Nanotechnology in Nature, Electronics, Agriculture and in Ayurveda Science - Possibility of Research that contribute to the Nation for sustainable development- My Experiences

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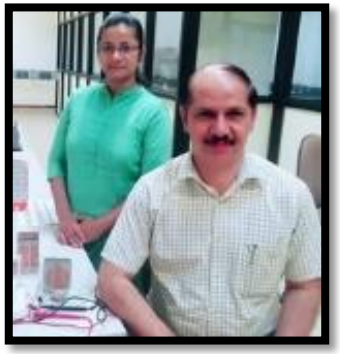

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Ph.D Scholar- Awarded/Thesis Submitted/ Working

1. Abhay K Aman, M.Tech- G.B.Univ, Delhi
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3. H.SatyaPal, M.Tech- B.I.T- Meshra
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5. Sweta Kumar, M.Sc, Faculty- Gaya College Gaya
6. Dr. P.K.Dwedi, Associate Prof., Govt. Ayurveda College, Patna
7. B.Bitramiditya, Global Chairman, Tekbrian, South Korea
8. Md. Tanvir, M.Sc, IIT Madras

M.Tech(PG level Research Project – Supervision)

Total no. of Research Project Guided-11

Total no. of Research Project continue-10

B.Sc - UG level Research Project Guided- 17 ,

under College with potential for excellence scheme of UGC, Basic Scientific Research, UGC special scheme and NAAC-A grade with CGPA 3.58/4- Research scheme at Patna Women's College, Patna University

NATURE, CURIOSITY, NANOMATERIALS PROPERTIES AND FUTURE PLAN

Lotus Leaf always clean

Seashell hard And Chalk-soft

Sharpness of Damascus Dagger

Luminescence of Lycurgus Cup

Migration of Bird

Multi colour Butterfly








Carbon soot, Cooking, detergent, Motion of Lizard, Ayurvedic Bhasma, Cosmetics etc.

Production of Nanosilica from Rice husk

Bihar is a potential area

Solar Cells

Paint Industries

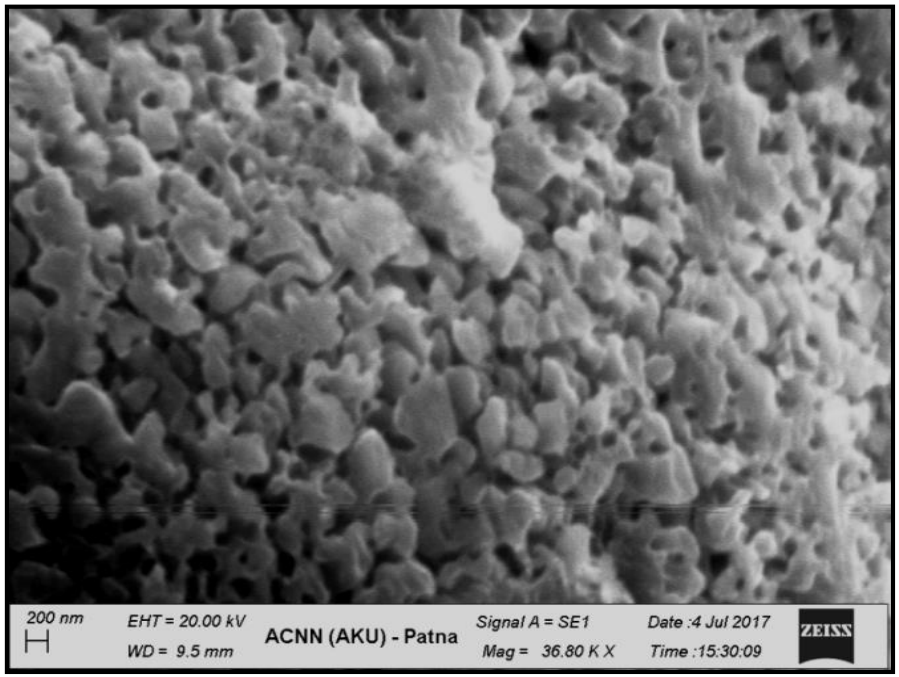
Drug delivery

Rubber industries

Big Plan for converting Waste in to Wealth

Agriculture and Nanotechnology

Grain Size distribution of Nano Silica

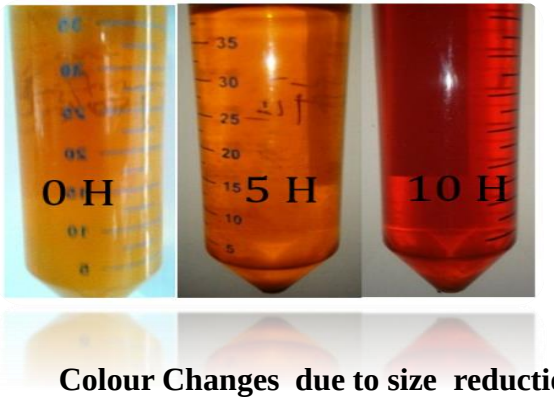


- Akansha Kumari, A.Kumar, Atul Jyoti, Magdhi Kirti of M.Tech-Nanoscience working under Dr. Rakesh Kr Singh on synthesis of nanosilica from Rice husk for different applications in rubber industry, cement, Biomedical science etc. They have synthesized 16 samples nanosilica, confirmed their nanosize measurement and measured their other properties. This may be thrust area of research for the devlopement of Bihar.
- Observed porosity, Amorphous and crystalline nature shows different applications.

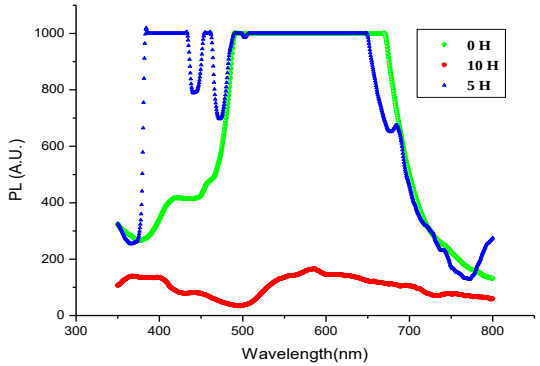
Food Science and Nanotechnology

change in Colour and Size of nanoscale haldi powder

Abhay Kr Aman, Rakesh Kr Singh, Archana et al.



Colour Changes due to size reduction



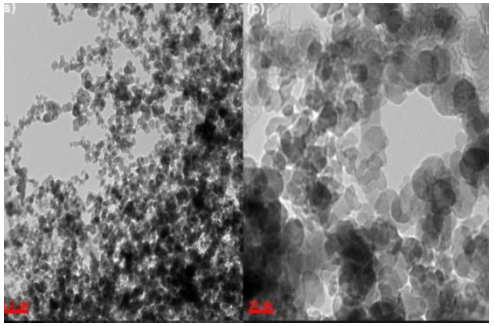


Photo luminescence

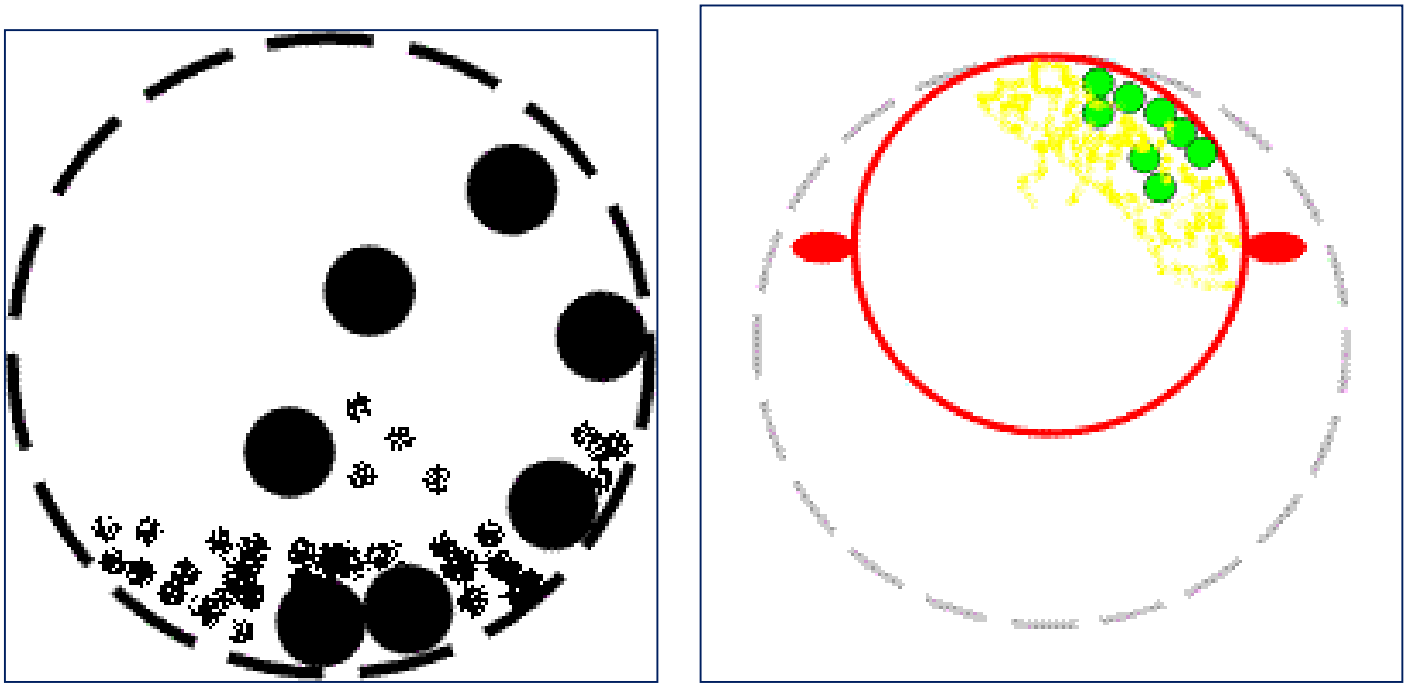
- **Potential Applications**

Nanometric food particles can improve the physicochemical properties of food materials. This materials also possess photo luminescence may be useful in biomedical applications and pharmaceutical industry & potential for drug delivery system.

