm)	2.66	5.22	7.11
Squareness Ratio (Mr/Ms)	0.171	0.191	0.210

Acknowledgement-
Authors are thankful to TEQUIP-III of Aryabhatta Knowledge University, Patna for financial support under Collaborative Research Scheme (Ref-005/Exam/1060/AKU/2019/4455).

Doctoral Research(Ph.D.) Scholar, their Research field and Supervisor; Details

Research Scholar	PhD Supervisor	Functional nanomaterials for various applications
		
Pushpa Kumar Sharma	**Dr. Rakesh Kumar Singh**	**Biochar for water purification**
		
Aniket Manash	**Dr. Rakesh Kumar Singh**	**Nanoporous ferrite material for hydroelectric cell**
		
Ritu Kumari	**Dr. Rakesh Kumar Singh**	**Bel Patra superfine nano powder**
		 
Vivek Kumar	**Dr. Rakesh Kumar Singh**	**Ionic conduction of splitted water in hydroelectric cell**
		 
Pallavi Singh	**Dr. Rakesh Kumar Singh**	**Potato and black pepper superfine nano powder**
		 
Naman Kr. Naik	**Dr. Rakesh Kumar Singh**	**Moringa superfine nano powder**
		
Bibhuti Bikramaditya	**Dr. Rakesh Kumar Singh**	**Garnet nanomaterial (YAB) for LED applications.**
		 
Prabhat Kr. Dwivedi	**Dr. Rakesh Kumar Singh**	**Study on Bhasma nanoparticles using modern scientific tools**

Note: In addition to these Doctoral Research activities 17 M.Tech research projects are being carried out in multidisciplinary area of Nanoscience & Nanotechnology

Nanotechnology Research in food and Agriculture.

ICTMIM 2021 IOP Publishing
IOP Conf. Series: Materials Science and Engineering 1126 (2021) 012020 doi:10.1088/1757-899X/1126/1/012020

Preparation of superfine cinnamon bark nanocrystalline powder using high energy ball mill and estimation of structural and antioxidant properties.

Archana[1], Aman Kr. Abhay [1], Singh Kr. Rakesh [1], Kr. Nishant [1], Prasad Birendra [2]

1. Aryabhatta centre for Nanoscience and Nanotechnology, School of Engineering and Technology, Aryabhatta Knowledge University, Patna, India, Pin-800001
2. Dept. of Biotechnology, Patna University, Patna, India, Pin-800005
Corresponding author-rakeshsinghpu@gmail.com (Dr. Rakesh Kumar Singh)

Published from - IOP. Material Science and Engineering (Scopus/Wos Indexed) USA

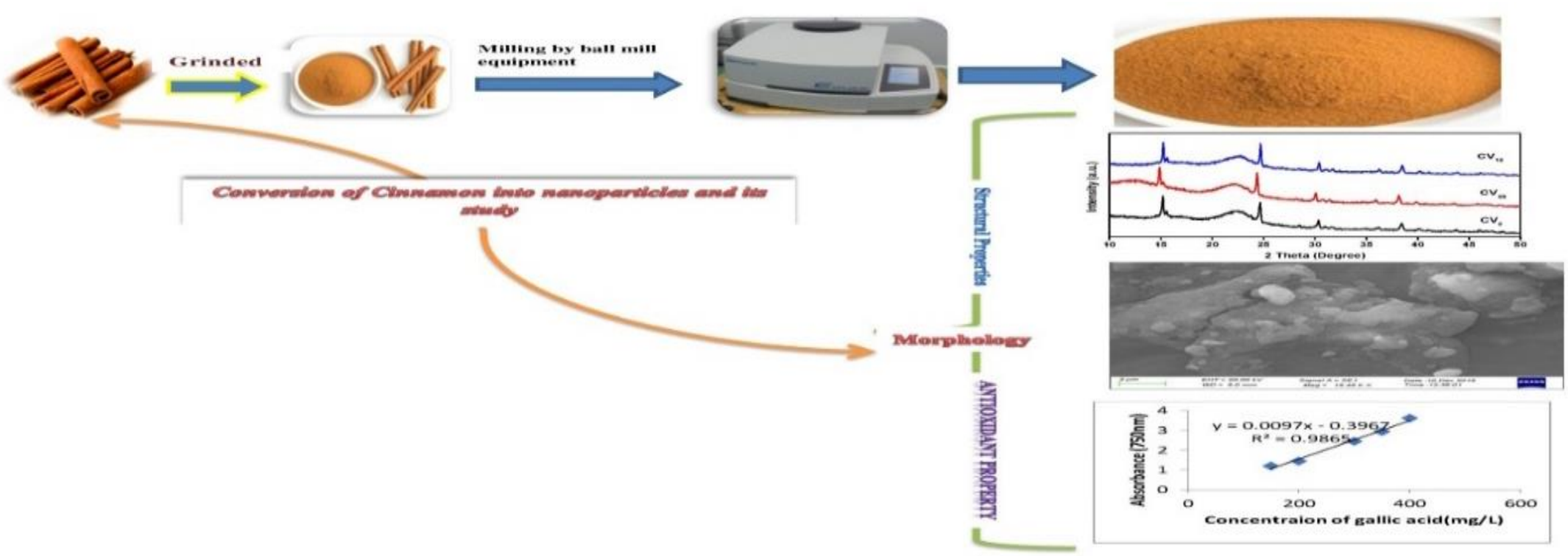
Research Team

Dr. Archana

Dr. Rakesh Kumar Singh

Dr. Abhay Kumar Aman

Nishant Kumar



Novelties of Research

• Application of Food material for medicinal use is become a common and safe approach to treat various diseases. Although Nanoscience is seeming to most promising area to be explore at every aspect of existing science including medicine and pharmaceuticals. Medicinal properties and application of various spices are well explored science but their nanopowder synthesis and effect is not very much known.

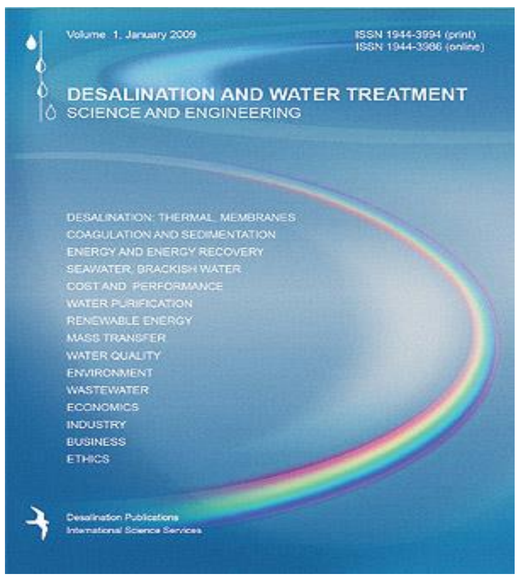
• In this present work, we have used a commonly known spice from Indian kitchen know as Cinnamon, for synthesis of nano powder high energy ball mill instrument was used. The crystallographic study, functional group analysis, were done using modern characterization equipment such as XRD (X-ray diffraction), FTIR (Fourier transform infrared spectroscopy), SEM (Scanning Electron Microscope), and UV-Visible spectroscopy. XRD measurement confirms that crystal structure of powder milled for 5 hours and 10 hours were different. Similarly, morphology of differently milled sample found to be different from general Cinnamon powder. Antioxidant properties of superfine powder was found greater than normal crude powder, which was confirmed by experiment on C.elegen.

• This might be due the formation of different fractions of particles were formed as a result of deterioration of cohesion bond due to high energy milling. The present study suggested that cinnamon superfine powder could be a potential source of natural antioxidant and thus could be useful as therapeutic agents and also open new window for the progress of surface science of food materials, which are beneficial for biomedical engineering, pharmaceutical, health, and medicine industries.

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.

Nanotechnology Research for purification of water



Desalination and Water Treatment
www.deswater.com
doi: 10.5004/dwt.2020.26002

197 (2020) 224–236
September

Equilibrium sorption of fluoride on the activated alumina in aqueous solution

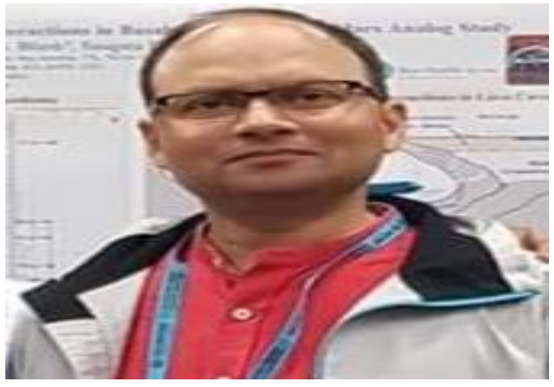
Rakesh Kumar[a], Prabhakar Sharma[a,*], Abhay Kumar Aman[b], Rakesh Kumar Singh[b]

[a]*School of Ecology and Environment Studies, Nalanda University, Rajgir, Bihar, India, Tel. +91 7033698509; email: psharma@nalandauniv.edu.in (P. Sharma), Tel. +91 8873844901; email: rakumar.sees17@nalandauniv.edu.in (R. Kumar)*
[b]*Aryabhatta Center for Nanoscience and Nanotechnology, School of Engineering and Technology, Aryabhatta Knowledge University, Patna, Bihar, India, Tel. +91 767748990; email: abhayaman.aku@gmail.com (A.K. Aman), Tel. +91 81029155849; email: rakeshsinghpu@gmail.com (R.K. Singh)*

Published from Hopkinton, USA

Research Team

Rakesh Kumar



Dr. Prabhakar Sharma

Dr. Abhay Kumar Aman

Dr. Rakesh Kumar Singh

Highlights of research

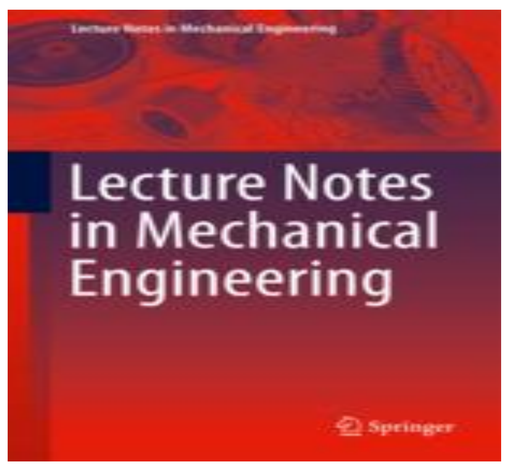
- **Removal of fluoride is a desalination technology in which fluoride ions from aqueous solution are adsorbed on suitable adsorbent surfaces. This work aim to determine equilibrium sorption of fluoride on surface modified activated nano-alumina in aqueous solution.**
- **Results indicated that adsorption occurred rapidly in beginning, and equilibrium was reached on surface modified, i.e., grinded activated alumina. At equilibrium, adsorption capacity was about 28 mg g-1 (i.e., mg of fluoride per g of alumina) in case of activated alumina, where as it was noted as 39 mg g-1 for grinded activated alumina for pH of 3.0 and fixed fluoride concentration of 100 mgL^{-1} in aqueous solution.**
- **Furthermore, adsorption isotherms and kinetics was performed in which Freundlich model indicated better fit, indicating heterogeneous nonlinear monolayer sorption among adsorbed particles. Overall, the present research reveals that the grinded activated alumina can be a prospective adsorbent for treatment of fluoride contaminated water.**

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 Electronics Nanomaterials 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)



