Department of
Electronics, IT, Bt and S&T

# BENGALURU INDIA NANO

March 7-9 2022

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BENGALURU INDIA NANO March 7-9 2022

NANOTECH FOR SUSTAINABLE FUTURE

## INDEX


| Poster Number | Title of Paper | Poster Author |
|---|---|---|
| POS-1 | Innovative Synthesis methods of carbon based quantum dots for tumour imaging and triggered drug release | Dr Ashajyothi C |
| POS-2 | Design and Simulation of a Coplanar Waveguide fed Antenna for X band applications | Aruna P |
| POS-3 | Fluorophores encapsulated, core-shell nanoparticles for improvising the diagnostics potential in light induced hyperthermia | Sharon George |
| POS-4 | Mist-Driven Transparency switching Glass: A New Smart Window Technology | Nilay Awasthi |
| POS-5 | Rare type Ultrathin reduced Graphene Oxide/metal oxides - rGO/ ZrO2 and rGO/Bi2O3 hybrid substrate for SERS based environmental pollutant | Dr. C. Kavitha |
| POS-6 | Novel corneal targeting cell penetrating peptide as a nanomedicine for ocular diseases and disorders | Sujithra Shankar |
| POS-7 | Conversion of scrap iron into ultrafine Î±-Fe2O3 nanorods for efficient visible light photodegradation of ciprofloxacin | Arushi Arora |
| POS-8 | One in a million Ni3+ that loves urea and hates COx for remarkable electrochemical urea oxidation | Muhammed Safeer N K |
| POS-9 | COMPOSITES OF SURFACE MODIFIED AGAVE AMERICANA FIBERS AND SILVER NANO PARTICLES FOR REMOVAL OF METHYLENE DYE FROM WATER | Shikha Dogra |
| POS-10 | Affordable Electrochromic Smart Window for Zero-Energy Buildings | Indrajit Mondal |
| POS-11 | Plasma treated CsPbBr3 NCs films with enhanced photoluminescence and improved water stability for optoelectronic applications | Radha Rathod |
| POS-12 | Structural and optical studies of Biosynthesized gold nano-particles | Dr Madhu A |
| POS-13 | Zinc substituted high-entropy oxides for magnetic hyperthermia applications | Prasun Banerjee |
| POS-14 | Anti-microbial and magnetic properties of pure and cobalt doped ZnO nanoparticles. | Venkatalakshmi N |
| POS-15 | Lithium and Manganese Rich Layered Li1.2NixMnyCoxO2 Cathode for Advanced Li-ion Battery Applications | Silpasree S J |
| POS-16 | Enhancing EDLC of Ti3C2Tx Mxene with Novel Synthesis and Tunable Surface Properties | Soorya Srinivasan |
| POS-17 | Long Life Li4Ti5O12 at low discharge voltage for High performance Lithium Ion Battery Application | Dona Susan Baji |
| POS-18 | Doped Na3V2(PO4)2O2F for high performance sodium-ion batteries | Pooja Bhaskar M |

| Poster Number | Title of Paper | Poster Author |
|---|---|---|
| **POS-19** | Development and characterization of engineered diosgenin encapsulated cellulose nanoonion as a controlled drug release nanosystem | Syed M.S. Abidi |
| **POS-20** | Cost-effective and Eco-friendly MnO2 based 2.2 V High Energy Aqueous Supercapacitor | Samhita Pappu |
| **POS-21** | Understanding the transformation of 2D layered perovskites to 3D perovskites in the sonochemical synthesis | Modasser Hossain |
| **POS-22** | Nanosized MOF functionalized smart textiles for adsorptive removal of harmful Air pollutants | Hardeep Singh Jhinjer |
| **POS-23** | Subatomic sized gold cluster for simultaneous imaging and photodynamic therapy | RESMI A N |
| **POS-24** | Realization of Self-Trapped Excitonic Emission in 2D Nanoplates of Layered Metal Halide RbPb2Br5 | Dr. Jayita Pradhan |
| **POS-25** | Sonochemical Assisted Molten Salt Syntheis of Ti2AlC MAX Phase | B. Srikanth Ragunath |
| **POS-26** | Combining 3D Bioprinting and Electrospinning Methods to Fabricate Multilayered 3D Human Skin Equivalents for Skin Tissue Engineering Applications | S. Muthu Parkkavi |
| **POS-27** | Realization of High Thermoelectric Figure of Merit in Solution Synthesized 2D SnSe Nanoplates via Ge Alloying | Sushmita Chandra |
| **POS-28** | Efficient Dual Crosslinking of Protein-in-Polysaccharide Bioink Towards Biofabrication of Functional Cardiac Tissue Constructs | Harshavardhan Budharaju |
| **POS-29** | A modular technology platform targeting unusual architectures of RNA/DNA genome for viral detection | Sumon Pratihar |
| **POS-30** | Cobalt decorated Carbon Nitride as an efficient catalyst for Photoelectrochemical Ethanol Oxidation | Ritika Wadhwa |
| **POS-31** | Hybrid vector Chemo-Geno therapy for the treatment of Acute myeloid leukemia | Pratheppa Rajagopal |
| **POS-32** | Additively Manufactured Biomimetic Nerve Constructs for Peripheral Nerve Regeneration | Allen Zennifer |
| **POS-33** | Confinement Matters: Stabilization of CdS Nanoparticles inside a Post-Modified MOF towards Photocatalytic Hydrogen Evolution | Adrija Ghosh |
| **POS-34** | Evaluation of VEGF silencing efficacy using novel PVI polyplex with multi-modal action against lung cancer in 2D and 3D models | Gayathri kandasamy |
| **POS-35** | Enhanced Band Convergence and Ultraâ€Low Thermal Conductivity Lead to High Thermoelectric Performance in SnTe | Riddhimoy Pathak |
| **POS-36** | Hydrogen Storage Performance in 2H-MoS2 | Mukesh Kumar |

| Poster Number | Title of Paper | Poster Author |
|---|---|---|
| **POS-37** | Structural Phase Transition Triggering High Thermoelectric Performance in p-type GeTe | Debattam Sarkar |
| **POS-38** | Formulation and evaluation of surfactant based nano lipid vesicles of aztreonam for inhalation-an emerging delivery to ameliorate the condition of infected lungs | Sayani Bhattacharyya |
| **POS-39** | Anti-amyloidogenic and fibril disaggregating potency of the levodopa functionalized gold nanoroses as exemplified in a diphenylalanine based amyloid model | Avneet Kour |
| **POS-40** | In-situ Synthesis of Nanodiamond on Textile Surface and its Functional Applications | KARAN CHANDRAKAR |
| **POS-41** | Enhanced thermal stability and monodomain growth in a 3D soft photonic crystal aided by graphene substrate | NURJAHAN KHATUN |
| **POS-42** | Formulation, characterization and comparative pre clinical evaluation of effective dermal penetration of in vitro isolated taxol nano formulations as a novel treatment for breast cancer | Kuntal Das |
| **POS-43** | Bandgap Engineered g-C3N4 and its Graphene Composites for Stable Photoreduction of CO2 to Methanol | Ramesh Chandra Sahoo |
| **POS-44** | Development of Boron Nitride Nanotubes-Gelapin Hydrogel Films for Cardiac Tissue Engineering | Sathyan Vivekanand Anandhan |
| **POS-45** | Synthesis and Optical Characteristics of Graphene Quantum Dots for Photovoltaic Devices | Grisham Ashish Darooka |
| **POS-46** | ZnO Assisted Defect Engineering in Nanostructured TiO2: An Efficient Photo-anode System for Dye Sensitized Solar Cells | Muthiah Ravichandran |
| **POS-47** | Fabrication and Studies on Platinum-free Dye Sensitized Solar Cells via Vacuum Filtration Assisted Aligned Carbon Nanotube Counter Electrodes | M. Arshad Basha |
| **POS-48** | Microfluidic-based photocatalytic reactor for environmental remediation | Bhanu Prakash |
| **POS-49** | Material Fabrication of SERS Substrates for Biomolecule Detection and Biosensor Application | P. Nandhagopal |
| **POS-50** | Bi-functional Electrode for Supercapacitor and UV Detector Applications Using Two-Dimensional Layered Coordination Polymers | Sabiar Rahaman |
| **POS-51** | Angle-Sensitive Nanoscale SOI Photodetector for Lensless Imaging | ANITHARAJ NAGARAJAN |
| **POS-52** | Universal nanoDs - The Real-time Unification of All Nanoanalytical & Quantum Technologies | Sagar Gosalia |

| Poster Number | Title of Paper | Poster Author |
|---|---|---|
| **POS-53** | Electrically conductive composites fibers using nanostructures of conjugated polymer | Kiran rana |
| **POS-54** | Development of Curcumin Loaded Protein-Glycosaminoglycan Nanocarrier to Target Macrophages | Madhumithra T |
| **POS-55** | Fungus Based Bio-Fabrication of Carbon Supported Silver Nanoparticles and their antimicrobial activity. | AZAM RAZA |
| **POS-56** | New Generation Nanotheranostic Agents Against Alzheimer Disease | Manju Sharma |
| **POS-57** | Carbon based nanozyme: Synthesis of metal free carbon nanosphere to mimic peroxidase and catalase activity | Ashish Kumar Shukla |
| **POS-58** | Single phase microfluidics for assembly of gold nanorods | Rama Pandillapally |
| **POS-59** | Red Emitting Graphene Nanosheets Conjugated Copper Nanoclusters for Targeted Antibiofilm Activity | Chandni sharma |
| **POS-60** | In-vitro Cytotoxicity of Zinc Oxide Nanoparticles Synthesized from Lagerstroemia indica on Human Cancer Cell Lines | Ambika Behera |
| **POS-61** | Musculoskeletal Analysis Integrating OFBG Sensors on a Scissorcal Hand Grip Measurement Device | Dr. Preeta Sharan |
| **POS-62** | Protein Pre-coated Gold Nanoparticles for Predictable Protein Corona and Improved Cellular Association | AQIB IQBAL DAR |
| **POS-63** | Nanomedicines for Intranasal delivery of Levodopa : A Promising Approach towards well-being of patients with Parkinson Disease. | Akanksha Lahiri |
| **POS-64** | Calcium Ferrite loaded PVDF-HFP flexible piezoelectric/magnetoelectric nanofibers for implantable energy generator application | Anshida Mayeen |
| **POS-65** | Nanostructured Antimicrobial Surfaces for Preventing Hospital Acquired Infections | Naveen Bharadishettar |
| **POS-66** | Selective SO2 Detection at Low Concentration by Ca Substituted LaFeO3 Thin Film Sensor | Chethana Aranthady |
| **POS-67** | Modelling and Composition Optimization for Hardness Properties of Agave Cantala Fibre and Multi-walled Carbon Nanotube Reinforced Polymer Nanocomposite: A Mixture Design Approach | Prof. Dr. Shreeranga Bhat |
| **POS-68** | Nanostructured NaFeS2 as a Cost-Effective and Robust Electrocatalyst for Hydrogen and Oxygen Evolution with Reduced Overpotentials | Dileepkumar V G |
| **POS-69** | Composite nanofiltration membrane comprising one-dimensional erdite, two-dimensional reduced graphene oxide, and silkworm pupae binder | Balaji K R |
| **POS-70** | Facile synthesis, characterization of plant-based biogenic silica nanoparticles and its antibacterial activity | Mohini Verma |

| Poster Number | Title of Paper | Poster Author |
|---|---|---|
| **POS-71** | Resveratrol Transfersomes for Transpapillary Iontophoretic Delivery to breast cancer | Shivaprasad Gadag |
| **POS-72** | Synthesis of gold nanorods and bulk refractive index sensing using sucrose | Prajna N D |
| **POS-73** | Effect of Zinc oxide nanoparticles loading on electrical conductive properties of Polyvinyl alcohol-Polyaniline polymer films | Pratibha Kanavi |
| **POS-74** | Identificaton of Unusually Low Glass Transition Temperature in Polyamide-6 Nanofibres | Dr. R. Ramani |
| **POS-75** | Re-designing the Food Packing tool by Reinforcing with the Bio-Degradable Composite | Rubalya Valantina.S |
| **POS-76** | Morphologically Tuned Self-Assembled Nanostructures: Their Impact on Cellular Internalization Efficiency and Anti-Cancer Drug Delivery | Sonika Chibh |
| **POS-77** | Uranium phthalocyanine anchored with acid functionalized MWCNT as an efficient electrocatalyst for oxygen evolution reaction | Giddaerappa |
| **POS-78** | Electrospun Nanostructured Magnesium Oxide for the Detection of Volatile Organic compounds | D. Balamurugan |
| **POS-79** | Green synthesis, characterization and evaluation of nano boron and Sulphur fertilizers on growth and productivity of sunflower | PRUTHVIRAJ N |
| **POS-80** | Comparative study of pure and polymer coated rare earth oxide nanoparticles for optoelectronic applications | Kartik Gopal |
| **POS-81** | Nickel foam-supported polymeric cobalt(II) phthalocyanine as an efficient electrocatalyst for oxygen evolution reaction | SHANTHARAJA |
| **POS-82** | Treatment of milk processing industry effluent via chitosan-titanium dioxide nanoadsorbent coated sand | Dinesha B L |
| **POS-83** | PULLULAN BASED NANOCARRIER FOR NUCLEIC ACID DELIVERY AND FREE RADICAL SCAVENGING | Rekha M R |
| **POS-84** | Dispersion of Co3O4 on CeO2 nanorod reduces Ce4+ to Ce3+ for effective synthesis of dimethyl carbonate from CO2: Integrated DFT & experimental study | Dr. Ganapati V. Shanbhag |
| **POS-85** | NANOFIBER BASED APPROACH FOR UTERINE AND PERIPHERAL NERVE TISSUE ENGINEERING | Dr. Manasa Nune |
| **POS-86** | Preparation and characterization of positive contrast agent encapsulated liposomal carrier system | Sathiyasivam Kaviarasi |
| **POS-87** | Nanostructured hybrid lipid capsules as a next generation platform for breast cancer therapeutics | Suparna Mercy Basu |
| **POS-88** | POLYHYDROXYBUTYRATE (PHB), A GREEN PLASTIC: TOWARDS AN ECO-FRIENDLY ENVIRONMENT | Aksha Dhawan |

| Poster Number | Title of Paper | Poster Author |
|---|---|---|
| **POS-89** | Nanostructure hybrid lipid capsules (nHLCs) for eradicating glioblastoma and glioblastoma stem cells | Uzma Hasan |
| **POS-90** | ROS responsive polymer coated magnetic nanoparticles for multimodal synergistic cancer therapy | Meenakshi Chauhan |
| **POS-91** | Application of ZnO nanoparticles in improving seedling establishment of legume and non-legume field crops | P. SARAVANANE |
| **POS-92** | Work function model of metallic nanoparticles for multi dye degradation from waste water: An approach towards ecological remediation | AAYASHA NEGI |
| **POS-93** | Overview on methods to overcome of degradation of CsPbBr3 PQDs in water for Bio-medical applications | Sanjayan C. G |
| **POS-94** | Biosynthesis of ZnO nanoparticles from the leaf extract of Cassia tora and its Electrochemical studies using cyclic voltammetry and Evaluation of Antimicrobial activities. | Mamata C. Naik |
| **POS-95** | Nanostructured Antimicrobial Surfaces for Health Care Applications | Naveen Bharadishettar |
| **POS-96** | Electrophoretic motion of a water microdroplet | Chintak K Parashar |
| **POS-97** | 2D Borocarbonitrides: Tunable electronic properties | Rohit |
| **POS-98** | Synthesis and Characterization of Nano-Iron from Green biomass and evaluation of it effect on Aerobic Rice (Oryza sativa L.) | Akshay Kumar, T. K. |
| **POS-99** | Charge-transfer regulated visible light driven photocatalytic H2 production and CO2 reduction in tetrathiafulvalene based coordination polymer gel | PARUL VERMA |
| **POS-100** | Surfactant contribution towards heat transfer in Fe Oxide nanofluids | Ajit Singh |
| **POS-101** | Spinel Ferrite Nanoparticles incorporated on Multiphase MoS2 electrocatalyst for Oxygen Evolution Reaction | Merin Mary Sebastian |
| **POS-102** | Effect of Mn Doped Ni-Co Mixed Oxide Catalysts on Urea Oxidation | Shilpa Santhosh |
| **POS-103** | Studies on the evaluation of Nano Urea for sustainable Finger millet production at Karaikal | S.RAJESHWARI |
| **POS-104** | Room Temperature Solid-Liquid-Solid Cation Exchange in CsPbBr3 Perovskite Nanocrystals with Copper | Fency Sunny |
| **POS-105** | Photophysical and Charge Transfer Properties of engineered Metal Oxide and Metal Nanocluster Hybrid | Fadeela Chundekat Ummer |
| **POS-106** | Detection of Nitrobenzene in pristine and metal functionalised 2D VSe2 monolayer (TMDC): A Density Functional Theory Study | Seetha Lakshmy |

| Poster Number | Title of Paper | Poster Author |
|---|---|---|
| **POS-107** | Vertically graphene sheets -TiO2 hybrids for enhanced Photocatalysis mechanism | Bosely Anne Bose |
| **POS-108** | Investigations on the Multiferroic Properties of P(VDF-TrFE)/Ferrite Self-standing Films | M T Rahul |
| **POS-109** | Unraveling the effectual binding potential of carbon nanotubes and norfullerene against multiple targets of SARS-CoV-2 by computational modeling and virtual screening | Dr. Sinosh Skariyachan |
| **POS-110** | Synthesis and Characterisation of Er3Fe5O12 Incorporated PVDF-HFP Polymer Nanocomposite Films For Multifunctional Applications | SOBI K CHACKO |
| **POS-111** | Structural, Dielectric and Magnetoelectric Properties of Modified PVDF-Ferrite Polymer Nanocomposites | Bhadrapriya B C |
| **POS-112** | Luminescent Gold Nanodots for advanced bioimaging applications | Raji Vijayamma |
| **POS-113** | Synthesis and Characterization of ZnO nanoparticles from the seed extract of Cassia tora and the study of electrochemical behavior of Dopamine using ZnO nanoparticles. | Dr. Jyothi Kini H |
| **POS-114** | Nanotechnology in prosthetics | Naleen Venkatesh |
| **POS-115** | Composites of surface modified Agave Americana fibers and Silver nanoparticles for the removal of dye from water. | Shikha Dogra |
| **POS-116** | Effect of Aloe vera incorporated Chitosan /Nano Cellulose based edible coating material to enhance the shelf life of fruits and vegetables | ANJUMOL K S |
| **POS-117** | Morphological Analysis of Sustainable Nanocomposites of Nanocellulose and Natural Rubber | Milanta Tom |
| **POS-118** | Nanosecond Optical Nonlinearity in Silver Decorated Graphene Oxide Nanohybrid Fabricated via Laser Ablation | Dr Parvathy Nancy |
| **POS-119** | Iron oxide nanoparticles effects on seed germination and plant growth in capsicum annum L, (Chilli) and S. melongenium (Brinjal). | Sushma shree.k |
| **POS-120** | Smart Nanocontainer-based Environment Friendly Protective Coatings on Mild steel | Aarti Gautam |
| **POS-121** | Novel Spinel Nanoparticles based Absorber Coated Receiver tubes for Concentrated Solar Thermal Industrial Applications | K. K. Phani Kumar |
| **POS-122** | An innovative ideology and a developmental sustainability related to Applied Sciences Nanotechnology and its perspectives for interaction of human welfare | R Srinivasa |
| **POS-123** | Large area perovskite modules with enhanced stability for niche applications | Reshma Dileep K |
| **POS-124** | Moth proofing of wool fabric using nano kaolinite | Seiko Jose |

| Poster Number | Title of Paper | Poster Author |
|---|---|---|
| **POS-125** | A Blend Of Nanotechnology & Forensic Science : A Comprehensive Review | Pragna M Shivannavar |
| **POS-126** | GalliuGallium Nitride-based composites for wastewater treatment: A remediation toolm Nitride-based composites for wastewater treatment: A remediation tool | Sakamuri Layasree |
| **POS-127** | Drug designing and discovery of new drug entities by the Structure Activity Relationship and Computer aided SAR by taking Chromone moiety as a lead. | Dr. Jyothi Kini H |
| **POS-128** | Synthesis and Characterization of Silver nanoparticles using extract of Aloe vera plant and evaluation of antimicrobial activities. | Dr. Jyothi Kini H |
| **POS-129** | Chemical Synthesis of Copper-Chitosan Nanoparticles and Their Biological Activity | Sushmitha |
| **POS-130** | Synthesis and Characterization of Silicon Dioxide Nanoparticles and Their Efficacy in inducing protection against pearl millet downy mildew pathogen | Anusha N |
| **POS-131** | Green Synthesis of Silver Nanoparticles by Cytobacillus firmus isolated from the Stem Bark of Terminalia arjuna and Their Antimicrobial Activity against Pearl millet blast pathogen Magnaporthe grisea | Yogitha N |
| **POS-132** | Green Synthesis of Zinc Oxide Nanoparticles (ZnO NPs) for Effective Degradation of Dye, Polyethylene and Antibacterial Performance in Waste Water Treatment | Raneem I |
| **POS-133** | Carbon Soot Derived from Wasted Rubber: An Additive in Lubricating Oil for Efficient Friction and Wear Reduction | Nowduru Ravikiran |
| **POS-134** | Nanocomposite Hydrophobic Coatings: A promising Intervention Against Bacterial Infections | Ramay Patra |
| **POS-135** | Chitosan nanoparticles having higher degree of acetylation induce resistance against pearl millet downy mildew through nitric oxide generation | Sushmitha S |
| **POS-136** | Graphene Oxide[GO] & Reduced Graphene Oxide[rGO]: Synthesis & Applications | Sharmila S |
| **POS-137** | One-pot three-component synthesis of thioether linked 4-hydroxycoumarin-benzothiazole derivatives under ambient condition and evaluation of their biological activity | Priya R. Kadam |
| **POS-138** | A Biodegradable Polymer-Assisted Efficient and Universal Exfoliation Route to a Stable Few Layer Dispersion of Transition Metal Dichalcogenides | Priyanka Yadav |
| **POS-139** | Development of Nanotech based COVID19 - Antigen Rapid Detection Test | Dr Chandranayaka S |
| **POS-140** | Different BiOCl nanostructures based PMMA nanocomposites | Sakshi Sharma |

# INNOVATIVE SYNTHESIS METHODS OF CARBON BASED QUANTUM DOTS FOR TUMOUR IMAGING AND TRIGGERED DRUG RELEASE

**Dr. Ashajyothi C**
Assistant Professor
Department of Biotechnology
Vijayanagara Sri Krishnadevaraya University,
Ballari-583 105, Karnataka, India
E-mail: drashajyothic@vskub.ac.in

Quantum dots (QDs) are semiconductor nanoparticles or nanocrystals with a dimension ranges from 2-10 nanometers (10-50 atoms). With the demand for more biocompatible QDs for applications in biology, essentially in controlled release of drug delivery systems for simultaneous cancer imaging and therapy, many researcher moved towards in the fabrication of cadmium-free quantum dots (CFQDs), such as silicon QDs (Si QDs), carbon dots (C-dots), graphene QDs (GQDs), Ag2Se, Ag2S, InP, CuInS2/ZnS. Current study hypothesize that a novel C-dots based drug delivery system is a promising theranostic strategy for tumour imaging and for triggered drug release. The superlative carbon source was screened and ultimately elected for the synthesis of C-dots (predominantly intended on CQD, GQD and 2D inorganic material). Morphological characteristics, stability and loading ability of (Doxorubicin) DOX@C-dots were investigated in the first step. The conjugated DOX@C-dots featured a delicate design with favourable tumor targeting property, good stability and superior drug loading efficiency. DOX@C-dots will show excellent biocompatibility and tumour targeting ability *in vivo*. Finally, potent therapeutic efficacy of DOX@C-dots was demonstrated in tumour-bearing mice. Therefore, the attractive features of DOX@C-dots promise great potential of this drug loading system for combined tumour targeting therapy.