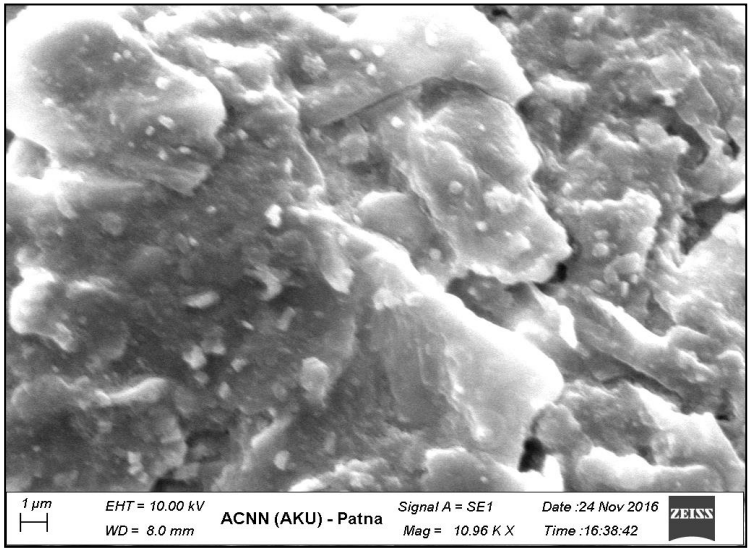
METHODOLOGY USED

Synthesis of Food nanomaterial by High Energy Ball Milling

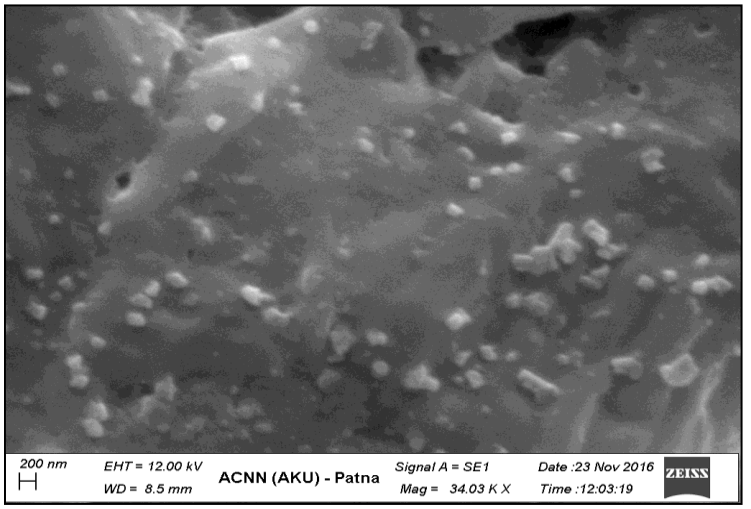
- It is a relatively new technique that has applications in processes for obtaining nanostructured materials.
- It is a process where a powder mixture placed in the ball mill is subjected to high-energy collision from the balls.



High-frequency impact (mixer mill), intensive friction (vibratory disc mill) and controlled circular jar movements (planetary ball mill) allow for unrivalled grinding performance.

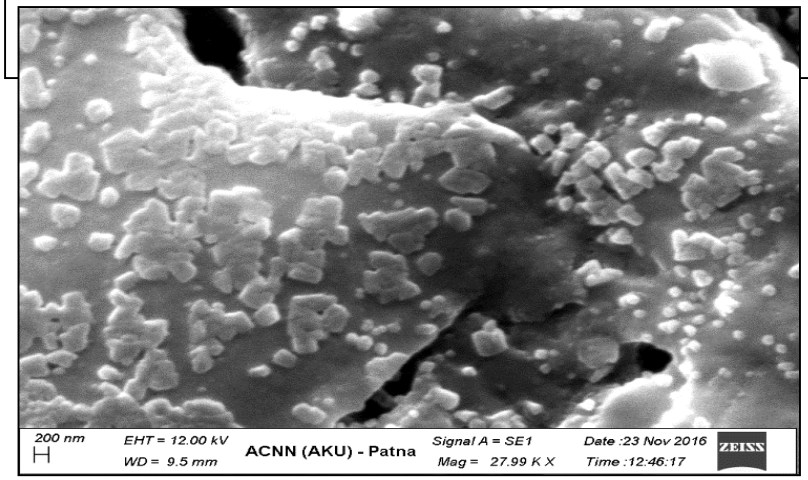


0 Hr. Ball Milling

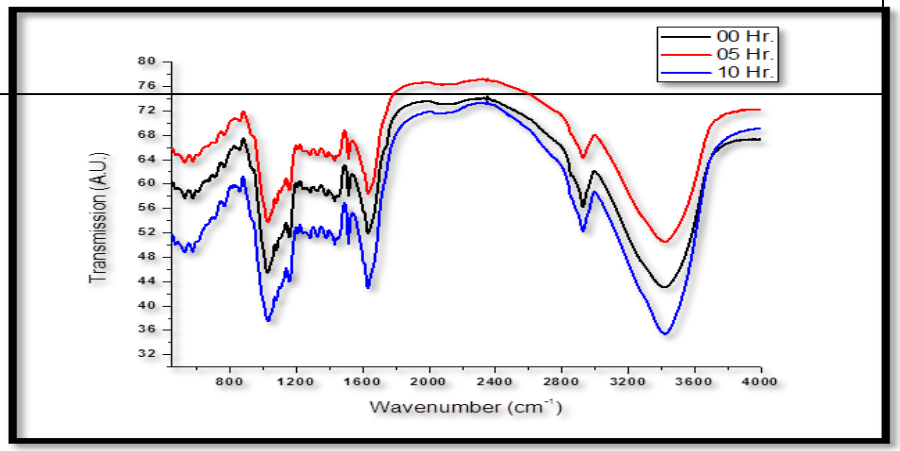


5 Hr. Ball Milling

Scanning Electron Microscopic Image confirm the superfine nanoscale powder without change in bond and but change in molecular structure. This will change the Physico-Chemico properties , which are treated as new functional food nanomaterials

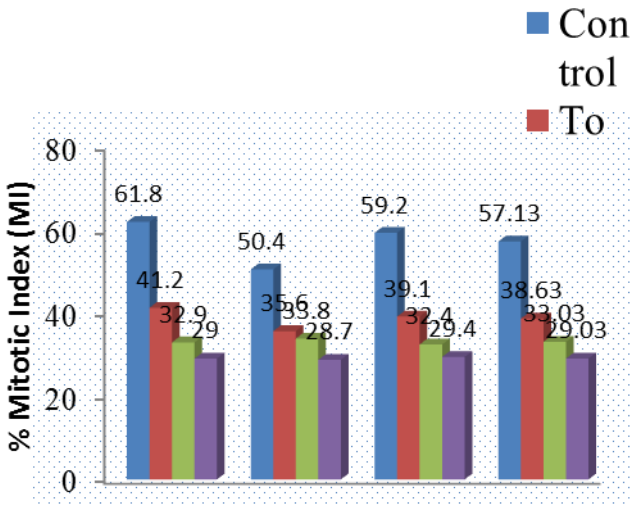


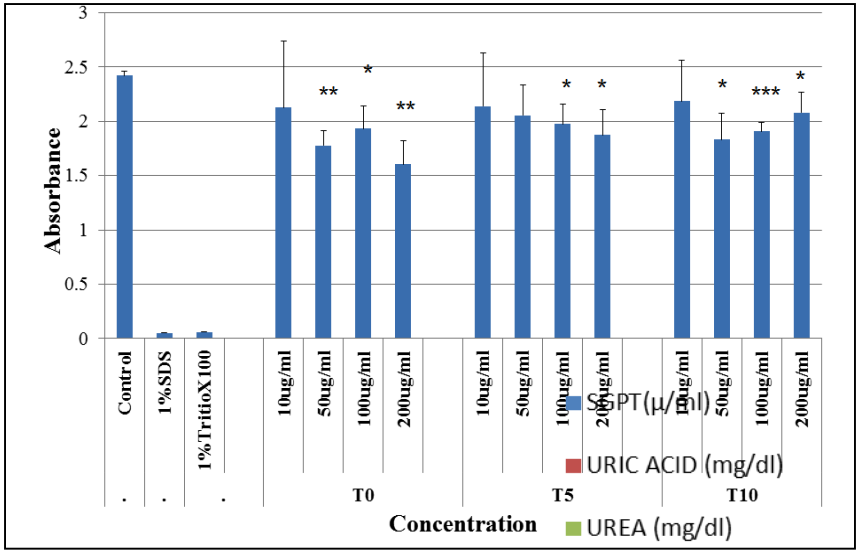
10 Hr. Ball Milling

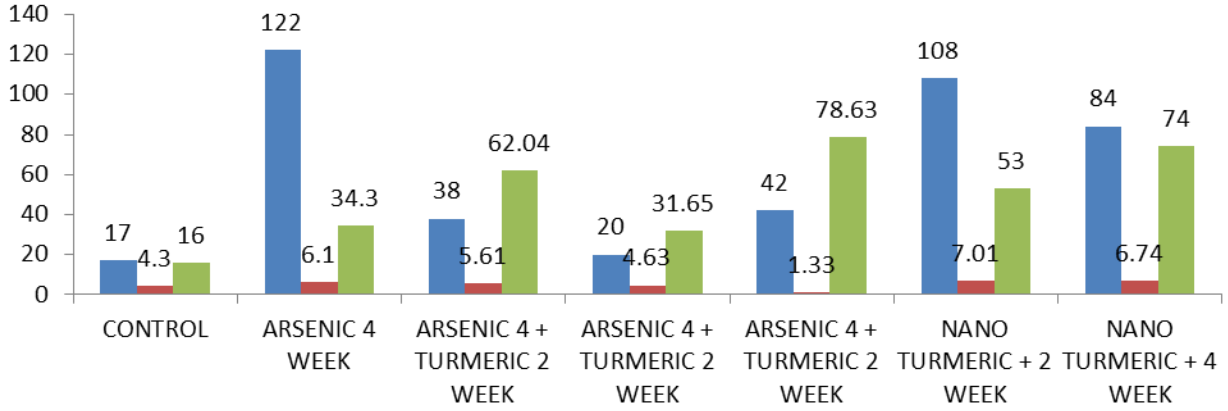


FTIR Spectra

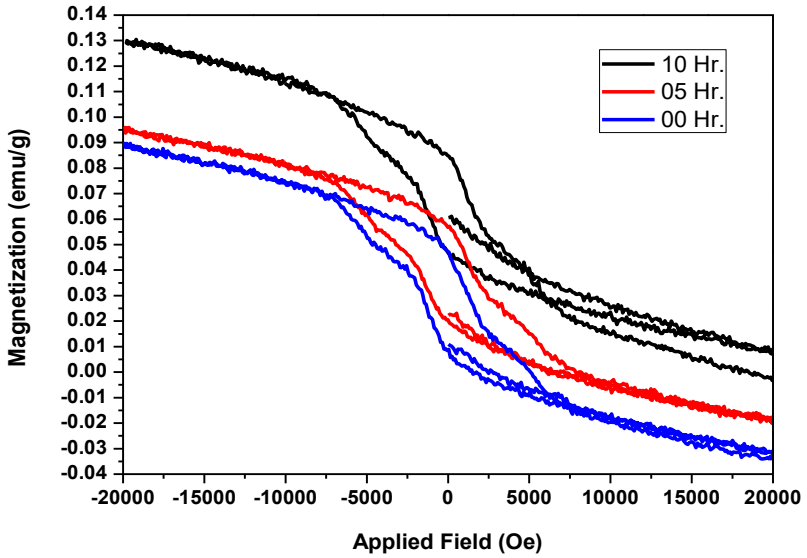
Biomedical investigations- Such as Geno-cytotoxicity, MTT Assay, Biochemical Test results of both Turmeric and Bitter Gourd powder as Nanoscale