California

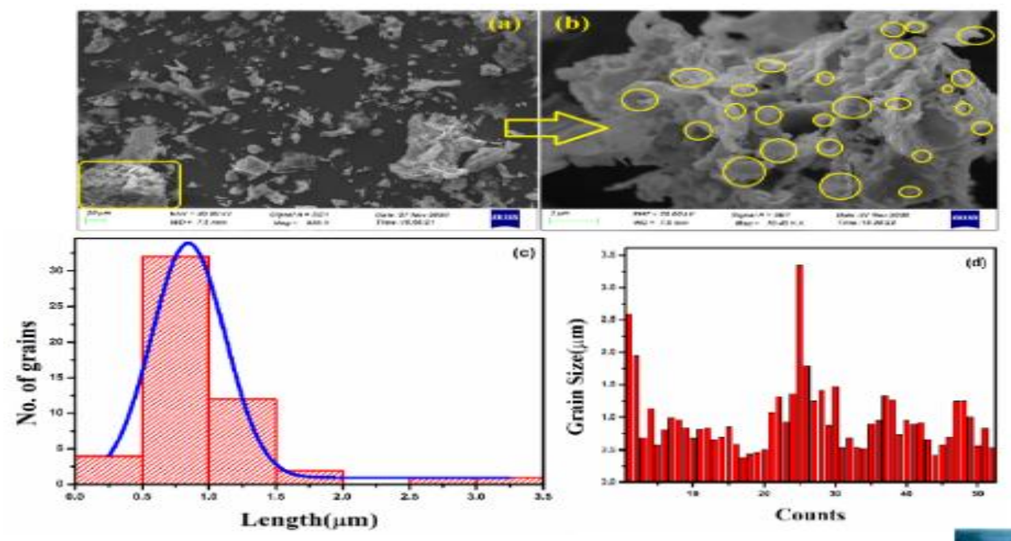
Research Team

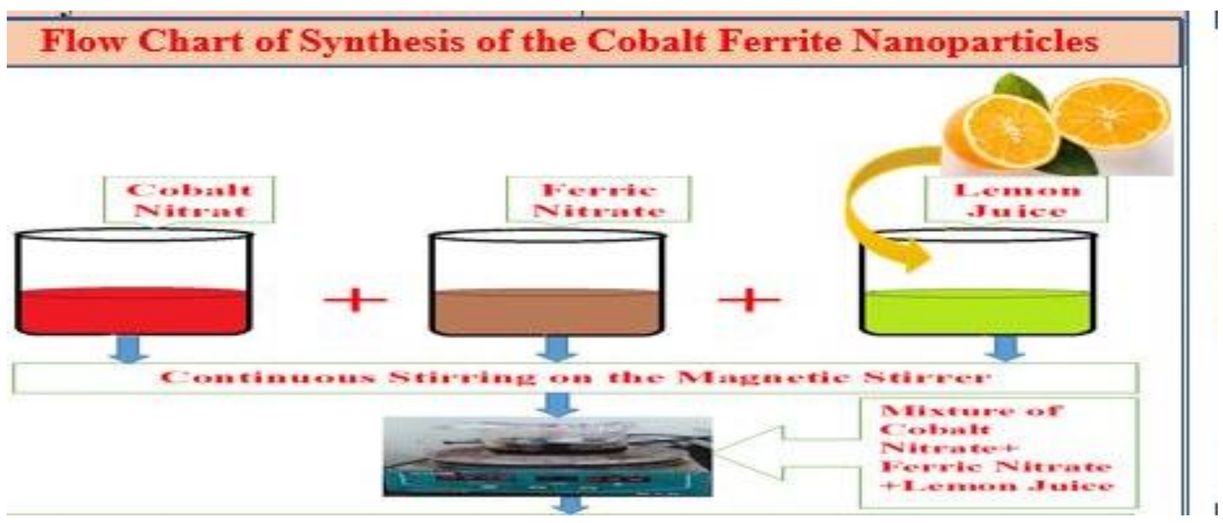
Shashank Bhushan Das

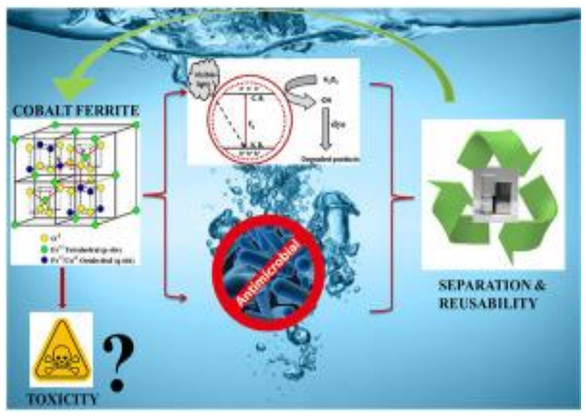
Dr. Rakesh Kumar Singh

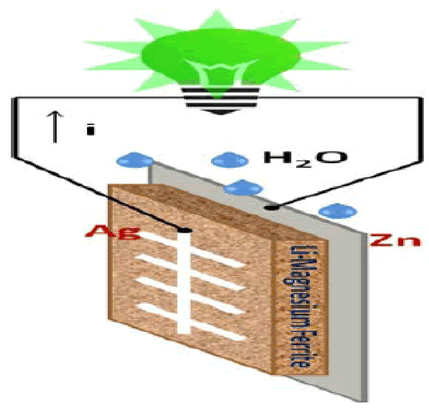
Vivek Kumar

Nishant Kumar









Possible applications

Research Highlights

- ✓ *Using* intention to use green synthesis approach, $CoFe_2O_4$ nanoparticles were successfully prepared using lemon juice and metal nitrates as a precursor material.
- ✓ 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 saturation magnetisation (Ms) 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 and 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.

Learning Science through low cost experiment
Developing Strong Scientific Human resource in Society at all levels of Study
Initiative of National Anveshika Network of India, IAPT
Coordinated by Padam shree Prof. H.C.Verma, IIT Kanpur

Prof. H.C.Verma, IIT Kanpur, felicitated by Hon'ble Sri Nitish Kr Ji, CM, Bihar in year 2018.

Teaching-learning, Demonstration & its Social Impact

159, पेज 12, मेट्रो संस्करण | सोमवार, 09 जुलाई 2012, पटना | www.livehindustan.com

कानपुर आईआईटी में बिहार के प्रो.एचसी वर्मा व उनकी टीम का इनोवेशन ला रहा रंग, बिहार के स्कूलों की बदली तस्वीर

देश के कोने-कोने में साइंटिफिक फीवर

पटना। अजय शंकर

खगड़िया के अलौली ब्लॉक का हाईस्कूल। यहां साइंस की पढ़ाई तो होती है पर प्रैक्टिकल के लिए लैब नहीं है। छात्र सिर्फ थ्योरी पढ़ते हैं। लेकिन, इन दिनों यहां प्रैक्टिकल भी हो रहा है। वह भी बिना लैब और ऑपरेट्स के। महज दो कागज के टुकड़ों के जरिए बरनौली का थ्योरम समझाया जा रहा है।

यह हाल केवल इस स्कूल का ही नहीं है, बल्कि पूरे बिहार और देश के कई स्कूलों का भी है। ऐसा संभव हो पा रहा है आईआईटी कानपुर में बिहार के प्रो. एचसी वर्मा और उनके साथियों के इनोवेटिव प्रयोग की वजह से। उन्होंने 'उत्साही फिजिक्स टीचिंग ग्रुप' नाम से एक टीम बनाई है। यह टीम देश के कोने-कोने में छात्रों और शिक्षकों में साइंटिफिक फीवर डेवलप करने में जुटी है। इससे बिहार के स्कूलों में बदलाव आ रहा है। जो शिक्षक साइंस फिजिक्स पढ़ाने में रुचि नहीं लेते

हो रहा है बदलाव

इस मिशन से बिहार के गांवों में मौजूद स्कूलों में काफी बदलाव आया है। जिन स्कूलों में कल तक लैब नहीं थी, आज वहां है। गांव के शिक्षक भी अपने स्तर ने नए-नए प्रयोग कर छात्रों को आसानी से चैप्टर समझा रहे हैं। छात्रों की नीरसता भी दूर हो रही है।

5000 शिक्षकों का बन चुका है कारवां

2004 में प्रो. एचसी वर्मा ने नेशनल लेवल पर फिजिक्स के 15 रिसोर्स पर्सन की मदद से 'उत्साही फिजिक्स टीचिंग ग्रुप' का गठन किया। इसमें बिहार के दो प्रोफेसर डॉ. अमरेंद्र नारायण एवं डॉ. राकेश कुमार सिंह शामिल हैं। आठ साल में ग्रुप ने देश के 5000 शिक्षकों को इनोवेटिव शिक्षा की ट्रेनिंग दी है। इनमें 500 शिक्षक बिहार के हैं।

रहे हैं। छात्र भी पढ़ाई भी ध्यान देने लगे हैं। 'उत्साही फिजिक्स टीचिंग ग्रुप' के सीनियर मेंबर डॉ. राकेश कुमार सिंह इन दिनों गांवों में कैंप कर खुद के द्वारा तैयार उपकरणों के जरिए शिक्षकों को फिजिक्स पढ़ाने के तरीके बता रहे हैं।

इनमें लेजर मशीन, बरनौली थ्योरम, मोमेंट ऑफ इनर्सिया, वेब, मोशन, सीबैक इफेक्ट व फिजिक्स के जरिए कॉलेज में प्रयोगशाला में भारी भरकम मशीन के बिना भी छोटे व सस्ते उपकरण से भी छात्रों को साइंस का प्रयोग दिखाया जा सकता है। इससे छात्रों व शिक्षकों में साइंस के प्रति रुचि जागृत होगी। इससे बिहार में भी प्योर साइंस डेवलप होगा व युवा वैज्ञानिक की तादाद में बढ़ोतरी होगी। इन युवा वैज्ञानिकों की मदद से भविष्य में बिहार एवं देश में मॉडर्न टेक्नोलॉजी का तीव्र विकास

20 Dec 2011, Mohania, Kamur, Sasaram, Bihar

ग्रामीण इलाकों से वैज्ञानिक निकालने की पहल

मोहनिया | एक संवाददाता

साईंस के बच्चों को कोचिंग संस्थानों के आक्रामक बाजारवाद से बचाने एवं उन्हें शोध तथा निर्माण आधारित साईंटिफिक सोच विकसित करने के उद्देश्य से स्थानीय एमपी कालेज में फिजिक्स की कार्यशाला आयोजित हुई। ग्रामीण क्षेत्र के कालेज में पहली बार इस तरह की कार्यशाला में इंटर, स्नातक एवं पीजी के छात्रों ने वेस्टेड मैटेरियल से फिजिक्स की प्रयोगशाला बनाने की जानकारी देश के जाने-माने वैज्ञानिकों से हासिल की।

आईआईटी कानपुर में फिजिक्स के प्रोफेसर डा. एचसी वर्मा द्वारा गठित उत्साही फिजिक्स टीचर्स ग्रुप के सीनियर रिसोर्स पर्सन एवं पटना वीमेंस कालेज के प्रोफेसर डा. राकेश कुमार सिंह ने फिजिक्स के कठिन सिद्धांतों को दैनिक जीवन में उपयोग आने वाली वस्तुओं से प्रायोगिक प्रदर्शन कर समझाया। गुरूत्वाकर्षण ध्वनि तरंग, विद्युत चुम्बकीय तरंग एवं प्रकाश के सिद्धांतों को आसान एवं रोचक ढंग से प्रदर्शित किया।

उनका कहना है कि बोतल, टूटी कलम, रस्सी, धागा आदि वस्तुओं को जिसे हम फेंक देते हैं उनकी सहायता से फिजिक्स के सिद्धांतों को समझा जा सकता है। मात्र सौ रुपये में फिजिक्स की प्रयोगशाला स्थापित की जा सकती है। चार घंटे तक चली कार्यशाला में बीएचयू एवं सासाराम के अलावा केमूर के छात्र-छात्राओं ने भाग लिया।

भारत सरकार रक्षा मंत्रालय के अधीन डीआरडीओ में वैज्ञानिक रह चुके विद्यादान इंस्टीच्यूट ऑफ टेक्नोलॉजी के चेयरमैन डा. एसके सिंह ने कार्यशाला में बताया कि आज बच्चे मैनेजमेंट एवं प्रशासनिक सेवाओं में जाने को बेचैन हैं। यदि साइंस को नेच्यूरल तरीके से सीखाया जाए तो वे वैज्ञानिक बनकर देश की सेवा कर सकते हैं। आज साइंस ग्लोबल बिजनेस बन गया है।

इसमें अपार संभावनाएं हैं। बस जरूरत है बच्चों में वैज्ञानिक प्रतिभा विकसित करने की। कार्यशाला की अध्यक्षता कालेज के प्राचार्य डा. अनिल [illegible] एवं संचालन डा. एलएस सिंह ने किया। मौके पर विज्ञान के शिक्षक डा. अभिराम सिंह, प्रो. ओपी सिंह, डा. केबी सिंह, डा. एसबी सिंह, प्रो. डीके उपाध्याय, डा. यूपी सिंह आदि मौजूद थे।

मोहनिया के एमपी कॉलेज में आयोजित कार्यशाला में फिजिक्स के सिद्धांत को समझाते युवा वैज्ञानिक व पुरस्कार से सम्मानित पटना वीमेंस कालेज के डॉ. राकेश कुमार सिंह

- **Dr. Rakesh Kr Singh, developed about 500 low cost science experiment at all levels of study, under the supervision of eminent academician Prof. H.C.Verma, IIT Kanpur. He demonstrated these experiment under various situations including classrooms/ conferences, public lecture, School and university students in different district of Bihar. Dr. Rakesh conducted more than 100 workshops with such low cost experiments, including in Rashtriya AviskarAbhiyan programme & Unnat Bharat Abhiyan -Initiative of Govt. of India.**
- **These workshops have attracted attention of students and encouraged them to ask relevant questions in science at all levels of study. Such efforts have also helped in demystifying scientific research and developing scientific thinking in students/ faculty members.**
- **Dr. Rakesh Kr Singh given training programme to almost district of Bihar students and faculty member. SCERT-Dept. of Education, Govt. of Bihar; Kilkari, Dept. of Education, Govt. of Bihar, Bihar School Examination board, Patna, Science for Society Bihar, College/Universities including IIT's, NIT's, BIT invited me to explore such low cost science teaching-learning methodologies**

National Anveshika Network of India (NANI), coordinated by Prof. H C Verma, IIT Kanpur and NANI, Patna unit coordinated by Dr. Amarendra Narayan, Dept. of Physics, Science College, Patna University and Dr. Rakesh Kr Singh of nanotechnology center(At present Registrar), Aryabhatta Knowledge University, Patna

Nanotechnology in electronic, magnetic industry to Environmental & Biological sector.