**KEYWORDS:** Semiconductor nanoparticles, Biocompitable, C-dots, Triggered drug release, Anticancer drug

**POS-01**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Dr. Ashajyothi C.** |
| Address | : | Department of P.G. Studies and Research in Biotechnology, Vijayanagara Sri Krishnadevaraya University, Jnana Sagara Campus, Ballari - 583105, Karnataka, India |
| Mobile | : | +91-8073259740 |
| Email | : | drashajyothic@vskub.ac.in |
| Affiliation | : | Department of Biotechnology Vijayanagara Sri Krishnadevaraya University, Ballari |

# DESIGN AND SIMULATION OF A COPLANAR WAVEGUIDE FED ANTENNA FOR X BAND APPLICATIONS

[1]ARUNA P, [1] NAVEENA S. M, [1]JOSEPH C. M, [2]NAGACHANDRA M. K, [2]MANJUNATH T. C.
[1]*Department of Physics, Dayananda Sagar College of Engineering, Bangalore, INDIA*
[2]*Department of Electronics, Dayananda Sagar College of Engineering, Bangalore, INDIA*
naveen-physics@dayanandasagar.edu
aruna-physics@dayanandasagar.edu

The proposed antenna, a coplanar waveguide (CPW) antenna, is designed to operate in the X band frequency (8-12 GHz) for weather and radar applications. In this work, the antenna showed the resonant behavior at 8.92 GHz and 11.65 GHz with a good return loss. The antenna simulations were performed by using Ansys HFSS EM 16.2 and the simulation results are presented in terms of Resonant Frequency, Return Loss, Radiation Pattern, the antenna Gain and its Current distribution. Advantages of using CPW design is utilized in this work and the designed antenna finds applications in Satellite Communication and Radar Communications.

Keywords: CPW, X band, Radar applications, Satellite communication

**POS-02**

| | | |
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| **Poster Presenter** | : | **Naveena S.M.** |
| Address | : | Dept. of Physics, Dayanandasagar College of Engineering, Kumaraswamy Layout, Bangalore - 560078, Karnataka, India |
| Mobile | : | +91-9482965259 |
| Email | : | naveen-physics@dayanadasagar.edu |
| Affiliation | : | Dayanandasagar College of Engineering |
| Co Author(s) | : | Naveena S M, Joseph C M, Nagachandra M K, Manjunath T C & Aruna P |

# FLUOROPHORES ENCAPSULATED, CORE-SHELL NANOPARTICLES FOR IMPROVISING THE DIAGNOSTICS POTENTIAL IN LIGHT INDUCED HYPERTHERMIA

Sharon George,[1] Shajesh Palantavida*
[1]*Centre for nano and material science, Jain (deemed to be university), Jain global campus, Ramanagaram, Karnataka 560062*
*p.shajesh@jainuniversity.ac.in

Theranostic nanoparticles are typically multifunctional and intended for specific and personalised disease management. Targeted photothermal probes, for example, can be modified to include fluorophores that can be tracked using fluorescence bioimaging, increasing their diagnostic potential. Photothermal therapy (PTT) / light induced hyperthermia is a relatively benign and non-invasive therapeutic solution for management of cancer. However, clinical translation of the procedure as a stand alone treatment still needs to overcome multiple challenges including minimizing uncontrolled heating and the consequential damage to healthy tissues. A self-limiting procedure would require real time follow-up of temperature during treatment. In this context we propose a core-shell construct with encapsulated dye molecules that can ratiometrically and linearly respond to change in temperature. The plasmonic core induces hyperthermia on light irradiation and fluorescence from the dye embedded shell varies with temperature. This design enables ratiometric sensing of temperature and removes design burden of multiple excitation sources. Using a combination of photo analytical measurements and linear decomposition of spectra, contributions of fluorophores to optical properties of single probes are deduced. The results indicate that probes with varying donor acceptor ratios can be predictively synthesized and the synthesized probes can ratiometrically measure local temperature.

**Keywords:** Photothermal therapy, Hyperthermia, Temperature sensor, Nanosensor, Ratiometric, Fluorescence.

**POS-03**

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| **Poster Presenter** | : | **Sharon George** |
| Address | : | Jain Global Campus, Ramanagaram, Bangalore, Karnataka, India |
| Tel | : | +91-7639033398 |
| Mobile | : | +91-8310465798 |
| Email | : | sharon.george@jainuniversity.ac.in |
| Affiliation | : | Jain (deemed to be university)/Centre for Nano and Material Science |
| Co Author(s) | : | Dr. Shajesh Palantavida |

# MIST-DRIVEN TRANSPARENCY SWITCHING GLASS: A NEW SMART WINDOW TECHNOLOGY

Nilay Awasthi, Dr. Indrajit Mondal, Mukhesh K.G, Dr. Ashutosh Kumar Singh
Centre for Nano and Soft Matter Sciences, Bangalore

Implementing Smart Window Technologies (SWT) in households is the most effective way to achieve on-demand privacy control and reduce energy consumption. Existing SWT have hardly made any impact in consumer market due to their complex fabrication process and use of expensive materials. Thus, the demand for inexpensive SWT has risen significantly in recent years. Therefore, researchers have been putting their effort to find alternative SWT which are cost-effective, power-efficient and simple to fabricate. Herein, a new class of smart windows named 'Mist-Driven SWT" is introduced. The transmittance value of the window can be controlled by varying the inflow/outflow of mist. The degree of visible light scattering is governed by the assembled droplets on the inner surface of glass panes while mist inflow. A detailed study is reported here to understand the correlation among glass contact angle, droplet size, mist inflow time, etc., which governs the device performance. The device shows an excellent transparency modulation of ~70% along with heat blocking properties (~3°C cooler than outside). In addition, the inexpensive fabrication process of the Mist-driven SWT gives an advantage over available SWT. It is expected that this unique technology will make an impact on the modern infrastructure market.

**POS-04**

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| **Poster Presenter** | : | **Nilay Awasthi** |
| Address | : | Centre for Nano and Soft Matter Sciences, Arkavathi, Survey No.7 Shivanapura, Dasanapura Hobli, Bangalore - 562162, Karnataka, India |
| Mobile | : | +91-7559339831 |
| Email | : | neil.awasthi39@gmail.com |
| Affiliation | : | Centre for Nano and Soft Matter Sciences |
| Co Author(s) | : | Dr. Indrajit Mondal, Mukhesh K.G, Dr. Ashutosh Kumar Singh |

# RARE TYPE ULTRATHIN REDUCED GRAPHENE OXIDE/METAL OXIDES - RGO/ $ZRO_2$ AND RGO/$BI_2O_3$ HYBRID SUBSTRATE FOR SERS BASED ENVIRONMENTAL POLLUTANT SENSORS

**Awati Prema Mahadev**[a], **Jil Rose Perutil**[b], **Neena S. John**[b], **Sudheeksha**[c] **C. Kavitha**[a*]

[a] B.M.S. Institute of Technology &Mangagement, an autonomous under VTU, Bangalore-560064, India

[b]*Centre for Nano and Soft Matter Sciences,* Arkavathi, Survey No.7, Shivanapura, Dasanapura Hobli, Bangalore - 562162, India

[c] Horiba-IISc Industry unit, IPC, IISc, Bangalore - 560012,

**Corresponding author E-mail:* gkavitha21@bmsit.in

A key problem in Surface Enhanced Raman (SERS) research is the selection of suitable substrates and the optimization of the preparation process. SERS substrates have changed from the original precious metals (Au, Ag and Cu) and the expensive metals (Pt and Pd) to semiconductor materials (ZnO, CuO, $TiO_2$). Semiconductor materials have good optics, electrics, biocompatibility, high stability, and low cost compared to the metal substrates. Semiconductors like $ZrO_2$ and $Bi_2O_3$ have excellent properties like electrochemical activity, oxidation resistance, high thermal and chemical stability which confirms their wide applications in energy storage, electronics and bio ceramics. Due to smaller particle size, large specific surface area, the Nano size $ZrO_2$ and $Bi_2O_3$ semiconductors can have an increase in the quantity of active sites on their surfaces. The use of semiconductor materials as SERS substrates is Universal; however, till date, only few countable studies describing the use of $ZrO_2$ as a SERS substrate have been reported [1,2]. Here, we would like to explain SERS activity of rGO-$ZrO_2$ and rGO-$Bi_2O_3$ prepared by one-step liquid/liquid interface method towards the detection of environmental pollutants like Rhodamine 6G (R6G) dye (fluorescent) and 4-MercaptoPyridine (non-fluorescent) analytes for the first time. R6G is a synthetic dye and proven carcinogenic, reproductive and neurotoxic that can cause skin, eyes and respiratory tract irritation. The rGO-$Bi_2O_3$ and rGO-$ZrO_2$ can be promising dye/chemical sensor candidates due to their enhanced SERS activity.

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**POS-05**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Awati Prema Mahadev** |
| Address | : | Physics/Chemistry R&D-Centre for Advanced Materials Research, BMSIT&M, Bangalore Karnataka, India |
| Tel | : | +91-80-29521171 |
| Mobile | : | +91-9972823856 |
| Email | : | awatiprema107@gmail.com |
| Affiliation | : | BMSIT&M, Bangalore |
| Co Author(s) | : | Jil Rose Perutil, Neena S. John, Sudheeksha, C. Kavitha |

# NOVEL CORNEAL TARGETING CELL PENETRATING PEPTIDE AS A NANOMEDICINE FOR OCULAR DISEASES AND DISORDERS

Sujithra Shankar [1], Sushmita G. Shah [2], Shikha Yadav [3], Archana Chugh [1*]

[1] Kusuma School of Biological Sciences, Indian Institute of Technology, Hauz Khas, New Delhi-110016, India

[2] Department of Cornea and Anterior Segment Service, Dr CM Shah Charitable Trust-Netra Mandir, Borivli, Mumbai-400103, India

[3] National Institute of Biologicals, Sector-62, NOIDA, Uttar Pradesh-201309, India

** Corresponding author: achugh@bioschool.iitd.ac.in*

Delivery of therapeutics to the ocular tissues is challenging due to various anatomical and physiological barriers imposed. Cell penetrating peptides (CPPs) have emerged as potent drug nanocarriers that have been shown to overcome these barriers and enhance bioavailability of therapeutic macromolecules in deep ocular tissues. In the present study, an ocular targeting CPP has been designed by exploring potential targets of anterior ocular tissues in particular receptors, transporters and glycosaminoglycans (GAGs). The novel 11 mer peptide sequence, Corneal Targeting Sequence 1 (CorTS 1), has been developed by modifying leucine rich repeat (LRR) motif ensuring that it interacts with small leucine rich proteoglycans and collagen present in the corneal stroma. CorTS 1 exhibited dose dependent cellular translocation from 5 µM in Human Corneal Epithelial cell line (HCE) with no cytotoxicity. CorTS 1 was also found to deliver protein cargo inside HCE cells. *Ex vivo* tissue penetration study of CorTS 1 demonstrated in goat eyes revealed an augmented accumulation of peptide in the stromal region of cornea than in aqueous humor. Interestingly, CorTS 1 showed an antimicrobial activity against MRSA and *Fusarium dimerum*. Therefore, CorTS 1 can be a promising candidate with dual traits of antimicrobial agent and nanocarrier for ocular drugs.

**POS-06**

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|---|---|---|
| **Poster Presenter** | **:** | **Sujithra Shankar** |
| Address | : | MS2, Block 1A, Kusuma School of Biological Sciences, IIT Delhi<br>Hauz Khas, New Delhi -110016, India |
| Mobile | : | +91-9940199675 |
| Email | : | sujishankar94@gmail.com |
| Affiliation | : | IIT Delhi |
| Co Author(s) | : | Sushmita G Shah, Shikha Yadav, Archana Chugh |

# CONVERSION OF SCRAP IRON INTO ULTRAFINE A-$FE_2O_3$ NANORODS FOR EFFICIENT VISIBLE LIGHT PHOTODEGRADATION OF CIPROFLOXACIN

Arushi Arora, Sunaina, Ritika Wadhwa, Menaka Jha*
*Institute of Nano Science and Technology, Knowledge City, Sec-81, Mohali, 140306, Punjab, India,*
*Email: arushi.ph20230@inst.ac.in*

Industrial wastes often contain metals and adversely affect human health and ecosystems. Scrap iron is one of the metal wastes contributed by both industrial and domestic activities.[1] One of the ways to mitigate such impacts is to deduce sustainable metal management by recycling. Such processes not only help in protecting the environment but also act as secondary sources and aid resource recovery.[2] According to a data available by EPA a total of more than 19,000 tons of ferrous waste has been generated in past each year. So a proper methods has to be devised not only to handle the waste effectively but to harness its potential in environmental remediation. In the present work we have proposed a method to integrate iron oxide generated from random scrap iron samples and exploit it in degradation of ciprofloxacin water toxicants thereby aiding to an effective remediating technology.

**Keywords:** Scrap iron, resource recovery, ferrous waste, iron oxide, ciprofloxacin

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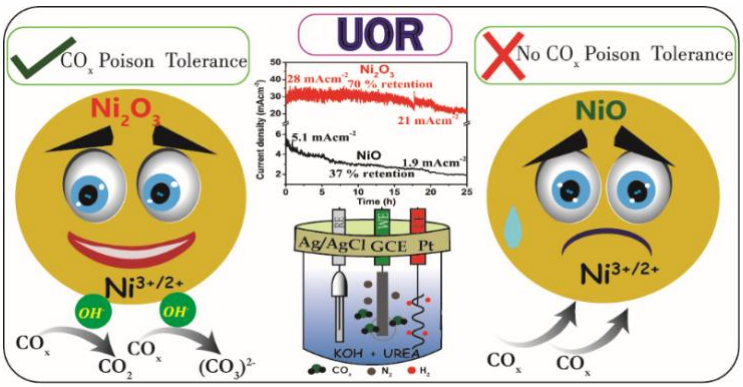
**POS-07**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Arushi Arora** |
| Address | : | Sector 81, Knowledge City, Mohali INST<br>S.A.S. Nagar Punjab - 140306 India |
| Mobile | : | +91-7301301111 |
| Email | : | arushi4995@gmail.com |
| Affiliation | : | Institute of Nano Science and Technology |
| Co Author(s) | : | Sunaina, Ritika Wadhwa, Menaka Jha |

# ONE IN A MILLION $Ni^{3+}$ ION THAT LOVES UREA AND HATES $CO_X$ FOR REMARKABLE ELECTROCHEMICAL UREA OXIDATION

Muhammed Safeer N. K.,[a,b] Chandraraj Alex,[a] Rajkumar Jana[c], Ayan Datta[c], Neena S John[a]*
[a]Centre for Nano and Soft Matter Sciences (CeNS), Shivanapura, Bengaluru 562162, India
[b]Manipal Academy of Higher Education, Manipal 576104, India
[c] School of Chemical Science, Indian Association for the Cultivation of Science (IACS), Kolkata 700032, India
Email: safeer.nk@cens.res.in, jsneena@gmail.com




The electrochemical urea oxidation reaction (UOR) provides a cost-effective way of generating hydrogen owing to its low thermodynamic energy barrier[1]. Although UOR is an effective way to generate hydrogen, sustained activity and long-term catalyst usage are retarded by $CO_x$ poisoning[2]. In this study, we show that $Ni_2O_3$ is a promising UOR catalyst with $Ni^{3+}$ ions being highly active. A 70 % UOR activity retention at a current density of 25 mA $cm^{-2}$ for 25 h duration is shown for $Ni_2O_3$, while NiO catalyst can only retain 37 % of initial low current density for the same duration. The sustained UOR performance for $Ni_2O_3$ is due to better $CO_x$ tolerance, understood from impedance spectra. The higher $CO_x$ tolerance of the $Ni_2O_3$ catalyst is the main reason behind the remarkable stability of the catalyst. The theoretical modeling supports the high activity of $Ni_2O_3$ through effective adsorption of reactants such as urea and hydroxide with feasible $CO_2$ removal on the $Ni_2O_3$ surface[3].

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3. M. Safeer N. K., C. Alex, R. Jana, A. Datta and N. S. John, *Journal of Materials Chemistry A*. 2022.

**POS-08**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Muhammed Safeer N K** |
| Address | : | Centre for Nano and Soft Matter Sciences (CeNS), Arkavathi, Survey No. 7, Shivanapura, Dasanpura Hobli, Bengaluru -562162, Karnataka, India |
| Mobile | : | +91-9447194166 |
| Email | : | safeer.nk@cens.res.in |
| Affiliation | : | Centre for Nano and Soft Matter Sciences (CeNS) |
| Co Author(s) | : | Chandraraj Alex, Rajkumar Jana, Dr. Ayan Datta, Dr. Neena S. John |

# COMPOSITES OF SURFACE MODIFIED *AGAVE AMERICANA* FIBERS AND SILVER NANO PARTICLES FOR REMOVAL OF METHYLENE DYE FROM WATER

**Shikha Dogra and Dr. Ashvinder Kumar**
Department of Chemistry, Sri Sai University, Palampur (H.P.) India 176061

Nowadays, water contamination is a serious issue all over the world, dyes used in textile industries and the industrial wastes are the main source of such contamination. Rapid growth in industrial development has resulted in the generation of a wide range of harmful toxic pollutants such as dyes, heavy metals, cleansers, acids etc. Dyes are the significant class of contaminants which are tremendously used in several industries like plastic, paint, pharmaceuticals, textiles etc. Several conventional methods such as coagulation, flocculation, adsorption, etc. have been used for the elimination of dyes from wastewater. In present work, efforts were made to modify the surface of *Agave americana* fibers (AAFs) by utilizing a sequence of chemical techniques and their subsequent utilization as adsorbent to remove methylene blue dye from waste water. The surface modification of AAFs was carried out by utilizing polydopamine (PDA) coating agent, which were subsequently graft copolymerized with vinyl monomer acrylic acid (AAc), and finally doped with silver nano particles (AgNPs) to synthesize nano composites. The synthesized surface modified AAFs and nano composites were characterized by using SEM, FTIR and XRD technique and finally assessed for their potential in removal of dye from waste water. The grafting of PDA, polyacrylic acid, and silver nanoparticles onto the cellulosic fibre resulted in morphological changes and the formation of new bands in the FTIR spectra of the grafted samples. Thus, confirming the grafting of polydopamine, polyacrylic acid and silver nanoparticles onto the cellulosic fibre. Among different surface modified fibers, silver nanoparticles doped/polyacrylic acid/PDA/ *Agave Americana* composites have been found to have a high potential (91% removal efficiency) in removal of dye from wastewater.

**POS-09**

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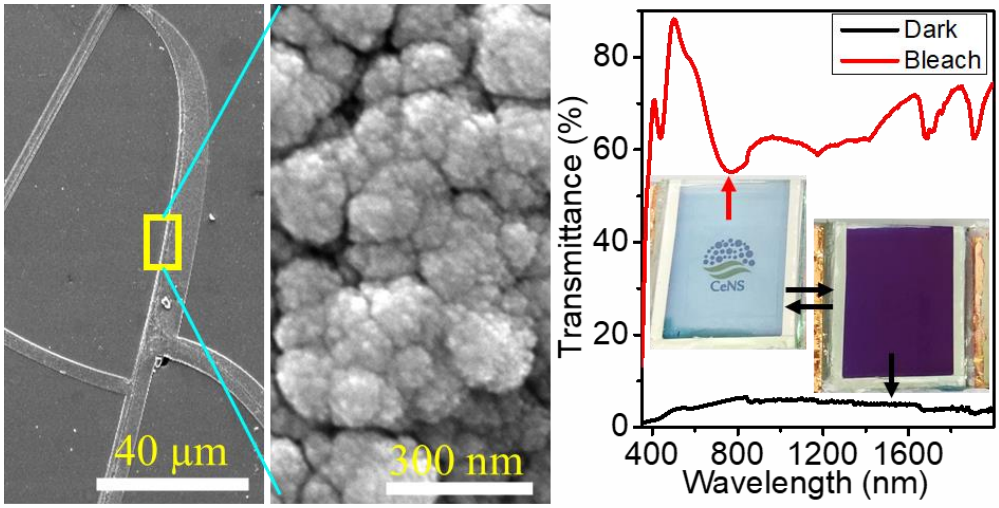
|---|---|---|
| **Poster Presenter** | : | **Shikha Dogra** |
| Address | : | VPO Dharer, Tehsil- Baijnath, Dist- Kangra<br>Baijnath - 176125, Himachal Pradesh, India |
| Mobile | : | +91-7807608144 |
| Email | : | shikhadogra932@gmail.com |
| Affiliation | : | Sri Sai University |

# AFFORDABLE ELECTROCHROMIC SMART WINDOW FOR ZERO-ENERGY BUILDINGS




Dual-functional electrochromic smart windows (ECSWs) are the backbone of the future zero-energy buildings since they offer energy-storing facilities along with energy-saving through electrochromism. High cost and insufficient transparency modulation in the visible range are the major drawbacks that presently exist. Herein, a solution towards this niche is provided by fabricating a ECSW utilizing $SnO_2$ coated aluminum metal mesh (Al_$SnO_2$) as the cost-effective ITO-alternative transparent conducting electrode. Ultra-high switching contrast of ~90% in a sputtered $WO_3$ film is accomplished by optimizing the deposition parameters such as power density, oxygen flow rate, film thickness, etc., which are the imperative controlling units for achieving high oxygen deficiency and large porosity in the film. The ECSW, devised on crackle lithographically fabricated Al_$SnO_2$, displays a switching speed two times faster than that of a ITO-based device. In addition, the film holds good cyclic stability of more than 500 cycles and an excellent coloration efficiency of 47 $cm^2$/C. As the prototype, a large-area smart window (10×10 $cm^2$) operable at 2 V is devised engaging $WO_3$ coated Al_$SnO_2$ as the active electrode. The dual-functionality is demonstrated by employing four series-connected (5×4 $cm^2$) devices charged for 1.5 minutes to operate a liquid crystal display for 70 minutes.

**POS-10**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|---|---|---|
| **Poster Presenter** | : | **Indrajit Mondal** |
| Address | : | Jawaharlal Nehru Centre For Advanced Scientific Research<br>Rachenahalli Lake Rd, Jakkur, Bengaluru - 560064, Karnataka, India |
| Mobile | : | +91-8944039554 |
| Email | : | indrajitmondal898@gmail.com |
| Affiliation | : | Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) |
| Co Author(s) | : | Mukhesh K. Ganesha, Ashutosh K. Singh*, Giridhar U. Kulkarni* |

# PLASMA TREATED $CSPBBR_3$ NCS FILMS WITH ENHANCED PHOTOLUMINESCENCE AND IMPROVED WATER STABILITY FOR OPTOELECTRONIC APPLICATIONS

Lead halide perovskites (LHPs) are emerging as promising materials due to their extraordinary optical properties and defect tolerant nature. However, their poor stability in ambient conditions hinders their practical applications. Most of the approaches taken to enhance the ambient stability of LHPs deteriorate their optical performance. In this study, we show an easy, scalable, and non-additive method to increase the stability of LHPs with improved optical properties by plasma treatment for a short duration of ~20 seconds. We have studied the mechanism of the enhanced stability of plasma-treated $CsPbBr_3$ nanocrystals (NCs) thin films, which increases the stability of NCs by plasma-induced ligand crosslinking and increases the photoluminescence intensity due to surface defect passivation. However, only limited time plasma treatment is favorable to enable such properties, as longer time plasma exposure leads to oxidation of ligands promoting degradation of $CsPbBr_3$ NCs.