Magnetic Measurement of Nanoscle food powder

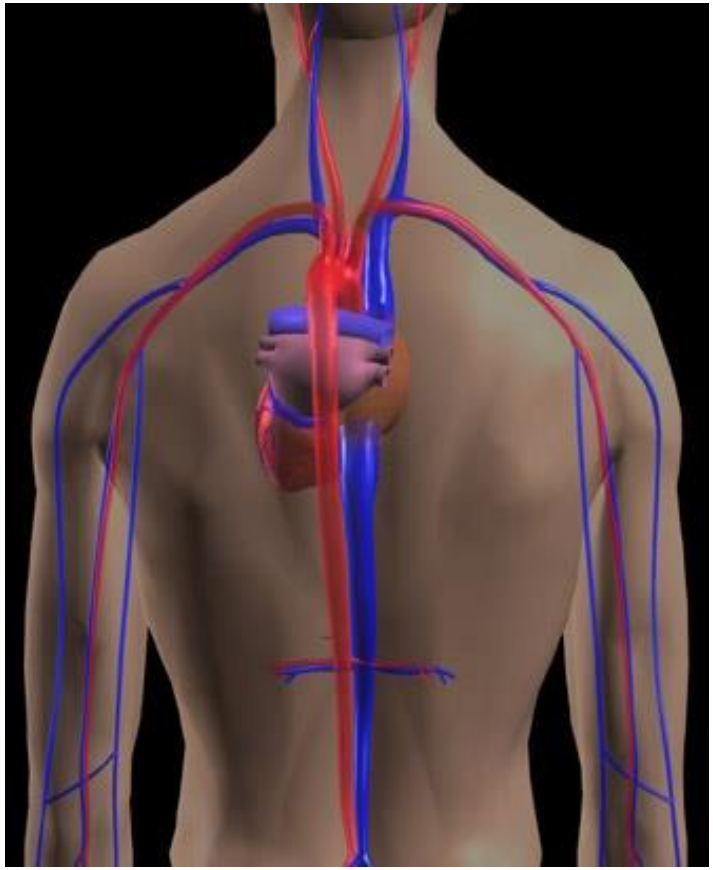


Sample	Magnetization
K0	0.09 emu/g
K5	0.095 emu/g
K10	0.13 emu/g

VSM Graph of Bitter gourd powder

Applications Magnetic Engineering nanomaterials in Medical Science

- Because of their small size, nanoscale devices can readily interact with biomolecules on both the surface of cells and inside of cells.
- By gaining access to so many areas of the body, they have the potential to detect disease and the deliver treatment
- Nanoparticles can can deliver drugs directly to diseased cells in your body.
- Nanomedicine is the medical use of molecular- sized particles to deliver drugs, heat, light or other substances to specific cells in the human body.



Turmeric Nanoscale powder

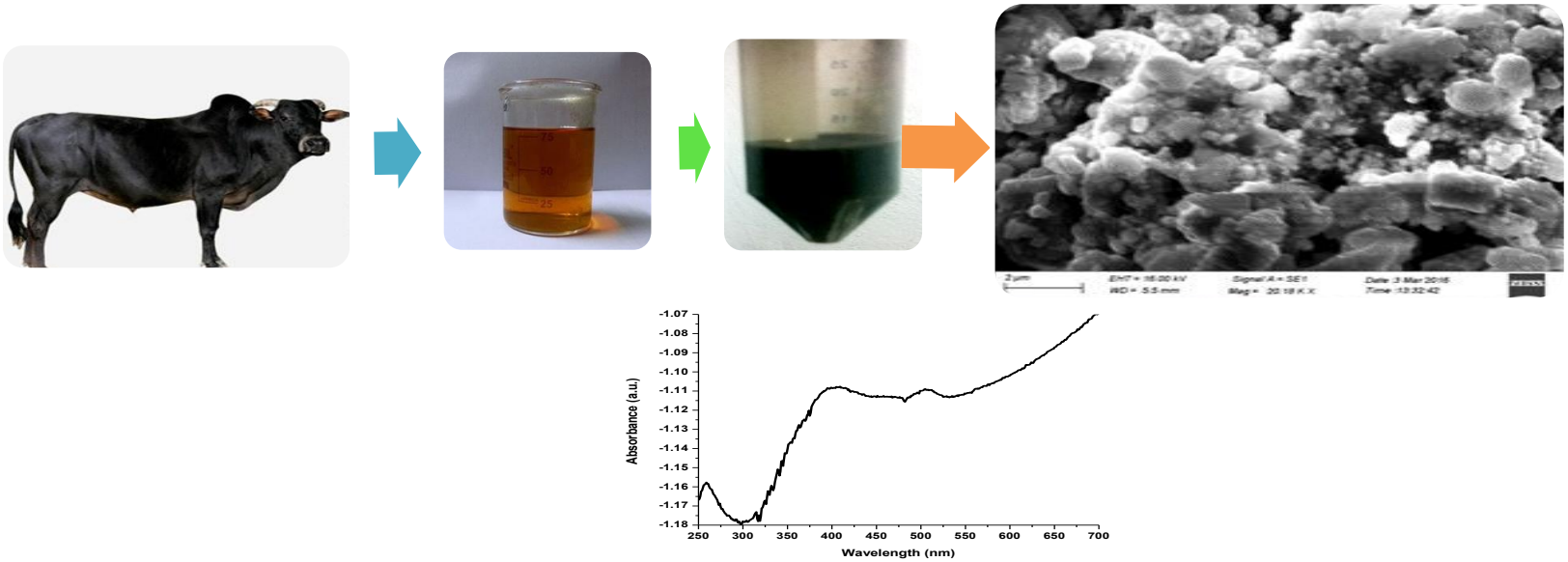
1. XRD and SEM result reveal the nanoscale nature of the prepared turmeric powder using high energy ball machine. Such changes can improve the physiochemical properties of food material in pharmaceutical, Biotechnology industries. Bihar and India May be potential state.
2. The change in colour and optical properties favours the variation in electronics structure of the food material, which may be a potential probes for drug distribution in biological system at atomic and molecular level.
3. Geno cytotoxicity results reveal loses in cell division in mitotic phase. Hence it shows effective on Cancer line cells. Effect on SGPT , Urea and uric acid reveals turmeric powder may protect against induced liver damage.
4. The Magnetism in turmeric powder is vary interesting finding in food material that favours medicinal values

Similarly same behaviour was found in Bitter gourd nanoscale powder and effective for Cancer and new functional food materials.

Our goal of this studies are

To develop low cost Herbal medicine to prevent and cure the disease.To establish composition of these functional foods in our diet for prevention and treatment of disease by nanotechnological approach. We should focus on searching right combination of these health promoting foods, along with adaptation of healthy life-style

Rapid synthesis of silver chloride nanoparticles using Indian Cow urine: - An Indian Vedic divine, by Abhay Kr. Aman,Ph.D scholar and Rakesh Kr. Singh.



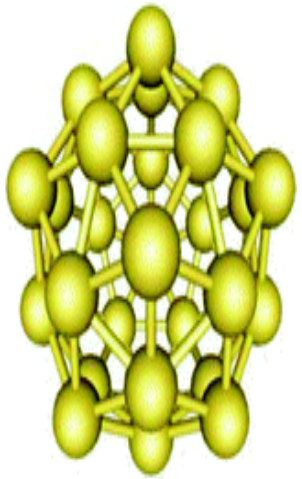
1. **Maximum absorption of UV radiation in this materials results cosmetics industry and better action on T.B patients as a nanomedicine. We are ready to file a patent of this work.**
2. **May be a potential, suitable for biological optoelectronics, in cosmetics and others applications.**

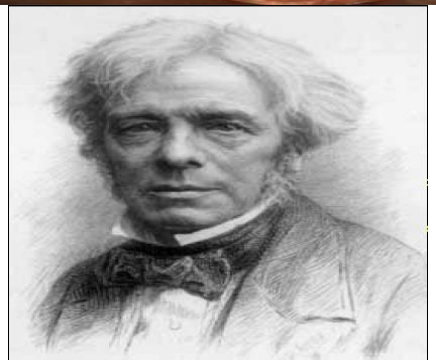
This work also highlight the Indian cow urine and their importance. Recently Govt. of India initiated the research work on cowdung & Urine under the leadership of Hon'ble Chancellor, Nalanda University, Rajgir.

Size effect and Emerging properties

Ref: Size matters: why nanomaterials , ***Chem. Soc. Rev.***, 2006,**35**, 583-592, **D**

- **Gold is known as a shiny, yellow noble metal that does not tarnish, has a face centred cubic structure, is non-magnetic and melts at 1336 K. However, a small sample of the same gold is quite different, providing it is tiny enough: 10 nm particles absorb green light and thus appearred. the *melting temperature* decreases dramatically as the size goes down. Moreover, gold ceases to be noble, and 2–3 nm nanoparticles are excellent *catalysts* which also exhibit considerable *magnetism*. At this size they are still *metallic*, but smaller ones turn into insulators.Their equilibrium *structure* changes to icosahedral symmetry, or they are even hollow or planar, depending on size. *a mere variation in the size of its particles gave rise to a variety of resultant colours*."**





New Findings from R.K. Singh and Co-Authors Describe Advances in Nanotechnology.

According to the authors of **recent research from Bihar, India,** "Two nano aluminate spinel materials ($ZnAl_2O_4$ and $NiAl_2O_4$) were synthesized by the Citrate precursor method. The citrate precursors consisting of co precipitated citrates of Zn^{2+}or Ni^{2+} and aluminum were first subjected to thermal analysis (TG-DSC) for determining the optimum temperature for annealing."

"Two step decomposition was observed incorporating dehydration and formation of the aluminate. The second step gives an endo peak (-2937 J/g) at 356 A degrees C in the DSC curve of the co precipitated nickel (II) citrate-aluminum citrate gel in O_2 atmosphere. Kinetic/mechanistic analysis of the TG data has also been----------.

