

Work done through online mode(though mail, whatsapp and E-Containts) and progress during Lock down (Till 21st April 2020)
Center for Nanoscience and Nanotechnology
Aryabhatta Knowledge University, Patna

Report by –**Dr. Rakesh Kumar Singh**
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(A). Details of Research Publications of M.Tech /Ph.D. scholar work with AKU affiliation are mentioned following. The M.Tech/Ph.D. scholar are in close contact through mail/What's app group/ mobile during lockdown. Average 2hr per academic session (total average 7 hr per day) time are being devoted of different affairs of academics of Ph.D. academic session 2018-21, M.Tech 2018-20 & 2019-21, students.

1. Research Paper reported and accepted for publication in Materials Today Proceeding- Elsevier An International Peer review Journal (Scopus indexed)

Title of the paper- Calcium oxide(CaO) Nanomaterial (KukutandatwakBhasma) from Egg shell: Green Synthesis, Physical Properties and Antimicrobial behaviour.

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Highlight of Research-

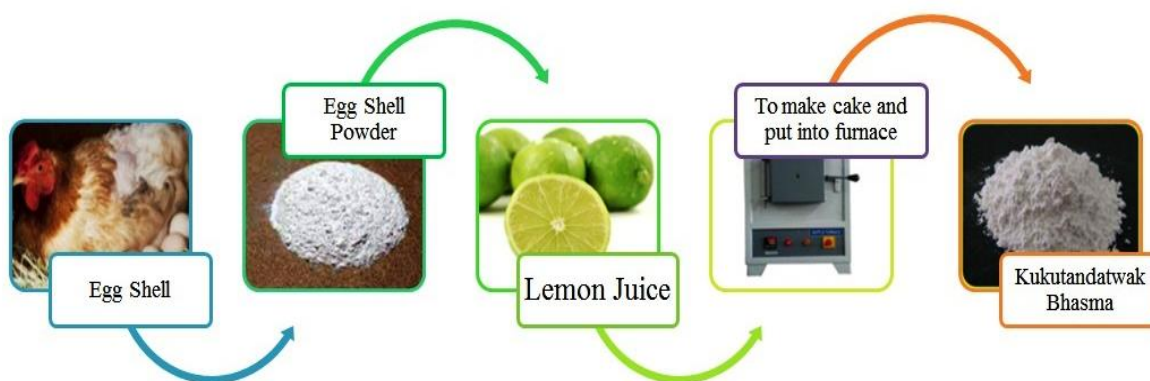


Figure 1- Green Synthesis process of Kukutandatwak Bhasma(CaONanomaterials)

- Calcium based Indian origin Ayurvedic medicine – Kukkutandatawak Bhasma(**KB**) prepared using low cost ecofriendly approach from Hen’s egg shell. Lemon juice was used as important ingredient in preparation.
- Physical properties using modern state of the art techniques such as XRD powder diffraction(XRD), Fourier Transform infra-red spectroscopy (FTIR) and Scanning Electron Microscopy (SEM) reveals that the kukkutandatawak Bhasma consist of Ca based oxidenanocrystalline materials. Total 4 calcinations cycle required to convert egg shell powder into superfine powder as nanometric scale.
- The Vibrating sample magnetometer(VSM) shows ferromagnetic behaviour at room temperature. XRD analysis determined its size 43nm. Antimicrobial evaluation revealed that Kukutandatwak Bhasma as as nanomedicine is effective antifungal agent than antibacterial.

2. Comments of reviewers submitted and accepted for publication in Journal of Materials- Materials in Electronics, Elsevier (SCI journal)

Title of research- Structural, Optical and Magnetic properties of non Stoichiometric Lithium substituted Magnesium ferrite nanoparticles for multifunctional applications.