**POS-11**


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|---|---|---|
| **Poster Presenter** | : | **Radha Rathod** |
| Address | : | Centre for Nano and Soft Matter Sciences (CeNS), Arkavathi, Survey no. 7 Shivanapura, Dasanapura Hobli, Bengaluru - 562162, Karnataka, India |
| Mobile | : | +91-7405032790 |
| Email | : | radha@cens.res.in |
| Affiliation | : | Centre for Nano and Soft Matter Sciences (CeNS) |
| Co Author(s) | : | Dr. Pralay K. Santra |

# STRUCTURAL AND OPTICAL STUDIES OF BIOSYNTHESIZED GOLD NANO-PARTICLES

Madhu A[1,*], Jaimson T James[2], C M Joseph[3], Srinatha N[4]
[1,*,3] Department of Physics, Dayananda Sagar College of Engineering, Kumaraswamy Layout, Bengaluru 560 078, India
[2]Spectroscopy and Analytical Test Facility, IISc.,Bengaluru-560012, India
[4]Department of Physics, RV Institute of Technology and Management, Bengaluru 560 076, India

The stingless bee by name Tetragonula Iridipennis, found in Kerala region is very peculiar specimen. The honey and pollen was collected and a gold nanoparticle was doped to understand peculiarity of the specimen discussed briefly. Certain spectroscopic studies were used to understand this bio mediated AuNPs in honey and pollen extracts. The XRD patterns of bio mediated AuNPs prepared using honey and pollen extracts are depicted in the Fig. 2. It is observed that, both honey and pollen mediated synthesis results in the formation of well crystalline particles as observed in the well-defined peaks in XRD patterns. In the XRD pattern of pollen mediated AuNPs, have shown few crystalline peaks (marks as *) are attributed to the organic matter. However, with honey reduction of AuNPs is complete and no organic peaks are observed in the XRD pattern. The crystallite size and strain of the AuNPs are estimated for the honey mediated AuNPs using Debye-Scherrer and strain equations. The size and strain of AuNps found to be 13.6 nm and 0.2708 % respectively. The XRD result concludes that, Honey as bio mediate results in the complete formation of AuNPs than Pollen. The UV-Visible spectroscopy was recorded in the region 200-1000 nm for both AuNPs doped honey and pollen sample. We observe 2 peaks at 263 and 600 nm which is clear indication of SPR obtained due to the presence of AuNPs.

***Fig.1.*** *Physical appearance of bio mediated AuNPs in honey and pollen extracts.*

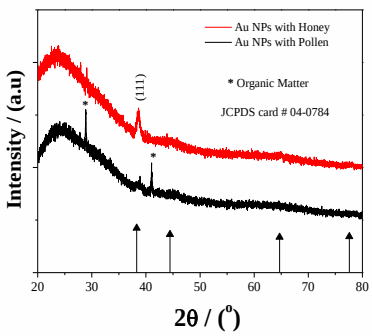


***Fig.2.*** *PXRD patterns of AuNPs prepared using honey and pollen extracts.*

**Keyword:** Biosynthesis, AuNPs, PXRD, UV-Vis studies

**POS-12**

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|---|---|---|
| **Poster Presenter** | : | **Dr. Madhu A.** |
| Address | : | Department of Physics, 1st Stage, Dayananda Sagar College of Engineering Kumarswamy Layout, Bengaluru - 560078, Karnataka, India |
| Mobile | : | +91-9902939048 |
| Email | : | mmathi.33@gmail.com |
| Affiliation | : | Dayananda Sagar College of Engineering |
| Co Author(s) | : | Jaimson T James, C M Joseph, Srinatha N |

# ZINC SUBSTITUTED HIGH-ENTROPY OXIDES FOR MAGNETIC HYPERTHERMIA APPLICATIONS

*Bhargavi K , Jhilmil Swapnalin, Daali Himaja and Prasun Banerjee**
*Department of Physics, GITAM University, Bengaluru*
**pbanerje@gitam.edu*

Zinc substituted high entropy oxides (M(1-x)ZnxFe2O4 , x=0.0,0.5) were prepared using combustion reaction techniques. The zinc substitution led to the increase in the crystal parameters with higher densities. The band shift in FTIR spectra was observed at 600 cm-1 for the A-site doping. The saturation magnetization decreased Co-CoZn pairs and increased for the Mg-MgZn and Ni-NiZn pairs. The anisotropy decreased for Co-CoZn and increased for Mg-MgZn and Ni-NiZn pairs respectively. The variation was presented through Yafet and Kittel model.

**POS-13**

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|---|---|---|
| **Poster Presenter** | **:** | **Prasun Banerjee** |
| Address | : | MMMRL, GSS, GITAM University, Nagadenahalli<br>Doddballapura, Bengaluru - 562163, Karnataka, India |
| Mobile | : | +91-9113854549 |
| Email | : | pbanerje@gitam.edu |
| Affiliation | : | GITAM University |
| Co Author(s) | : | Bhargavi K, Jhilmil Swapnalin |

# ANTI-MICROBIAL AND MAGNETIC PROPERTIES OF PURE AND COBALT DOPED ZNO NANOPARTICLES

*N. Venkatalakshmi[1,2], H. Jyothi Kini[1], H. S. Bhojya Naik[2]*
*[1] Department of P.G. Studies and Research in Industrial chemistry, Sir M.V. Government Science College, Bommanakatte, Bhadravathi 577302, Karnataka, India E-mail-lakshmigowda01575@gmail.com*
*[2] Department of P.G. Studies and Research in Industrial chemistry, School of Chemical Sciences, Kuvempu University, Shankaraghatta 577451, Karnataka, India*

Cobalt doped ZnO nanoparticles were fabricated using solution combustion technique and its micro-structural, optical and magnetic characteristics were determined thoroughly. The phase purity, chemical composition and optical properties of prepared samples have been determined using X-ray diffraction technique, Fourier transform infrared, Raman and UV-Visible spectroscopy. The Magnetic behaviour was analysed using vibrating sample magnetometer, diamagnetic behaviour of pure ZnO changed into ferromagnetic for Cobalt doped ZnO nanoparticles. The antibacterial property examined against two gram positive and two gram negative pathogens using agar well diffusion technique.

**Keywords:** Ferromagnetism, Antibacterial study, Raman spectroscopy

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**POS-14**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Venkatalakshmi N** |
| Address | : | 8th Cross, Chamundipura, Ayanur, Shimoga - 577211, Karnataka, India |
| Mobile | : | +91-6353057046 |
| Email | : | lakshmigowda01575@gmail.com |
| Affiliation | : | Kuvempu University |
| Co Author(s) | : | H. Jyothi Kini, H. S. Bhojya Naik |

# LITHIUM AND MANGANESE RICH LAYERED $LI_{1.2}NI_XMN_YCO_XO_2$ CATHODE FOR ADVANCED LI-ION BATTERY APPLICATIONS

Vinoth Kumar, Silpasree S Jayasree, Shantikumar Nair and Dhamodaran Santhanagopalan*
*Centre for Nanosciences and Molecular Medicine, Amrita Vishwa Vidyapeetham*
*Kochi 682 041, India*
**Email ID: dsgopalan20710@aims.amrita.edu*

Lithium and manganese rich layered transition metal oxides have gained significance as an advanced Li-ion battery cathode owing to its properties like high specific capacity and high operational voltage [1]. In the present work, we deal with the study of three different compositions of lithium and manganese rich oxides. We synthesized layered $Li_{1.2}Ni_{0.13}Mn_{0.54}Co_{0.13}O_2$ (S1), $Li_{1.2}Ni_{0.15}Mn_{0.50}Co_{0.15}O_2$ (S2) and $Li_{1.2}Ni_{0.20}Mn_{0.40}Co_{0.20}O_2$ (S3) via sol-gel method. XRD reveals the phase purity and crystalline structure of the powdered samples. Electrochemical studies conducted on all three compositions showed good rate performance for S2, 184 mAh/g at 50 mA/g and 105 mAh/g at 500 mA/g. Decreased concentration of Mn in the stoichiometry resulted in less Mn dissolution and thereby promoted higher capacity at higher cycle numbers. Among the three compositions investigated two compositions (S2 and S3) are not yet reported. Also, when compared with the previously reported Li and Mn-rich compositions in the literature, the two novel variants S2 and S3 exhibited reasonable performance. We believe that there is scope to enhance the energy density and cycle life of these new composition by adopting surface engineering strategies.

**Keywords**: Li and Mn-rich oxide, NMC, layered cathode, Li ion battery.

**References**:
[1] Y. Chen *et al.*, *RSC Adv.*, vol. 9, no. 4, pp. 2172-2179, 2019.

**POS-15**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Silpasree S J** |
| Address | : | Nanoenergy Division, Amrita Center For Nanosciences And Molecular Medicine, Kochi - 682041, Kerala, India |
| Mobile | : | +91-8547424202 |
| Email | : | sreesilpa.03@gmail.com |
| Affiliation | : | Amrita Center For Nanosciences And Molecular Medicine Amrita Viswa Vidyapeetham |

# ENHANCING EDLC OF TI3C2TX MXENE WITH NOVEL SYNTHESIS AND TUNABLE SURFACE PROPERTIES

Numerous Researchers are investigating new electrode materials on a regular basis to find a solution to the problem of storing energy. Compared with bulk materials, 2D materials have tunable physical and chemical properties such as metal-organic frameworks polyoxometalates, and black phosphorus. Many of these electrodes face major challenges which includes volume expansion, reduced interlayer spacing, lower conductivity, hydrophobicity, surface oxidation and surface defects. Among the new members of the 2D family, MXene is distinguished by its large interlayer spacing, excellent electrical conductivity, fast ion and molecules diffusion, easy accessibility, hydrophilic nature, thickness controllability, and large surface area. MXenes have a boundless range of potential applications, ranging from catalysis to electrochemical energy storage, by dint of their chemical diversity, electrical, mechanical and optical properties. MXenes, or 2D transition metal carbides, carbonitrides, and nitrides, are formed by removing the A atom layer from the parent MAX phase with an etchant such as aqueous fluoride-containing acidic solutions. $Ti_3C_2$, a member of the MXene family, is a promising electrode material for supercapacitors owing to its physical and chemical properties. Due to the large surface area of 649.171 $m^2g^{-1}$ and its pore volume of 0.844 $cm^{-3}g^{-1}$, the specific capacitance of the $Ti_3C_2T_X$ increases at an unprecedented rate of charge storage up to 633 F $g^{-1}$.

**POS-16**


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|---|---|---|
| **Poster Presenter** | : | **Soorya Srinivasan** |
| Address | : | 10/1 Hospital Street, Porayar,Tharangambadi Taluk<br>Mayiladuthurai - 609307, Tamil Nadu, India |
| Mobile | : | +91-8608001397 |
| Email | : | sooryaphd@gmail.com |
| Affiliation | : | T.B.M.L College |
| Co Author(s) | : | M. Jothibas |

# LONG LIFE $Li_4Ti_5O_{12}$ AT LOW DISCHARGE VOLTAGE FOR HIGH PERFORMANCE LITHIUM ION BATTERY APPLICATION

*Keerthi Dilraj V, Dona Susan Baji, Binitha Gangaja, Shantikumar Nair and Dhamodaran Santhanagopalan*
Centre for Nanosciences and Molecular Medicine, Amrita Vishwa Vidyapeetham, Ponekkara, Kochi
Email ID:dsgopalan20710@aims.amrita.edu

**Keyword**: Lower discharge cut-off, Anode, High rate, Long cycle life, Lithium Ion Battery

Considering the large scale energy storage and electric vehicle applications of lithium ion battery, the requirement of both high power and safety cannot be compromised. The zero-strain $Li_4Ti_5O_{12}$ has captivated the interest due to its structure and thereby having an excellent reversibility and structural stability even at higher rates. However, the limited theoretical capacity of 175 mAh/g and voltage range of 1.0 - 2.5 V limits the energy density. Increasing the specific capacity of $Li_4Ti_5O_{12}$ is possible by extending the discharge voltage range down to lower voltage, which can effectively enhance the full-cell energy. Yet, most of the works on $Li_4Ti_5O_{12}$ was focused in a voltage range of 1.0 - 2.5 V due to poor cycle life while lowering the discharge cut-off [1-2]. Herein, we report high performance long cycle life $Li_4Ti_5O_{12}$ for lithium ion battery applications. This $Li_4Ti_5O_{12}$ nanostructure has been synthesized in large volume by hydrothermal process. Structural and morphology of this material has been confirmed by XRD and TEM. Surface analysis of the material has been characterized by XPS. The electrochemical testing was carried out with two different voltage window of operation (i) 1.0 - 3.0 V and (ii) 0.05 - 3.0 V for comparison of the respective half-cells performances. At both the voltage range the $Li_4Ti_5O_{12}$ displayed good high-rate performance ranging from 1C to 10C and cycling performance up to 500 cycles with good capacity retention in comparison to the literature reports.

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**POS-17**

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|---|---|---|
| **Poster Presenter** | : | **Dona Susan Baji** |
| Address | : | Amrita Centre For Nanosciences And Molecular Medicine<br>Amrita Vishwa Vidyapeetham, Kochi - 682041, Kerala, India |
| Mobile | : | +91-9746057364 |
| Email | : | donasusan93@gmail.com |
| Affiliation | : | Amrita Centre For Nanosciences And Molecular Medicine |
| Co Author(s) | : | Keerthi Dilraj V, Binitha Gangaja, ShantiKumar Nair, Dhamodaran Santhanagopalan |

# DOPED $NA_3V_2(PO_4)_2O_2F$ FOR HIGH PERFORMANCE SODIUM-ION BATTERIES

Pooja Bhaskar M, Shantikumar V. Nair and Dhamodaran Santhanagopalan*
*Centre for Nanosciences and Molecular Medicine, Amrita Vishwa Vidyapeetham University, Kochi, India*
**E-mail: dsgopalan20710@aims.amrita.edu*

Sodium-ion batteries are a potential candidate for grid-scale application, due to the abundant and cost-effective nature of sodium. Even though the technology is suffering from lack of suitable cathode material which promises high energy density [1]. Among the developed cathodes $Na_3V_2(PO_4)_2O_2F$ (NVPOF) is a possible choice for sodium storage, because of the higher redox potential arising from the oxy-fluro-phosphate chemistry [2]. Herein, we report an improved rate performance and cycling stability of NVPOF by the doping of aliovalent ions in vanadium lattice using a facile hydrothermal method. We found out that the doping with aliovalent ions helps in the nanostructuring of NVPOF, which in turn reduce the diffusion path of sodium ion and helps for faster ion migration. Furthermore, the aliovalent doping in the transition metal site creates a local lattice distortion, which pushes the $Na^+$ ion to opt for the easiest pathway than usual. Doped samples showed excellent rate performance and a stable longer cycling stability compared with undoped NVPOF.

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**POS-18**

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|---|---|---|
| **Poster Presenter** | : | **Pooja Bhaskar M.** |
| Address | : | Amrita Vishwa Vidyapeetham, Kochi - 682041, Kerala, India |
| Mobile | : | +91-8113852331 |
| Email | : | poojabhaskarm@gmail.com |
| Affiliation | : | Amrita Centre for Nanoscience and Molecular Medicine |
| Co Author(s) | : | Dr. ShantiKumar V Nair, Dr. Dhamodaran Santhanagopalan |

# DEVELOPMENT AND CHARACTERIZATION OF ENGINEERED DIOSGENIN ENCAPSULATED CELLULOSE NANOONION AS A CONTROLLED DRUG RELEASE NANOSYSTEM

Syed M.S Abidi, [1,2] and Amitabha Acharya[1,2, *]

[1]*Biotechnology Division, CSIR-Institute of Himalayan Bioresource Technology, Palampur (H.P.) 176061, India*

[2]*Academy of Scientific & Innovative Research (AcSIR), Ghaziabad-201002, India*

[*]Author to whom the correspondence should be addressed, E-mail: amitabhachem@gmail.com; amitabha@ihbt.res.in; Tel (off): +91-1894-233339; Extn. 397; Fax: +91-1894-230433

Plant based phyto-steroid including Diosgenin (DGN) (isolated from *Dioscorea* wild yam) are secondary plant metabolite that have been reported to prevent neurodegenerative diseases. Moreover, the high hydrophobicity of diosgenin result in low water solubility and bioavailibity, which limits the therapeutics efficacy and impedes its biological application. Here, we report the encapsulation of diosgenin in cellulose nanoonion as a controlled release nanosystem. The fabrication of water-soluble cellulose nanoonion as a biocompatible novel nanocarrier is developed from *Camelia sinensis* (CS-CNO) and *Pinus roxburghii* (PR-CNO) plant-based species. These are loaded with diosgenin (DGN@ CS-CNO and(DGN@PR-CNO) having size ~60-140 nm size. We have investigated the physicochemical properties of diosgenin loaded cellulose nanoonion with Transmission electron microscopy TEM, DLS-Zeta potential, HPLC, FTIR, XPS, P-XRD and TGA-DSC. The encapsulated nanoparticles showed enhanced solubility of diosgenin in an aqueous solution. All the data support the utility of cellulose nanoonion as the advanced nanocarrier for the application in controlled drug delivery.

**Keywords***: Diosgenin, cellulose nanoonion, bioavailibity, controlled release*

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**POS-19**

| | | |
|---|---|---|
| **Poster Presenter** | **:** | **Syed M.S. Abidi** |
| Address | : | Nanobiology Lab, CSIR-IHBT, Palampur (H.P)<br>Palampur, Himachal Pradesh, India |
| Mobile | : | +91-9082011232 |
| Email | : | aamirabidi1994@gmail.com |
| Affiliation | : | CSIR-IHBT, Palampur (H.P.) |
| Co Author(s) | : | Dr. Amitabha Acharya |

# COST-EFFECTIVE AND ECO-FRIENDLY $MNO_2$ BASED 2.2 V HIGH ENERGY AQUEOUS SUPERCAPACITOR

Samhita Pappu,[a,b] Tata N. Rao,[a] Surendra K. Martha,[b] Bulusu V. Sarada[a,*] [a]*Centre for Nano Materials, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Balapur, Hyderabad - 500005, Telangana, India*

[b]*Department of Chemistry, Indian Institute of Technology Hyderabad, Kandi, Sangareddy-502285, Telangana, India*

*Email: samhitapappu.11@gmail.com, sarada@arci.res.in*

Aqueous supercapacitors with enhanced energy densities are much needed for their nontoxic and environmental benignity. Metal oxide based pseudocapacitors enhance the specific capacitance and energy density of the device by enlarging the potential window of aqueous electrolyte beyond 1.0 V along with faradic participation. To capture this advantage, $MnO_2$ nanosheets are synthesized by eco-friendly electrodeposition technique. The charge storage capability of $MnO_2$ in 0.5 M $Na_2SO_4$ could be extended to 1.20 V *vs.* Ag/AgCl, thus becoming the best positive electrode for asymmetric supercapacitors (ASCs). The effect of potassium iodide (KI) redox additive to the electrolyte in improving the energy density and device performance is analyzed with varying concentrations. ASC designed with YP-50 carbon and $MnO_2$ as negative and positive electrodes in optimized KI concentration with 2.2 V electrochemical window resulted in superior specific capacitance of 134 F $g^{-1}$ and capacity retention of 83 % for 10000 cycles with a high energy density of 90 Wh $kg^{-1}$ owing to the dual pseudocapacitance of active material and electrolyte. The work further provides an understanding of $MnO_2$ charge storage properties beyond the most reported 0-0.8/ 0-1.0 V potential window and redox mediator's role in boosting overall device performance in aqueous ASC's.

**POS-20**

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|---|---|---|
| **Poster Presenter** | **:** | **Samhita Pappu** |
| Address | : | 2-4-118/111 South Swaroop Nagar, Uppal<br>Hyderabad - 500039, Telangana, India |
| Mobile | : | +91-8332865503 |
| Email | : | samhitapappu.11@gmail.com |
| Affiliation | : | International Advanced Research Centre for Powder Metallurgy and New Materials |
| Co Author(s) | : | Dr. Tata N. Rao, Dr. Surendra K. Martha, Dr. B. V. Sarada |

# UNDERSTANDING THE TRANSFORMATION OF 2D LAYERED PEROVSKITES TO 3D PEROVSKITES IN THE SONOCHEMICAL SYNTHESIS

Modasser Hossain, Pralay K. Santra*
Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru, India
Email Id: modasser@cens.res.in, psantra@cens.res.in*

Two-dimensional (2D) layered Ruddlesden-Popper metal halide perovskites (MHPs) show enhanced stability compared to three-dimensional (3D) MHPs. The general formula of 2D layered perovskite is $L_2A_{n-1}M_nX_{3n+1}$, where L is the large organic spacer, and 'n' is the number of metal octahedra. We have sonochemically synthesized 2D layered of type (MA)n+1PbnI3n+1 perovskite and with the help of absorption and emission spectroscopy, we have traced the reaction mechanism and shown that the dimensionality, 'n', can be controlled by both reaction time and temperature. At both lower temperature and early stage of the reaction, 2D layered perovskites with lower dimensionality forms and eventually covert to higher dimensional layered perovskite before transforming to 3D perovskite. The dissimilarity in the solubility of the precursors ($PbI_2$ and MAI) is responsible for such transformations. We show that these mixed (2D layered and 3D MAPI) perovskites can be used to fabricate a white light-emitting diode.

**Reference:**

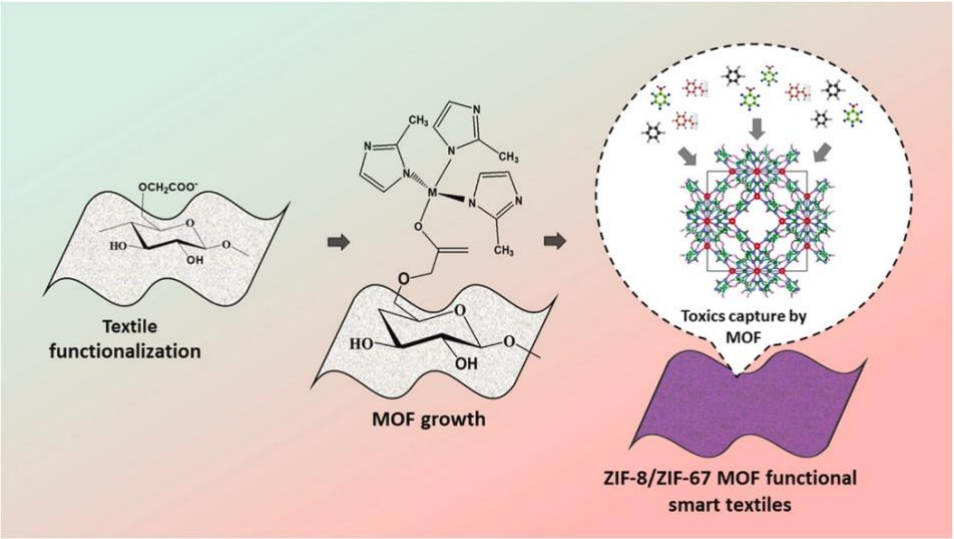
Modasser Hossain, Trupthi Devaiah C., and Pralay K. Santra; *J. Phys. Chem. C* **2021**, 125, 12131-12139.

**POS-21**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Modasser Hossain** |
| Address | : | Centre for Nano and Soft Matter Sciences(CeNS) Arkavathi, Survey No.7 Shivanapura, Dasanapura Hobli, Bengaluru - 562162, Karnataka, India |
| Mobile | : | +91-8918589984 |
| Email | : | modasser@cens.res.in |
| Affiliation | : | Centre for Nano and Soft Matter Sciences (CeNS) |
| Co Author(s) | : | Trupthi Devaiah C, Pralay K. Santra |

# NANOSIZED MOF FUNCTIONALIZED SMART TEXTILES FOR ADSORPTIVE REMOVAL OF HARMFUL AIR POLLUTANTS

Hardeep Singh Jhinjer #, Manjeet Jassal * and Ashwini K. Agrawal *
SMITA Research Lab, Department of Textile and Fibre Engineering
Indian Institute of Technology, Delhi
*E-mail address: hardeep.singh@smita-iitd.com




Organic pollutants pose a serious hazard to human health as their quantities in the ambient air rise. Metal-organic frameworks (MOFs) have emerged as viable materials for capturing organic pollutants and cleansing the environment/air due to their active functionalities and porous nature. The in-situ growth of Nanosized ZIFs (ZIF-8 and ZIF-67) on carboxymethylated cotton (CM Cotton) is presented in this work as a quick and environmentally friendly method for functionalizing cotton fabric. The physicochemical analysis of Nanosized ZIF functionalized fabrics (ZIF-8@CM Cotton and ZIF-67@CM Cotton) indicated a homogeneous and wash-resistant adhesion of porous ZIF nanocrystals on the fabric surface. These Nanosized ZIF functionalized fabrics have a large surface area and were found to adsorb significant amounts of organic pollutants/VOCs from the air, such as aniline, benzene, and styrene. Surprisingly, these fabrics could be regenerated and reused multiple times without deterioration of their adsorption efficiency. These Nanosized ZIF-MOF textiles have a lot of potential as protective textiles, anti-odor garments, air filters, and medical textiles.