J Therm Anal Calorim (2012) 107:205-210
DOI 10. 1007/s10973-011-1860-7

Thermal, XRD, and magnetization studies on $ZnAl_2O_4$ and $NiAl_2O_4$ spinels, synthesized by citrate precursor method and annealed at 450 and 650 °C

Rakesh K. Singh · A. Yadav · A. Narayan · Mukesh Chandra · R. K. Verma

29th STAC-ICC Conference Special Chapter

Abstract Two aluminate spinel materials ($ZnAl_2O_4$ and $NiAl_2O_4$) were synthesized by the citrate precursor method. The citrate precursors consisting of coprecipitated citrates of Zn^{2+} or Ni^{2+} and aluminum were first subjected to thermal analysis (TG-DSC) for determining the optimum temperature for annealing. Two step decomposition was observed incorporating dehydration and formation of the aluminate. The second step gives an endo peak (−2937 J/g) at 356 °C in the DSC curve of the coprecipitated nickel(II) citrate–aluminum citrate gel in O_2 atmosphere. Kinetic/mechanistic analysis of the TG data has also been carried out and values of E_a, $\Delta S^{\#}$, $\Delta G^{\#}$, and A were approximated. On the basis of the findings, 450 °C has been chosen for annealing of the gels. Annealing has also been done at 650 °C for 1 h in muffle furnace in an attempt to obtain nanometric particles of aluminates (MAl_2O_4) {M = Ni, Zn} and to find out their magnetic properties which could render them useful for chemical sensing applications, etc. The TG-DSC curves of various powders which were obtained on annealing at the two temperatures did exhibit thermal instability when carried out in N_2 atmosphere. $NiAl_2O_4$ and $ZnAl_2O_4$ spinels (particle size 17 and 34 nm, respectively) are obtained in pure crystalline phase at 650 °C. $ZnAl_2O_4$ prepared this way shows coercivity values of 470 and 58.37 G and $NiAl_2O_4$, 107 and 23.24 G when annealed at 450 and 650 °C, respectively. $ZnAl_2O_4$ prepared by a polymer precursor method and annealed at 1000 °C, has earlier been reported to have coercivity value of 469 G. Thus, the citrate precursor method is good for the synthesis of $ZnAl_2O_4$, producing single phase nanocrystalline powder of high quality and crystallinity. The value of magnetization was found to be small in the present case for the $NiAl_2O_4$ spinel obtained at 450 °C.

Keywords Nickel aluminate · Zinc aluminate · Annealing temperature · XRD pattern · Coercivity · Magnetization · Thermal stability · TG-DSC · Kinetic parameters · Nano particles · Spinel

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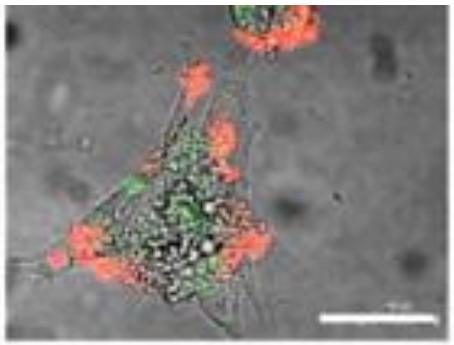
Introduction



Ayurvedic Bhasama as Nanomedicine – An ancient **Indian Glorious Past**





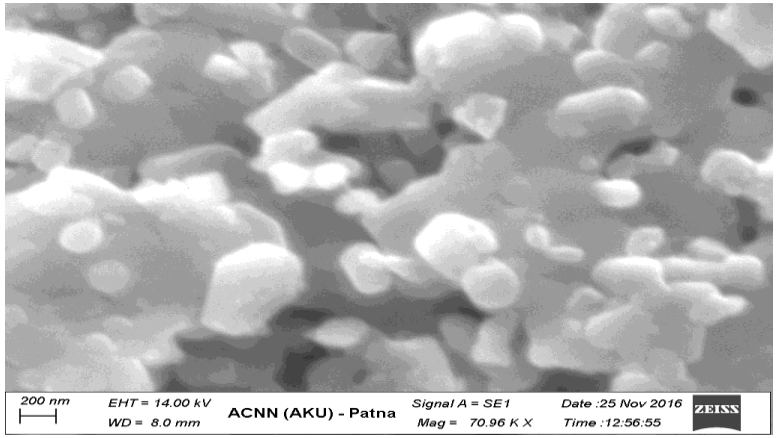


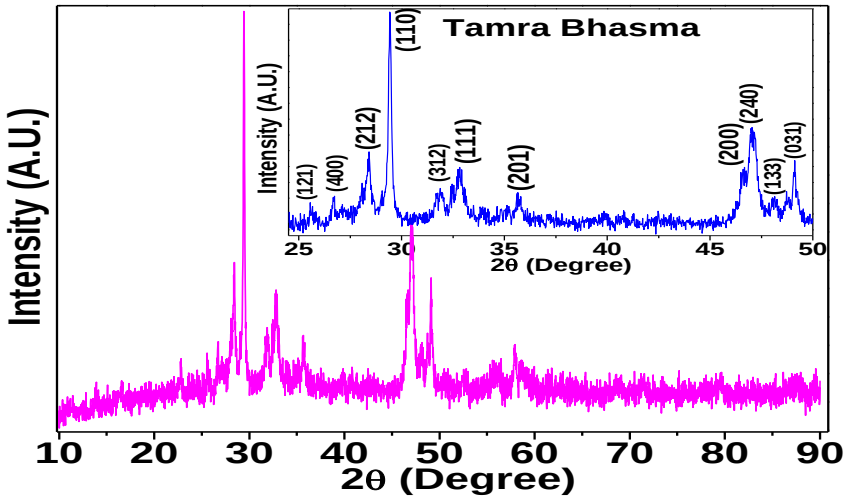

We have prepared four bhasma- Lauh, Tamra, Shankh and Abhrakh bhasma. All bhasma shows nanocrystalline materials using using Modern scientific tools, available at Nanoscience center at AKU. Various Biomedication testing results shows that- be useful to control the bacterial infection disease and others.

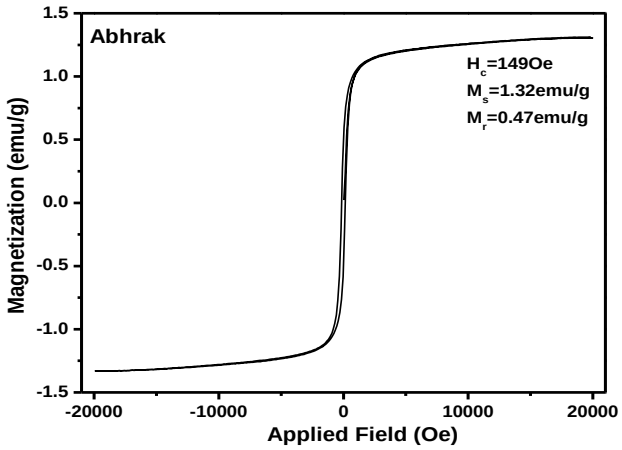
- present study, scientific data obtained and evidence would support in utililizing the ancient Indian wisdom of Ayuveda for the development of newer drugs as a modern nanomedicine and open a path to understand the traditional Ayurvedic medicine at nanometric level and its use in various diseases.

Ayurvedic Bhasma as Nanomaterial's and Modern Scientific Tools

Rakesh Kr Singh, Sanjay Kr, Abhay Kr Aman, Manoranjan Kar, Internation J. Ayurvedic and Integrative medicine (2017)1-7, Elesevier





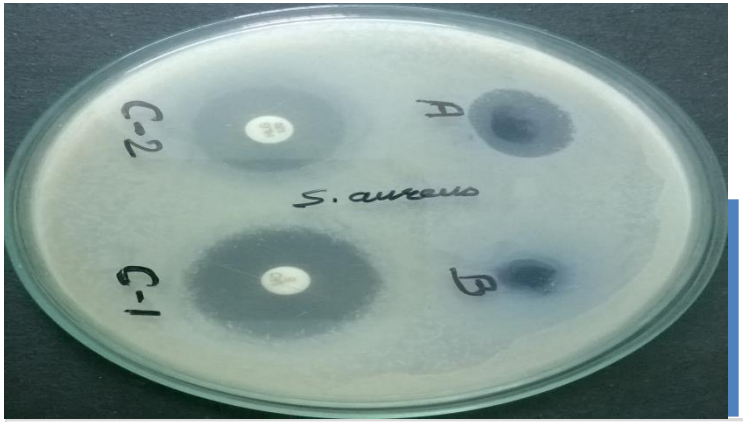


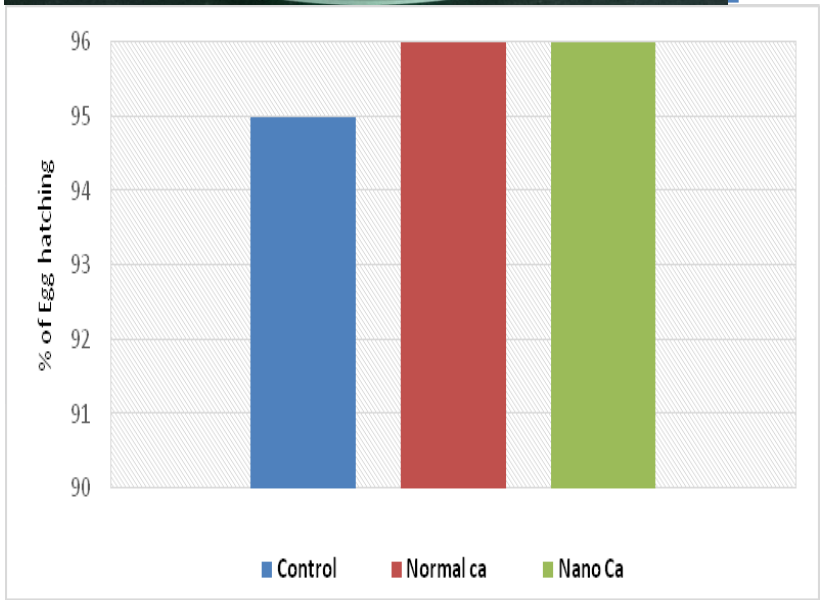
Structural, Microstructural and Magnetic measurement of Tamra bhasma reveal that bhasma are nanocrystalline super paramagnetic, uniform size distributed particles that support its medicinal value together with better action on disease treatment. This reminds our ancient Indian wisdom was so great. Hence we should not forget our root/ancestors.