SPRINGER NATURE

J Mater Sci: Mater Electron (2021) 32:23843–23853

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

Monalisa[1], Saurabh Sharma[1], Harendra Kumar Satyapal[1,*], and Rakesh Kumar Singh[1]

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

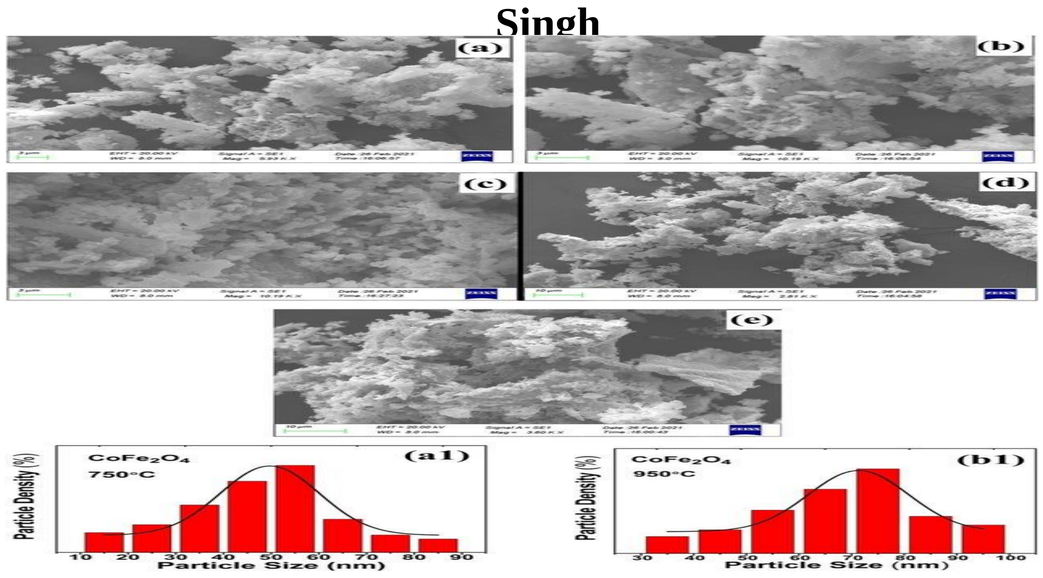
Research Team

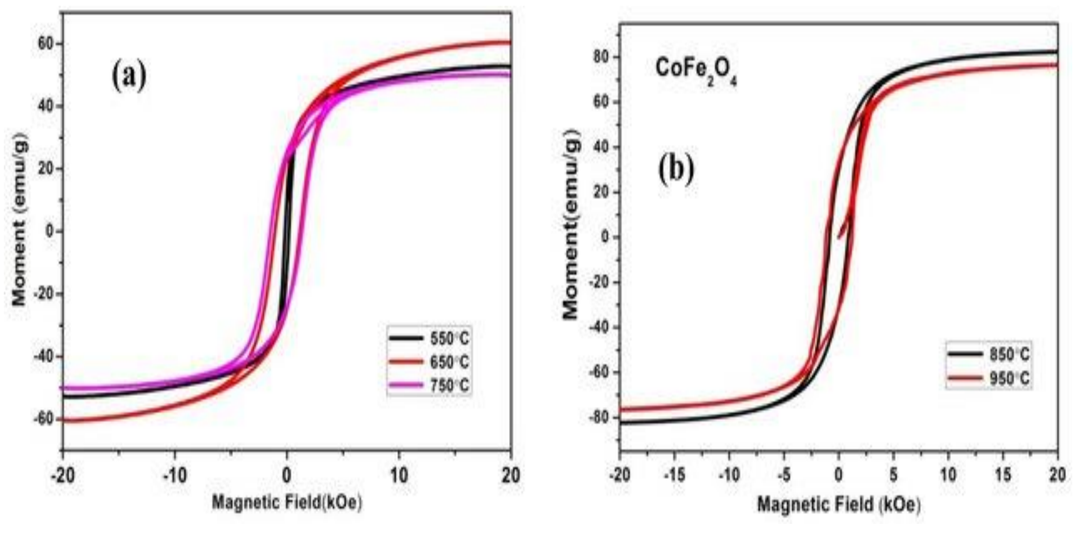
Monalisa

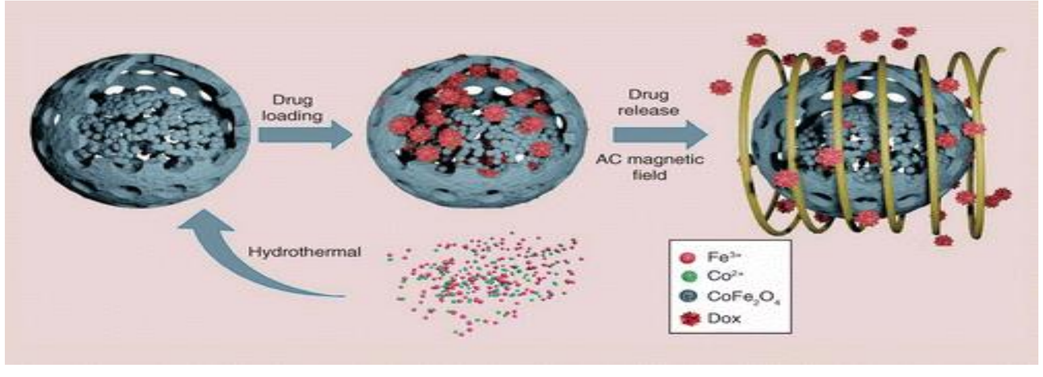
Dr. Rakesh Kumar Singh

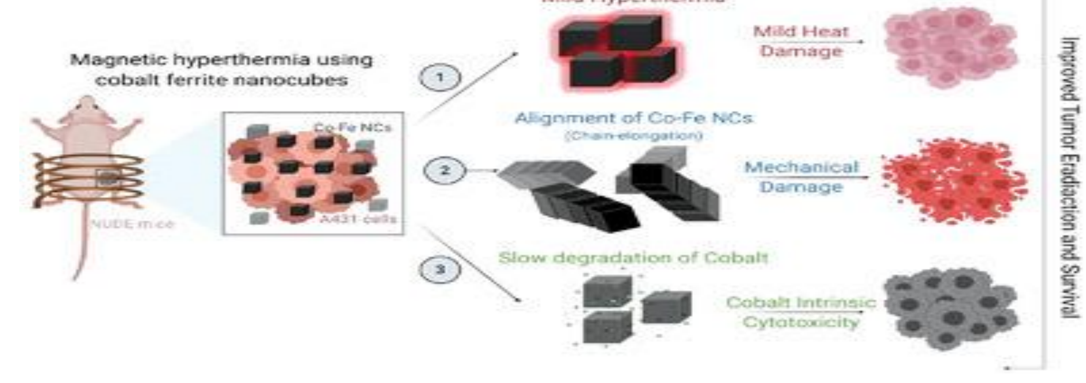
Saurabh Sharma

Harendra Kumar Satyapal









Research Summary:

• Spinel cobalt ferrite (CoFe2O4) 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 CoFe2O4 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 (Ms), anisotropy field (B1), and magnetocrystalline anisotropy (k1). These magnetic properties show improvement due to the annealing effect, with Ms ranging from 24.60 to 77.68 emu/g and retentivity (Mr) 5.12–47.08 emu/g. The coercivity (Hc) shows an appreciable increment from 175 to 1402 Gauss. The anisotropy (k1) ranges from 2.22 to 11.68 × 106 erg/cm3. These remarkable improvements in magnetic properties motivated us to explore the correlation between induced lattice strain and magnetic response of CoFe2O4 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.

Nanotechnology in electronic industry and Environmental sector.

Materials Science in Semiconductor Processing xxx (xxxx) 106632

Contents lists available at ScienceDirect

Materials Science in Semiconductor Processing

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

Structural, magnetic, optical and ferroelectric properties of Y^{3+} substituted cobalt ferrite nanomaterials prepared by a cost-effective sol-gel route

Shashank Bhushan Das, Rakesh Kumar Singh *, Vivek Kumar, Nishant Kumar, Pallavi Singh, Naman Kumar Naik

Aryabhatta Center for Nanoscience and Nanotechnology, Aryabhatta Knowledge University, Patna, 800001, Bihar, India

Published in Material Science in Semiconductor Processing

Research Team

Shashank Bhushan Das

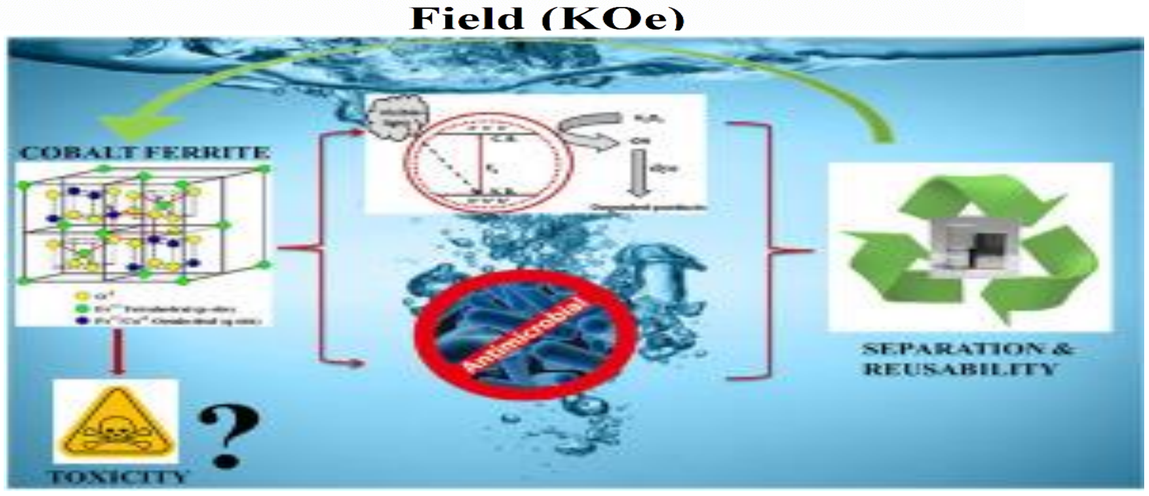
Dr. Rakesh Kumar Singh

Vivek Kumar

Nishant Kumar

Pallavi Singh

Naman Naik



Research Summary:

• Ferrite nanomaterials are known as popular magnetic materials for their applications in the electronics industry, energy storage and environmental monitoring. Yttrium substituted CoYxFe2-xO4 nanomaterials, were synthesized at 750℃ by a sol-gel process.

• The surface morphology of CoFe2O4 and CoY0.3Fe1.7O4samples 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 CoYxFe2-xO4 (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 (Hc), saturation magnetization (Ms), retentivity (Mr) 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.

Nanotechnology for Green Energy Source (Hydroelectric Cell)
Research Team

Dr. Rakesh Kumar Singh

Research Published from ACS publishing , Washington.

energy&fuels

pubs.acs.org/EF Article

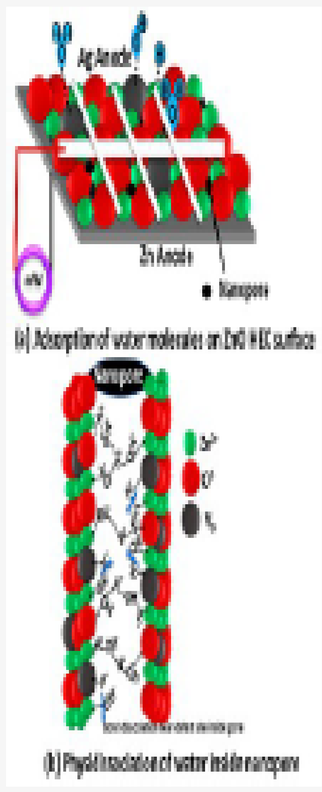
Nonphotocatalytic Water Splitting Process to Generate Green Electricity in Alkali Doped Zinc Oxide Based Hydroelectric Cell

Rekha Gupta, Jyoti Shah, Rakesh Singh, and R. K. Kotnala*

Cite This: https://doi.org/10.1021/acs.energyfuels.1c01164 Read Online

ACCESS | Metrics & More | Article Recommendations | Supporting Information

ABSTRACT: Efficient nonphotocatalytic water molecule splitting and electricity generation has been obtained from alkali (Li, Na, K) doped zinc oxide (ZnO) hydroelectric cells (HECs) at room temperature. The existence of defect centers including zinc and oxygen vacancies in pure and alkali-doped ZnO has been observed by optical spectroscopy. Broadband dielectric spectroscopy has been carried out to investigate the charge transfer mechanism in the physisorbed layer of water molecules on the surface of porous ZnO HEC. Temperature dependence of dielectric relaxation was also determined to identify the reorientation dynamics of water molecules near the defect site in ZnO. Minimum activation energy for dipolar reorientation, $E_a \sim 128.54$ kJ/mol, was calculated for the K-ZnO sample depicting easy hopping of H^+ ions near the defect site. Maximum lattice strain induced by K doping in ZnO led to faster dipolar reorientation and easy hopping of the proton over the physisorbed layer of water molecules on the cell surface. Maximum output power, $P_{out} \sim 5.71$ mW/cm^2, has been delivered by K doped ZnO HEC, which is comparable to the best achieved power density by a ZnO nanoparticle-based dye-sensitized solar cell, ~9.17 mW/cm^2. Zinc oxide based hydroelectric cells are a low cost, environmentally friendly solution for energy generation scarcity for the masses living in remote locations without the use of any harmful chemicals.



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.