**POS-22**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Hardeep Singh Jhinjer** |
| Address | : | SMITA Research Lab, Department of Textile and Fibre Engineering Indian Institute of Technology, Delhi, New Delhi - 110016, India |
| Tel | : | +91-11-26596615 |
| Mobile | : | +91-9417674089 |
| Email | : | hardeep.singh@smita-iitd.com |
| Affiliation | : | Indian Institute of Technology Delhi |

# SUBATOMIC SIZED GOLD CLUSTER FOR SIMULTANEOUS IMAGING AND PHOTODYNAMIC THERAPY

**Resmi A.N,** Rekha C.R, Jayasree R S*
*Sree Chitra Tirunal Institute for Medical Sciences and Technology, BMT Wing, Thiruvananthapuram.*
** jayasree@sctimst.ac.in, phone no:0471-2520273*

Development of cost-effective theranostic nanoagents with minimal side effects and precise targeting at therapeutic window with enhanced efficacy can be considered as the thrust area in nanomedicine. In the recent years, the biological application of nanoparticles is a rapidly developing area of nanotechnology that raises new possibilities in the diagnosis and treatment of cancers. Photodynamic therapy(PDT) is one of the non-invasive therapeutic strategies, where organic photosensitizers (PS) and light are employed to induce cellular death and tissue destruction. In order to accomplish that, we developed a facile, sub atomic size, fluorescent gold nanoclusters that are able to perform simultaneous bioimaging and therapy for the destruction of cancer cells. The physico-chemical properties demonstrated the ability to generate singlet oxygen through the direct photosensitization, under visible light irradiation. The cluster also showed enhanced photoadsorption which facilitate the amplified light reactive therapeutic and imaging efficacies. The enhanced PDT efficacy and the nontoxicity provide an exciting new nano-platform with promising clinical translational potential.

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**POS-23**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Resmi A.N.** |
| Address | : | Division of Biophotonics and Imaging, Biomedical Technology Wing (BMT Wing), SCTIMST, Trivandrum, Kerala, India |
| Mobile | : | +91-949726969 |
| Email | : | reshusimyan@gmail.com |
| Affiliation | : | Sree Chitra Tirunal Institute for Medical Sciences & Technology (SCTIMST) |
| Co Author(s) | : | Rekha C R |

# REALIZATION OF SELF-TRAPPED EXCITONIC EMISSION IN 2D NANOPLATES OF LAYERED METAL HALIDE RBPB2BR5

Low-dimensional metal halides have recently drawn huge attention for the optoelectronic application owing to their fascinating broadband emissions, instigate from the self-trapped excitons (STEs). Moreover, the *all-inorganic* metal halides with proficient STE emission are limited in contrast to hybrid STE-emitting systems. In this work, we have explored the two-dimensional (2D) *all-inorganic* metal halide, $RbPb_2Br_5$ which has been synthesized by both solid-state and solution-based approach. Bulk polycrystals of $RbPb_2Br_5$ displayed an indirect wide band gap of 3.48 eV accompanied by a broadband emission, which offers a reddish colour under UV light irradiation. Further, the ligand-assisted reprecipitation method was implemented to synthesize the nanoplates of $RbPb_2Br_5$. The existence of STE states is characterized by a large Stokes shifted broadband emission, reasonable photoluminescence quantum yield (PLQY ~ 13%), and long-lived PL lifetime without any overlap between their excitation and emission spectra at room temperature. From the in-depth analysis of temperature-dependent PL events and Raman spectroscopy, it is evident that the strong electron-phonon coupling is responsible for the structural deformation of crystal lattice upon photo-excitation and the subsequent formation of STE states. This study not only sheds light on the structure-optical property relationships, but also provide direction for designing and fabrication of highly luminescent metal halides.

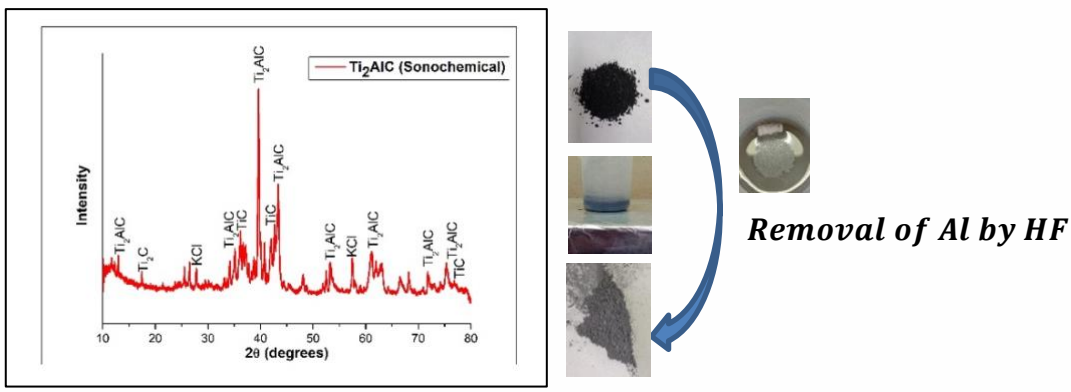
**POS-24**


| | | |
|---|---|---|
| **Poster Presenter** | : | **Dr. Jayita Pradhan** |
| Address | : | Jakkur Jawaharlal Nehru Centre For Advanced Scientific Research<br>Rachenahalli Lake Rd, Bangalore - 560064, Karnataka, India |
| Mobile | : | +91-9748582716 |
| Email | : | jayitap@jncasr.ac.in |
| Affiliation | : | Jawaharlal Nehru Centre for Advanced Scientific Research |
| Co Author(s) | : | Prof. Kanishka Biswas |

# SONOCHEMICAL ASSISTED MOLTEN SALT SYNTHESIS OF $Ti_2AlC$ MAX PHASE

B. Srikanth Ragunath and Ayyappan Sathya*
School of Electrical & Electronics Engineering, SASTRA Deemed to be University, Thanjavur 613401, Tamil Nadu, India
*Corresponding Author Email: ayyappansathya@gmail.com

In the ongoing crisis of energy demand there is a wide span of research on exotic 2D materials in the field of energy conversion and harvesting. MXenes - a new class of 2D material [1], have been a potential candidate for energy storage applications. MXenes are obtained from their parent phase called the MAX phases which are generally ternary transition metal carbides and nitrides having both the properties of metals and ceramics. However, the synthesis of MAX phases requires higher temperature annealing, uniform milling and inert atmosphere. Here, we report a modified molten salt synthesis [2] of $Ti_2AlC$ MAX phase material. This method involves the use of powerful probe sonication for mechanical milling and molten salt technique to synthesize the desired material at relatively lower temperature under air atmosphere. We achieved phase pure MAX phase $Ti_2AlC$ without any oxidation of metals. Further, we successfully replaced the mechanical milling by probe sonication to activate the metallic precursors and reduced the synthesis temperature from 1300℃ to 1000℃ without the utilization of inert gas purging. Also successfully etched the MAX phase using Hydrofluoric acid to produce the $Ti_2C$ MXene nanosheets. This method could be useful for developing other MAX phases and related MXenes nanosheets for energy storage applications.

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**POS-25**

| | | |
|---|---|---|
| **Poster Presenter** | : | **B. Srikanth Ragunath** |
| Address | : | Trichy-Tanjore Highway, Thirumalaisamudiram<br>Thanjavur - 613401, Tamil Nadu, India |
| Mobile | : | +91-8754284830 |
| Email | : | srikanthragunath96@gmail.com |
| Affiliation | : | SASTRA Deemed to be University |
| Co Author(s) | : | Ayyappan Sathya |

# COMBINING 3D BIOPRINTING AND ELECTROSPINNING METHODS TO FABRICATE MULTILAYERED 3D HUMAN SKIN EQUIVALENTS FOR SKIN TISSUE ENGINEERING APPLICATIONS

**Muthu Parkkavi Sekar[1], Dhakshinamoorthy Sundaramurthi[1] and Swaminathan Sethuraman[1]***

*[1] Center for Nanotechnology and Advanced Biomaterials (CeNTAB), SASTRA Deemed University, Thirumalaisamudram, Thanjavur, India*

Presenting author: muthuparkkavi@gmail.com; *Corresponding author: swami@sastra.edu

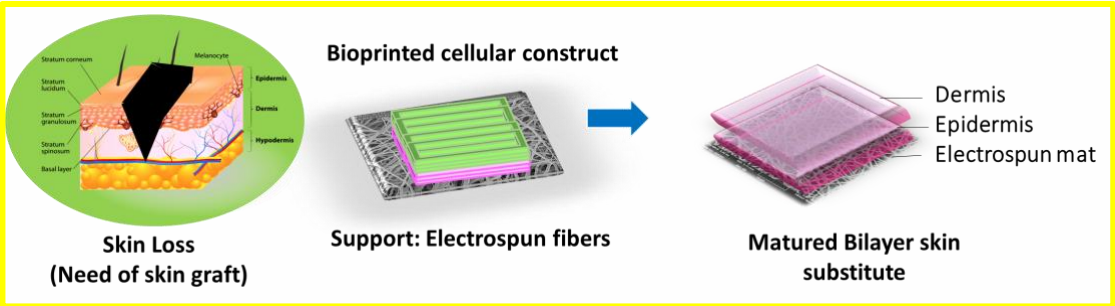


*Figure 1 Graphical representation of the combined approach of combining bioprinting and electrospinning technique to fabricate 3D skin substitute*

Personalised tissue grafts with biomimetic features have been gaining interest in the field of regenerative medicine. Combination of electrospinning with 3D bioprinting could facilitate the fabrication of bilayer skin epidermis & dermis substitute with improved features. This approach could overcome the bottlenecks of these techniques to fabricate a living skin construct to treat full-thickness wounds. Electrospun nanofibers have a large surface area-to-volume ratio and also mimic the native collagen present in the skin ECM. These nanofibers may offer a favourable milieu to the skin cells and promote the adhesion, proliferation and gene expression of skin cells. This study mainly focuses on the development of skin tissue by using extrusion bioprinting system to fabricate 3D cellular construct with electrospun fiber matrix as support material. Here, we have used PLCL/PEOz electrospun nanofibers as the dermal substrate to print epidermal layers using extrusion bioprinter. PLCL/PEOz electrospun fiber fabrication, bioinks concentration, & printing parameters were optimized & studied to achieve the printing resolution of 200-300 µm to print skin equivalent construct.

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**POS-26**

**Poster Presenter** : **S. Muthu Parkkavi**
Address : Plot No 5, Alagarasan Nagar, Nagai Road
Thanjavur - 613001, Tamil Nadu, India
Mobile : +91-9786194531
Email : muthuparkkavi@gmail.com
Affiliation : SASTRA

# REALIZATION OF HIGH THERMOELECTRIC FIGURE OF MERIT IN SOLUTION SYNTHESIZED 2D SNSE NANOPLATES VIA GE ALLOYING

Recently single crystals of layered SnSe have created a paramount importance in thermoelectrics owing to their ultralow lattice thermal conductivity and high thermoelectric figure of merit (*zT*). However, nanocrystalline or polycrystalline SnSe offers a wide range of thermoelectric applications for the ease of its synthesis and machinability. Here, we demonstrate high *zT* of ~2.1 at 873 K in two-dimensional nanoplates of Ge-doped SnSe synthesized by a simple hydrothermal route followed by spark plasma sintering (SPS). Anisotropic measurements also show a high *zT* of ~1.75 at 873 K parallel to the SPS pressing direction. Ge doping (3 mol %) in SnSe nanoplates significantly enhances the p-type carrier concentration, which results in high electrical conductivity and power factor of ~5.10 μW/cm $K^2$ at 873 K. High lattice anharmonicity, nanoscale grain boundaries, and Ge precipitates in the SnSe matrix synergistically give rise to the ultralow lattice thermal conductivity of ~0.18 W/mK at 873 K

**POS-27**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Sushmita Chandra** |
| Address | : | JNCASR, Jakkur, Bengaluru - 560064, Karnataka, India |
| Tel | : | +91-80-22082647 |
| Mobile | : | +91-9916738225 |
| Email | : | sushmita.2.chandra@gmail.com |
| Affiliation | : | Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) |
| Co Author(s) | : | Prof. Kanishka Biswas |

# EFFICIENT DUAL CROSSLINKING OF PROTEIN-IN-POLYSACCHARIDE BIOINK TOWARDS BIOFABRICATION OF FUNCTIONAL CARDIAC TISSUE CONSTRUCTS

Harshavardhan Budharaju,[1] Dhakshinamoorthy Sundaramurthi,[1] Swaminathan Sethuraman, [1*]
[1]*Centre for Nanotechnology and Advanced Biomaterials, School of Chemical and Biotechnology, SASTRA Deemed to be University, Thanjavur-613401, India*
*Corresponding author: swami@sastra.edu
Presenting author: harshavardhandbt@gmail.com

Myocardial infarction (MI) is one of the lethal cardiac diseases that contribute to most of the mortality causes across the world. As an efficient alternative to the existing treatment strategies for MI, 3D bioprinting has evolved as an advanced tissue fabrication technique where the cell-laden bioinks are printed layer-by-layer to create functional cardiac patches. In this study, pre-crosslinking of the physically blended alginate-fibrinogen bioinks with $CaCl_2$ and post-crosslinked with $CaCl_2$ & thrombin enhanced the shape fidelity and printability of the printed structures. Other physico-chemical properties of the blend bioinks such as rheology, FTIR, SEM, were determined and found to be ideal for bioprinting of cardiac constructs. *In vitro* results revealed that printed cell-laden (human ventricular cardiomyocytes - AC16 cells) constructs showed ≥ 80% cell viability with a significant increase in cell proliferation on day 7 and 14 in AF-DMEM-20mM $CaCl_2$ bioink compared to A-DMEM-20mM $CaCl_2$ ($p<0.05$). Further, constructs printed with neonatal ventricular rat myocytes (NVRM) also showed ≥ 80% cell viability up to day 21 & native cardiac markers expression at day 7 and day 14. These results indicate that this dual crosslinking strategy is cytocompatible and also possess the potential to be used for the biofabrication of thick myocardial constructs for regenerative medicine applications.

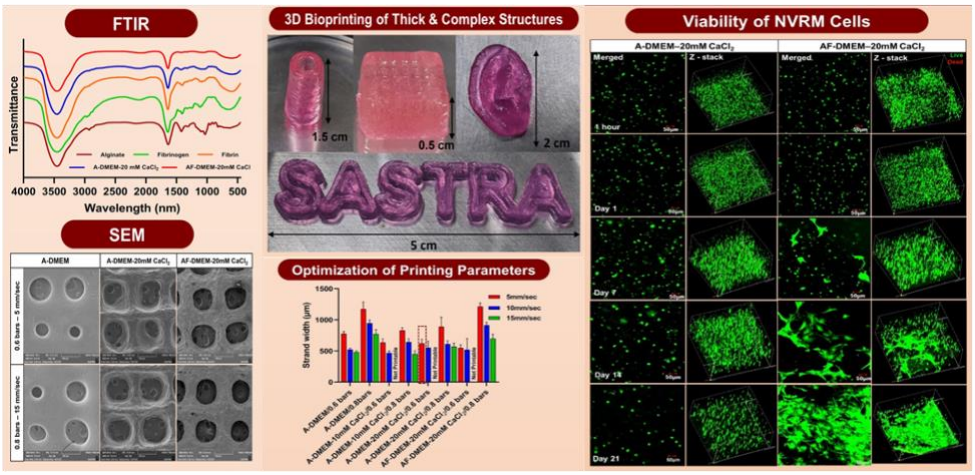


***Figure*** *- 3D Bioprinting of pre-crosslinked alginate & alginate/fibrinogen bioinks for myocardial patch fabrication.*

**POS-28**

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| **Poster Presenter** | : | **Harshavardhan Budharaju** |
| Address | : | Budharaju Harshavardhan, ICMR - SRF, Tissue Engineering & Additive Manufacturing (TEAM) Lab, Centre for Nanotechnology & Advanced Biomaterials, School of Chemical and Biotechnology, SASTRA Deemed to be University, Thanjavur - 613401, TN, India |
| Mobile | : | +91-8801567874 |
| Email | : | harshavardhandbt@gmail.com |
| Affiliation | : | SASTRA Deemed University |
| Co Author(s) | : | Dhakshinamoorthy Sundaramurthi, Swaminathan Sethuraman |

# A MODULAR TECHNOLOGY PLATFORM TARGETING UNUSUAL ARCHITECTURES OF RNA/DNA GENOME FOR VIRAL DETECTION

Sumon Pratihar[1], Ragini Agrawal[2], Virender Kumar Pal[2], Amit Singh[2], Thimmaiah Govindaraju[1,*]
[1] Bioorganic Chemistry Laboratory, New Chemistry Unit, School of Advanced Materials (SAMat), Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Jakkur P.O., Bengaluru 560064, Karnataka, India
[2]Department of Microbiology and Cell Biology, and Centre for Infectious Disease Research, Indian Institute of Science, Bangalore 560012, India

Unravelling unique molecular targets specific to a viral pathogen is challenging yet critical for diagnosing emerging viral diseases. Nucleic acids and proteins are the major nanobiosensor-based targets in diagnostic assays of viral pathogens. Identification of novel sequences and conformations of nucleic acids as targets is desirable for developing diagnostic assays specific to a virus of interest, and minimize false-positive results. In this poster, we disclose the identification and characterization of a highly conserved antiparallel G-quadruplex (GQ)-forming DNA sequence present within the SARS-CoV-2 genome. The two-quartet GQ with unique loop compositions formed a distinct molecular recognition motif. Design, synthesis, and fine tuning of structure-activity of a set of small molecules led to the identification of a benzobisthiazole-based fluorogenic probe which unambiguously recognizes the target SARS-CoV-2 GQ DNA. A robust cost-effective assay was developed through thermal cycler PCR-based amplification of the antiparallel GQ-forming ORF1ab region of the SARS-CoV-2 genome and endpoint fluorescence detection with the probe. An exclusive pH window (3.5-4) helped trigger reliable conformational polymorphism (RCP) involving DNA duplex to GQ transformation, which aided the development of a novel diagnostic platform GQ-RCP for the diagnosis of SARS-CoV-2 clinical samples. This modular technology platform can be adapted for the development of specific diagnostic assays targeting noncanonical nucleic acid sequences of pathogens and viruses such as HIV, influenza, HCV, Zika, and Ebola among others.

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**POS-29**

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|---|---|---|
| **Poster Presenter** | : | **Sumon Pratihar** |
| Address | : | C/O- Prof. T Govindaraju, Bioorganic Chemistry Laboratory, New Chemistry Unit, JNCASR, Jakkur, Bangalore - 560064, Karnataka, India |
| Tel | : | +91-80-22082556 |
| Mobile | : | +91-9884184031 |
| Email | : | sumon@jncasr.ac.in |
| Affiliation | : | JNCASR, Bangalore |
| Co Author(s) | : | Ragini Agrawal, Virender Kumar Pal, Amit Singh Thimmaiah Govindaraju (Corresponding author) |

# COBALT DECORATED CARBON NITRIDE AS AN EFFICIENT CATALYST FOR PHOTOELECTROCHEMICAL ETHANOL OXIDATION

Ritika Wadhwa,[a] Krishna K Yadav,[a] Ankush,[a] Menaka Jha.[a]*
[a]*Institute of Nano Science & Technology, Knowledge City, Sector-81, Mohali, Punjab-140306, India*
E-mail: ritikawadhwa33@gmail.com

In the recent times, increase in global energy demand has lead researcher's to find alternative sources of energy. The implementation of fuel cells based on biofuel ethanol can be one of the best renewable alternatives to meet the future energy demand. Active and durable catalyst are required for the efficient energy conversion of ethanol in the Direct Ethanol Fuel Cells. In the present work, Co has been decorated in different molar ratios via solution phase method on the surface of graphitic carbon nitride (gCN) nanosheets that has been synthesized by pyrolysis of urea. The catalyst containing 3 mol % Co shows the best activity and current density of 6.91 mA/cm$^2$ is obtained at peak potential of 0.31 V. The prepared catalysts have also been utilized for the photoelectrochemical studies. When the surface of electrode is illuminated with light, an increment of 85 % in current density is observed. Thus, Co-$C_3N_4$ can be used as photoactive anode material for carrying out the photoelectrocatalytic oxidation of ethanol.

**POS-30**

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|---|---|---|
| **Poster Presenter** | : | **Ritika Wadhwa** |
| Address | : | 2152, Phase 10, Sector 64, Mohali - 160062, Punjab, India |
| Mobile | : | +91-6283834789 |
| Email | : | ritikawadhwa33@gmail.com |
| Affiliation | : | Institute of Nano Science and Technology |
| Co Author(s) | : | Krishna K Yadav, Ankush, Menaka Jha |

# HYBRID VECTOR - CHEMO-GENO THERAPY FOR THE TREATMENT OF ACUTE MYELOID LEUKEMIA

**Pratheppa Rajagopal**[1], Giridhara R. Jayandharan[2], Uma Maheswari Krishnan[1,*]
[1]Centre for Nanotechnology & Advanced Biomaterials, SASTRA Deemed University
[2]Department of Biological Sciences and Bioengineering, Indian Institute of Technology, Kanpur-208016, Uttar Pradesh, India

Acute myeloid leukemia (AML) has a poor prognosis and low survival rates. Conventional chemotherapy for AML is limited by its toxicity and poor therapeutic outcomes. To enhance the therapeutic efficacy, the use of multi-modal therapeutics has been investigated. The present work explores a 'chemo-genotherapy' approach to treat myeloid leukemia. The current work employs a pH-responsive PCADK polyketal nanocarrier to co-deliver dual therapeutic moieties to leukemic cells and manage their endosomal egress. The resultant hybrid PCADK nanoparticles encapsulating the anticancer drug cytarabine and self-organized assembly of adeno-associated virus containing the suicide gene HSV-TK, were evaluated for their cytotoxicity and effect on key markers of apoptosis and cell cycle analysis. The anti-cancer activity of the hybrid system was found to be superior to free cytarabine, free AAV on U937 cells and THP1 cells. Apoptosis, gene expression, and cell cycle analysis also confirm the same trend. *In vivo* xenograft of immune-compromised SCID mouse model of AML revealed the superior therapeutic efficacy of the developed hybrid system when compared to unencapsulated moieties indicating its promise as a smart therapeutic option for AML therapy.

**Keywords:** Acute myeloid leukemia, chemo-geno therapy, PCADK polyketal nanoparticles, co-delivery, suicide gene therapy, cytarabine

**POS-31**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Pratheppa Rajagopal** |
| Address | : | SASTRA Deemed University<br>Thanjavur - 613401, Tamilnadu, India |
| Mobile | : | +91-9003689305 |
| Email | : | pratheeparaj91@gmail.com |
| Affiliation | : | SASTRA Deemed University |
| Co Author(s) | : | Uma Maheswari Krishnan, Giridhara R. Jayandharan |

# ADDITIVELY MANUFACTURED BIOMIMETIC NERVE CONSTRUCTS FOR PERIPHERAL NERVE REGENERATION

**Allen Zennifer,** Anuradha Subramanian, Dhakshinamoorthy Sundaramurthi and Swaminathan Sethuraman*
Centre for Nanotechnology & Advanced Biomaterials (CeNTAB), Tissue Engineering & Additive Manufacturing (TEAM) Lab, School of Chemical & Biotechnology (SCBT), SASTRA Deemed University, Thanjavur - 613401
*Corresponding author: swami@sastra.edu

Peripheral nerve injuries (PNI) lead to biochemical and electrical imbalances, improper motor activities and coordination, which result in impairment of functional organs. The first-line treatment for PNI is autograft, which is successful only for small-sized injuries. Allografts are considered for larger-sized nerve injuries (> 6 mm), however successful fabrication of hollow nerve conduits remain challenging. Further, these synthetic nerve grafts possess limitations such as donor availability, immune rejection, secondary surgery and mismatch in the fascicular dimensions and architecture. To overcome these drawbacks, additive manufacturing (AM) offers ease for developing personalized three-dimensional (3D) objects with intricate features and higher accuracy on a larger scale. By using Fused Deposition Modelling (FDM), we have successfully fabricated a 3D flexible and anatomically-equivalent peripheral nerve constructs. The 3D printed constructs were biodegradable, suturable and exhibited native nerve-equivalent mechanical strength. Variations in the infill densities of the constructs enabled ideal porous architecture and allowed cell infiltration into the deeper regions of the printed constructs. *In vitro* cytotoxicity studies using PC12 cells showed excellent cytocompatibility of the printed constructs. Further, the printed constructs promoted neuronal differentiation of PC12 cells in presence of nerve growth factor (NGF) which confirms the potential of the developed nerve construct for peripheral nerve repair.