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Highlight of research-

- In the present research article, structural, optical and magnetic properties along with Curie temperature of lithium substituted magnesium ferrite nanoparticles, $Mg_{0.5+x}Li_{1-2x}Fe_2O_4$ ($0 \leq x \leq 0.35$) have been reported.
- The nanomaterial was prepared successfully using chemical based Citrate precursor sol-gel method and annealed at $550^\circ C$. The X-ray diffraction (XRD) analysis of the prepared nanomaterials confirms the formation of cubic spinal structure.
- The W-H plots were used to calculate crystal structure and lattice strain. The crystallite size was found to be 24 nm, 78 nm and 50 nm respectively for three composition. The lattice strain was found to decrease and lattice constant was found to increase as the molar concentration of Li ion increases. The EDS measurements confirmed the presence of Mg, Fe and Oxygen. Functional group was measured using FTIR in the range of

wave number 1000-400 cm^{-1} which confirms spinel structure. SEM are used for grain size determination with surface morphology analysis and found agglomerated nanocrystalline of different size.

- The optical properties were measured using UV/VIS/NIR and PL spectrometer. The energy band gap was found 2.5 eV, 1.98 eV and 2.41eV respectively for the three prepared nanomaterials. While enhancement in Photoluminescence spectra measured using Photoluminescence spectrometer(PL) observed with decrease in lithium concentration. The magnetic parameter like saturation magnetization(, coercivity and anisotropic constants were found to be increasing with the decrease in lithium ion concentration
- This non-stoichiometric structure was observed to affects the Curie temperature from 479°C to 454°C which opens provides the possibility of this nanomaterials for broad range of applications in memory devices, isolators, circulator etc.

3. Paper reported and accepted for publication in Materials Today Proceeding-An International Journal, Elsevier (Scopus indexed)

Title of the research -Effect of superfine grinding on Structural, Morphological and Antioxidant properties of Ginger (*Zingiber officinale*) Nano powder

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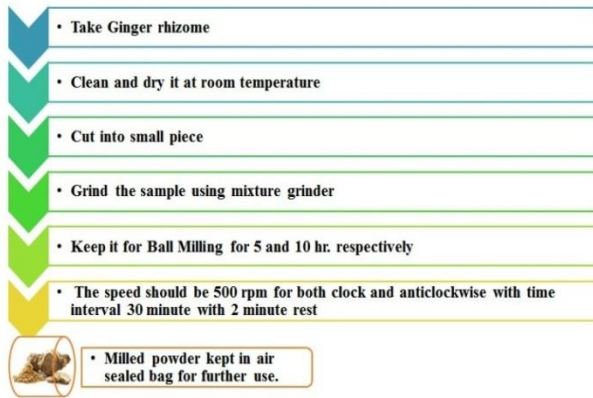


Figure 1- Synthesis processes of ginger Nano powders using Ball milling

Highlight of Research-

- Regardless of high industrial and scientific interest in the crystal structure, thorough study of surface science and their Biomedical action of food powder is not very much visible. While food powders are natural product, being used as spices, as medicines in pharmaceutical and environmental sectors at large scale.
- Ginger powder was prepared using high energy ball milling equipment. The crystal structure, surface science, 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 milling of ginger powder for 5 hours and 10 hours the crystal structure, surface morphology is different from general ginger powder. While FTIR studies shows that there is no change in the functional group due to milling.
- The aim of present study is to investigate the changes occur in metabolic properties of ginger powder due milling. The present study shows that the total phenolic content (TPC), antioxidant property and bioavailability of ginger powder increased due to change in crystalline structure, surface morphology and large surface to volume ratio, Which are beneficial for health sector.

4. Paper reported and for publication in Journal of Electronics Materials Letter (SCI Journal)

Title of the paper- Tuning in Optical, Magnetic and Curie Temperature behaviour of Nickel Ferrite by Substitution of K^{+1} ion of $Ni_{0.8}K_{0.2}Fe_2O_4$ Nanomaterials.