Note- Dr. R K Kotnala, at present chairman of NABL-Delhi

Nanotechnology Research in food and Agriculture

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

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

Effect of superfine grinding on structural, morphological and antioxidant properties of ginger (*Zingiberofficinale*) nano crystalline food powder

Archana [a], Abhay Kr. Aman [a], Rakesh Kr. Singh [a,*], Nishant Kr. [a], Amber Jabeen [b]

[a] Aryabhatta Center for Nanoscience and Nanotechnology, School of Engineering and Technology, Aryabhatta Knowledge University, Patna, 800001, India
[b] Dept of Biotechnology, Patna University, Patna 800005, India

Journal Material Todays Proceeding (Scopus/Wos Indexed) -Elsevier

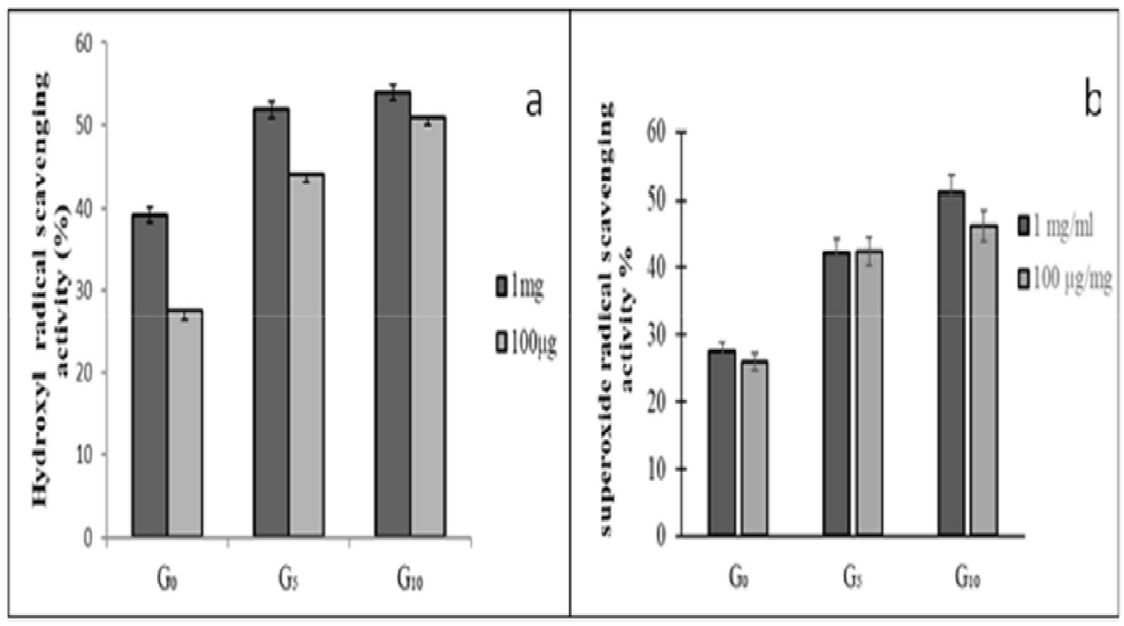
Research Team

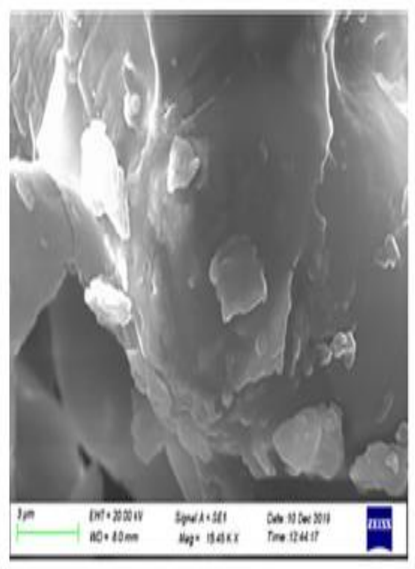
Dr. Archana

Dr. Abhay Kumar Aman

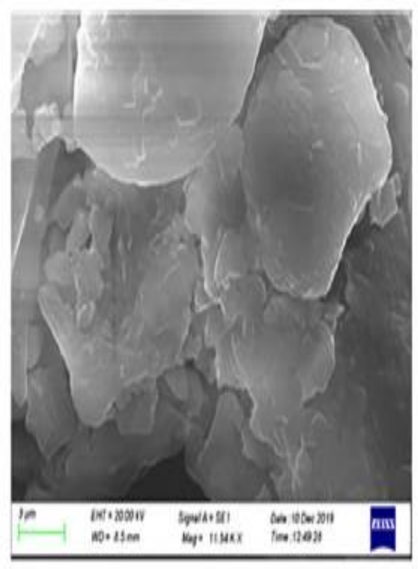
Dr. Rakesh Kumar Singh

Nishant Kumar

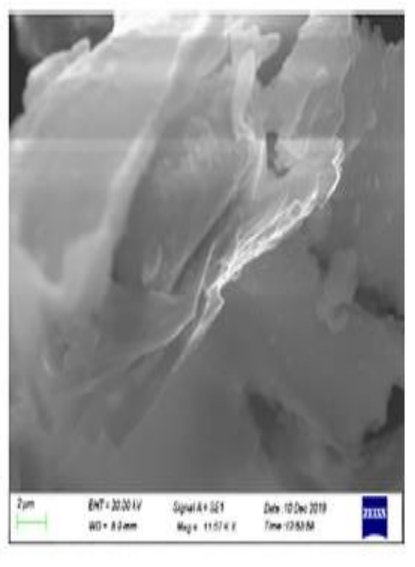




(a) G_0-powder



(b) G_{05}-powder



(c) G_{10}-powder

Novelties of Research

- Regardless of high industrial and scientific interest in the crystal structure, a thorough study of surface science and their biomedical action of superfine food powder is not very much visible. While food powders are a natural product, being used as spices, as medicines in pharmaceutical and environmental sectors at a large scale.
- The superfine ginger powder was prepared using high energy ball milling equipment The crystal structure, surface morphology, and the functional group were identified and recorded using modern scientific tools, such as X-ray diffraction (XRD), Scanning Electron Microscope (SEM), Fourier transform infrared spectroscopy (FTIR), and UV–Visible spectroscopy.
- The XRD study confirms that the crystal sizes of superfine powder are in between 1 nm and 100 nm and milling of ginger powder for 5 h and 10 h using a high energy ball mill, alters the crystal structure, surface morphology, which is different from ginger powder, which was prepared using mixture grinding. FTIR measurement shows that there is no change in the functional group due to milling for different time duration.
- The aim of the present study is to investigate the changes that occur in the physical and metabolic properties of superfine ginger powder due to milling. The present study shows that the total phenolic content (TPC), antioxidant property, and superoxide radicals scavenging of ginger powder increased due to change in a crystalline structure, surface morphology, and large surface to volume ratio.

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.

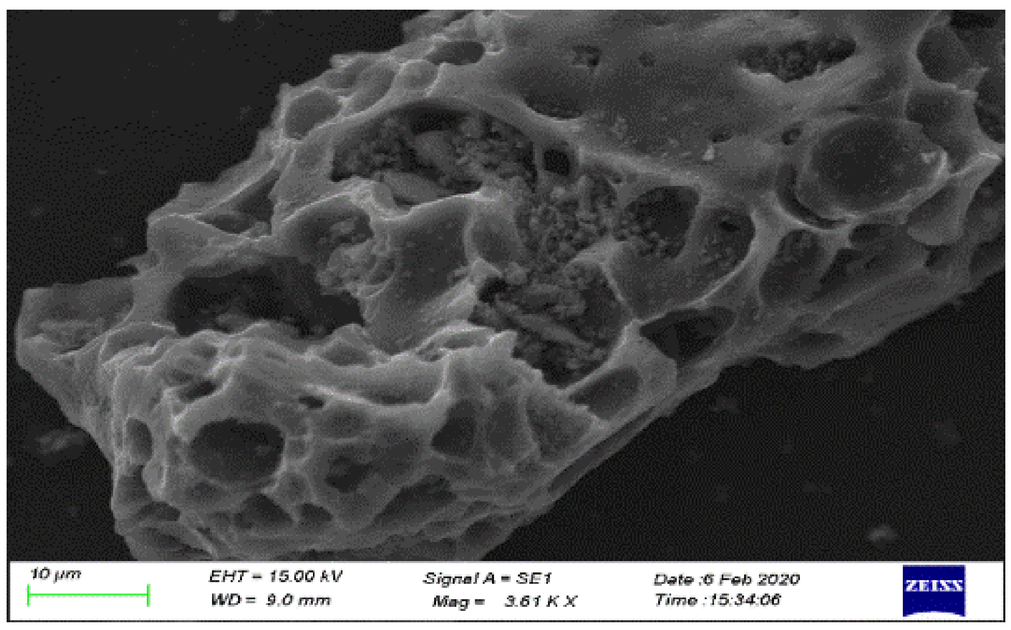
Nanotechnology in Indian Ancient wisdom.

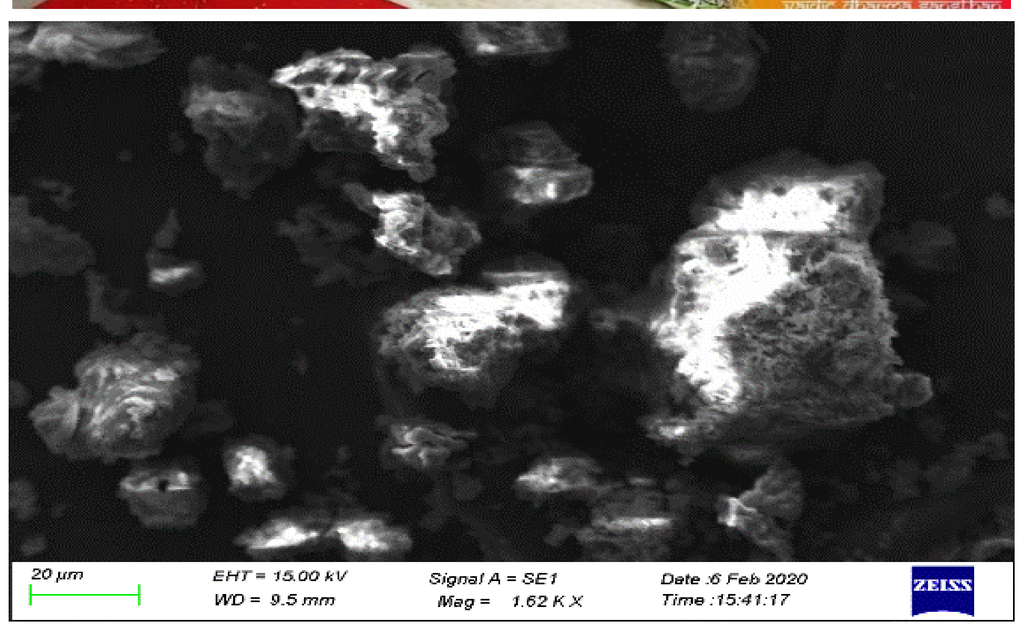
Research finding presented in International Conference in JNU, Delhi
Accepted for publication in SCI Journal

Research Title- Structural Characterization of Ash of Sri Athi Rudra Homa using Modern Scientific Tools for its Various Applications.

Research team

Dr. Rakesh Kumar Singh **Ms. Divya Kanchibhotla** **Nishant Kumar** **Prateek Hansora**





Electron microscopy image of ash of Hawan as functional nanomaterials

Novelties of Research:

• The Athi Rudra Homa(ARH) is a very rare and auspicious vaidic fire ceremony performed for universal peace, health and prosperity. As with the Agnihotra Homa, this homa too involves chanting and offering of medicinal herbs in the sacred fire, and the ash generated is considered to be very beneficial as minute size functional materials. The objective of the present research was to determine the physical properties of the ash from the ARH, including its crystal structure, surface morphology, the functional groups present, and the light emission behaviour from the ash, using state of the art technology, in order to understand its functional properties for various applications.

• X-ray diffraction and Scanning electron microscope measurement reveal that the size of pure and impure ash is tiny, less than 100nm, and hence this material falls under the category of nanomaterial. Fourier Transform Infrared Spectroscopy indicates the presence of O-H, C-H, C-Cl, C-Br, C-I, N-H functional groups. Due to its nano-crystalline nature and the presence of these functional groups, such material may be useful in agriculture as herbal fertilizer and in some other fields. PL measurement shows broad luminescence in the ultra violet and visible range.

• Due to its physical properties and specially its nanoscale size, luminescence behavior, presence of compound of Ca, N etc, this ‘holy’ ash may be found suitable for use in various areas of science and technology, with potential applications in agriculture, water purification and other sectors

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. The authors are also thankful to Art of living foundation, Banglore for providing samples and help in writing the manuscript.

Nanotechnology in agriculture
Conversion of waste into wealth and Knowledge

Materials Science and Engineering B 263 (2021) 114871

Contents lists available at ScienceDirect

Materials Science & Engineering B

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

‘Synthesis and properties of amorphous nanosilica from rice husk and its composites

Atul Jyoti [a], Rakesh Kr Singh [a,*], Nishant Kumar [a], Abhay Kr Aman [a], Manoranjan Kar [b]

[a] Aryabhatta Center for Nanoscience and Technology, Aryabhatta Knowledge University, Patna 800001, India
[b] Department of Physics, Indian Institute of Technology, Bihta, Patna 801103, India

Netherland

Research Team

Atul Jyoti

Dr. Rakesh Kumar Singh

Nishant Kumar

Dr. Manoranjan Kar

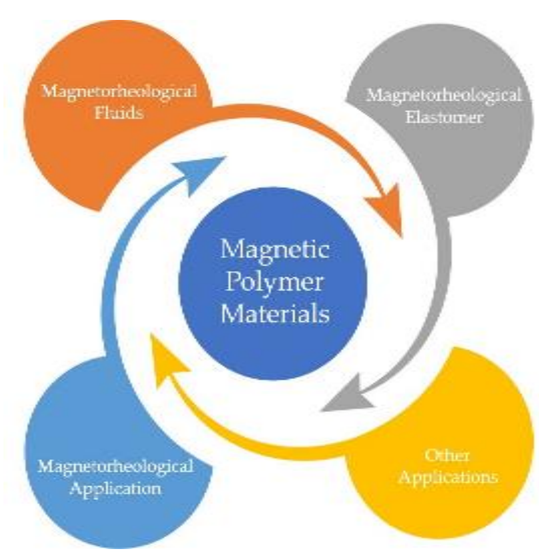
Rice Husk

Materials used in the preparation of polymer composite

Twin-screw extruder

Injection moulding machine

Polymer composite



Magnetic Polymer

Novelties of Research

- **Amorphous Nano silica (SiO_2) was prepared from Agriculture waste rice husk by a cost-effective and environment-friendly method.**
- **The particle size of SiO^2 was observed from Transmission Electron Microscopy analysis and found to be very small, which suggests the formation of amorphous Nano silica from the rice husk.**
- **FTIR spectra show the absorption peaks of Si–Oi–Si (silanol) functional group.**
- **The Nano composite of amorphous Nano silica-Ferrite-PVDF exhibits ferromagnetic nature due to the presence of ferrite in the Nano composite. The magnetic hysteresis loop of Nano composite reveals that the materials can be used as polymer magnet.**
- **The present study may help to use prepared Nano silica materials in various technological 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.