Biomedical Results of Ayurvedic Bhasma and Nanotechnology

Sanjay Kr, Ph.D. thesis, Guided by Dr. Rakesh Kr Singh, AKU, Patna

Antimicrobial tests, action on C.elegen etc. sresults shows that Lauh, Tamra, Shankh and Abhrakh Bhasma can be used as effective as a nanomedicine.Therefore Product with scientific evidence can be shaped as Ayurvedic Industry in state Bihar and India





International Level research presentation on Glorious Indian Past

AKU Nanoscience faculty felicitated at Stockholm, Sweden

After detail Discussion in presentation on-

How bhasma is nanocrystalline materials, quantum vibration of energy in hurb, Scientific analysis and fundamentals of science of notable research contributions and exploring the ancient Indian wisdom- Ayurvedic Bhasma as Nanomedicine. The Excutive chairs feliciatated me on 25 Aug. 2016, at 9.a.m at Stockholm, Sweden by

felicitated at Stockholm,Sweden in International Conferencevf

Honoured by Excutive 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) and Prof. Asutosh Tiwari ,**Prof. Linkoping University, **Sweden.**

European Advanced Materials Congress-2016, Stockholm, Sweden

Nano Ferrites : Engineering Materials

It has been estimated that in the world market 40% of the total magnetic materials is dominated by Ferrite. 2Ph.D and 3 M.Tech Scholar working on this material. While 2 M.Tech scholar submitted their M.Tech Research project.

Recently total no. of 36 paper published in peer reviewed Journal(UGC approved). Possible applications of this materials are in Electronics industry, Purification of water, Biomedical imaging, humidity sensor, etc.

Some more uses

- Core of transformers
- magnets in TV beam focusing
- storage devices of computers
- RF oscillators of future
- Temperature sensors

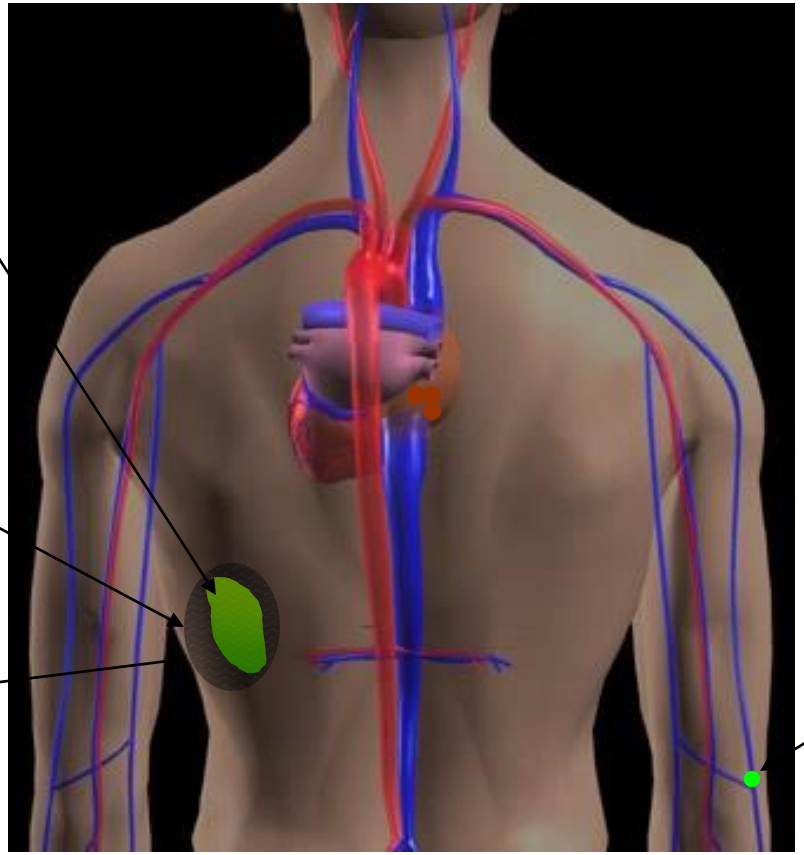
.....and many more yet to be found

Nanoparticles inGuided Drug Delivery

Solid tumor

Apply magnetic field to concentrate particles

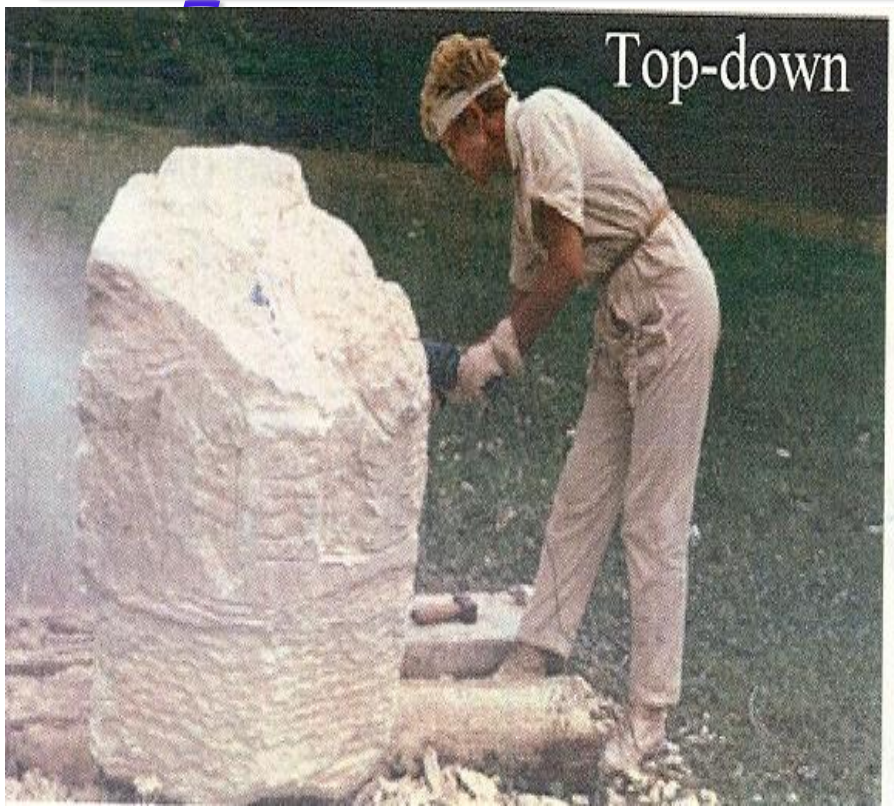
Modulate field to release drug from particles

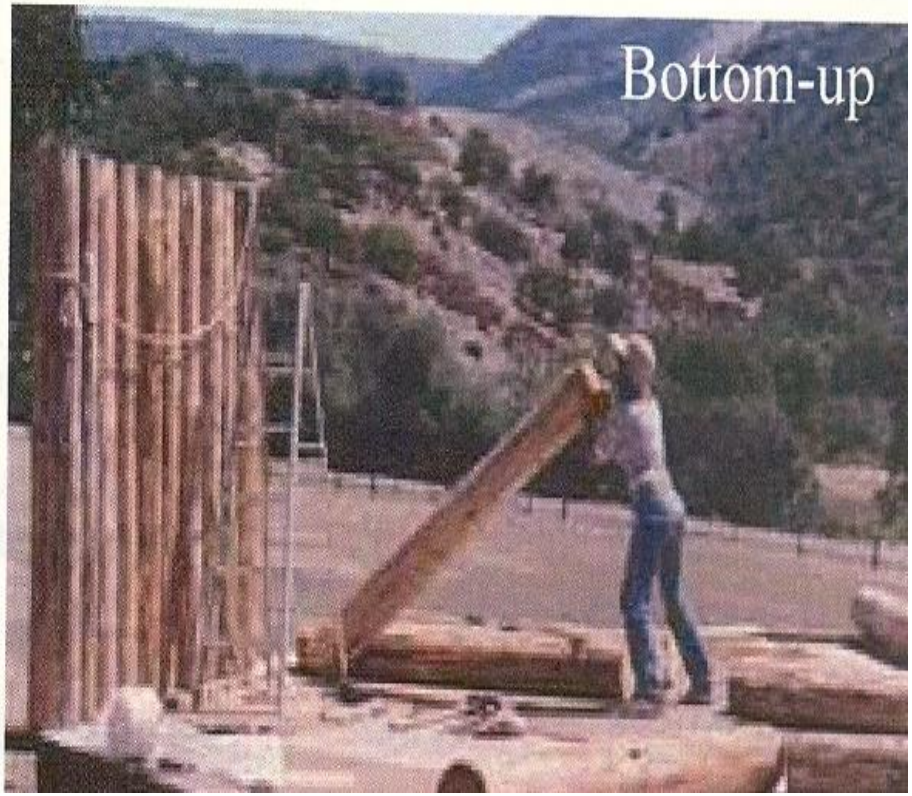


Other options for targeting:
1 - Direct injection into tumor site
2 - Coating NMP with antibodies to target tumor