**POS-32**

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|---|---|---|
| **Poster Presenter** | **:** | **Allen Zennifer** |
| Address | : | Lab No. 409, Tissue Engineering & Additive Manufacturing Lab, ASK-1 CeNTAB, SCBT, SASTRA Deemed University, Thanjavur - 613401, TN, India |
| Mobile | : | +91-9500662311 |
| Email | : | allenzennifer2@gmail.com |
| Affiliation | : | SASTRA Deemed University |
| Co Author(s) | : | Anuradha Subramanian, Dhakshinamoorthy Sundaramurthi, Swaminathan Sethuraman - Corresponding author |

# CONFINEMENT MATTERS: STABILIZATION OF CDS NANOPARTICLES INSIDE A POST-MODIFIED MOF TOWARDS PHOTOCATALYTIC HYDROGEN EVOLUTION

The materials that can tune the waste by-product of one process to the benefit of the other exemplify an environmentally as well as economically lucrative approach. Herein, we report the development of a MOF-based heavy metal trap, MOF-808-cys by post-synthetically grafting L-cysteine into the nano space of MOF-808 pores. MOF-808-cys shows high removal efficiency of heavy metal ions like $Cd^{2+}$ which are contaminants in industrial wastewater. Further, the $Cd^{2+}$ encapsulated MOF-808-cys-Cd hybrids have been utilized for in-situ growth of CdS nanoparticles (NPs) inside the nanosized MOF pores. The formation of CdS@MOF-808 opens up a possibility for visible-light photocatalysis as CdS NPs are a well-studied semiconductor system with a bandgap of ~2.6 eV. Insights into developing innovative routes for the stabilization of photogenerated charge-separated states in photocatalysts is a topic of immense importance. Herein, the spatial confinement of the photosensitizing CdS NPs inside the MOF pores, close to the $Zr^{4+}$ cluster, opens up a shorter electron transfer route from CdS to the catalytic $Zr^{4+}$ cluster and shows a high rate of $H_2$ evolution (10.41 mmol $h^{-1}g^{-1}$) from water. In contrast, a similar composite where CdS NPs are supported on the external surface of MOF-808 reveals much poorer activity (0.15 mmol $g^{-1}$ $h^{-1}$) stemming from slower and inefficient electron transfer kinetics compared to CdS stabilized inside the nanospace of MOF as realized by the transient absorption measurements. Therefore, this work demonstrates a recycling scheme where heavy metal ion contaminants from wastewater are captured and utilized to generate an efficient photocatalyst for the production of clean and renewable energy.

**POS-33**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Adrija Ghosh** |
| Address | : | Students' Residence, JNCASR, Rachenahalli Lake Road, Jakkur<br>Bangalore - 560064, Karnataka, India |
| Tel | : | +91-80-22082932 |
| Mobile | : | +91-8902007035 |
| Email | : | adrija@jncasr.ac.in |
| Affiliation | : | Jawaharlal Nehru Centre for Advanced Scientific Research |
| Co Author(s) | : | Sanchita Karmakar, Faruk Ahamed Rahimi, Raj Sekhar Roy<br>Tapas Kumar Maji |

# EVALUATION OF VEGF SILENCING EFFICACY USING NOVEL PVI POLYPLEX WITH MULTI-MODAL ACTION AGAINST LUNG CANCER IN 2D AND 3D MODELS

***Gayathri Kandasamy[1], Vadim Annenkov[2], Uma Maheswari Krishnan[1,*]***

[1]Centre for Nanotechnology & Advanced Biomaterials (CeNTAB), School of Chemical & Biotechnology, SASTRA University, Thanjavur - 613 401, Tamil Nadu, India

[2]Principal Researcher, Limnological Institute, Siberian Branch of the Russian Academy of Sciences, Irkutsk, Russia - 664033

Small interfering RNA (siRNA) is a new therapeutic approach for successfully silencing target genes that has a lot of potential in anti-cancer therapy. Despite significant progress in creating siRNAs with a variety of targets and therapeutic potential, the lack of an appropriate delivery method for siRNA remains a hurdle in the clinical translation of si-RNA-mediated cancer therapy. In the present study, we aimed to develop an efficient siRNA delivery strategy that uses a nanosized polymeric carrier formed using poly(vinyl imidazole) to avoid endosomal and enzymatic degradation. We employed A549 human carcinoma cell line to investigate the efficacy of a siRNA loaded polyplex that targeted VEGF (Vascular endothelial growth factor) and examined the gene silencing efficiency in the treatment of Non-small cell lung cancer (NSCLC). Experiments on 2D and 3D models developed using A549 lung cancer cells were carried out to assess the polyplex's cytotoxicity and intracellular internalization using fluorescently tagged siRNA. The anti-angiogenic potential of the polyplex was studied using HUVECs. The VEGF silencing efficiency of the polyplex was tested using Western blots, and gene expression investigations were performed using RT-PCR. The polyplex exhibited superior internalization and silencing efficacy both in 2D as well as 3D models. The same trend was also observed in trials carried out using the mouse lewis lung cancer cell line (LLC / LL2). *In vivo* investigations employing an orthotopic model are currently underway.

**Keywords**: siRNA, polyplex, Nano carrier, polymer, polyvinylimidazole

**POS-34**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Gayathri Kandasamy** |
| Address | : | Thirumalaisamudram, Thanjavur - 613001, Tamilnadu, India |
| Mobile | : | +91-9994010947 |
| Email | : | gayathri.ks86@gmail.com |
| Affiliation | : | SASTRA Deemed to be University |
| Co Author(s) | : | Vadim Annenkov |

# ENHANCED BAND CONVERGENCE AND ULTRA-LOW THERMAL CONDUCTIVITY LEAD TO HIGH THERMOELECTRIC PERFORMANCE IN SNTE

SnTe, a structural analogue of champion thermoelectric (TE) material PbTe, has recently attracted wide attention for TE energy conversion. Herein, we demonstrate a co-doping strategy to improve the TE performance of SnTe via simultaneous modulation of electronic structure and phonon transport. The electrical transport is optimized by 3 mol % Ag doping in self-compensated SnTe (i.e., $Sn_{1.03}Te$). Further, Mg doping in $SnAg_{0.03}Te$ resulted in highly converged valence bands, which enhanced the Seebeck coefficient markedly. The energy gap between two uppermost valence bands ($\Delta E_v$) decreases to 0.10 eV in $Sn_{0.92}Ag_{0.03}Mg_{0.08}Te$ compared to 0.35 eV in pristine SnTe. The optimized p-type carrier concentration and highly converged valence bands gave a high power factor of ca. 27 $\mu W\ cm^{-1}\ K^{-2}$ at 865K in $Sn_{0.92}Ag_{0.03}Mg_{0.08}Te$. The major reduction in the lattice thermal conductivity of $Sn_{0.92}Ag_{0.03}Mg_{0.08}Te$ was caused due to the formation of in-situ nanoprecipitates of MgTe within the SnTe matrix. These precipitates with a size of around 20-30 nm were successful in scattering the heat carrying acoustic phonons resulting in an ultra-low lattice thermal conductivity of 0.23 W/m.K at 865 K for $Sn_{0.92}Ag_{0.03}Mg_{0.08}Te$ .These combined effects resulted in a high TE figure of merit, $zT \approx 1.55$ at 865 K in $Sn_{0.92}Ag_{0.03}Mg_{0.08}Te$.

**POS-35**


| | | |
|---|---|---|
| **Poster Presenter** | : | **Riddhimoy Pathak** |
| Address | : | Students' Residence, JNCASR, Bangalore - 560064, Karnataka, India |
| Tel | : | +91-80-22082647 |
| Mobile | : | +91-8697400241 |
| Email | : | riddhimoy@jncasr.ac.in |
| Affiliation | : | Jawaharlal Nehru Centre for Advanced Scientific Research |
| Co Author(s) | : | Debattam Sarkar, Kanishka Biswas |

# HYDROGEN STORAGE PERFORMANCE IN 2H-MOS2

Producing green energy according to demand is a big challenge, almost all population is just dependent on fossil fuel, which is limited. Hydrogen is a highly efficient source of green energy, which can be used in various applications. However, its low ignition energy and high flammability, makes hydrogen difficult to store and transport. Therefore, there is a need to find such material which can hold hydrogen effectively. 2D materials were found to be very effective in storing hydrogen due to their large surface to volume ratio and special electronic structure. After the success of graphene-based materials research is boosted to find other 2D materials for purpose of hydrogen storage. It is found that $MoS_2$-based materials show superior performance in hydrogen storage. The hydrogen storage capacity mainly depends on the adsorption strength of the gas molecules over the carrier's surface. In the present work, we have carried out a hydrogen storage study of 2H-$MoS_2$. A systematic study of the hydrogen adsorption properties of 2H-$MoS_2$ at different temperatures and pressures was carried out using a high-pressure Sievert's apparatus. Measurement is done in a high vacuum (~$10^{-6}$ mbar) environment. All measurements were carried out in the pressure range of 1to 30 bar and temperature range of 25 °C to 100 °C. At 25°C, the hydrogen storage capacity of pristine 2H- $MoS_2$ is found to be 1.13 wt.% at 15.56 bar at room temperature.

**POS-36**


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|---|---|---|
| **Poster Presenter** | : | **Mukesh Kumar** |
| Address | : | IIT Madras, Chennai - 600036, Tamil Nadu, India |
| Mobile | : | +91-7876081671 |
| Email | : | mk666998@gmail.com |
| Affiliation | : | IIT Madras |
| Co Author(s) | : | Dhanya A R, Sundara Ramaprabhu, Pramoda K. Nayak |

# STRUCTURAL PHASE TRANSITION TRIGGERING HIGH THERMOELECTRIC PERFORMANCE IN *P*-TYPE GETE

Debattam Sarkar, and Kanishka Biswas*
*New Chemistry Unit, International Centre for Materials Science, School of Advanced Materials, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Jakkur P.O., Bangalore, India*
**E-mail: kanishka@jncasr.ac.in*

The cubic rock-salt phase of GeTe has recently been reckoned as one of the highly promising thermoelectric materials in medium temperature range due to its favorable electronic band structure. However, the thermoelectric (TE) performance of pristine rhombohedral GeTe is strongly impeded by its natural excessive Ge-vacancies and detrimental phase transition, which hinders to achieve maximum possible TE performance in GeTe and deteriorates the mechanical robustness. In this work we introduce a versatile dopant Sb in GeTe which serves the pivotal concurrent role in the optimization of p-type carriers and converging the valence bands. In addition, the stabilization of cubic-like structure of Sb doped GeTe at room temperature via engineering a simple innovative strategy leads to the (1) highly elevated Seebeck coefficient owing to the convergence of valence bands to the better extent and facilitated by the highly degenerate valence bands and (2) significantly suppressed lattice thermal conductivity caused due to the strong phonon scattering by hierarchal micro/nanoprecipitates, point defects and grain boundaries etc. As a result, a remarkably high thermoelectric figure of merit of ~ 2.45 is realized at 662 K. Fabricated single leg thermo-element shows promising output power of ~ 213 mW for temperature difference of 417 K, directing towards a new avenue for a sustainable energy management.

**POS-37**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Debattam Sarkar** |
| Address | : | Rachenahalli Lake Rd, Jakkur, Bengaluru - 560064, Karnataka, India |
| Tel | : | +91-80-22082647 |
| Mobile | : | +91-7031420029 |
| Email | : | sarkar@jncasr.ac.in |
| Affiliation | : | Jawaharlal Nehru Centre for Advanced Scientific Research |
| Co Author(s) | : | Prof. Kanishka Biswas |

# FORMULATION & EVALUATION OF SURFACTANT BASED NANO LIPID VESICLES OF AZTREONAM FOR INHALATION-AN EMERGING DELIVERY TO AMELIORATE THE CONDITION OF INFECTED LUNGS

Sayani Bhattacharyya[1*], Preethi Sudheer[1]
[1]Department of Pharmaceutics, Krupanidhi College of Pharmacy, Bengaluru, Karnataka, 560035.
Corresponding Author
Sayani Bhattacharyya
Email: sayanibh@gmail.com
Cell :9845561865

Liposomal inhalation has shown promising effect on delivery and enhancing the penetration of drug through biofilms and macrophages in infected lungs. Nano-lipid vesicles of aztreonam for inhalation therapy were proposed for research using LIPOID SPC-3, LIPOID PC 16:0/16:0 and cholesterol with surfactant span 20 using thin film hydration technique. The lipids' composition and surfactant determine the stability, efficacy, and *in-vitro/ in-vivo* performance of the formulation. Hence a statistical optimization process was adopted to evaluate the effect of factors on liposomal stability, vesicular size, and entrapment of the drug. The experimentation yielded a stable, highly entrapped, nano-lipid vesicle of aztreonam. The physical properties and morphology of the formulation were characterized by the thermal, surface characteristics, and morphology studies. The *in-vitro* diffusion and *in-vivo* lungs deposition of aztreonam from the liposomal dispersion were found to be biphasic with initial bursts followed by sustenance for 8 h. The uptake of liposomal aztreonam in epithelial cell line of CHO Cricetulus griseus was enhanced six times compared to the uptake of pure drug. Hence it can be concluded that a surfactant-based nano-lipid vesicular system of aztreonam could be a paradigm to target and localize the drug with long residence time in the lungs.

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| | | |
|---|---|---|
| **Poster Presenter** | : | **Sayani Bhattacharyya** |
| Address | : | Krupanidhi College of Pharmacy, No 12/1 Chikkabellandur, Varthur Hobli Carmelaram Post, Bengaluru - 560035, Karnataka, India |
| Mobile | : | +91-9845561865 |
| Email | : | sayanibh@gmail.com |
| Affiliation | : | Krupanidhi College of Pharmacy |
| Co Author(s) | : | Preethi Sudheer |

# ANTI-AMYLOIDOGENIC & FIBRIL DISAGGREGATING POTENCY OF THE LEVODOPA FUNCTIONALIZED GOLD NANOROSES AS EXEMPLIFIED IN A DIPHENYLALANINE BASED AMYLOID MODEL

*Avneet Kour [a,b], Taru Dube [a], Ashwani Kumar [b], Jiban Jyoti Panda [a]*
*[a]Institute of Nano Science and Technology, Mohali, Punjab, 140306, India*
*[b]University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh, India*
*Email: kauravneet75@gmail.com*

The phenomenon of proteins/peptide assembly into amyloid fibrils is associated with various neurodegenerative and age-related human disorders. Inhibition of the aggregation behavior of amyloidogenic peptides/proteins or disruption of the pre-formed aggregates is a viable therapeutic option to control the progression of various protein aggregation related disorders such as Alzheimer's disease (AD). In the current work, we investigated both the amyloid inhibition and disaggregation proclivity of levodopa functionalized gold nanoroses (GNR) against two peptide based amyloid models, the amyloid beta peptide [Aβ (1-42)] and the dipeptide, phenylalanine-phenylalanine (FF). Results depicted anti-aggregation behavior of the GNR, towards both FF and Aβ (1-42) derived fibrils. The peptides demonstrated a variation in their fiber-like morphology and a decline in thioflavin T (ThT) fluorescence after being co-incubated with the GNR. We further demonstrated the neuroprotective effects of the GNR in neuroblastoma cells, against FF and Aβ (1-42) fibers induced toxicity, exemplified both in terms of regain of cellular viability and reduced production of reactive oxygen species (ROS). Overall, these findings support the potency of the GNR as promising platforms for combating AD.

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**POS-39**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Avneet Kour** |
| Address | : | Institute of Nano Science and Technology, Knowledge City<br>48 Mohali Non-US/Non-Canadian, Punjab - 140306, India |
| Mobile | : | +91-9797219011 |
| Email | : | kauravneet75@gmail.com |
| Affiliation | : | Institute of nanoscience and technology |
| Co Author(s) | : | Taru Dube, Ashwani Kumar, Jiban Jyoti Panda |

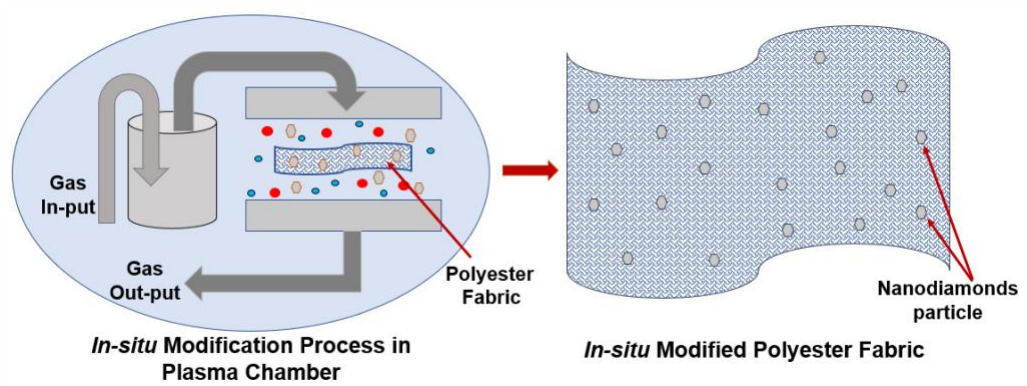
# *IN-SITU* SYNTHESIS OF NANODIAMOND ON TEXTILE SURFACE AND ITS FUNCTIONAL APPLICATIONS

Karan Chandrakar, Ashwini K. Agrawal and Manjeet Jassal
SMITA Research Lab, Department of Textile and Fibre Engineering,
Indian Institute of Technology Delhi, Hauz Khas, New Delhi, 110016, India
karan.chandrakar@smita-iitd.com

Nature is abundant in carbonaceous material, and its nanostructures have attracted much attention due to their unique properties. Conventional synthesis of these nanostructures is a long process which requires the use of high temperature and high pressure. In this study, we have explored the use of atmospheric pressure low-temperature plasma for *in-situ* synthesis of carbon nanostructures on the polyester fabric surface. *In-situ* synthesis of these carbon nanostructures resulted in the formation of nanodiamonds, which were found to impart enhanced functional properties to the polyester fabric. This study provides a novel approach for *in-situ* functionalized textiles without compromising the intrinsic properties of textile materials.

**Keywords**: Carbon nanostructures, Nanodiamond, Polyester

**Graphical Abstract:**




**POS-40**

**Poster Presenter :** **Karan Chandrakar**
Address : Ph.D. Research Scholar, Smita Research Lab, Department of Textile & Fibre Engineering, Indian Institute of Technology, Delhi Hauz-Khas, South Delhi - 110016, India
Tel : +91-11-26596615
Mobile : +91-9511801967
Email : karan.chandrakar@smita-iitd.com
Affiliation : Indian Institute Of Technology, Delhi, India
Co Author(s) : Prof. Ashwini Kumar Agrawal, Prof. Manjeet Jassal

# ENHANCED THERMAL STABILITY AND MONODOMAIN GROWTH IN A 3D SOFT PHOTONIC CRYSTAL AIDED BY GRAPHENE SUBSTRATE

**Khatun, Nurjahan**[1,2*]; Sridurai, Vimala[1]; Pujar, Rajashekhar[1,2]; Kanakala, Madhu B.[1]; Choudhary Shyam Kumar[3]; Kulkarni, Giridhar U.[1,4]; Yelamaggad, Channabasaveshwara V. and Nair, Geetha G.[1]

[1]Centre for Nano and Soft Matter Sciences, Bengaluru 562162, India

[2]Manipal Academy of Higher Education, Manipal 576104, India

[3]Tata steel LTD, Jamshedpur 831001, India

[4]Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bangalore 560064, India

Blue phase liquid crystals (BPLCs) are soft 3D photonic crystals in which the liquid crystal molecules self-assemble to form a cubic structure with a lattice spacing of a few 100 nm resulting in selective reflection of colours in the visible spectrum [1]. The corresponding wavelength or the 'photonic band gap' can be tuned using various external stimuli such as thermal, electric, magnetic and optical fields [1, 2]. Due to its photonic nature, the blue phase (BP) has several applications such as laser, mirrors, optical filter, grating, reflective displays etc. Though BP has several advantages, the inherent low thermal stability (0.2 -1 °C) and polycrystalline nature hinder their use in practical application. Here we report [3] the growth of monodomain BPLCs and their thermal stability on reduced graphene oxide-grown quartz substrates using optical reflection microscopy and spectroscopy. Optical textural images show that the graphene substrate enhances the thermal range of the BP by a factor of four compared to conventional ITO-coated glass substrate. The phase is stabilized down to sub-ambient temperatures (from 60 °C to 18 °C), with the BP domains remaining undistorted at ambient conditions for more than three months. Also, the graphene substrate aids the monodomain formation, with the average BP platelet size being nearly two orders of magnitude larger compared to the ITO / bare quartz substrates. The enhanced thermal stability and single-crystal-like growth of the BP are due to the improved wettability and non-covalent π-π interaction between graphene layers and liquid crystal molecules, as confirmed from the contact angle and Raman spectroscopic measurements, respectively. Thus, the room temperature stable, graphene layer stabilized-blue phase is an ideal candidate for high-performance photonic applications such as laser, waveguides etc.

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[2] Johnson et. Al., Phys. Rev. Lett., 45 (1980), 641−644.

[3] Nurjahan et.al., J. Mol. Liq., 325 (2021), 115059

* Author for Correspondence: nurjahank13@gmail.com

**POS-41**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Nurjahan Khatun** |
| Address | : | Centre for Nano and Soft Matter Sciences (CeNS) Shivanapura, Dasanapura Hobli, Bengaluru North - 562162, Karnataka, India |
| Mobile | : | +91-9609176564 |
| Email | : | nurjahank13@gmail.com |
| Affiliation | : | Centre for Nano and Soft Matter Sciences |
| Co Author(s) | : | Vimala Sridurai, Rajashekhar Pujar, Kanakala, Madhu B, Geetha G. Nair |

# FORMULATION, CHARACTERIZATION & COMPARATIVE PRE CLINICAL EVALUATION OF EFFECTIVE DERMAL PENETRATION OF IN VITRO ISOLATED TAXOL NANO FORMULATIONS AS A NOVEL TREATMENT FOR BREAST CANCER

**Kuntal Das**
Department of Pharmacognosy and Natural Product chemistry,
Krupanidhi College of Pharmacy, Carmelaram Post,
VarthurHobli, Bengaluru-560035, INDIA
**E-Mail:**drkkdsd@gmail.com; Mob: +919632542846

Breast cancer is the most prevalent malignancy that spreads to adjacent lymph nodes in women. The objective of this study is to develop two new nano formulations, 51oisome and liposome, as prospective carriers for breast cancer treatment, and to evaluate how enhancing skin permeability affects the comparative efficacy and targeting of the two nano formulations. Isolated taxol from in vitro grown *Taxus wallichiana* was used as a natural potent drug. Niosome was prepared by the thin film hydration method whereas 1,2-dipalmitoyl-Sn-glycero-3-phosphocholine (DPPC) lipid was used for the liposome preparation for the said natural drug. Physical characterization viz. transmission electron microscopy, scanning electron microscopy, and Fourier transform infrared spectroscopy were used to characterise both formulations. Furthermore, the encapsulation effectiveness of isolated taxol in both carriers as well as in-vitro drug release was also assessed. Thereafter, laboratory rabbits were used for the test as preclinical trial for cellular uptake and the findings revealed that both the nano formulations lasted a long time through the skin, ensuring that anticancer isolated taxol is present in the skin for an extended period of time but among them, noisome formulation showed higher penetration than the liposome and concluded the effective alternate drug delivery system of chemotherapy.