Nanotechnology for purification of water

ELSEVIER

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, 1], Rakesh Kumar Singh [a] ✉, Prabhakar Sharma [b] ✉, Ashok Ghosh [c, d] ✉

[a] Aryabhatta Centre for Nanoscience & Nanotechnology, Aryabhatta 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, Phulwarisharif, Patna, 801505, Bihar, India
[d] Bihar Pollution Control Board, Patna, 800010, Bihar, India

Published from Netherland

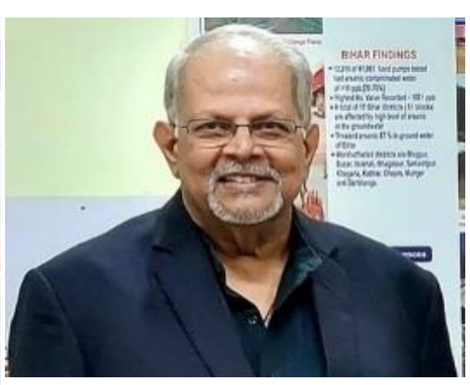
Research Team

Pushpa Kumari Sharma

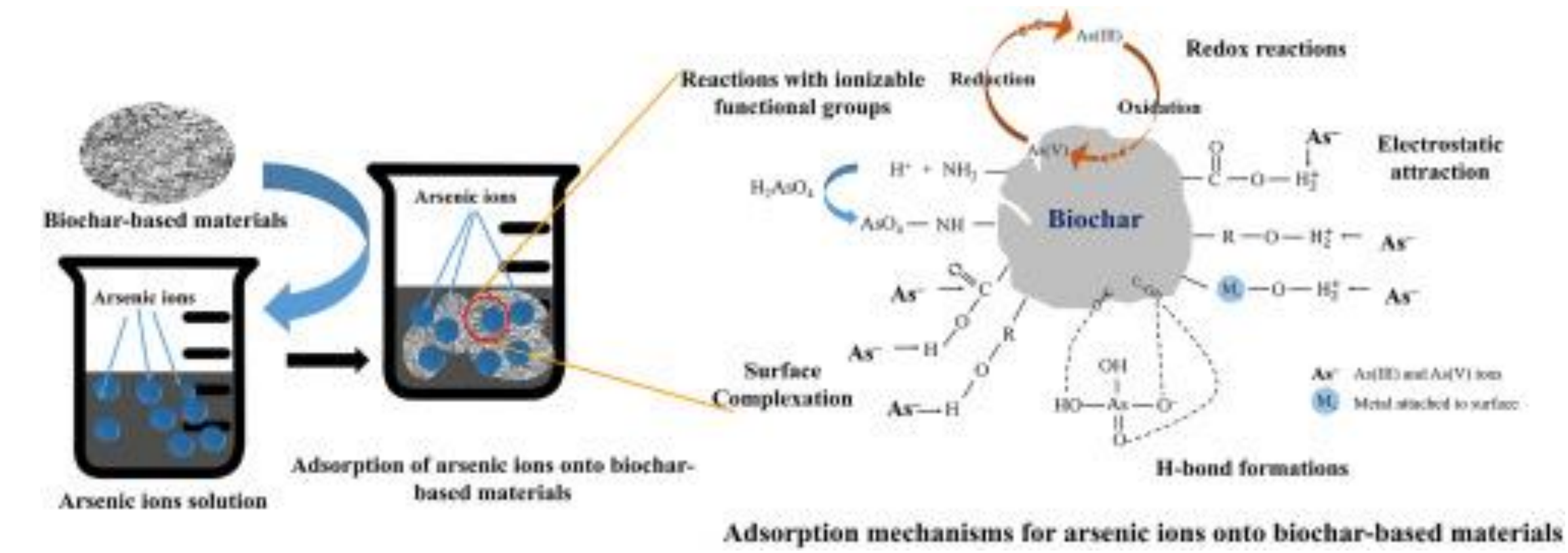
Rakesh Kumar

Dr. Rakesh Kumar Singh

Dr. Prabhakar Sharma



Prof. Ashok Ghosh



Adsorption mechanisms for arsenic ions onto biochar-based materials

Research Summary:

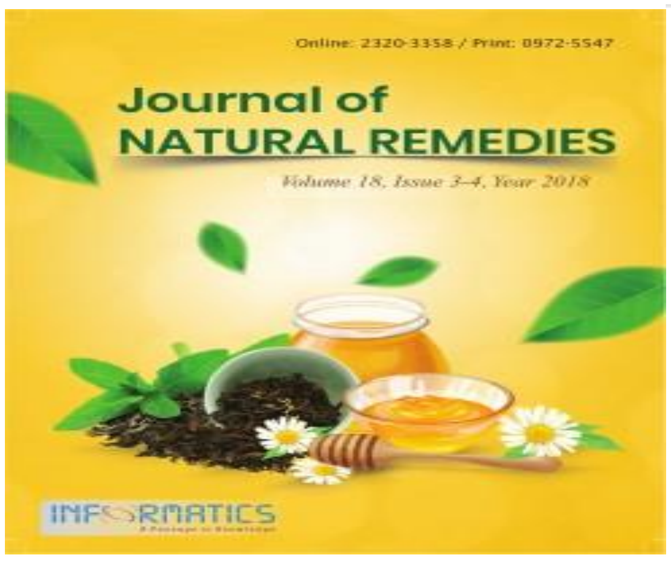
- **This review work significantly summarized the current state of knowledge for arsenic-contaminated water treatment.**
- **Firstly, this paper insight a brief understanding of arsenic speciation, toxicity, and accumulation in the food chain, and secondly, explains the adsorption techniques for as remediation 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 Aryabhatta Knowledge University, Patna for frontiers research establishment, support and functioning of the Nanoscience and Nanotechnology center.

Nanotechnology in Ayurveda Science.

Research finding on Animal Origin Calcium based Shankh Bhasma as Nanomedicine



JOURNAL OF NATURAL REMEDIES
DOI: 10.18311/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 Sinha[1], Rakesh Kr. Singh[1*], Nishant Kumar[1], Subhash Pd. Singh[2], Prabhat Kr. Dwivedi[1] and Rekha Kumari[3]

[1]Aryabhatta Centre for Nano Science and Nanotechnology, School of Engineering and Technology, Aryabhatta Knowledge University, Patna – 800001, Bihar, India; rakeshsinghpu@gmail.com
[2]Department of Chemistry, AN College, Patna, Patliputra University, Patna – 800001, Bihar, India
[3]Department of Zoology, AN College, Patna and Department of Education, Govt. of Bihar, Patna – 800001, Bihar, India

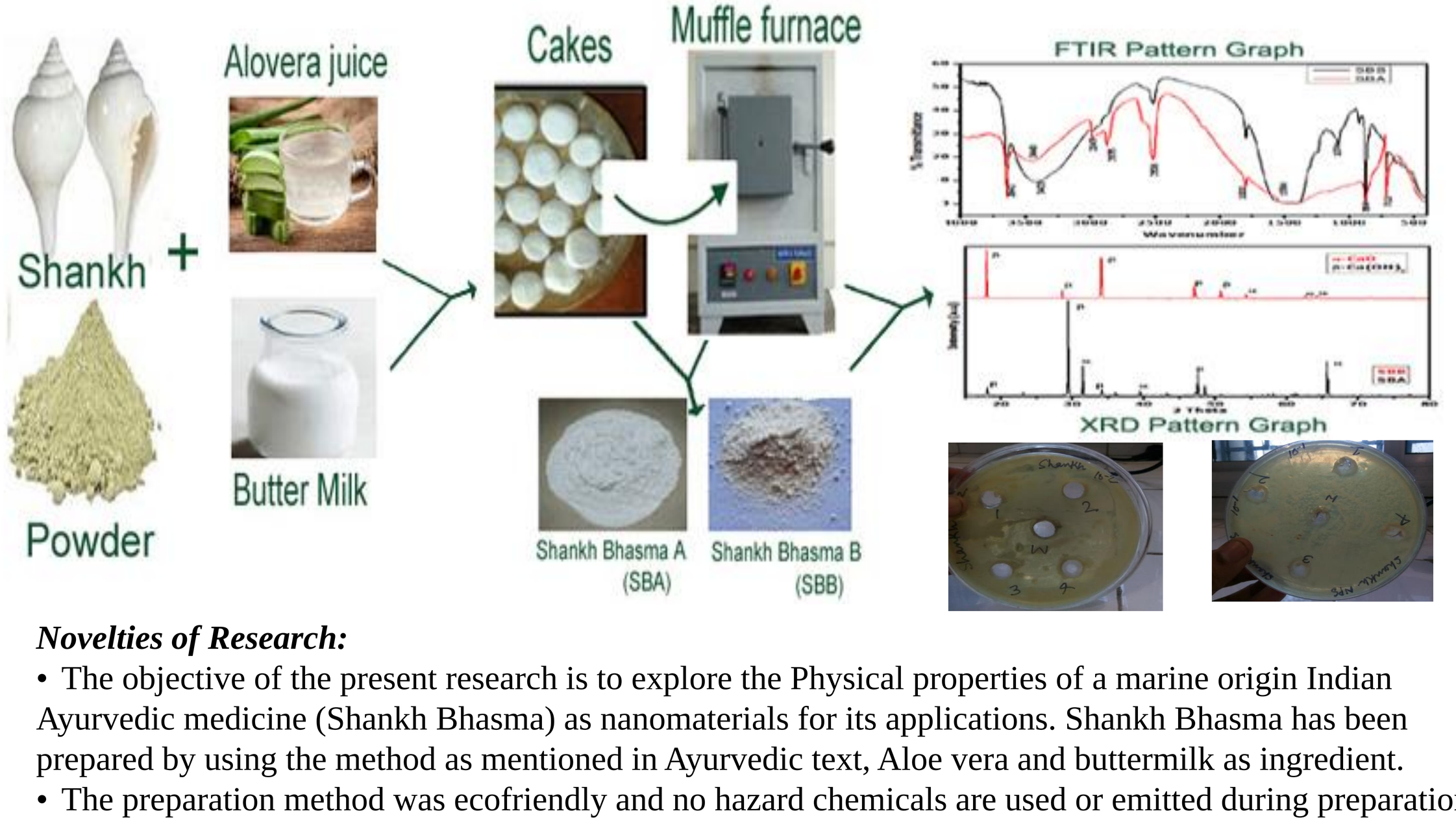
Dr, Sweta Sinha

Dr, Rakesh Kumar Singh

Prof, Rekha Kumari

Prof. 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.

Nanotechnology research as electronics to Nanomedice.

SPRINGER 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 Kumar[1] · Rakesh Kumar Singh[1] · Vivek Kumar[1] · Shashank Bhushan Das[1] · Gufran Ahmed[2] · Shyam Narayan[2] · Rekha Kumari[3]