Inject NMPs IV, NMP will circulate through the blood stream

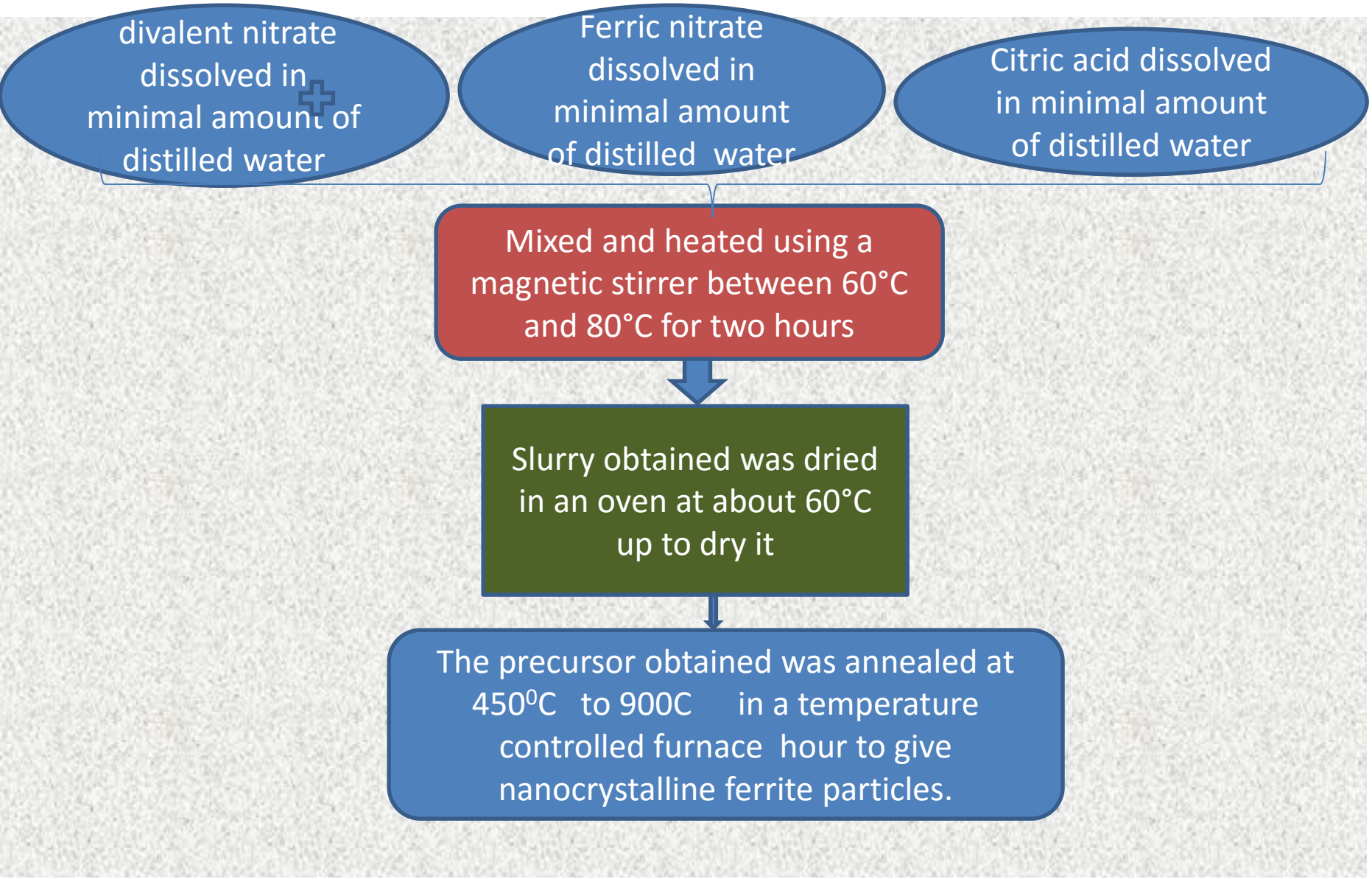
Preparation methods for nano particles





- **TOP-DOWN APPROACH: Such as High energy Ball-milling method**
- **BOTTOM-UP APPROACH:- Such as Chemical techniques**

Citrate Precursor Method and Low cost technique



Sector	Applications in various area of Science and Engineering
1. Bio medical & Environmental Science	Drug delivery, NMR imaging enhance ment, Arsenic removal from contaminated ground water, Cancer treatment, Tumor treatment, Bioimaging in nanobiotechnology
2. Computer Science	Pulse transformer cores, memory cores, substrate for bubble memories, power transformer, reactor cores
3. Permanent magnet	Loudspeaker, Moters, Erase heads, Rubber magnets, Erase heads, Moters
4. Magnetic recording	Audeo tapes, Magnetic diskette, Computer tapes, Video tapes, Magnetic cards
5.Microwave	ferrite microwave absorber, Rubber ferrite, Isolator, circulator, Noise absorber core
6.Radio & TV	Antenna cores, Delay line cores, IFT cores, Deflection yoke cores
7.Telecommunication	Low Accommodation core, Low loss core, Low temperature coefficient cores, High stability cores, Magnetic recording heads
8. Miscellaneous	Ferrite powder for copying machine, Impedence cores, Electrolytic electrodes, Electromagnetic cores, magnetostrictive vibrators
9. Electronics-advanced	Quantum computer

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Article-17 -

EVALUATION OF CYHALOFOP BUTYL AND OTHER HERBICIDES FOR THE CONTROL OF BARNYARD GRASS (ECHINOCHLOA CRUSGALLI L.) IN TRANSPLANTED RICE by

Sangwan, N K, Singh, Samar, Malik, R K, Singh, V

Published in Annals of Applied Biology (12/1996) Get full text Journal Article

Article-18

EVALUATION OF CYHALOFOP BUTYL AND OTHER HERBICIDES FOR THE CONTROL OF BARNYARD GRASS (ECHINOCHLOA COLONUM LINK) IN DIRECT SEEDED RICE by

Sangwan, N K, Singh, Samar, Malik, R K

Published in Annals of Applied Biology (12/1996) Get full text Journal

Article- 19

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Article- 20

Cation distribution of $Ni_{0.5}Zn_{0.5}Fe_2O_4$ Nanoparticles **by**

Singh Rakesh K, Yadav A, Upadhyay Chandan, Layek, Samar

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Assistant Professor
Centre for Nanoscience & Nanotechnology **(University Department)**
Aryabhatta Knowledge University, Patna
Assistant Professor in Physics, **Patna Women's College,** Patna University (Aug. 04-13)

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Cation distribution of $Ni_{0.5}Zn_{0.5}Fe_2O_4$ nanoparticles

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Abstract

A set of $Ni_{0.5}Zn_{0.5}Fe_2O_4$ samples were prepared by citrate precursor route to investigate the growth mechanism and its effect on cationic distribution. Following the information from DTA–TGA analysis, samples were annealed at 550 ^{0}C, 700 ^{0}C and 750 ^{0}C. Magnetization and Mössbauer studies suggest that initially the cationic distribution deviates from its normal preferences but it gets back to the normal preference at a temperature around 675 ^{0}C. It has been found that size onset for having the bulk cation configuration exclusively depends on the composition.

Keywords: Mössbauer Spectroscopy; Ferrite; Nanoparticles, Cationic distribution

1. Introduction

Ferrites are technologically important material and an object of study for quite long time (Ishino *et al.*, 1987; Smit *et al.*, 1959). Nickel-Zinc ferrite has been extensively used as high permeability material. Research in this field has received a major boost in the recent years when new techniques for synthesis and characterization of nanoparticles in the range 5-20 nm were developed. Several research groups are exploring the possibility of preparing ferrites with novel properties by forcing the system to acquire metastable and non-equilibrium configurations (Albuquerque *et al.*, 2000; Vanderzalgetal *et al.*, 1996; Fanin *et al.*, 1999; Bercoff *et al.*, 2000). Apart from the application aspects, investigations have been directed towards understanding the basic physics of nanophase interactions. Synthesizing these materials in nanophase leads to different exotic properties (Hamdeh *et al.*, 1997; Goya *et al.*, 1993; Upadhyay *et al.*, 2001; Rath *et al.*, 2000). The magnetic properties of these ferrites are mainly controlled by the cation distribution of Ni, Zn and Fe among the available tetrahedral A sites and octahedral B sites (Smit *et al.*, 1959). Zinc is known to have a high degree of affinity for the tetrahedral sites in the spinel structure and nickel has a similar affinity for octahedral B site. Hence bulk nickel ferrite is a model 'inverse' ferrite while bulk zinc ferrite is a model 'normal' ferrite. The sample having both the cations is termed as "mixed" ferrite (Navrotsky *et al.*, 1968).

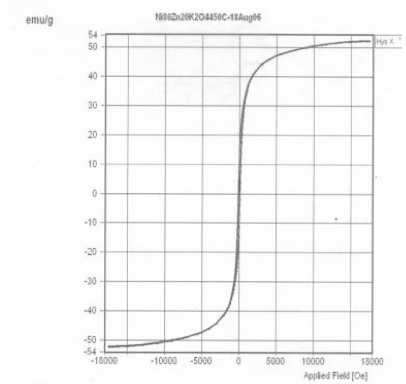
The cation preferences can be greatly altered by preparing the spinel ferrites in nanosize. Several reports have indicated that for particle size less than or around 10 nm, sizeable fraction of zinc present in spinel structure occupies octahedral B sites, against its normal preference. The magnetic properties are likewise altered once the cation distribution is changed (Ma *et al.*, 2000; Albuquerque *et al.*, 2001; Uen *et al.*, 1982). $Ni_{0.5}Zn_{0.5}Fe_2O_4$ offers the most complex cationic distribution in the series of Ni-Zn ferrites. Most of the studies on nanophase ferrites therefore have been associated with the cationic distribution in the structure. However, very less emphasis has been paid on the growth process of these systems. In this investigation we have attempted to study the systematic growth of this system by allowing the particles to grow under the influence of thermal energy and study their magnetic and cationic distribution in the structure by vibrating sample magnetometer and Mössbauer spectroscopy.

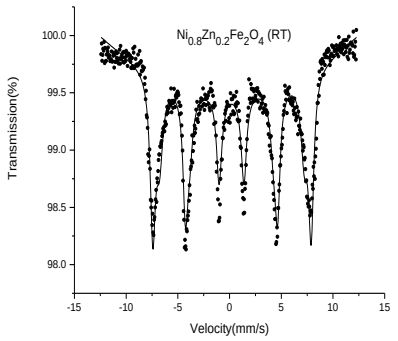
Advantage of Citrate precursor method

Rakesh Kr Singh, ,A.Yadav, A. Narayan, S.Lyeak, **H.C. Verma**

Ni-Zn Ferrite Nanoparticles and their Applications, manthan, Int. J.(2011)

- single annealing temperature 450C for all our samples of nanocrystalline Ni-Zn mixed ferrite.
- . The most interesting case seems to be with Ni0.8Zn0.2Fe2O4 ,where both the coercive field(116.10 Oe) and the saturation magnetization (52.18emu/g) are largest. Values of saturation magnetization is higher than 50 emu/g have so far been achieved by using other methods, only through sintering attemperatures much above 450oC. The Mössbauer spectrum shows that Fe occupies both the A and B sites in the sample and superparamegnetic fluctuations are not significant.