**Keywords:** Physical characters; Liposome; Niosome, Taxol, *Taxus wallichiana.*

**POS-42**

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| **Poster Presenter** | : | **Kuntal Das** |
| Address | : | Krupanidhi College of Pharmacy #12/1, Chikkabelandur<br>Carmelaram Post, Varthur Hobli, Bangalore - 560035, Karnataka, India |
| Mobile | : | +91-9632542846 |
| Email | : | drkkdsd@gmail.com |
| Affiliation | : | Krupanidhi College of Pharmacy |

# BANDGAP ENGINEERED G-$C_3N_4$ AND ITS GRAPHENE COMPOSITES FOR STABLE PHOTOREDUCTION OF $CO_2$ TO METHANOL

Ramesh Chandra Sahoo,[1,2]† Haijiao Lu,[3]† Dimple Garg,[1] Zongyou Yin[3] and H. S. S. Ramakrishna Matte[1]*
1. Energy Materials Laboratory, Centre for Nano and Soft Matter Sciences (CeNS), Arkavathi, Shivanapura, Dasanapura Hobli, Bangalore 562162, India
2. Manipal Academy of Higher Education (MAHE), Manipal 576104, India
3. Research School of Chemistry, Australian National University, Canberra 2601, Australia.
*Corresponding author: E-mail: matte@cens.res.in, krishnamatte@gmail.com

Carbon nitride (g-$C_3N_4$) is a two-dimensional material with several advantages over other photocatalysts, such as metal-free, biocompatible, chemically and thermally stable, to name a few. However, it usually suffers from low charge carrier mobility, high recombination rate, low electrical conductivity, and, more importantly, low absorption in the visible range. To address the multiple shortcomings, a simple and cost-effective copolymerization strategy is developed to synthesize g-$C_3N_4$ by selecting the appropriate precursors and optimizing the synthesis parameters, which resulted in lowering the bandgap from 2.80 eV to as narrow as 2.40 eV. To further improve the charge separation and conductivity, g-$C_3N_4$ and reduced graphene oxide (rGO) based composites are synthesized. The obtained composite catalysts are studied for photocatalytic $CO_2$ reduction. It is important to note that g-$C_3N_4$/rGO composites resulted in the selective photoreduction of $CO_2$ to methanol as the only liquid product with evolution rates of ~114 µmol $g^{-1}$ $h^{-1}$ along with $H_2$ (68 µmol $g^{-1}$ $h^{-1}$) under scavenger free conditions and exhibited robust stability.

**POS-43**

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| **Poster Presenter** | : | **Ramesh Chandra Sahoo** |
| Address | : | Centre for Nano and Soft Matter Sciences (CeNS) Arkavathi, Survey No.7 Shivanapura, Dasanapura Hobli,Bengaluru - 562162, Karnataka, India |
| Mobile | : | +91-9668154122 |
| Email | : | ramesh@cens.res.in |
| Affiliation | : | Centre for Nano and Soft Matter Sciences |
| Co Author(s) | : | Haijiao Lu, Dimple Garg, Zongyou Yin, H. S. S. Ramakrishna Matte |

# DEVELOPMENT OF BORON NITRIDE NANOTUBES-GELAPIN HYDROGEL FILMS FOR CARDIAC TISSUE ENGINEERING

**Sathyan Vivekanand Anandhan[1, 2], Anupama Natarajan[1, 2], Swaminathan Sethuraman[1, 2], Uma Maheswari Krishnan*[1, 2, 3]**
[1]*Centre for Nanotechnology and Advanced Biomaterials,*
[2]*School of Chemical & Biotechnology,*
[3]*School of Arts, Science, Humanities & Education,*
*SASTRA Deemed-to-be-University, Thanjavur-613401*
Email: sathyanvivekanand@gmail.com

Cardiac tissue engineering is an emerging strategy for end-stage cardiac diseases. It still remains a challenge in mimicking the cardiac microenvironment and achieving electromechanical coupling. Herein, we present, Boron nitride nanotubes (BNNTs) incorporated genipin crosslinked gelatin (Gelapin) hydrogel films as the scaffold. Gelatin is rich in arginine-glycine-aspartate (RGD) sequences which aid in cell adhesion. Genipin, a non-toxic,geniposide, present in the fruit of the gardenia plant, *Gardenia jasmindides Ellis* was used as the cross-linker to improve its mechanical stability and as well as genipin as such can promote angiogenesis. BNNTs, a piezoelectric material were incorporated in the gelapin films to electrically stimulate cardiac scaffold on applying mechanical stress. *In vitro* evaluation was performed by culturing human cardiomyocytes AC16 on these patches. The results suggest that this patch can be a promising material for myocardial engineering as they integrate topographical, chemical and electromechanical cues.

**Keywords:** genipin, RGD, piezoelectric, cardiomyocytes

**POS-44**

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| **Poster Presenter** | **:** | **Sathyan Vivekanand Anandhan** |
| Address | : | Lab No: 413, ASK - I, CeNTAB, SASTRA Deemed University<br>Thirumalaisamudram, Thanjavur - 613401, Tamil Nadu, India |
| Mobile | : | +91-9597014418 |
| Email | : | sathyanvivekanand@gmail.com |
| Affiliation | : | SASTRA Deemed University |
| Co Author(s) | : | Anupama Natarajan, Swaminathan Sethuraman, Uma Maheswari Krishnan |

# SYNTHESIS AND OPTICAL CHARACTERISTICS OF GRAPHENE QUANTUM DOTS FOR PHOTOVOLTAIC DEVICES

**Grisham Ashish Darooka,[1] Muthiah Ravichandran,[1] M. Arshad Basha,[1] Mariyappan Shanmugam[2] ***

'Department of Aerospace Engineering

^Department of Physics, Centre for Clean Energy and Nano Convergence

Centre for Sensors and Process Control

Hindustan Institute of Technology and Science, Chennai-603103, Tamil Nadu, India

*Corresponding author e-mail: *smari(cb,hindiistaminiv.ac.in*

Graphene is a 2D-layered material with zero optical bandgap and thus no significant optical absorption in the visible spectral window. It is a major limitation in graphene that impede application in photovoltaic devices as an energy absorbing layer. We demonstrate the possibility of employing graphene quantum dots as a major photo-active material in photovoltaic device. Studies show the possibility of tuning the optical bandgap of graphene quantum dots by confining the lateral dimensions. Wet-chemical processed graphene quantum dots of different sizes were prepared and observed that UV-Visible absorption in the wavelength window of 300 nm-800 nm varied significantly with respect to the size variation of graphene quantum dots. Further, the quantum was coated onto electron acceptors and fabricated nanostructured photovoltaic device which exhibited performance with respect to the variation in the sizes of graphene quantum dots. Further, it was also noticed that incorporating graphene quantum dots into electron acceptor in photovoltaic device improved the charge transport characteristics as observed in the electrical transport measurements.

**Keywords:** Quantum dots, optical absorption, graphene, size effect

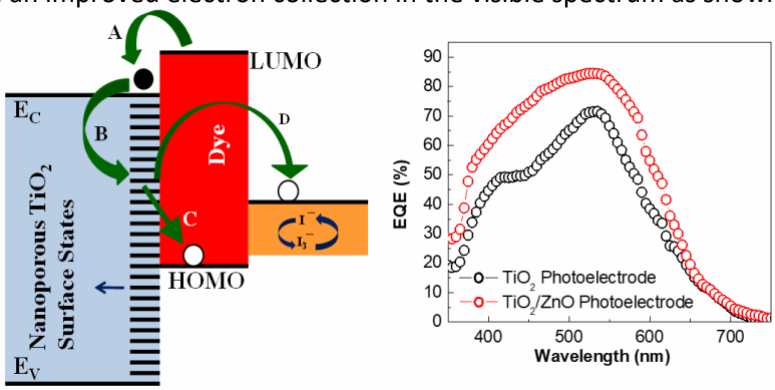
**POS-45**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Grisham Ashish Darooka** |
| Address | : | 201/202, New Pareejat, J.B Nagar, Andheri (East)<br>Mumbai- 400059, Maharashtra, India |
| Mobile | : | +91-9167190339 |
| Email | : | grishamdarooka040103@gmail.com |
| Affiliation | : | Hindustan Institute Of Technology and Science |
| Co Author(s) | : | Muthiah Ravichandran, M Arshad Basha, Mariyappan Shanmugam |

# ZNO ASSISTED DEFECT ENGINEERING IN NANOSTRUCTURED $TIO_2$: AN EFFICIENT PHOTO-ANODE SYSTEM FOR DYE SENSITIZED SOLAR CELLS

**Muthiah Ravichandran,**[1] **M. Arshad Basha,**[1] **Grisham Ashish Darooka,**[1] **Mariyappan Shanmugam**[2, *]
[1]Department of Aerospace Engineering, [2]Department of Physics
Hindustan Institute of Technology and Science, Chennai-603103, Tamil Nadu, India
*Corresponding author e-mail: smari@hindustanuniv.ac.in

We demonstrate the possibility of improving the photovoltaic performance of Dye sensitized solar cells (DSSCs) by applying ZnO as a passivation layer on $TiO_2$ photo-anode which resulted in more than 30 % enhancement in the overall efficiency compared to a DSSC with conventional $TiO_2$ photoelectrode. It proved that surface defect states present in the electron acceptor $TiO_2$ were significantly suppressed by ZnO coating. The density and activity of defect states in the electron acceptor play critical role on charge transport and recombination. In the Fig, process A represents electron injection from the organic dye to $TiO_2$ through which they need to travel towards electrode for collection. However, defects in the $TiO_2$ will not allow them and lead to recombination. ZnO coating created an energy barrier which suppressed the interfacial recombination and resulted in improved performance. The effect of ZnO passivation on $TiO_2$ was further confirmed via external quantum efficiency measurement as well. It showed an improved electron collection in the visible spectrum as shown in the Fig.




**Keywords**: Photovoltaics, electron acceptors, charge transport, absorption

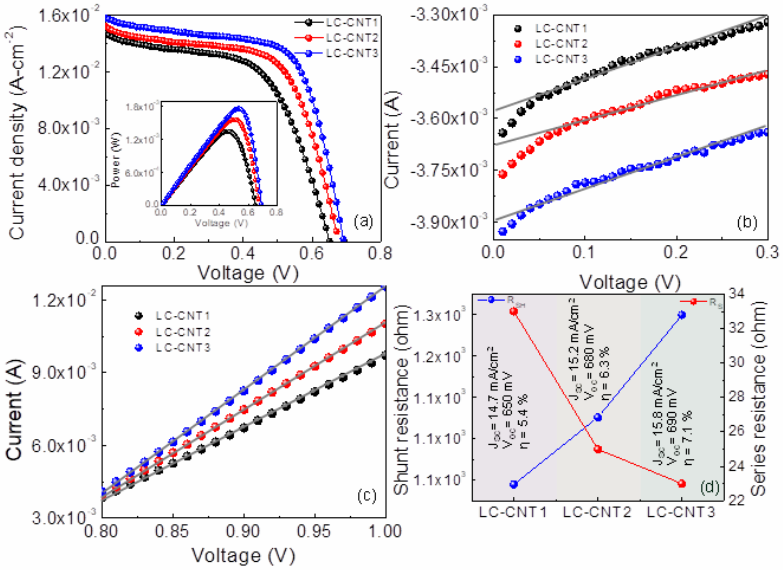
**POS-46**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Muthiah Ravichandran** |
| Address | : | G1, Plot No. 10 Perfect Homes, Anandhammal Nagar, Perumbakkam Chennai - 600100, Tamil Nadu, India |
| Mobile | : | +91-7598344406 |
| Email | : | suriya.muthiah@gmail.com |
| Affiliation | : | Hindustan Institute of Technology and Sciences |
| Co AuthOr(s) | : | Grisham Ashish Darooka, M Arshad Basha, Dr. Mariyappan Shanmugam |

# FABRICATION AND STUDIES ON PLATINUM-FREE DYE SENSITIZED SOLAR CELLS VIA VACUUM FILTRATION ASSISTED ALIGNED CARBON NANOTUBE COUNTER ELECTRODES

**M. Arshad Basha,**[1] **Muthiah Ravichandran,**[1] **Grisham Ashish Darooka,** [1] **Mariyappan Shanmugam**[2,] *
[1]Department of Aerospace Engineering, [2]Department of Physics, Hindustan Institute of Technology and Science, Chennai-603103, Tamil Nadu, India
*Corresponding author e-mail: smari@hindustanuniv.ac.in

We demonstrate vacuum filtration assisted well aligned carbon nanotube (CNT) film as a potential counter electrode material for dye sensitized solar cells (DSSCs). Major objective of the present work is to remove expensive platinum from the DSSCs to achieve cost effective fabrication process. Nematic phase of the CNT was achieved via vacuum filtration method and the film was transferred onto glass substrate as a counter electrode for DSSCs. The Current-voltage characteristics of the DSSCs employed CNT film as a counter electrode exhibited performance in the range of 5% -7%. Further, our studies showed that the performance can be varied by varying the quantity (thickness) of CNT in the film. The variation in the performance of DSSCs due to the change in CNT is attributed to the enhanced catalytic activity between the counter electrode and the hole transporting electrolyte. Further, the shunt and series resistances also were influenced by the CNT and thus change in the performance.




**Key words**: Carbon nanotube, counter electrode, series resistance, shunt resistance

**POS-47**

| | | |
|---|---|---|
| **Poster Presenter** | : | **M. Arshad Basha** |
| Address | : | 49-50A-87H-6D, Lakshmi Nagar<br>Kurnool - 518002, Andhra Pradesh, India |
| Mobile | : | +91-8688010300 |
| Email | : | arshad724398@gmail.com |
| Affiliation | : | Hindustan Institute of Technology and Science |
| Co Author(s) | : | Grisham Ashish Darooka, Muthiah Ravichandran, Dr. Mariyappan Shanmugam |

# MICROFLUIDIC-BASED PHOTOCATALYTIC REACTOR FOR ENVIRONMENTAL REMEDIATION

Vibhav Katoch and Bhanu Prakash*
Institute of Nano Science and Technology, Sector-81, Knowledge City, SAS Nagar, Punjab, 140306
*bhanup@inst.ac.in

Our study indicates that the role of reactor is also quite crucial in determining the overall efficiency of photocatalysis for different environmental applications. In the present work, we demonstrate the use of PMMA based microreactor fabricated using laser micromachining technique for inline photocatalysis. Microfluidic platforms such as flow rates and channel length have been evaluated for degradation efficiency of various metal oxide and sulphide based photocatalysts. A comparison of the microfluidic platform with batch photocatalysis has also been evaluated, where the dye degradation efficiency using inline microfluidic reactors is superior when compared to the batch synthesis platform.
Keywords: Microfluidics, photocatalysis, inline photocatalysis

**POS-48**

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|---|---|---|
| **Poster Presenter** | : | **Vibhav Katoch** |
| Address | : | Institute of Nano Science and Technology, SAS Nagar<br>Punjab - 140306, India |
| Mobile | : | 91-7579066597 |
| Email | : | vibhavkatoch@yahoo.com |
| Affiliation | : | Institute of Nano Science and Technology |

# MATERIAL FABRICATION OF SERS SUBSTRATES FOR BIOMOLECULE DETECTION AND BIOSENSOR APPLICATION

P. Nandhagopal, Risa Marium Philip, Anil Kumar Pal, and D. Bharathi Mohan
*Nano Plasmonics group, Department of Physics, Pondicherry University.*
d.bharathimohan@gmail.com

Surface-Enhance Raman Spectroscopy (SERS) is a rapid molecular detection module for ultra-low concentration detection of biomolecules in complex environments. Our aim is to prepare low-cost, abundant alternatives to gold metal as a material for SERS platform. We have prepared, Ag metal and Ag-Cu bimetal thin films using physical vapour deposition methods for detection of neurotoxin from Clostridium Botulinum. The substrates were calibrated with the dye molecule methylene blue which was detectable up to a concentration of $10^{-11}$ M. To further improve upon the limit-of-detection (LoD) capability, ZnO nano-rods were grown on top of Ag nanoisland films using hydrothermal method followed by decoration with Ag, Au and Pt nanoparticle of which silver decorated ZnO nano-rods showed promise as a single molecule detection ($10^{-18}$ M) platform for Rhodamine-6G. The substrates were used to detect haemoglobin and λ-DNA with LoD up to $10^{-7}$ M and 10 ng/µL respectively. To detect biomolecules with absorption in ultraviolet region, bismuth thin films with UV-plasmonic activity was prepared using sputtering technique. The relatively abundant, biocompatible bismuth nanoparticle have high stability towards oxidation and was used to improve the SERS detection of bovine serum albumin (BSA) and histidine amino acids. The bismuth thin film SERS substrate was also used to detect Rhodamine-6G up to a concentration of $10^{-11}$ M with linear detection limit.

**POS-49**

| | | |
|---|---|---|
| **Poster Presenter** | : | **P. Nandhagopal** |
| Address | : | 114, ground floor, Department of Physics Pondicherry University Puducherry - 605014, India |
| Mobile | : | +91-9442790104 |
| Email | : | p.nandhagopal9@gmail.com |
| Affiliation | : | Pondicherry University |
| Co Author(s) | : | Risa Marium Philip, Anil Kumar Pal, D. Bharathi Mohan |

# BI-FUNCTIONAL ELECTRODE FOR SUPERCAPACITOR AND UV DETECTOR APPLICATIONS USING TWO-DIMENSIONAL LAYERED COORDINATION POLYMERS

Sabiar Rahaman, Madhu Babu Kanakala, Manmohansingh Waldiya, Channabasaveshwar V. Yelamaggad and Kavita A. Pandey*
*Centre for Nano and Soft Matter Sciences (CeNS), Arkavathi, Bengaluru 562 162, India*
*Corresponding author email: kavitapandey@cens.res.in

The development of next-generation energy storage devices will play an essential role in the future of sustainable energy since they have been widely used in portable electronics, electric/hybrid vehicles, stationary power stations, etc. To achieve a truly sustainable energy storage device, researchers have widely used two-dimensional (2D) layered structures as electrode materials for energy storage applications. However, more recently, there has been a renewed interest to develop facile strategies to demonstrate the use of layered coordination polymers (COPs) as strong alternatives to 2D electrode materials for energy storage applications. Herein, we report the use of such 2D layered COPs for supercapacitor as well as UV detector applications. A rare-earth element is coordinated with the ligand 3,3' - diaminobenzidine (DAB) to form the lanthanide-based metal-coordination polymer in a gram scale. FE-SEM imaging, Raman and X-ray Photoelectron Spectroscopy, and HR-TEM analysis suggest 2D COP repeating units. Furthermore, this COP has been profoundly studied to understand its ability to be used as an electrode material for energy storage applications. A conventional three-electrode configuration has been utilized to examine their electrochemical properties in a 1 M $H_2SO_4$ electrolytic solution. Cyclic voltammogram (CV) and galvanostatic charge-discharge (GCD) shows electric double-layer capacitor (EDLC) behaviour. A maximum specific capacitance of up to 90 $mFg^{-1}$ (at 10 $mVs^{-1}$) have been achieved with remarkable cycling stability of about 100% capacitance retention after 5000 cycles. Also, this 2D material is showing very promising results in UV detection with fast response. Further, to build up more understanding, three more different lanthanide-based 2D-COPs have also been synthesized, and all are showing EDLC behaviour with high cycling stability. This study would undoubtedly help to design a more promising, highly stable supercapacitor cum UV detector using the lanthanide-based layered coordination polymers.

**POS-50**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Sabiar Rahaman** |
| Address | : | Centre for Nano and Soft Matter Sciences(CeNS), Arkavathi, Survey No.7 Shivanapura, Dasanapura Hobli, Bengaluru - 562162, Karnataka, India |
| Mobile | : | +91-9564557078 |
| Email | : | sabphysics96@gmail.com |
| Affiliation | : | Centre for Nano and Soft Matter Sciences (CeNS) |
| Co Author(s) | : | Madhu Babu Kanakala, Manmohansingh Waldiya, Channabasaveshwar V. Yelamaggad, Kavita A. Pandey |

# ANGLE-SENSITIVE NANOSCALE SOI PHOTODETECTOR FOR LENSLESS IMAGING

We present a pixel-level angle sensitive detector composed of silicon-on-insulator (SOI) photodiode (PD) stacked with a gold surface plasmon (SP) antenna to detect the incident angle. The SPs are excited in the grating-type SP antenna and enhance the diffraction efficiency of the grating. The diffracted light is coupled strongly with the propagation light in the SOI waveguide when the phase matching condition is satisfied. The phase matching takes place at a specific angle of light incidence, and the discrimination of the light based on the incident angle is achieved. As spatial patterns in the polar coordinate of the elevation-azimuth angles ($\vartheta, \phi$) of the incident light, we present the phase matching condition theoretically, the absorption efficiency in the SOI by simulation, and also the quantum efficiency of the SOI PD experimentally one-dimensional (1D) line-and-space (L/S) grating SP antenna under various polarization angles. A good agreement among the theory, simulation, and experiment is attained. The proposed PD is compatible with SOI complementary metal-oxide-semiconductor (CMOS) circuit technology, features relatively high quantum efficiency as an angle-sensitive pixel (ASP) and may open up a new field of integrated ASPs for applications in lensless imaging, three-dimensional (3D) imaging and depth-of-field extension.

**POS-51**


| | | |
|---|---|---|
| **Poster Presenter** | : | **Anitharaj Nagarajan** |
| Address | : | No.18, 3rd Cross, Shankarappa Layout, RR Nagar<br>Bangalore - 560098, Karnataka, India |
| Mobile | : | +91-6369866585 |
| Email | : | anithr.91@gmail.com |
| Affiliation | : | SRMIST, India and Shizuoka University, Japan |
| Co Author(s) | : | Shusuke Hara, Hiroaki Satoh, Aruna Priya Panchanathan, Hiroshi Inokawa |

# UNIVERSAL NANODS - THE REAL-TIME UNIFICATION OF ALL NANOANALYTICAL & QUANTUM TECHNOLOGIES

Universal Nanofluidic Device (UNanoD) - A first of its kind - disruptive device that can handle biological problems and material science problems in fluid in real-time at the single-molecule level. We call this device UNanoD - Universal Nanofluidic Devices. UNanoD will be a standard (like USB) that will be established with existing specifications for various optical microscopes, electron microscopes, and electronics to interface between one nanoscopic measurement device to another.

**POS-52**


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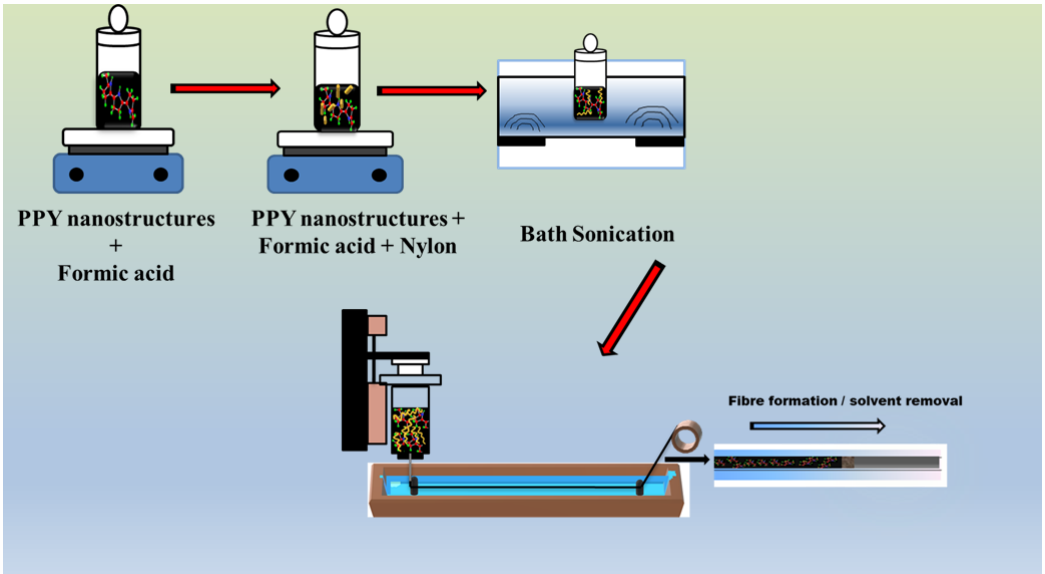
|---|---|---|
| **Poster Presenter** | : | **Sagar Gosalia** |
| Address | : | International Center for Nanodevices Private Limited<br>Centre for Nano Science and Engineering, Indian Institute of Science<br>Bangalore - 560012, Karnataka, India |
| Mobile | : | +91-7878696786 |
| Email | : | sagar@icend.xyz |
| Affiliation | : | International Center for Nanodevices Private Limited |

# ELECTRICALLY CONDUCTIVE COMPOSITES FIBERS USING NANOSTRUCTURES OF CONJUGATED POLYMER

Kiran Rana, Manjeet Jassal* and Ashwini K. Agrawal*
SMITA Research Lab, Department of Textile and Fibre Engineering
Indian Institute of Technology, Delhi
*E-mail address: kiran.rana@smita-iitd.com

Electrically conducting polymeric fibers are an important component in realizing wearable electronic textiles due to their ease of integration with traditional textile substrates. However, the blends of conjugated polymers with spinnable polymers have only yielded poor electrical properties. In this study, we have synthesized nanostructures of a conjugated polymer, polypyrrole, and blended them with nylon-6 to demonstrate the fabrication of electrically conductive composite fiber by the wet-spinning process. The composite fibers, thus obtained, showed good electrical conductivity at a low percolation threshold. The study further investigated the effect of loading of polypyrrole nanostructures on the mechanical and electrical properties of conductive composites.