Research Team

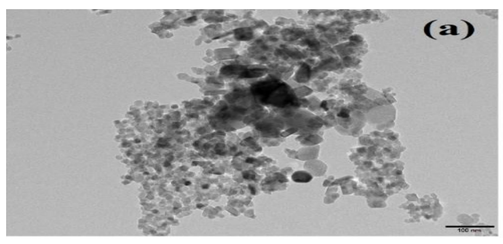
Nishant Kumar

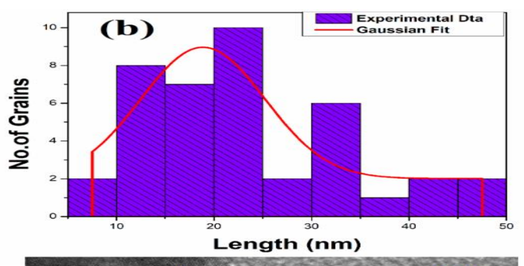
Dr. Rakesh Kumar Singh

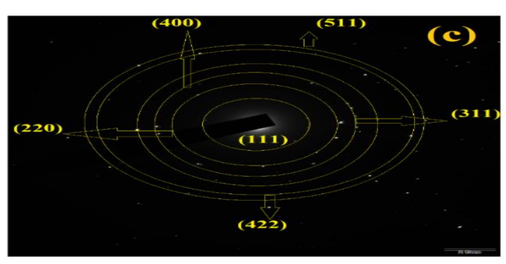
Prof. Rekha Kumari

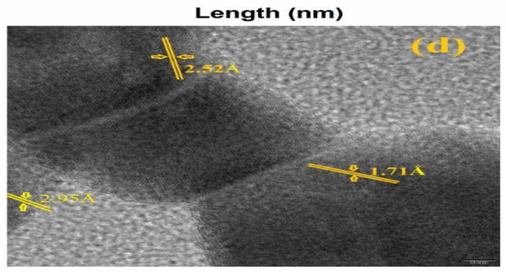
Vivek Kumar

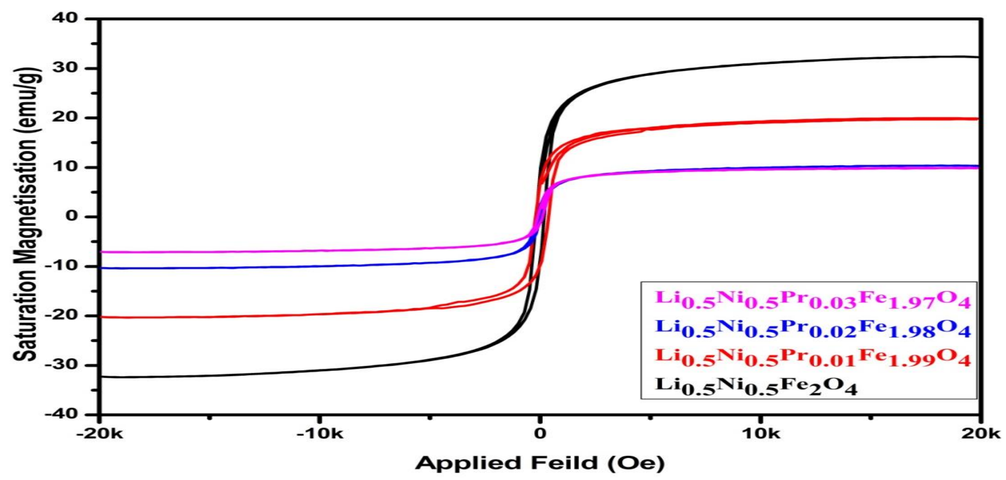
Shashank Bhushan Das

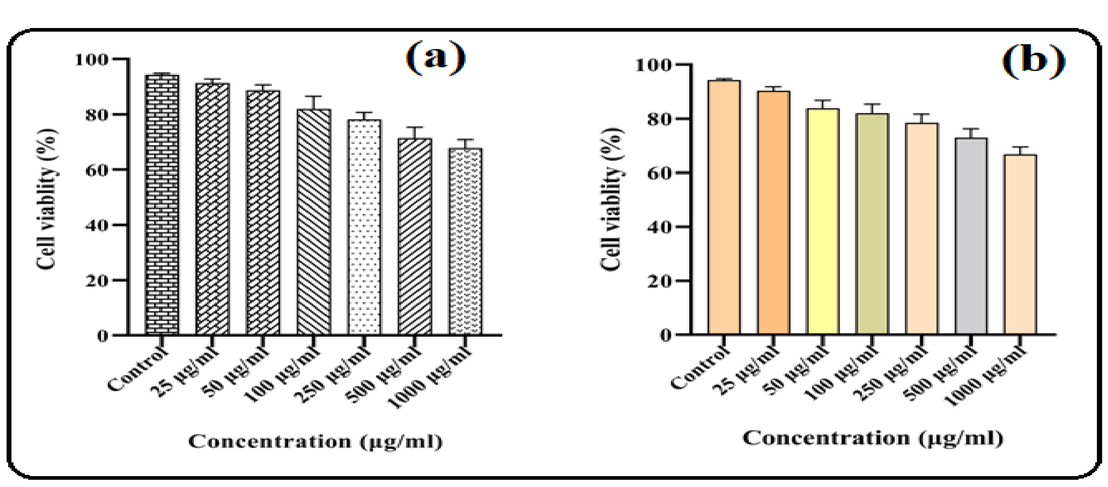


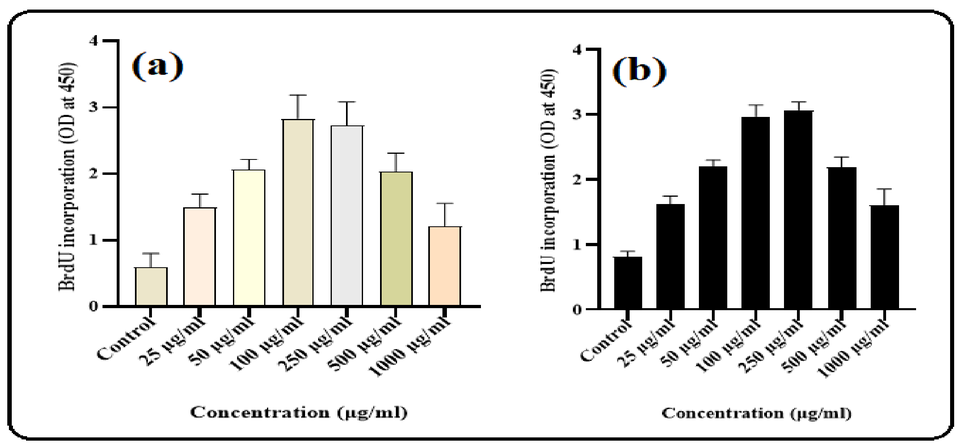












Research Highlights

- $Li_{0.5}Ni_{0.5}Pr_xFe_{2-x}O_4$ (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 $Li_{0.5}Ni_{0.5}Pr_xFe_{2-x}O_4$ ferrites.
- The coercivity was estimated in between 185.24–98.78Oe 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.

ELSEVIER
United Kingdom

Materials Today: Proceedings 49 (2022) 1664–1669

Contents lists available at ScienceDirect

Materials Today: Proceedings

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

Low temperature synthesis and influence of Ce^{3+} substitution on structural and magnetic properties of nanocrystalline cobalt ferrite using citrate precursor sol-gel method

Gaurav Kumar, Rakesh Kumar Singh, Singh Sonu Kumar, Uday Shankar et al

Gaurav Kumar

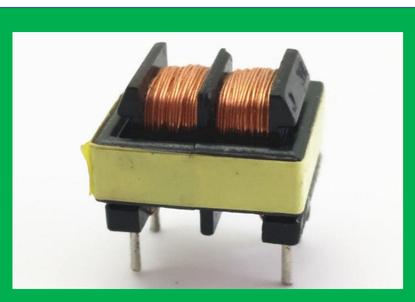
Dr. Rakesh Kumar Singh

Singh Sonu Kumar

APPLICATION OF PREPARED NANO MATERIALS(IMAGE SOURCES:GOOGLE)

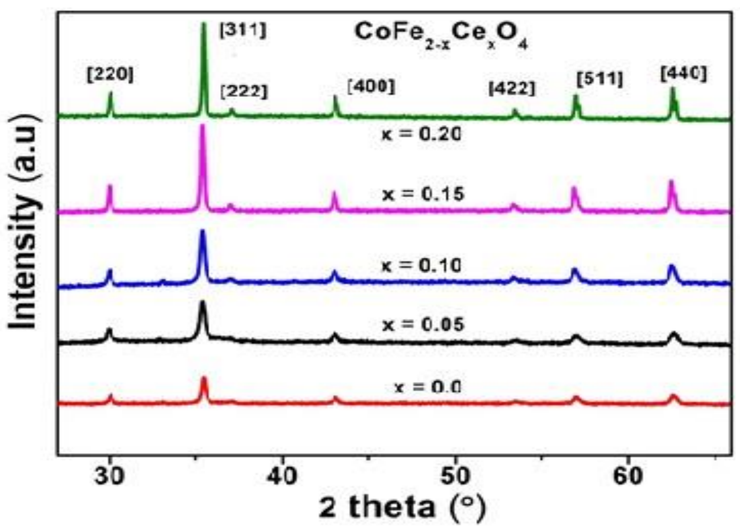
PREPARED FERRITE NANOMATERIALS IN LAB

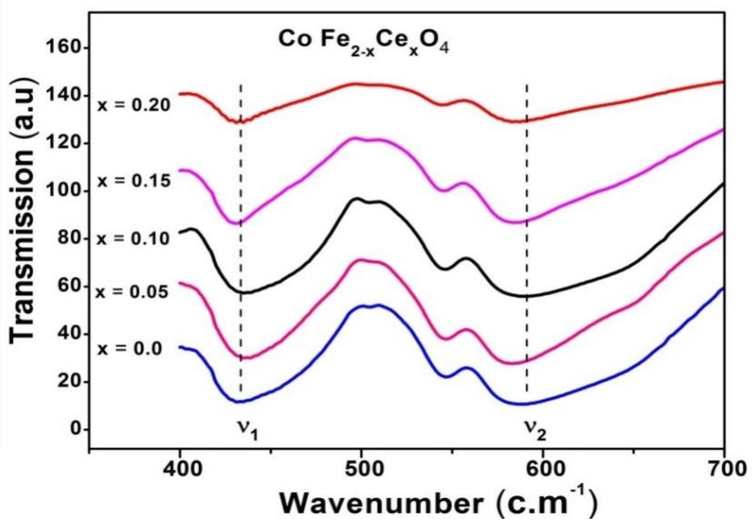
BIO-SENSORS



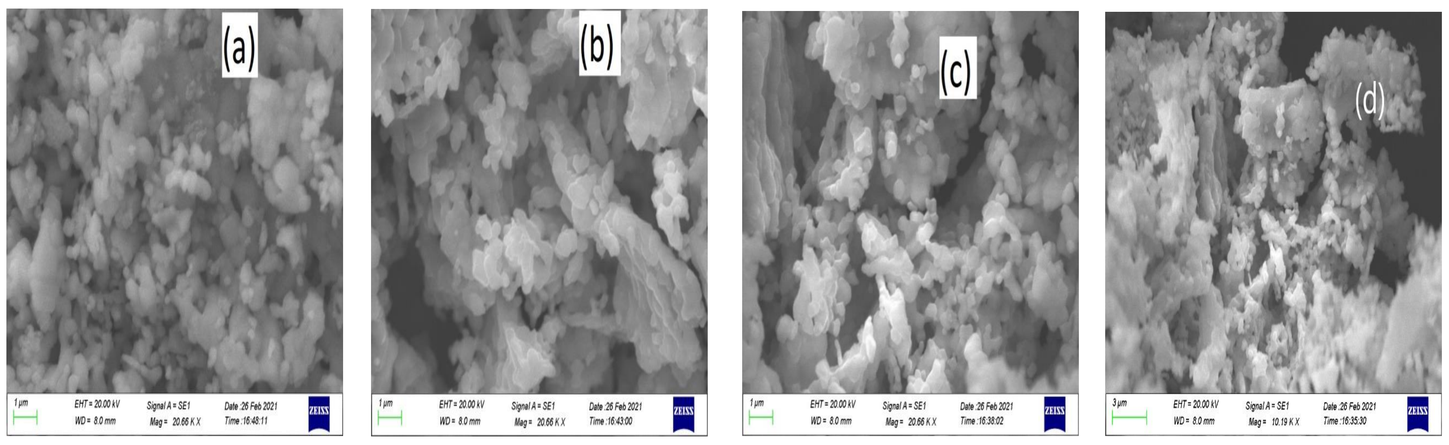
Electrical And Electronics Materials

STRUCTURAL MEASUREMENTS



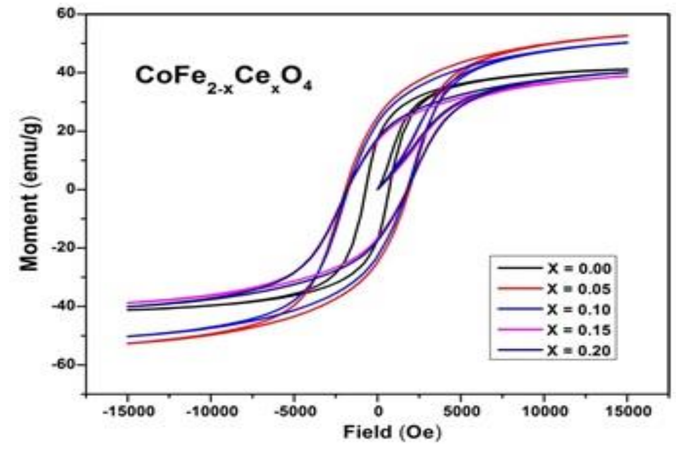


FTIR SPECTRUM

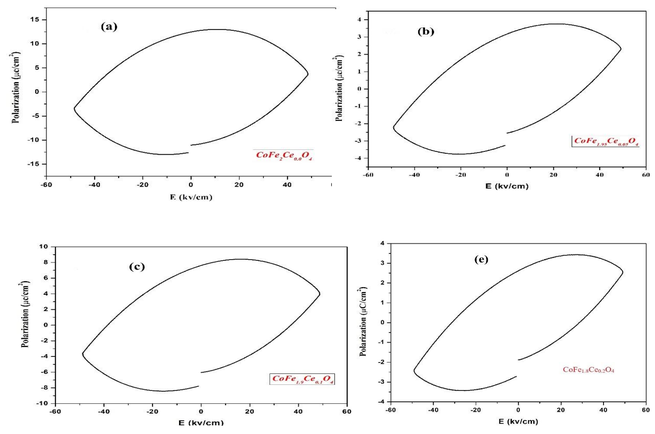


SEM ANALYSIS

MAGNETIC MEASUREMENTS



HYSTERESIS LOOP



FERRO ELECTRIC LOOP

STRUCTURAL PROPERTIES

$CoFe_{2-x}Ce_xO_4$	Crystallite size (nm)	a=b=c(Å)	cell volume(Å³)
x= 0.0	48.89	8.314	574.685
x= 0.05	52.71	8.319	575.722
x= 0.10	54.06	8.322	576.345
x= 0.15	56.98	8.325	576.969
x= 0.20	62.20	8.327	577.385

MAGNETIC PROPERTIES

S.N.	$CoFe_{2-x}Ce_xO_4$	Coercive Polarisation (Ec) (KV/cm)	Remanent Polarisation(Pr) ($\mu C/cm^2$)
1	X = 0.0	42.00	1.25
2	X = 0.05	24.19	5.51
3	X = 0.10	36.87	7.62
4	X = 0.15	38.97	14.72
5	**X = 0.20**	**28.63**	**26.19**

Acknowledgemer

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.