Sample	H_c (Oe)	M_r (emu/g)	M_s (emu/g)	Squareness/Particle size(nm)
$Ni_{0.2}Zn_{0.8}Fe_2O_4$.	22.42	0.5744	17.50	0.033/ 16
$Ni_{0.4}Zn_{.6}Fe_2O_4$	1.53	0.1049	43.43	0.002/7
$Ni_{0.5}Zn_{.0.5}Fe_2O_4$	90.86	5.658	40.54	0.140/16
$Ni_{0.6}Zn_{0.4}Fe_2O_4$	35.77	2.678	43.64	0.059/9
$Ni_{0.75}Zn_{0.25}Fe_2O_4$	93.10	4.610	38.94	0.118/9
$Ni_{0.8}Zn_{0.2}Fe_2O_4$	**116.10**	**11.38**	**52.18**	**0.148/18**

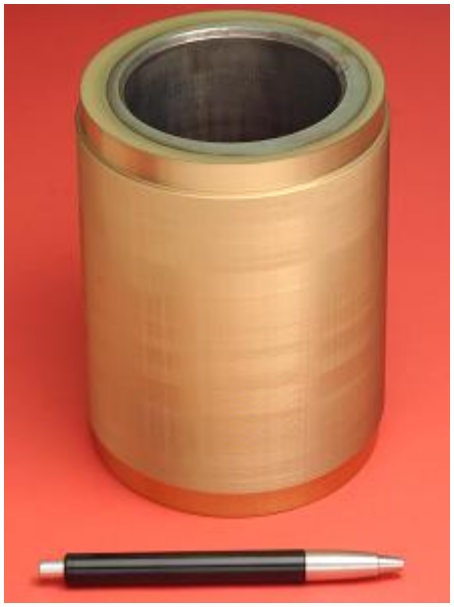
Why Nano electronics or Nano Engineering

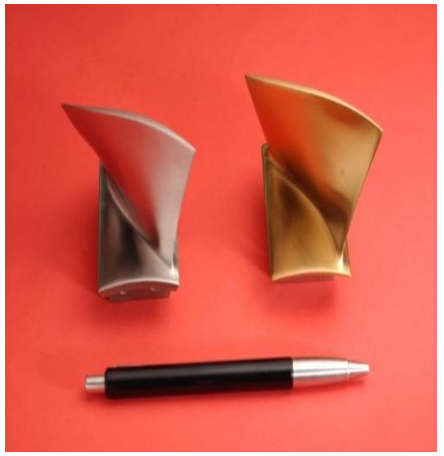
- Fast Speed inversely proportional to size and Efficient performance
- Energy efficiency- input and output and Cheaper
- Smarter- additional functions and High packing density
- Integration with optics and mechanics

Such applications depends of size, High magnetization & Coercivity, Low dielectric loss

Possibility in Surface Engineering as a Coated Materials

Hard Coatings : TiO_2 etc. , Tribological Coatings: Mo-S etc., Lubrication Coatings, Protective, Passivating , Antistatic, Dust –resistant, Corrosion-resistant Coatings, Hydrophobic and Hydrophilic, Decorative Coatings, Optically and Thermally Selective Coatings, Solar Selective Coatings for Energy Conversion Stealth Coatings, Barrier (Thermal, Diffusion, etc) Coatings





Porous Materials :Ion exchange (ionic conductivity) The counter-cations in zeolites and Magnetic nanomaterials are mobile, and may easily be exchanged.This results in ion exchange capability utilized e.g. in detergents and in waste water purification. Or pigs food

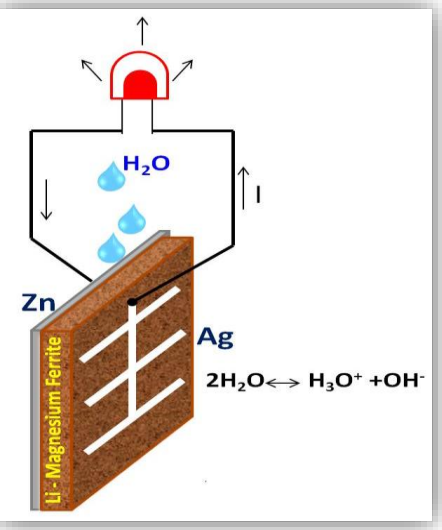
Swine Research Shows Increased Growth Rate

INVENTION OF HYDROELECTRIC CELL

A Boon for Masses: Green Energy Source through MgFerrite Nanomaterials

Dr. R.K. Kotnala & **Dr. Jyoti Shah** from CSIR-NPL have invented an energy source, coined as "Hydroelectric Cell", which produces electricity from water droplets using no acid/alkali. This invention is exceptional.

Societal Impact for Rural India



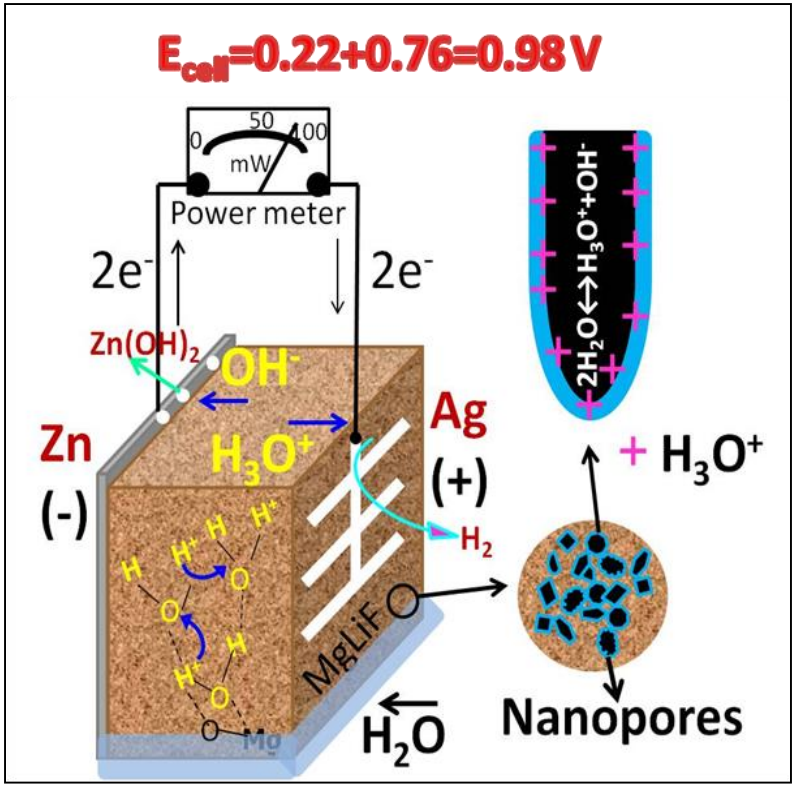
Energy from splitting of water has opened a new class of revolutionary research in the field of green energy. Hydroelectric cell can be used in a wide variety of consumer products especially in Rural India.

Replacement for:

- Solar cell
- Fuel cell
- Batteries & Other power backups

Working of Hydroelectric Cell

Water molecule dissociated by Li-magnesium ferrite was collected by taking electrode pairs zinc and silver. Water molecule dissociation occurred spontaneously on ferrite surface of the pellet. Water molecule dissociated at interface of ferrite pellet and zinc foil immediately oxidizes the zinc into zinc hydroxide by releasing two electrons. Oxidation reaction occurring at Zn electrode as:



Schematic diagram of working hydroelectric cell

At Li-$MgFe_2O_4$:

$$4H_2O \rightarrow 2H_3O^+ + 2OH^-$$

At Zn electrode:

$$Zn + 2OH^- \rightarrow Zn(OH)_2 + 2e^- \quad E_{oxd} = -0.76V.$$

At Ag electrode:

$$2H_3O^+ + 2e^- \rightarrow H_2\uparrow + 2H_2O \quad E_{red} = +0.22V.$$

Total Cell Potential:

0.22V+0.76V =0.98V

Salient Features of Hydroelectric Cell

- 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.

Publications and International Recognitions

❑**R. K. Kotnala, and Jyoti Shah, Green hydroelectrical energy source based on water dissociation by nanoporous ferrite, International Journal of Energy Research, Int. J. Energy Res., Vol. 40, issue 11, 2016.**

❑**Jyoti Shah, Ravinder Kumar Kotnala, Rapid green synthesis of ZnO nanoparticles by hydroelectric cell without using any electrolyte, Journal of Physics and Chemistry of Solids 108 , 15–20, 2017.**

•US Patent Application No.**US 20160285121 A1,**

•Indian Patent # 792/DEL/2015

For more technical details contact:

***Dr. R.K. Kotnala**, Head of Environmental Sciences & Biomedical Metrology Division, CSIR-NPL, New Delhi*

Email : rkkotnala@gmail.com Webpage :http://www.drrkkotnala.com, Phone :9811237051;

**For demo visit www.youtube.com/watch?v=P0BTHFF8ENI*

Why Science Education& Research and Only Few dedicated people ?

- Innovation
- Natural Process of Learning
- Ethics
- Love with Nature and Almighty

If there is some power in Natotechnology which is nature

Certainly some power that help for Science & Research

'Science is a global business'

Interview with Senator **Kim Carr**, Australian Minister for Innovation, Industry, Science and Research.

After assuming office in 2007, the Labour Government in Australia instituted a separate Ministry for fostering innovation, for the first time in the country's history. Two years later, the government published a White Paper, titled "Powering Ideas," which reflected the understanding that research policy needs to incorporate a substantial role for international collaboration.

In this interview, done in Bangalore with **V. Sridhar**, *Senator for Victoria* **Kim Carr**, *a former school teacher for 10 years and now Minister for Innovation, Industry, Science and Research, outlines the challenges facing Australia, which have influenced the government's priorities for scientific research. Excerpts:*

You have followed science, innovation and research affairs during the last decade, first as a shadow Minister and later as Minister in the Labour Government. What are the key elements of Australia's strategy of fostering innovation?

My portfolio brings together university research, science and business innovation for the first time in Australian history. It is aimed at building on our strengths. We understand that we are working in an international context. What we do in the economy is linked to what we do as a society.

The key issue is about improving the living standards of our people. But we are also trying, through international cooperation, to assist other people to build their standards of living. Also, the social agenda is as important as the economic agenda.

How has the ordering of your priorities been shaped by your understanding of the areas in which Australia is strong, and of areas in which you need to develop partnerships with other countries?

We want to collaborate in all areas. We do not discriminate between areas of research. We will encourage our best and brightest to work with the best and brightest in other countries. The big problems facing humanity — climate change, the problem of ageing [populations], the global problem of food or water security — are such that no one country can ever hope to solve [them] by

KIM CARR: *"With Indian scientists and institutions we are talking about nanotechnology, biotechnology, water conservation, and astronomy."* — PHOTO: K. MURALI KUMAR

Our fundamental premise is that you need constant improvement if you want to maintain the quality of life at a certain level. No society can survive on the presumption that the status quo is good enough. Only societies that are capable of profoundly questioning themselves will be able to build better living standards. The key to innovation is problem-solving, identifying ways of improving indigenous communities, we need to do a lot more. Despite our weaknesses, we have done well in supporting people through change.

The structure of the Australian economy has changed dramatically in the last 30 years; it is going to change a lot more in the next 30 years. We have to provide support to enable people to move to new jobs. We need to ensure that people are

the answers — not even by the U.S., the most powerful country of the world. The scientific method is predicated not on the individual, but on teamwork and the sharing of knowledge, despite all the fantasies of Hollywood.

Australia produces three per cent of the scientific papers published worldwide. Our scientific contributions may be disproportionately large when compared to our share of the global population, but that is not good enough.