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Highlight of research

- Monovalent K^{1+} ions substituted nickel ferrite is prepared by sol-gel auto combustion method. The structural, optical and magnetic properties were investigated using XRD (X-ray Diffractometer), FTIR (Fourier Transform Infrared Spectroscopy), UV-Visible spectrometer, (PL) Photoluminescence spectrometer and VSM (Vibrating Sample Magnetometer) . The XRD pattern confirms the pure phase nanocrystalline nickel ferrite nanoparticles. The FTIR spectra were recorded in the range of 560-590 cm^{-1} to analyze the changes in nickel ferrite due to K^{1+} ion manipulation.
- Optical property was studied in the range of 200 nm to 1000 nm using UV visible spectrometer and results shows that band gap was improve as in case for nickel ferrite the observed value was 2.20 eV which was furthered decreased to 1.91 eV.
- The saturation magnetization was found to increase as substitution of monovalent potassium. Thus prepared materials is soft magnetic, posses strong luminescence in visible and high Curie temperature (798K). Hence the present materials may be used as

Electronics nanomaterials for various applications.

5 . Paper reported for publication in Journal of Materials Science and Engineering: B (SCI Journal)

Synthesis and Physical properties of amorphous Nanosilica from Rice husk(agriculture waste) and its composite materials.

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Highlight of Research



Production of Silica nanomaterials from Rice husk ash at AKU

- Small size amorphous nano silica (SiO₂) was prepared by using cost-effective and environment-friendly method. Magnetic composite prepared using injection molding equipment. The XRD data analysis presented that the small size amorphous SiO₂ particles were successfully prepared. FTIR spectra shows the absorption peaks indicating the existence of Si-O-Si (silanol) functional group.
- The photoluminescence spectrum reveals the broad excitation of radiation in the visible region. A characteristics peak in UV-Vis absorption spectra occurs at 365nm. Magnetic study shows the diamagnetic nature of amorphous silica. The silica-Ferrite composite material shows the ferromagnetic nature due to the presence of ferrite in the composite.
- The magnetic polymer could be prepared by using amorphous silica, magnetic ferrite, and PVDF polymer. Nano-silica as an engineering materials has numerous applications in various area of science and technology including , Electronics, biomedical science and biomedicine etc. due to its physical characteristics.
- Hence, Measurement of physical characteristics of nanosilica from rice husk(Agriculture waste) and its magnetic polymer composite suggest scientific knowledge for various industrial applications. The magnetic hysteresis loops of silica-ferrite composite reveal that these materials can be used as polymer magnet

(B.) Study Materials/E-contant related to syllabus through email/whatsapp.

About 20 text materials/ Documents, which are related to M.Tech/Ph.D. course work/ research project have been sent through whatsapp group/through mail. Students are studying and asking his/her queries. They are in touch with us. These materials are also being uploaded on website.

C. Synopsis preparation of M.Tech/Ph.D. for session 2018-20 and 2018-21 session scholars

Students of M.Tech of session 2018-20, Ph.D. students of session 2018-21 are engaged their synopsis preparation. The synopsis work includes-General introduction, Objective, Literature review, methodology etc. Some of the students send the 1st draft of synopsis through mail for correction. While some of them are engaged in their synopsis writing. They are in touch with mobile/whatsapp/emails.

D. Online Training session on X-ray diffraction and Microscopy, hosted by Bruker training office on 21st April 2010

Various presenters invited to participate as an attendee in Online Training session on X-ray diffraction and Microscopy, hosted by Bruker training office, Kolkata. Nanoscience center of AKU is also associated with Bruker training center, Kolkata. Some of the students of Nanoscience center of AKU informed me for their participation. I had already informed all the students through whats app/email.

E. Ph.D. Thesis correction for their evaluation

Ph.D. students, who have completed their thesis work/ Pre-Ph.D. thesis submission presentation completed, are in constant touch for final submission. They send different chapters through mails. After correction, I send corrected/with comments documents section to the Ph.D. scholars. At present Md. Qamar Tanbir, Archana Sharma, Sweta Sinha and Harenda Satyapal, 4 Ph.D. scholar are in constant touch through mail/whatsapp/mobile and working for their final thesis submission process.

F. AMC work of Lab of ACNN, Infrastructure of Teaching lab and Synthesis lab and other related work

We are in touch with vendors/office staff for AMC related file work. Required technical specification and related requirement of infrastructure for teaching and synthesis lab are being prepared. As soon as office resume, we will initiate file for further action. UPS, A.C etc. for structural, magnetic lab are urgently required and we are working for their progress with staff member.

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