Nanotechnology in ancient wisdom/Ayurveda

ICAPSM 2021 IOP Publishing
Journal of Physics: Conference Series **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 Kumar [1], Shambhu Nath Guha [2], Rakesh Kr. Singh [3]*, Jitendra Kr Singh[5], Dineshwar Prasad[4], Shashank Bhushan Das[3], Nishant Kumar[3]

Research Team

Dr. Dinesh Kr

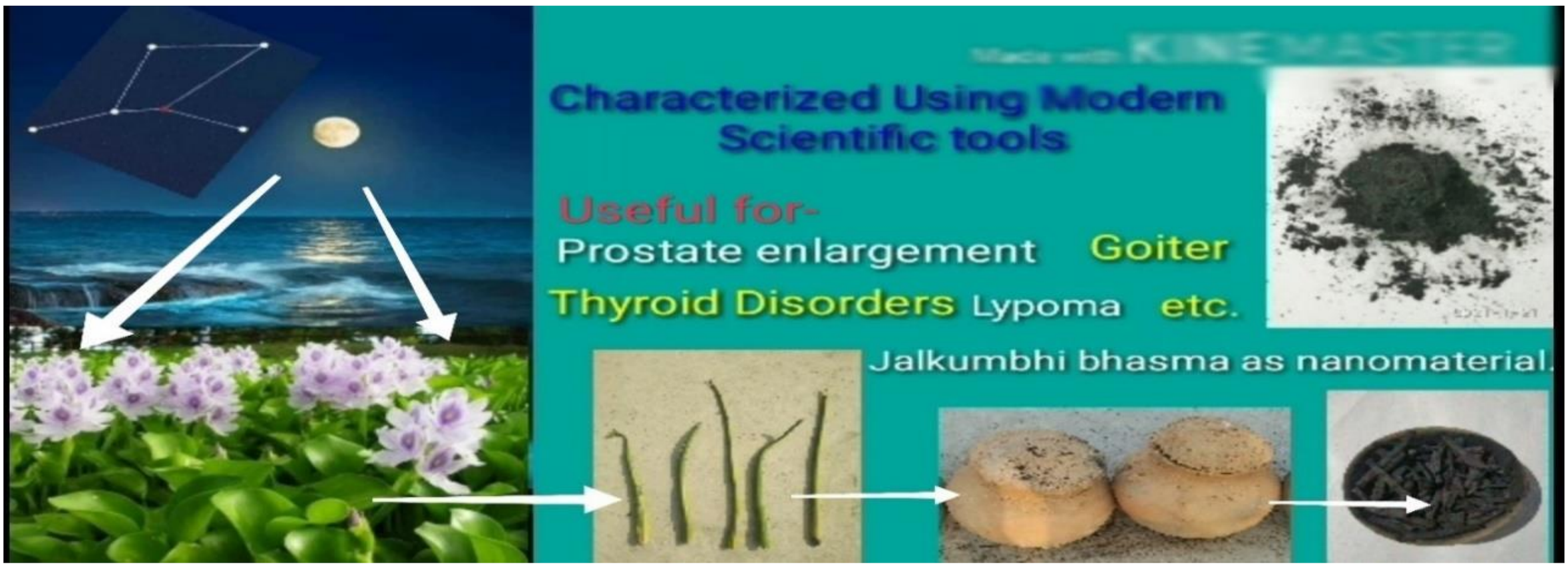
Dr. Rakesh Kr Singh

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 diffaraction 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.

IOP Conference Series: Materials Science and Engineering

IOP Publishing

Published from United Kingdom

PAPER • OPEN ACCESS

Investigating structural, magnetic and multiferroic properties of gadolinium substituted strontium hexaferrite ($SrFe_{12-x}Gd_xO_{19}$)

Singh S Kumar[1], Rakesh K Singh[1,*], Aniket Manash[1], Gaurav Kumar[1],

Singh Sonu Kumar

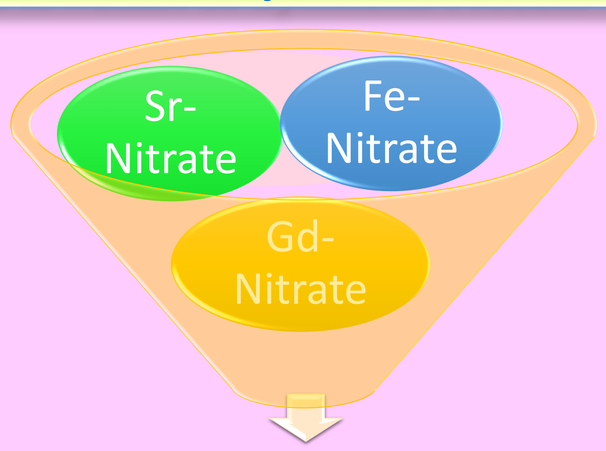
Dr. Rakesh Kumar Singh

Aniket Manash

Gaurav Kumar

Nanomaterials for Electronics and Environmental applications

Flowchart of Synthesis Process



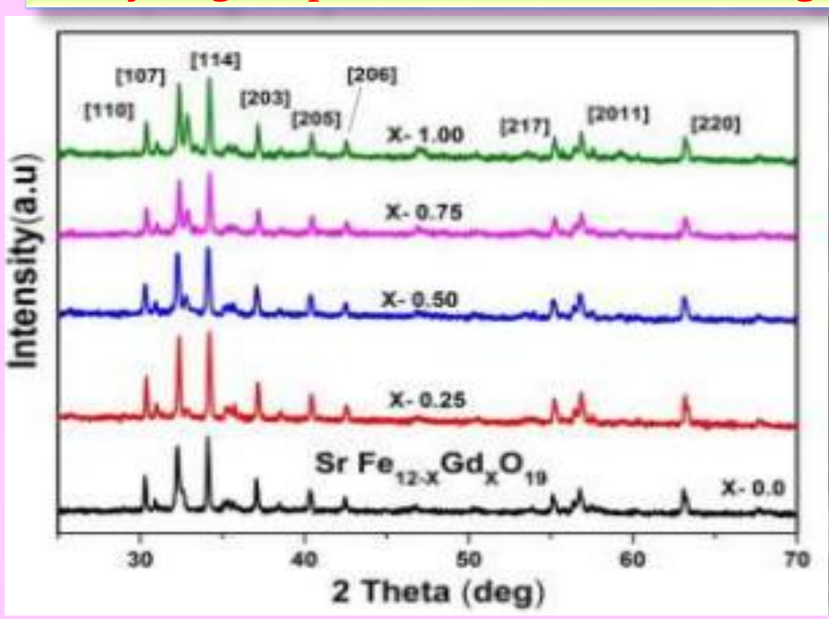
Weighed in Stoichiometric ratio

DI Water

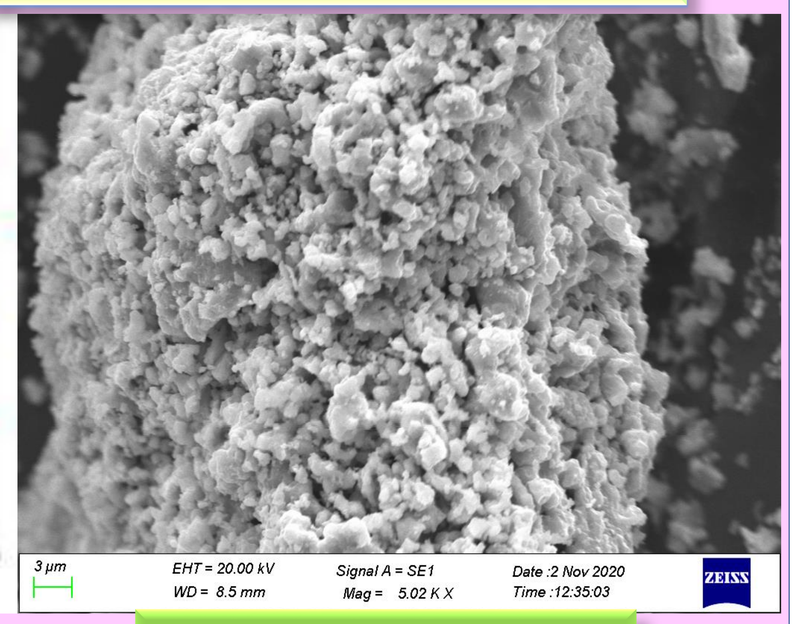
Followed by Gel Conversion and Burning

Prepared Nanomaterials

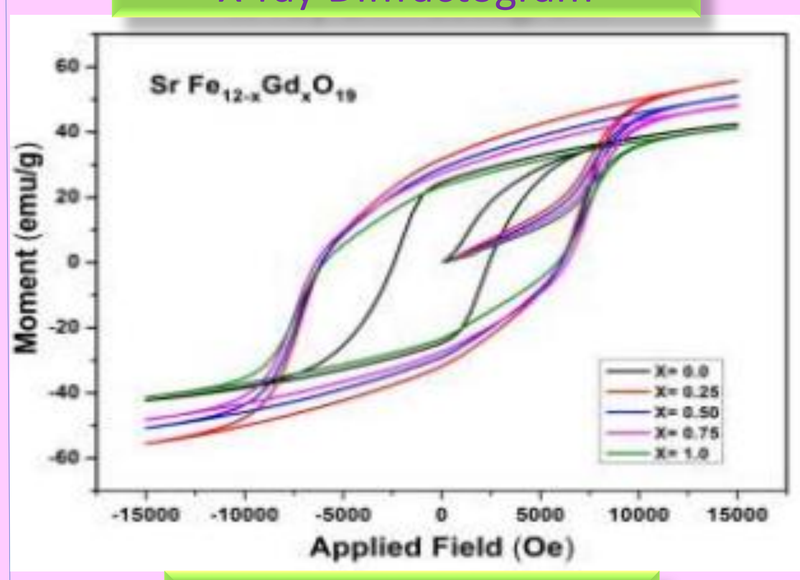
Analyzing Prepared Nanomaterials using Different Characterization tools



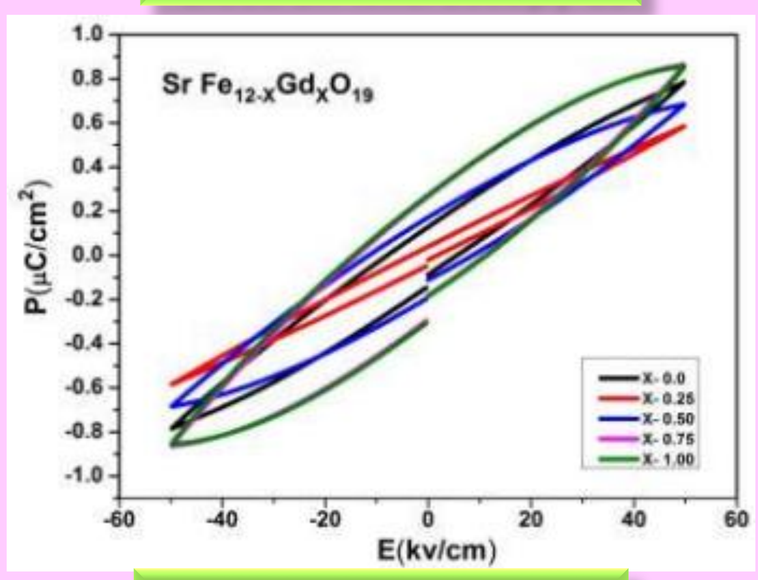
X-ray Diffractogram



Electron Microscopy es

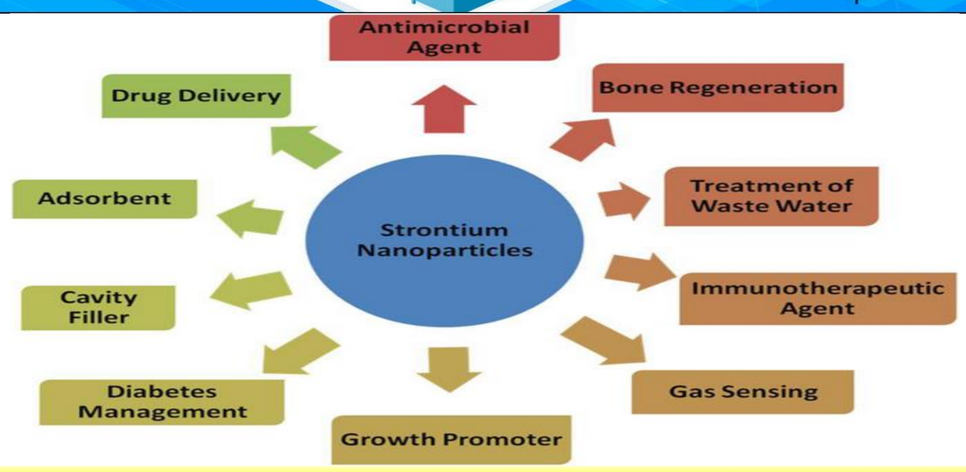


Magnetization Curves



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 SrFe12- xGdxO19 for x = (0.25 - 1.00).
- The particle size and crystal strain in samples amplified with an increasing Gd3+ content in lattice.
- The coercive field of order 6310 Gauss is recorded for SrFe12O19 doped with 0.75 mole Gd.
- Also, occupancy of Gd3+ ions in SrFe12-xGdxO19 crystals successfully enhanced electrical polarization by prohibiting electrical leakages.
- . These tuned physical properties of SrFe12O19, due to lattice strain mediated by Gd3+ 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.