With Indian scientists and institutions we are talking about nanotechnology, biotechnology, water conservation and astronomy — we have a broad engagement. The Australia-India Strategic Research Fund, which started in 2008, has a contribution of A$65 million from our side, with an equal amount committed by the Indian counterparty, the Department of Science and Technology. We have spent A$31 million so far on 9 projects in India and Australia.

You have an MoU with the Indian Space Research Organisation (ISRO), which is due for renewal. What have been the achievements of this collaboration?

Neither country at this time has the capacity to launch a manned space vehicle. It is more about collaboration on spatial technologies. In particular, it is about having a better understanding of earth observation systems, especially in relation to climate change. It also includes other areas, such as understanding the oceans, issues relating to geology and monitoring natural disasters. We are also working with NASA, and the European and Japanese space agencies along similar lines.

Our collaboration with ISRO complements these other engagements. The beauty of it is that we have much to contribute because of our geographic location.

What has been the progress in the Square Kilometre Array (SKA) project? What is India's contribution?

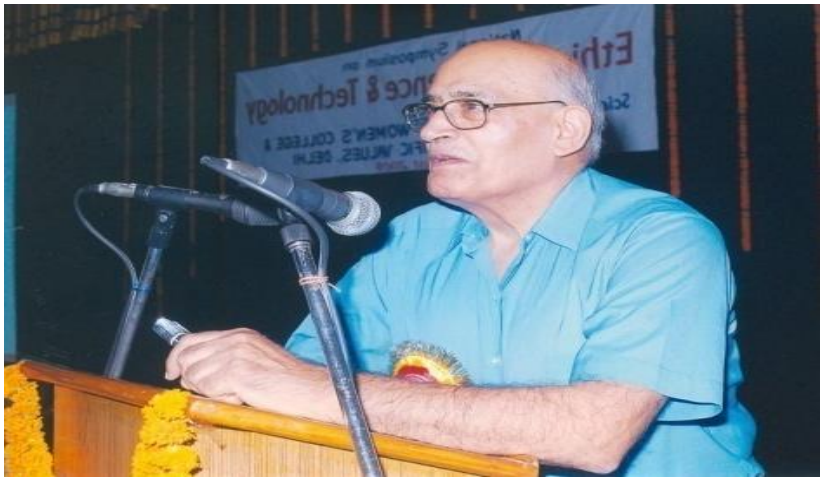
The decision on the siting of the project — whether it will be in Australia and New Zealand or southern Africa — will be taken next February. We welcome India's entry with an observer's status on the governing board of the project. Two Indian institutions — the Rama Research Institute [in Bangalore] and

Research driven learning- Teaching through low cost experiment
(**Natural process of Learning for Innovation- at all levels of study**

- Developed about 200 low cost science experiment, under the supervision of eminent academician Prof. H.C.Verma, IIT Kanpur and demonstrated these experiment under various situations including classrooms/ conferences, public lecture. As a impact, they observed that such low cost teaching through experiment is very effective tools for concept building and interest generation in basic science and scientific research. In April 2017 and October 2016, we have conducted the session at IIT Patna under Rashtriya Aviskar Abhiyan programme - Initioative of Govt. of India.

Society for Scientific Values: Delhi
For Global Personality

- According to Article 51-A (h) of the Indian Constitution the duty of every citizen is to develop scientific temper along with humanism and a sprit of inquiry and reforms.
- It has also been stated in The Bhagwat Gita that our world civilization and societies have risen to a higher level not through mechanical or technological efficiencies but practising sound moral and ethical values

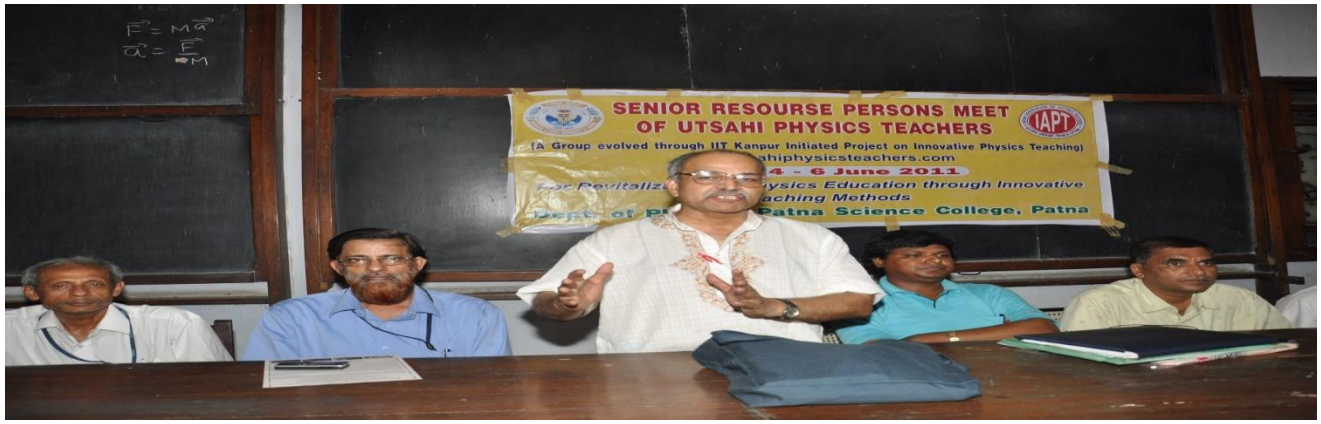


1. Dr. Rakesh Kr Singh 2. Dr. S. Prasad, 3. Dr A.K.Bhomik, Director, I.I.T Patna
4. Dr. S.Lal, V.C, Patna Univ 5. Dr. K..L. Chopra, Director- I.I.T Kharagpur
6. Dr. Kotnala, Dy- Directoir, NPL-Delhi 6. Dr.Sister D' Souza, Principal, PWC

Youth must be made to understand the beauty of doing science, the pleasure of doing science, and the ultimate bliss when results of science make you understand nature, master it, control it, and finally make things that improve the quality of life of humankind.

Advance in Nanotechnology not Nanoscience-?

Confidence and Constructive energy



My Teacher and Mentor, Prof. H.C. Verma Sir always Inspire- Atambishawas is like a neutrino particle. No walls or mountain can stop its motion. Even if earth comes in front of neutrino particles this particles can penetrate in to the earth. Therefore a Person full of Enthusiasm and confidence can create a Path of success. This is law of Nature.

Europe to bet up to €1 billion on quantum technology- Frontiers area of Science

Two similarly ambitious schemes showering money on a single topic, called Flagship projects, have been underway in the European Union since 2014. One focuses on the study of graphene, the other on a computer model of the entire human brain.

RESEARCH LAB

ARYABHATTA CENTRE FOR NANO SCIENCE AND NANO TECHNOLOGY
SCHOOL OF ENGINEERING AND TECHNOLOGY
(ARYABHATTA KNOWLEDGE UNIVERSITY PATNA)
Head
DR.RAKESH KUMAR SINGH

Nanoscience Structural characterization Research Lab

Scanning Electron Microscope (Make: Carl Zeiss Microscopy Ltd., UK)

FTIR spectrophotometer (PerkinElmer, UK) (Make: PerkinElmer, UK)

X-Ray Diffractometer with temperature variation facility,Make: Bruker, Germany)

Atomic Force Microscope cum Scanning Tunnelling Microscope, (Make: NT-MDT, Ireland)

Nanoscience Optical characterization Research Laboratory

UV-Vis-NIR spectrophotometer with temperature variation facility(Make: PerkinElmer, UK)

Dynamic Light Scattering Particle Size cum Zeta Potential Analyser (Make: Micromeritics Instruments Corp., USA)

Photoluminescence measurement system with temperature variation facility (Make: PerkinElmer, **UK**)

Nanoscience Magnetic and Electrical characterization Research Laboratory

Vibrating Sample Magnetometer with temperature variation facility (Make: **Lake Shore Cryotronics, Inc., USA**)

Precision Multiferroic Test System (*P-E*, piezoelectric, piezoelectric, magneto-electric for bulk and thin-films) with temperature variation facility (Make: USARadiant Technologies Inc., USA)

Impedance Analyser (40 Hz – 110 MHz) with temperature (up to 1000°C) variation facility (Make: Keysight Technologies, USA)

Nanoscience Thermal analysis characterization Lab and Hydrothermal analysis Laboratory

High Temperature (*lq*. N_2 - 1600°C) Simultaneous TG-DTA / DSC Analyser, =(Make: NETZSCH Technologies, Germany)

Microwave assisted Hydrothermal technique for nonmaterial synthesis (Milestone, Italy)

Atomic force microscope and Scanning tunneling microscope

Nanoparticle Tracking Analysis system
(Make: Malvern Instruments, UK)

High Precision Dilatometer (NETZSCH Technologies, Germany) (Make: NETZSCH Technologies, **Germany)**

Water cooled bench top grinding machine (Planetary ball mill type) (Make: Retsch, Germany)

Digital Refractometer with temperature variation facility
(Make: Mettler Toledo AG, Switzerland)

Microprocessor based High-Temperature Furnace (Temperature range: up to 1800°C)
(Make: Nabertherm, Germany)

Automatic pH and Conductivity meter
(*Make:* Mettler Toledo AG, Switzerland)

Thankful to Mentors/ Teachers

- 1. **Prof. H.C.Verma, Dept. of Physics, I.I.T Kanpur**
- 2. **Dr. Amarendra Narayan, Dept. of Physics, Patna University**
- 3. Dr. Sister Doris D'Souza, Principal, Patna Women's College, Patna Univ
- 4. Prof. S.P.Verma, Chairman, NCSTC –network, New Delhi and Ex-Univ. Prof. And Head, Dept. of Physics, Science College, Patna
- 5. Prof. S.N.Guha, Ex-PG head & Dean, Faculty of Science, Patna University
- At present-V.C, AKU, Patna
- **5. *Prof. Asheshwar Yadav, Former Vice Chancellor, Bihar Univ. Muzaffarpur***
- ***(Post-Doctoral research suppervisor*)**
- 6. Dr. R.K.Kotnala, , National Physical Laboratory (NPL), Delhi
- 7. DR. Chandan Upadhay, IIT, BHU
- 8. Prof. A.C.Pandey, Nanotechnology Centre, Univ. Of Allahabad (At present V.C of Jhansi University)
- 9. Prof. K.L.Chopra, Ex-Director, I.I.T Kharagpur
- Dr. Ranjan Kr Singh, BHU
- Dr. Permendra Ranjan Singh, J.P.University

Happy

NanoScience & Nanotechnology

There is plenty of room at the bottum


THANK YOU