**POS-53**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Kiran Rana** |
| Address | : | IIT Campus, Textile & Fiber Engineering Department, Hauz Khas South Delhi, India Near Main Building, Delhi - 110016, India |
| Mobile | : | +91-7984687445 |
| Email | : | kiran.rana@smita-iitd.com |
| Affiliation | : | Indian institute of technology |
| Co Author(s) | : | Prof. Manjeet Jassal, Prof. Ashwini K. Agrawal |

# DEVELOPMENT OF CURCUMIN LOADED PROTEIN-GLYCOSAMINOGLYCAN NANOCARRIER TO TARGET MACROPHAGES

**Madhumithra T, Swaminathan S, Anuradha S***

Tissue Engineering and Additive Manufacturing (TEAM) Lab, Artificial Intelligence / Bio-Nano / Cyber Systems / Digital Manufacturing / Energy & Environment (ABCDE) innovation center, Center for Nanotechnology & Advanced Biomaterial (CeNTAB), SASTRA Deemed University, Thanjavur, Tamil Nadu

*Corresponding Author: Dr. Anuradha S (Email: anuradha@bioengg.sastra.edu)

Rheumatoid arthritis (RA) is an autoimmune disorder found common in 1% of the worldwide population that affect the joints in symmetric pattern. The existing treatment options for RA management are palliative and limited to minimize the disease progression with more side effects. In this study, Zein(Z), FDA-approved GRAS protein and chondroitin sulfate (ChS) have been used to synthesize Z-Chs nanoparticles to target the synovial $M_1$ macrophages. Further, curcumin (Cur) loaded Z-Chs nanoparticles were synthesized at a ratio of 1:1 w/w (Z:Cur) with maximum encapsulation (99.6%) and loading efficiency (24.8%). The morphology and particle size were determined using scanning electron microscopy. The loading of curcumin was further confirmed using FTIR. The hydrodynamic size of Cur loaded Z-Chs nanoparticles was 346.7 nm and the zeta potential was found to be -33.8 mV. The cellular internalization into the differentiated macrophages such as $M_0$ & $M_1$ was evaluated using fluorescence microscopy, where higher internalization in activated macrophages was confirmed with Cur loaded Z-Chs nanoparticles. These results clearly indicate that the Cur loaded Z-Chs nanoparticles may be a promising nanocarrier to target the inflammatory macrophages in RA conditions.

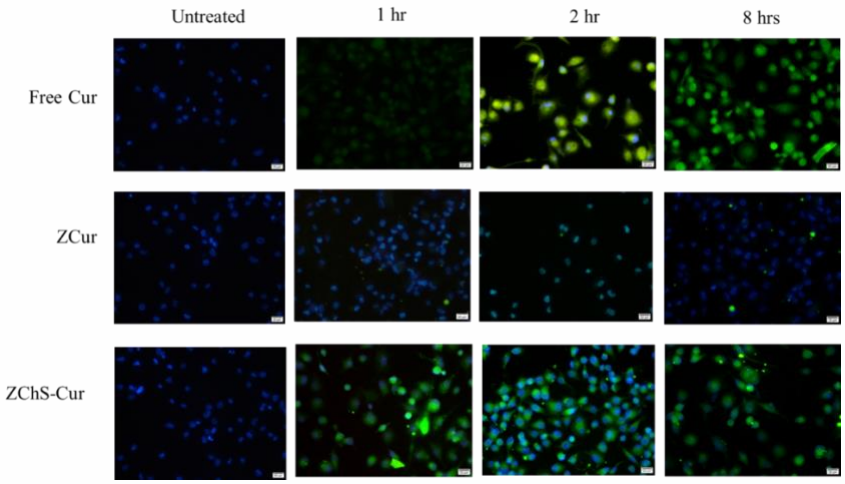



Fig.1: Cellular uptake of free curcumin, Zein curcumin and Zein ChS curcumin nanoparticles by activated ($M_1$) Macrophage.

**POS-54**

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| **Poster Presenter** | : | **Madhumithra T.** |
| Address | : | SASTRA Deemed University, Thirumalaisamudhram<br>Thanjavur - 613401, Tamil Nadu, India |
| Mobile | : | +91-9865006969 |
| Email | : | madhumithrabt@gmail.com |
| Affiliation | : | SASTRA Deemed University |
| Co Author(s) | : | Dr. Swaminathan S, Dr. Anuradha S |

# FUNGUS BASED BIO-FABRICATION OF CARBON SUPPORTED SILVER NANOPARTICLES AND THEIR ANTIMICROBIAL ACTIVITY

Azam Raza, Absar Ahmad, Sk. Najrul Islam, Syed Mohd Adnan Naqvi, Sadia Parveen.
Interdisciplinary Nanotechnology Centre (INC), Z. H. College of Engineering and Technology, Aligarh Muslim University, AMU, Aligarh, UP-202002, India
Email address: azamraza1330@gmail.com

For biologists, chemists, and materials scientists, bio-directed synthesis of nanoparticles is an exciting field that is rapidly progressing, especially in light of efforts to identify green methods of inorganic material synthesis. The use of fungus (*Fusarium oxysporum*) in the production of carbon-supported silver nanoparticles (C/AgNPs) is reported first in this study. At room temperature, intracellular AgNPs were produced by reacting silver nitrate ($AgNO_3$) and fungul biomass in aqueous solutions. Further, we burnt the sample (intracellular AgNPs) at 800°C in the tubular furnace in argon atmosphare and obtained the C/AgNPs. UV-Vis spectroscopy, X-ray diffraction(XRD), transmission electron microscopy (TEM), SEM with EDAX mapping and FTIR spectroscopy were used to analyze the synthesized nanoparticles. Among the many biological resources that have been presented for reducing Ag ions into AgNPs, green approaches such as employing fungus have outstanding benefits for synthesizing biological metal nanoparticles due to their environmentally friendly properties. Green strategies, such as using fungus, have exceptional benefits for synthesizing biological metal nanoparticles due to their eco-friendly nature and low levels of cytotoxicity among a wide range of biological resources presented for reducing Ag ions into AgNPs. Furthermore, the C/AgNPs produced by this route was tested for antimicrobial activity.

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**POS-55**

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|---|---|---|
| **Poster Presenter** | : | **Azam Raza** |
| Address | : | Room No.14, Jai Kishan Hostel, Sir Shah Sulaiman Hall, Amu Aligarh - 202002, Uttar Pradesh, India |
| Mobile | : | +91-7417359684 |
| Email | : | azamraza1330@gmail.com |
| Affiliation | : | Aligarh Muslim University, Aligarh, U. P |
| Co Author(s) | : | Absar Ahmed, Sk. Najrul Islam, Syed Mohd Adnan Naqvi, Sadia Parveen |

# NEW GENERATION NANOTHERANOSTIC AGENTS AGAINST ALZHEIMER DISEASE

Manju Sharma[1], Virendra Tiwari[2], Shubha Shukla[2]* and Jiban Jyoti Panda[1]*
[1] *Institute of Nano Science and Technology, Mohali, Punjab-140306, India*
[2]*CSIR-Central Drug Research Institute Sector 10, Jankipuram Extension, Sitapur Road, Lucknow, India*
*Email: manju.ph17206@inst.ac.in*

The aggregation and accumulation of neurotoxic amyloid-β (Aβ) is the major neuropathological hallmark of Alzheimer's disease (AD). Inhibiting their aggregation is one of the most viable approach to control the progression of this deadly disease. The available anti-AD drugs have some limitations such as their physicochemical nature, limited ability to pass the blood–brain barrier (BBB), and low bioavailability in the central nervous system (CNS). Thus, our nanotheranostics systems are able to overcome all these limitations. We have developed a multimodal fluorescent theranostic dopamine–tryptophan nanocomposites (DTNPs) and self-fluorescent lone tryptophan nanoparticles (TNPs) by a simple hydrothermal reaction. Both nanostructures can potentially cross the Blood-brain barrier (BBB) via LAT1 transporters and serving as simultaneous amyloid inhibitors and aggregate detecting agents under one roof. Moreover, we have also tried to use the FF dipeptide as a reductionist model for establishing Aβ polypeptide aggregation, as opposed to large peptide/protein-derived robust and high-molecular-weight amyloid aggregation models of Alzheimer's disease, our dipeptide-based amyloid model provides an edge over others in terms of the ease of handling, synthesis, and cost-effectiveness. Our results have demonstrated positive antiaggregation behavior of the both DTNPs and TNPs toward both FF-derived amyloid fibrils and preformed Aβ-peptide fibers. We have further tried to decipher the ability of both DTNPs and TNPs as neuroprotective agents both under cellular conditions (neural cells) and in ICV STZ injection induced amyloid animal models. *Overall,* these studies clearly illustrate that the DTNPs and solo TNPs can serve as promising nanotheranostic agents for AD treatment.

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**POS-56**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Manju Sharma** |
| Address | : | Main Building, B12 Lab Sector - 81, Mohali INST, SAS Nagar<br>Punjab - 140306, India |
| Mobile | : | +91-9459738617 |
| Email | : | sharmamanju1735@gmail.com |
| Affiliation | : | Institute of Nanoscience and Technology, sector-81, Mohali, India |
| Co Author(s) | : | Virendra Tiwari, Shubha Shukla, Jiban Jyoti Panda |

# CARBON BASED NANOZYME: SYNTHESIS OF METAL FREE CARBON NANOSPHERE TO MIMIC PEROXIDASE AND CATALASE ACTIVITY

**Ashish K Shukla, 1,2 # and Amitabha Acharya1,2 ***
**1Biotechnology Division, CSIR-Institute of Himalayan Bioresource Technology, Palampur (H.P.)**, India
2Academy of Scientific and Innovative Research (AcSIR), Ghaziabad- 201002, India
*Author to whom the correspondence should be addressed,
amitabha@ihbt.res.in, amitabhachem@gmail.com

The unique enzymatic properties and advantages of carbon nanomaterials (CNMs) has received much attention in recent times and will continue to be an active and challenging field for the years to come. Nanozymes have advantages over natural enzymes, such as facile production on large scale, long storage time, low costs, and high stability in harsh environments. CNMs, including fullerenes, carbon nanotubes, graphene, carbon quantum dots, and graphene quantum dots, have become an interstellar family in materials science. In continuation of this, we synthesized nitrilotriacetic acid (NTA) functionalized carbon nanosphere from tea plant Camellia Sinensis (CS) (CS-CNS@NTA) using a simple hydrothermal reaction condition. The characterization studies revealed size of ~160 ± 20 nm along with fluorescence (Ext. 440nm and Em. ~520nm). Synthesized CS-CNS@NTA shows strong peroxidase and catalase activity over a wide range of substrate. In the presence of H2O2 and TMB as a substrate CS-CNS@NTA shows peroxidase activity with Km and Vmax value of ~ 413µM and 1.42 µM/s and 378 µM and 1.63 µM/s, respectively. Similarly, in the presence of H2O2 it shows good catalase activity with Km and Vmax value of ~0.874 µM and 2.87 µM/s, respectively. Interestingly, it was observed that our synthesized carbon nanozyme can act as a good combat agent against the reactive oxygen species (ROS) inside cellular in vitro studies and may help to maintain cellular integrity via peroxidase and catalase mimic activity.

**Keywords:** Carbon nanosphere; Nanozyme; Fluorescence; oxidative stress; Catalase and peroxidase activity.

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**POS-57**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Ashish Kumar Shukla** |
| Address | : | Nanobiology lab, Biotechnology Division, CSIR-IHBT, Holta Palampur - 176061, Himachal Pradesh, India |
| Mobile | : | +91-7905662261 |
| Email | : | ashishgkp.shukla@gmail.com |
| Affiliation | : | CSIR-Institute of Himalayan Bioresource Technology |
| Co Author(s) | : | Amitabha Acharya |

# SINGLE PHASE MICROFLUIDICS FOR ASSEMBLY OF GOLD NANORODS

Rama Pandillapally and Suhanya Duraiswamy
Department of Chemical Engineering, Indian Institute of Technology, Hyderabad, India

Self-assembly of anisotropic metal nanoparticles finds applications in several fields such as biomedical, optoelectronics, sensing, imaging, to name a few. Several studies have specifically shown the advantages and applications of self-assembly of anisotropic nanomaterials: for example, assembling gold nanorods (GNR) in either side by side or end to end configurations using different solvents, enhances both their optical and electrical properties as compared to isolated nanorods. However, these studies lack in reproducibility and/or configurable self-assembly as well as suffer from batch-to-batch variations due to the inherent disadvantages posed by the synthetic approach adopted-batch based methods. In this article, we use microfluidic approach for the self-assembly of GNR, using the well-established thiol terminated polystyrene method. The thiol groups in the polymer attach themselves to the exposed gold on the surface of GNR while the polymer itself brings them together. The side by side or end to end arrangement of GNR depends on the solvent used for assembly-using tetrahydrofuran (THF) and dimethylformamide (DMF) has shown to assemble the GNR end to end and side by side respectively which can be detected by the redshift and blue shift respectively of the optical spectra of the GNR. We use a microfluidic Y-junction geometry, to bring the GNR together with solvent, dissolved in thiol terminated polystyrene. The slow and controlled diffusive mixing in such devices leads to a reproducible assembly of GNR, which is highlighted in the current work.

**POS-58**

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|---|---|---|
| **Poster Presenter** | : | **Rama Pandillapally** |
| Address | : | Girls Hostel, IIT Hyderabad<br>Sangareddy - 502285, Telangana, India |
| Mobile | : | +91-9959409259 |
| Email | : | ch19resch11001@iith.ac.in |
| Affiliation | : | IITH |
| Co Author(s) | : | Suhanya Duraiswamy |

# RED EMITTING GRAPHENE NANOSHEETS CONJUGATED COPPER NANOCLUSTERS FOR TARGETED ANTIBIOFILM ACTIVITY

Chandni Sharma[1,2] and Amitabha Acharya[1,2*]
[1]*Biotechnology Division, CSIR-Institute of Himalayan Bioresource Technology, Palampur (H.P.), India*
[2]*Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, India*
[*]*Corresponding Author: A. Acharya, E-mail: amitabhachem@gmail.com; amitabha@ihbt.res.in;* Tel (off): +91-1894-233339; Extn. 397; Fax: +91-1894-230433

The great demand for antibiofilm, biocompatible and easily manufactured coating nanostructures has led to the designing of graphene-oxide (GO) hosted copper oxide nanoclusters (CuONC). In this study, we have developed red fluorescence emitting GO/CuONC nanostructures which are electrostatically coupled *via* cetyltrimethylammonium bromide (CTAB). As synthesized nanostructures were characterized by various spectroscopic and microscopic techniques *viz.,* fluorescence, UV-Vis, FTIR, DLS-Zeta, XRD, XPS and TEM, SEM, respectively. The fluorescence stability studies were estimated at different physiological conditions *viz.,* metal ions, NaCl, temperature and pH. Herein, we have investigated the extracellular amyloid fibrils targeted antibiofilm properties for Gram-positive (*Staphylococcus aureus*) and Gram-negative bacteria (*Escherichia coli*). Swarming and spreading assay for bacterial motility evaluation has also revealed that the developed nanoclusters restricted the growth of *E. coli* and *S. aureus* respectively. Mechanistic studies based on outer; N-phenyl-1-naphthylamine (NPN) and inner (3,3'-dipropylthiadicarbocyanine iodide (DiSC3-5) membrane permeabilization probes have also suggested their disruption induced antibacterial properties. Hence, the developed graphene oxide hosted copper nanoclusters can be used as an antibacterial coating agents in catheters and medical devices.

**Keywords:** Graphene nanosheets, copper nanocluster, red emission, spreading, swarming

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**POS-59**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Chandni Sharma** |
| Address | : | Nanobiology Lab, Biotechnology Division, CSIR-Institute of Himalayan Bioresource Technology, Palampur - 176061, Himachal Pradesh, India |
| Mobile | : | +91-6283128495 |
| Email | : | sharma092chandni@gmail.com |
| Affiliation | : | CSIR-Institute of Himalayan Bioresource Technology |
| Co Author(s) | : | Dr. Amitabha Acharya |

# IN-VITRO CYTOTOXICITY OF ZINC OXIDE NANOPARTICLES SYNTHESIZED FROM *LAGERSTROEMIA INDICA* ON HUMAN CANCER CELL LINES

Ambika Behera[1, a *] and Shruti Awasthi[2,b]
[1,2]Garden City University, Bengaluru, India
[a]ambika18325@gcu.ac.in, [b]shruti.awasthi@gardencity.university

This study evaluated the unique properties of in-vitro cytotoxicity of Zinc Oxide (ZnO) nanoparticles (NPs) on human breast cancer cell lines (MCF-7) and cervical cancer cell lines (Hela cells), synthesized from *Lagerstroemia indica*, which belongs to family Lythraceae. The synthesis of ZnO-NPs has been confirmed by various analytical characterizations like Ultraviolet-Visible (UV-Vis) spectroscopy, X-Ray Diffraction (XRD) analysis, Transmission Electron Microscopy (TEM), Fourier Transform Infrared (FTIR) analysis, and Scanning Electron Microscope (SEM) with Energy Dispersive Spectroscopy (EDS) micrograph. The antimicrobial potential of ZnO NPs was determined by the Microdilution method. Invitro cytotoxicity of the synthesized ZnO NPs has been investigated on MCF-7 and Hela cell lines through MTT assay. It has been found that cell viability decreases with an increase in the concentration of synthesized ZnO NPs. These ZnO NPs also showed a significant reduction of Mitochondrial Membrane integrity. In Dual Staining of AO/EtBr, ZnO showed more number of early apoptotic and late apoptotic cells as compared to the standard drug. ZnO does not have any hemolytic potential on human RBCs in both the cell lines. Thus, the synthesized ZnO NPs offer potential and recommending properties to be used in therapeutic and biomedical applications.

**POS-60**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Ambika Behera** |
| Address | : | Garden City University School of Sciences, Dept. of Life Science, 16th KM Old Madras Road Battarahalli, Bengaluru - 560049, Karnataka, India |
| Mobile | : | +91-9448011796 |
| Email | : | ambika18325@gcu.ac.in |

# MUSCULOSKELETAL ANALYSIS INTEGRATING OFBG SENSORS ON A SCISSORCAL HAND GRIP MEASUREMENT DEVICE

The Oxford College of Engineering, 10th Milestone, Hosur Rd, Bommanahalli, Bengaluru 560102
Dr. Preeta Sharan | Naveen Kumar Jaishwal | Dr. Manju Devi

Handgrip strength is an easy tool to evaluate skeletal muscle function and a good predictor of disability, morbidity, and mortality. To measure grip strength, a novel fiber-optic approach is developed. The strain-dependent wavelength response of fibre Bragg gratings was used to calculate a human's handgrip strength. It, like the hand dynamometer, is used for regular handgrip strength screening as well as preliminary and ongoing assessment of patients with hand dysfunction or injuries. This study shows the design and simulation of an Optical Fiber Bragg Grating (OFBG) sensor. Different parameters, as well as the strain, stress, and wavelength shift values associated with them, are being examined. Electromagnetic interference immunity, remote sensing, and environmental stability are all features of OFBG utilized.OFBG sensors aid in situations where standard sensors fail because of their multiplexing, high sensitivity, and wide dynamic range. The OFBG sensor is used to assess pressure, stress, and strain changes by measuring a shift in Bragg's wavelength generated by applied pressure on the sensor. GratingMOD is a design tool that may be used to evaluate and synthesise complex grating profiles.

**Keywords:** ***Handgrip Strength, OFBG, musculoskeletal, Bragg's wavelength, fiber Bragg grating***

**Objective of project:**

- Strain dependency for applied force as wavelength shifts.
- Measurement of hand grip muscle strength based on age and gender.
- Grip strength analysis for various body positions.

**POS-61**

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|---|---|---|
| **Poster Presenter** | : | **Dr. Preeta Sharan** |
| Address | : | Dept Of Ece, The Oxford College of Engineering, Bomanahalli Hosur Road, Bangalore - 560068, Karnataka, India |
| Mobile | : | +91-9449612666 |
| Email | : | sharanpreeta@gmail.com |
| Affiliation | : | The Oxford College of Engineering |
| Co Author(s) | : | Naveen Kumar Jaishwal, Dr Manju Devi |

# PROTEIN PRE-COATED GOLD NANOPARTICLES FOR PREDICTABLE PROTEIN CORONA AND IMPROVED CELLULAR ASSOCIATION

Aqib Iqbal Dar,[1,2] and Amitabha Acharya[1,2,*]

[1]*Biotechnology Division, CSIR-Institute of Himalayan Bioresource Technology, Palampur (H.P.) 176061, INDIA*

[2]*Academy of Scientific and Innovative Research (AcSIR), Ghaziabad - 201002, INDIA*

[*]Author to whom the correspondence should be addressed, E-mail: amitabhachem@gmail.com; amitabha@ihbt.res.in; Tel (off): +91-1894-233339; Extn. 397; Fax: +91-1894-230433

The formation of protein corona (PC) is still a key stumbling block in successful delivery of nanomedicines. PC formation alters the chemical and biological identity of nanoparticles (NPs), affecting their transport, targeting ability, and cellular internalization. In the present study, pre-adsorption of self-proteins like RBC protein (RBCP) and human serum albumin (HSA) on NP surface has been used as PC shield to bypass macrophage clearance process. This primary cloaking of NPs with RBC and HSA protein aid in enhancing the colloidal stability, cellular association and controlling pathophysiology in the biological milieu. Further, when these protein engineered NPs were re-exposed to human serum (HS), it was found that the secondary protein signature on NP surface was governed by primary protein coating. Moreover, in the PC of the HS treated bare NPs, the major molecular/biological function of adsorbed proteins was related to immune response while contrary to this, the PC of HS treated HSA/RBCP pre-coated NPs did not show any such protein abundance. Thus, these protein coatings will permit specific proteins to adsorb on NP surface, limiting macrophage clearance and thus increasing cellular targetability. Hence, these biomimetic protein pre-coated nanoparticles can lay the first stone for future targeted therapy *via* immunosurveillance escape.