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 Kumar[1] · Rakesh Kumar Singh[1] · Aniket Manash[1]

Received: 15 July 2021 / Accepted: 2 September 2021

Singh Sonu Kumar

Dr. Rakesh Kumar Singh

Aniket Manash

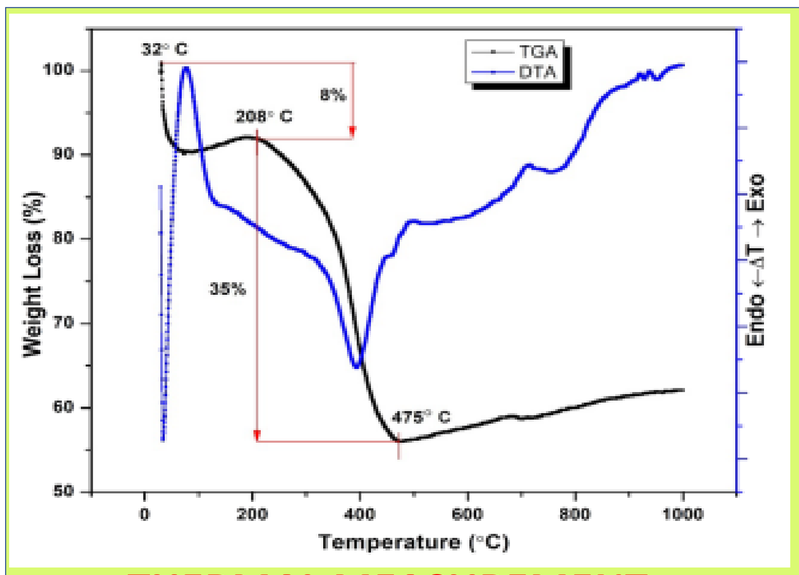
Weighing of Nitrate Salts

Mixing of Solute

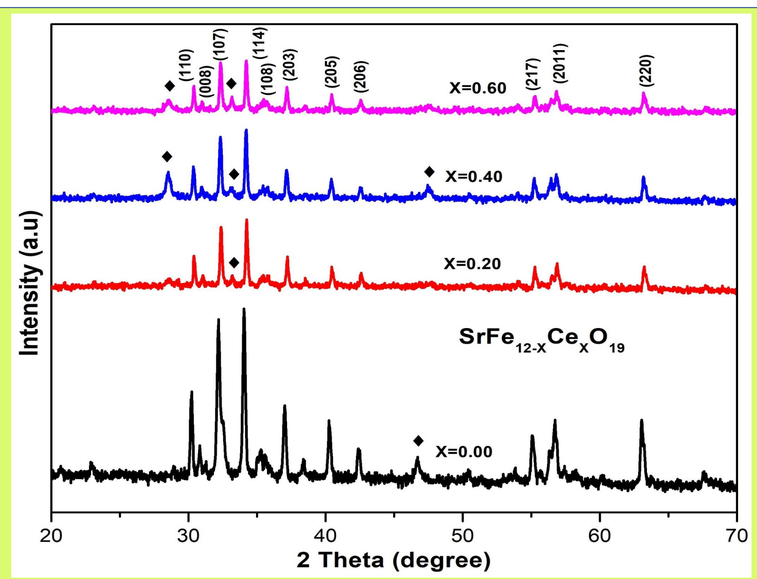
Gel Conversion on Magnetic Stirrer

Ferrite Tree

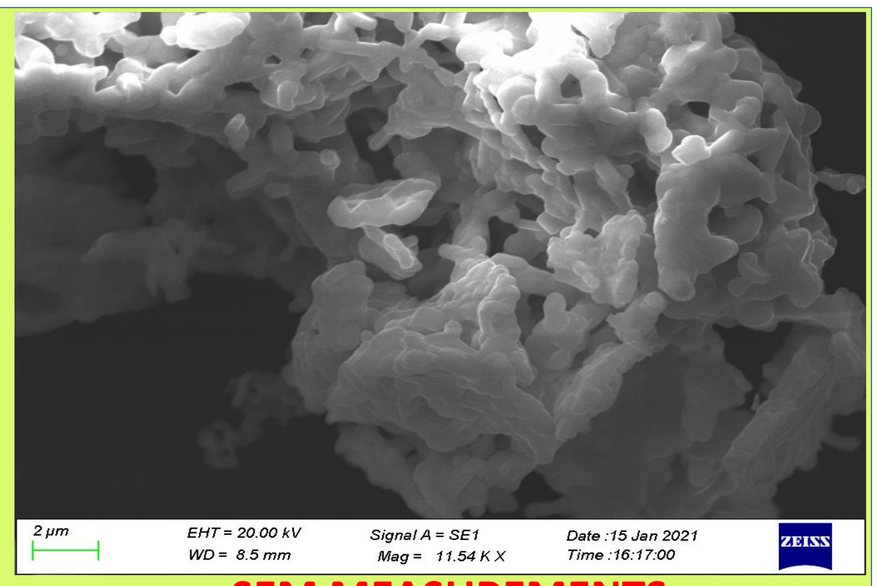
Flowchart of Preparation of Ferrite Magnetic Materials Tree in the Lab



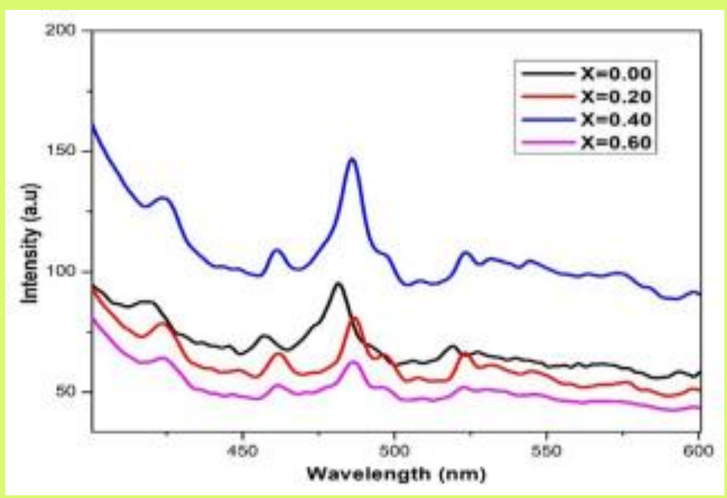
THERMAL MEASUREMENT



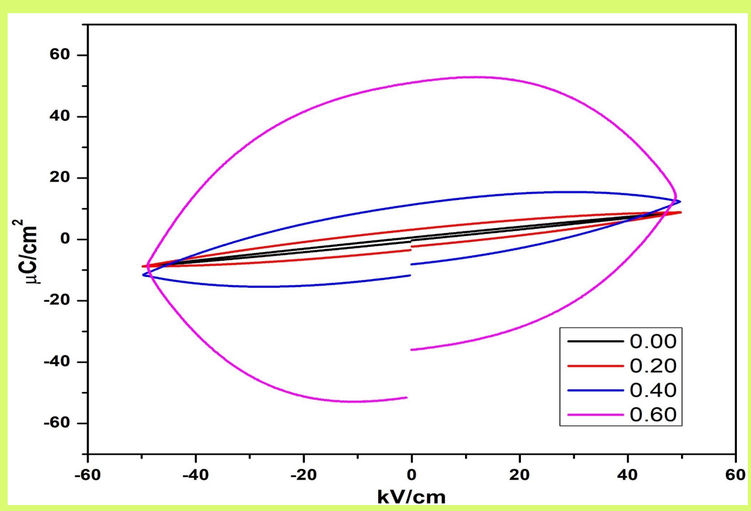
XRD MEASUREMENTS



SEM MEASUREMENTS



MAGNETIC MEASUREMENTS



PE- LOOP

Potential Application

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 $SrFe_{12-X}Ce_XO_{19}$ 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 $SrFe_{12-X}Ce_XO_{19}$ 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.

Nanotechnology in electronic industry and biomedical sector.

Studies on the structural properties and band gap engineering of Ag+ modified MgFe2O4 nanomaterials prepared by low-cost sol-gel method for multifunctional application

Published in Journal of Superconductivity & Novel magnetism

Research Team

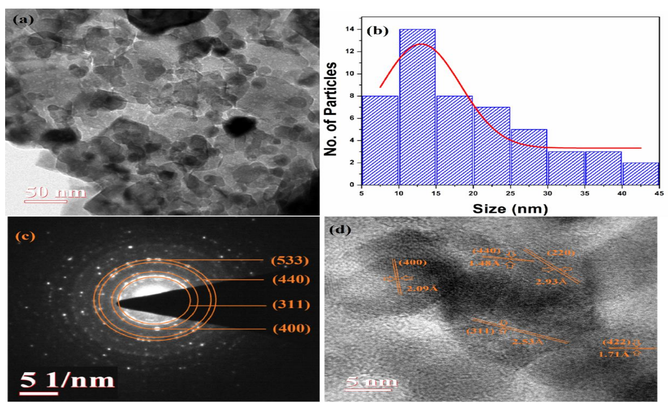
Uday Shankar

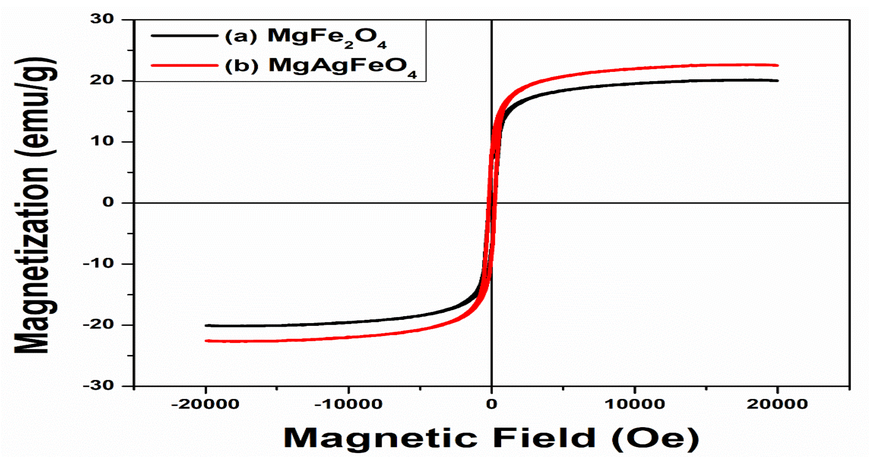
Dr. Rakesh Kumar Singh

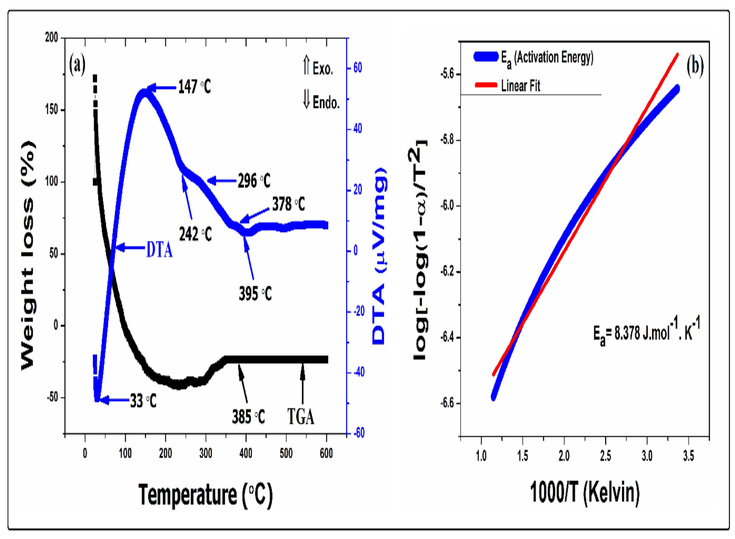
Shashank Bhushan Das

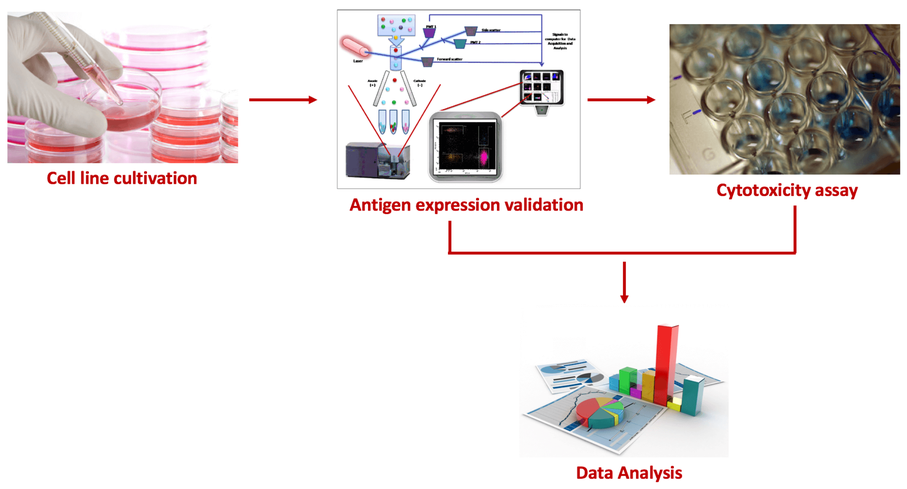
Vivek Kumar

Nishant Kumar









Research Summary:

• Ag+ substituted MgFe2O4 nanomaterials were successfully prepared by a citrate precursor method at 550°C for 2 hrs. The TG-DTA confirmed the annealing temperature beyond 400°C to get crystalline phase

• The SEM micrographs have shown porous structures in the prepared samples, which decreased with the increase in Ag+ content. The existence of metal oxide bonds between 423 and 571 cm-1 points towards spinel phase of MgFe2O4 by FTIR

• 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 MgFe2O4 and MgAgFeO4, respectively by HRTEM.

• Magnetic measurements revealed that the coercivity (Hc) decreased, but saturation magnetization (Ms) and retentivity (Mr) 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.

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.