**Keywords**: Protein corona; Pre-adsorption; Colloidal stability; Proteomic analysis; Cellular association.

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**POS-62**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Aqib Iqbal Dar** |
| Address | : | Nanobiology Lab, Block J, CSIR-IHBT, Palampur CSIR-IHBT<br>Palampur - 176061, Himachal Pradesh, India |
| Mobile | : | 91-7006151227 |
| Email | : | aqibnano1@gmail.com |
| Affiliation | : | CSIR-Institute of Himalayan Bioresource Technology |
| Co Author(s) | : | Dr. Amitabha Acharya |

# NANOMEDICINES FOR INTRANASAL DELIVERY OF LEVODOPA : A PROMISING APPROACH TOWARDS WELL-BEING OF PATIENTS WITH PARKINSON DISEASE

Authors: Akanksha Lahiri[1]*, Deeksha K S[2], Dr Balamuralidhara V[3]
[1]PhD - Research Scholar, Department of Pharmaceutics, JSS College of Pharmacy, Mysuru
JSS Academy of Higher Education Research, Mysuru-570015, Karnataka
Email ID: akankshalahiri26@gmail.com
[2]PhD - Research Scholar, Department of Regulatory Affairs, JSS College of Pharmacy, Mysuru, JSS Academy of Higher Education Research, Mysuru-570015, Karnataka
Email ID: deekshaksjss@gmail.com
[3]Associate Professor, Department of Pharmaceutics, JSS College of Pharmacy, Mysuru
JSS Academy of Higher Education Research, Mysuru-570015, Karnataka
Email ID: baligowda@jssuni.edu.in

Parkinson's disease is the second most common neurodegenerative disease. L-DOPA is the most potent "gold standard" for its therapy although its efficacy is significantly reduced due to metabolism, along with side effects like irregular fluctuations in its plasma levels, neurotoxic effects, dyskinesias. The ability of nanocarrier systems to get surface modification to facilitate barrier crossing, improving targeting efficiency, attracted towards the utilization of nanomaterials as a potential and promising strategy to deliver Levodopa as nanomedicine. The intranasally administered nanoparticles induces Blood Brain Barrier (BBB) contact and triggers a successful BBB crossing thus circumventing the BBB and hepatic first metabolism passage. As conventional nasal formulations lacks some effectiveness therefore the use of nanomedicines with our synthesized novel PLGA polymer permited more controlled release and prolonged duration of drugs, increasing surface area, and decreasing mucocilliary clearance therefore slowing and targeting the release of levodopa prolonging its therapeutic effect and reducing the dosing. Thus, nanomedicine is an emerging cross discipline with positive prospect which involves employing nanoparticles to enhance the action of levodopa in parkinsonism treatment. Our study highlights the intranasal delivery of nanomedicine of levodopa as paradigm of Parkinson disease treatment.

**KEYWORDS** - Parkinson Disease, Levodopa, Nanomedicine, Blood Brain Barrier, Drug delivery Systems.

**POS-63**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Akanksha Lahiri** |
| Address | : | JSS College of Pharmacy, Mysuru - 570015, Karnataka, India |
| Mobile | : | +91-7897102701 |
| Email | : | akankshalahiri26@gmail.com |
| Affiliation | : | JSS College of Pharmacy, Mysuru, Karnataka |
| Co Author(s) | : | Dr Balamuralidhara V, Deeksha K S |

# CALCIUM FERRITE LOADED PVDF-HFP FLEXIBLE PIEZOELECTRIC/MAGNETOELECTRIC NANOFIBERS FOR IMPLANTABLE ENERGY GENERATOR APPLICATION

***Anshida Mayeen[1], Robin Augustine [2,]Alap Ali Zahid [2,3], Anwarul Hasan[2,3],, Didier Rouxel [4], Sabu Thomas[5], Nandakumar Kalarikkal [5 *]***

*[1] Inter University Centre for Nanomaterials and Devices, Cochin University of Science and Technology, Kochi, 682022, Kerala, India*

*[2]Department of Mechanical and Industrial Engineering, College of Engineering, Qatar University- 2713, Doha, Qatar*

*[3]Biomedical Research Center, Qatar University- 2713, Doha, Qatar*

*[4] Institut Jean Lamour-UMR CNRS 7198, Facult´e des Sciences et Techniques, Campus Victor Grignard-BP 70239, 54506, Vancouver-les-Nancy Cedex, France.*

*[5]International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam, Kerala, India-686 560.*

Biocompatible smart piezoelectric/magnetoelectric nanocomposites have gained considerable attention among the scientific community because of its exciting application potential in implantable medical electronics (IMEs). In line with this, calcium ferrite-PVDF-HFP nanocomposites (abbreviated as CFO-PVDF-HFP) were fabricated by electrospinning method and characterized by the following techniques like X-Ray Diffraction, Fourier Transform Infrared Spectroscopy, Field Emission Scanning Electron Microcopy and Atomic Force Microscopy. Magnetoelectric, piezoelectric, mechanical properties of CFO-PVDF-HFP nanocomposites were evaluated. These nanofibers possessed excellent piezoelectricand magnetoelectric response at room temperature with a magnetoelectric coupling coefficient of 44.2 mV/cm.Oe. Besides these functional tests, *in vitro* cell culture studies were performed to demonstrate the biocompatibility of the developed materials. The present CFO-PVDF-HFP nanofibers with excellent magnetoelectric/piezoelectric properties, with high degree of mechanical strength and acceptable biocompatibilty can be used for the fabrication of smart implantable energy generators.

**Corresponding author: - nkkalarikkal@mgu.ac.in (Nandakumar Kalarikkal)**

**Keywords:-** $CaFe_2O_4$, PVDF-HFP, magnetoelectric nanofibers, dielectrics, ferroelectrics

**POS-64**

| | | |
|---|---|---|
| **Poster Presenter** | **:** | **Anshida Mayeen** |
| Address | : | Cochin University of Science and Technology<br>Kochi - 682022, Kerala, India |
| Mobile | : | +91-7511134133 |
| Email | : | anshidaanshu@gmail.com |
| Affiliation | : | Inter University Centre For Nanomaterials and Devices |
| Co Author(s) | : | Robin Augustine, Anwarul Hasan, Sabu Thomas, Nandakumar Kalarikkal |

# NANOSTRUCTURED ANTIMICROBIAL SURFACES FOR PREVENTING HOSPITAL ACQUIRED INFECTIONS

Naveen Bharadishettar, Udaya Bhat K
Department of Metallurgical and Materials Engineering, National Institute of Technology Karnataka
Surathkal - 575025

Surface contamination by microbes leads to several detrimental consequences like hospital and device-associated infections. Antimicrobial copper coatings are rapidly emerging technology for global mitigation strategy in preventing healthcare-acquired infections (HAIs). Synergistic developments in materials science, biotechnology, chemistry, and environmental microbiology have promoted huge opportunities to design surfaces with antimicrobial properties. Particularly, advancements in materials science and chemistry have brought about a clear understanding of the mechanism of antimicrobial activity, microbe-surface interactions, and structure-property relationship. In this context, strategies for developing copper-based antimicrobial copper coatings are discussed in detail. Copper, unlike other antimicrobial materials, demonstrates rapid and high microbicidal efficacy due to its highest toxicity. Antimicrobial properties of copper coatings produced by various deposition methods including thermal spray technique, electrodeposition, electroless plating, chemical vapor deposition (CVD), physical vapor deposition (PVD), and sputtering techniques are compared to understand the mechanism of antimicrobial activity and surface-structure-property interactions. The coating produced using different processes did not produce similar properties. Also, process parameters often could be varied for any given coating process to impart a change in structure, topography, wettability, hardness, surface roughness, and adhesion strength. In turn, all of them affect antimicrobial activity.

**POS-65**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Naveen Bharadishettar** |
| Address | : | Department of Metallurgical and Materials Engineering<br>National Institute of Technolgy Karnataka, Surathkal PO, Srinivasnagar<br>Mangalore - 575025, Karnataka, India |
| Mobile | : | +91-9886228989 |
| Email | : | naveenbharadishettar@gmail.com |
| Affiliation | : | National Institute of Technology Karnataka Surathkal |
| Co Author(s) | : | Prof. Udaya Bhat K |

# SELECTIVE $SO_2$ DETECTION AT LOW CONCENTRATION BY CA SUBSTITUTED $LAFEO_3$ THIN FILM SENSOR

**Chethana Aranthady**, [a,b] Teena Jangid, [c] Kapil Gupta, [d] Abhishek Kumar Mishra, [e] S. D. Kaushik, [f] V. Siruguri, [f] G. Mohan Rao, [c] Ganapati V. Shanbhag,[a] Nalini G Sundaram, [a,g]*

[a] *Materials Science & Catalysis Division, Poornaprajna Institute of Scientific Research, Devanahalli-562164, Bengaluru, India*

[b] *Graduate Studies, Manipal Academy of Higher Education, Manipal - 576104, Karnataka, India.*

[c] *Department of Instrumentation and Applied Physics, Indian Institute of Science, Bengaluru, India*

[d] *Indo-Korea Science and Technology Center, New airport road, Yelahanka, Bengaluru 560064, India*

[e] *Department of Physics, School of Engineering, University of Petroleum and Energy Studies, Bidholi via Premnagar, Dehradun 248007, India*

[f] *UGC-DAE Consortium for Scientific Research, Mumbai Centre, 246-C Common Facility Building, BARC Campus, Mumbai-400085, India*

[g] *Department of Chemistry, St. Josephs's Colleges (Autonomous), Bengaluru-560027, India*

**Corresponding author: nalini@poornaprajna.org*

***Presenting Author's Email**: chethana@poornaprajna.org*

In the present work, a detailed investigation of $La_{1-x}Ca_xFeO_3$ (0.4<x<0.8) pellets and $La_{0.6}Ca_{0.4}FeO_3$ thin films for the selective detection of low concentration $SO_2$ gas has been performed. The $La_{0.6}Ca_{0.4}FeO_3$ thin films exhibited superior gas sensing performance than $La_{1-x}Ca_xFeO_3$ (0.4<x<0.8) pellets in terms of sensitivity, operating temperature, detection limit, response, and recovery time. TEM analysis ensured that the material is in a nanometric regime. The material crystallized in the orthorhombic crystal system with the *Pbnm* space group. Further, occupancy refinement of neutron diffraction data indicates the presence of oxygen vacancies which was also supported by XPS analysis. Among the various compositions of $La_{1-x}Ca_xFeO_3$ (0.4<x<0.8), the x=0.4($La_{0.6}Ca_{0.4}FeO_3$) was found to exhibit the best gas sensing performance and chosen for thin film preparation. The gas sensing studies of thin films, prepared by the DC magnetron sputtering method, confirm the enhanced gas sensitivity towards 3 ppm $SO_2$ gas at a low operating temperature of 120 °C. The gas sensing mechanism and high sensitivity of the $La_{1-x}Ca_xFeO_3$ sensor towards the detection of $SO_2$ gas were explained by DFT (Density Functional Theory) calculations which gave evidence for the strong binding of $SO_2$ molecules on the surface of the 121 planes of the sensor surface.

**POS-66**

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| **Poster Presenter** | **:** | **Chethana Aranthady** |
| Address | : | Poornaprajna Institute of Scientific Research<br>#4 16th Cross Sadashivanagar, Bengaluru - 560080, Karnataka, India |
| Mobile | : | +91-7892169744 |
| Email | : | chethana@poornaprajna.org |
| Affiliation | : | Poornaprajna Institute of Scientific Research |

# MODELLING & COMPOSITION OPTIMIZATION FOR HARDNESS PROPERTIES OF AGAVE CANTALA FIBRE & MULTI-WALLED CARBON NANOTUBE REINFORCED POLYMER NANOCOMPOSITE: A MIXTURE DESIGN APPROACH

Pavana Kumara Bellairu1, Shreeranga Bhat 2, Gowrish S.3, Vandana Sadananda4
1,2 Department of Mechanical Engineering, St Joseph Engineering College, Vamanjoor, Mangaluru - 575028, Karnataka, India
3,4 Department of Conservative Dentistry and Endodontics, A. B. Shetty Memorial Institute of Dental Sciences, Nitte (Deemed to be University), Mangaluru, Karnataka, India

This article aims to foster an environmentally friendly, low-cost natural fibre (Agave cantala Fibre) and Multi-Walled Carbon Nanotube composite by the robust experimental design approach. Specifically, the study's primary goal is to use the Mixture Design approach to optimize the composition of natural fibre reinforced polymer nanocomposites for material hardness. From an engineering standpoint, hardness tests are necessary for material science since hardness improves resistance to wear produced by friction or erosion. The inference drawn from the experimental analysis is that the optimum composition percentage lies towards a higher percentage of MWCNT and a lower percentage of cantala fiber. The analysis was performed using the Minitab statistical software to analyze the interactions between the components, determine the ideal composition, and produce the prediction model. The predicted model can predict the hardness with a confidence level of 95.85%. Linearity, normality, and residuality were observed in the residual plot, implying that the experimental data used in the regression analysis are credible, and the regression model generated is substantiated. The optimum composition to obtain maximum Shore D hardness is MWCNT = 0.818182 wt%, Cantala fibers = 40.1818 wt%, and Epoxy resin = 59 wt%. The composite material of optimum composition is refabricated and retested for hardness and compared with the predicted model. Values differ by a percentage error of 1.63%, which is considered minimum and accepted. The approach adopted aids in optimizing the mixture component amount of the novel composite material to maximize the impact strength. The study will help develop an optimal combination of component mixtures and establish a predictive model for an sustainable composite material through the structured statistical methodology, which will guide practitioners and academicians to optimize materials' composition, focusing on natural fibre reinforced nanocomposites. This material will assist in cleaner and greener manufacturing of composite materials. The approach adopted will help researchers as a template for robust composite material development.

**Keywords** - Polymer nanocomposite, Mixture design, Design of experiments, Composition optimization, Hardness

**POS-67**

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|---|---|---|
| **Poster Presenter** | : | **Pavana Kumara Bellairu** |
| Address | : | Vamanjoor, Mangaluru - 575028, Karnataka, India |
| Mobile | : | +91-9901630288 |
| Email | : | pavana1388@gmail.com |
| Affiliation | : | St. Joseph Engineering College |
| Co Author(s) | : | Prof. Dr. Gowrish S., Dr. Vandana Sadananda |

# NANOSTRUCTURED $NAFES_2$ AS A COST-EFFECTIVE AND ROBUST ELECTROCATALYST FOR HYDROGEN AND OXYGEN EVOLUTION WITH REDUCED OVERPOTENTIALS

One of the biggest challenges currently in the field of energy generation and conservation is to develop a stable, scalable, and cost-effective electrocatalyst with reduced overpotentials for both hydrogen evolution reaction (HER) and oxygen evolution reaction (OER). This unprecedented effort presents a robust, non-costly ternary alkali metal-based chalcogenide ($NaFeS_2$) as an effective and highly active electrocatalyst prepared by the hydrothermal method. The differences in the atomic radii of Na and Fe favor the formation of Fe-S bonds largely contributing to the enhanced electrocatalytic activity of $NaFeS_2$. Further, a decrease in the kinetic energy of the catalytic reaction increases the electrocatalytic property of $NaFeS_2$. $NaFeS_2$/NF shows a current density of 200 mA $cm^{-2}$ with a small potential of 1.60 V and an overpotential of 370 mV indicating that the material possesses a remarkable electrocatalytic activity. Further, by displaying a potential of -220 mV, $NaFeS_2$/NF attained a current density of -100 $mAcm^{-2}$. The density functional theory (DFT) calculations indicated that out of the possible adsorption sites on the $NaFeS_2$ surface, only (010) and (100) exhibit catalytically preferential adsorption energy (EH) values, which are eventually responsible for the superior electrocatalytic activity.

**POS-68**


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|---|---|---|
| **Poster Presenter** | : | **Dileepkumar V G** |
| Address | : | Coal to Hydrogen Energy for Sustainable Solutions (CHESS) CSIR - Central Institute of Mining & Fuel Research (CIMFR) (Ministry of Science & Technology, Government of India), Digwadih Campus, PO: FRI, Dhanbad - 828108, Jharkhand, India |
| Mobile | : | +91-9901690605 |
| Email | : | deepuvg29@gmail.com |
| Affiliation | : | CSIR-CIMFR |
| Co Author(s) | : | Balaji K R, Dr. M.S. Santosh |

# COMPOSITE NANOFILTRATION MEMBRANE COMPRISING ONE-DIMENSIONAL ERDITE, TWO-DIMENSIONAL REDUCED GRAPHENE OXIDE, AND SILKWORM PUPAE BINDER

Composite nanofiltration membranes offer advantages because of synergetic effects among the constituent materials' properties. We report the facile fabrication of a nanocomposite membrane composed of a two-dimensional (2D) material of reduced graphene oxide (rGO) combined with a one-dimensional (1D) material of a ternary metal-based chalcogenide (NaFeS2) using silkworm pupae protein as a natural binder. All the source materials can be derived from either nature or waste, ensuring the sustainability of the membrane and its production method. The structural characteristics of the synthesized membranes were analyzed, and the morphology of the composite membranes was studied. The water flux, salt, dye, and pollutant rejections, and long-term membrane performance were evaluated. Solute rejection was observed to increase with increasing concentration of the nanomaterials in the membrane. The fine-tuning of the molecular weight cutoff from 794 to 600 g/mol was achieved by varying the concentration of the nanomaterials. Our research findings demonstrate the synergetic effects of combining 1D and 2D materials using silkworm pupae binder. The composite membrane was stable in different classes of organic solvents, including alcohols, esters, ethers, halogenated solvents, and ketones. This first use of natural binder in constructing membrane materials paves the way toward the development of more sustainable membranes.

**POS-69**


| | | |
|---|---|---|
| **Poster Presenter** | : | **Balaji K R** |
| Address | : | Digwadih Campus, PO: FRI, Dhanbad - 828108, Jharkhand, India |
| Mobile | : | +91-9686771808 |
| Email | : | balajikr81@gmail.com |
| Affiliation | : | CSIR-CIMFR |
| Co Author(s) | : | Dileepkumar V G, Dr. M S Santosh |

# FACILE SYNTHESIS, CHARACTERIZATION OF PLANT-BASED BIOGENIC SILICA NANOPARTICLES AND ITS ANTIBACTERIAL ACTIVITY

Mohini Verma,[1,2] and Amitabha Acharya[1,2*]

[1]*Biotechnology Division, CSIR-Institute of Himalayan Bioresource Technology, Palampur (H.P.) 176061, INDIA*

[2]*Academy of Scientific and Innovative Research (AcSIR), Ghaziabad - 201002, INDIA*

[*]Author to whom the correspondence should be addressed, E-mail: amitabhachem@gmail.com; amitabha@ihbt.res.in; Tel (off): +91-1894-233339; Extn. 397; Fax: +91-1894-230433

Silica ($SiO_2$) is the most abundant elemental form of silicon present in the environment. The plant absorbs silica with water in the form of silicates and deposits it into roots, leaves, stems. Such phytogenic silica (PhSi) reinforces plant cell walls, aids in environmental stress resistance, enhances plant mineral and water uptake capacity, and plays an important part in plant defense mechanisms. Natural silica resources offer a low-cost, environmentally friendly option for isolating silica for usage in medicinal and material fields. In this study, we have isolated plant-based crystalline silica nanoparticles (NPs). These NPs have undergone surface modification with cetyltrimethylammonium bromide (CTAB) and (3-Aminopropyl) triethoxysilane (APTES) that enhances its physico-chemical properties *viz.,* solubility, stability. Further, characterization of all the formed NPs was done using transmission electron microscopes (TEM)**,** scanning electron microscope (SEM), Fourier transform infrared spectroscopy (FTIR), Powder X-ray diffraction (P-XRD), X-ray photoelectron spectroscopy (XPS). These NPs have shown good antibacterial activity against *P. aeruginosa* and *S. aureus*. In continuation with its antibacterial activity, these NPs also exhibited good cytocompatibility with NIH-3T3 fibroblast cells.

**Keywords:** Biogenic silica NPs, surface modification, physico-chemical properties, antibacterial activity

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**POS-70**

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|---|---|---|
| **Poster Presenter** | : | **Mohini Verma** |
| Address | : | CSIR-IHBT, Palampur (H.P), Palampur Non-US - 176061, India |
| Mobile | : | +91-7009404371 |
| Email | : | mohiniverma0071993@gmail.com |
| Affiliation | : | CSIR-IHBT |
| Co Author(s) | : | Amitabha Acharya |

# RESVERATROL TRANSFERSOMES FOR TRANSPAPILLARY IONTOPHORETIC DELIVERY TO BREAST CANCER

Shivaprasad Gadag[a], Jayalakshmi N. Sabhahit[b], Usha Y. Nayak[a*]
[a]Department of Pharmaceutics, Manipal College of Pharmaceutical Sciences, Manipal Academy of Higher Education, Manipal 576104, Karnataka, India; [b]Department of Electrical & Electronics Engineering, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal 576104, Karnataka, India

The aim of the present study was to formulate resveratrol (RVT) transferosomes for the treatment of breast cancer. RVT was encapsulated within the transfersomes to enable a sustained release of the drug and delivered through transpapillary route. The iontophoresis was applied to accelerate the penetration of the RVT transfersomes across the mammary papilla to the breast tissue. The RVT loaded transfersomes were prepared by thin-film hydration technique followed by size reduction. The parameters were optimized by Box-Behnken design approach. The transpapillary device was fabricated in-house and RVT transfersomes evaluated for various parameters. The developed formulation showed a sustained release of 66.15 ± 7.04% RVT at the end of 12 h. Further, the *in vitro* transpapillary iontophoretic study revealed enhanced penetration, that 1277.57 µg of RVT permeated at the end of 2 h when compared to that via passive diffusion. The transpapillary delivery was further confirmed from the *in vitro* fluorescent microscopy study using FITC conjugated transfersomes. The optimized RVT transfersomes delivered via transpapillary route showed a higher $C_{max}$ and AUC when compared to oral RVT. A significant reduction in the tumor volume and the serum biomarker CA 15-3 when evaluated in a chemically induced breast cancer rat model further provided strong evidence of the effectiveness of the developed formulation when delivered locally via transpapillary route. The histopathological analysis of the breast tissue also revealed a reduction in the necrotic lesions after the duration of the treatment with RVT transfersomes, proving it to be an efficient delivery system. Overall, the results indicated that the developed RVT-TRF administered via transpapillary iontophoresis technique may be a promising strategy enabling a localized delivery for the effective therapy of breast cancer.

**POS-71**

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|---|---|---|
| **Poster Presenter** | : | **Usha Y Nayak** |
| Address | : | MCOPS, MAHE, Manipal - 576104, Karnataka, India |
| Mobile | : | +91-9449207925 |
| Email | : | usha.nayak@manipal.edu |
| Affiliation | : | Manipal College of Pharmaceutical Sciences |
| Co Author(s) | : | Jayalakshmi N. Sabhahit and Shivaprasad Gadag |

# SYNTHESIS OF GOLD NANORODS AND BULK REFRACTIVE INDEX SENSING USING SUCROSE

**Prajna N D[1], Santosh Chidangil[2], Tom Devasia[3], and Rajeev K. Sinha[4]**
[1]Research Scholar, Department of Atomic and Molecular Physics,
Manipal Academy of Higher Education, Manipal
[2]Professor and Head, Department of Atomic and Molecular Physics,
Manipal Academy of Higher Education, Manipal
[3]Professor and Head, Department of Cardiology, Kasturba Medical College, Manipal,
[4]Associate Professor, Department of Atomic and Molecular Physics,
Manipal Academy of Higher Education, Manipal
E-mail IDs: 1 ndprajna@gmail.com; 2 santhosh.cls@manipal.edu;
3 tom.devasia@manipal.edu; 4 rajeev.sinha@manipal.edu

Localized surface Plasmon resonance (LSPR) is observed in metal nanoparticles with dimensions smaller than the wavelength of incident light. The LSPR depends upon the size, shape, dielectric properties of nanoparticles, and the dielectric properties of the surrounding environment to the metal nanoparticles. Because of their unique optical properties, gold nanorods have been used extensively in the field of biosensors. Extensive work has been in progress for the past few decades on the synthesis and applications of gold nanorods. Among various available methods, seedmediated synthesis is considered the most useful and promising method. In this work, we present the synthesis of nanorods of different aspect ratios, along with their refractive index sensing capabilities. The longitudinal peak positions and hence, the aspect ratio of Au nanorods were tuned by varying the concentrations of silver nitrate. Bulk refractive index sensitivity measurements of nanorods reveal maximum RI sensitivity of 253nm/RIU for nanorods of the longitudinal peak at 778.7 nm. The gold nanorods with maximum refractive index sensitivity can be used for surfacefunctionalization and biomolecular sensing.

**POS-72**

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| **Poster Presenter** | : | **Prajna N.D.** |
| Address | : | PhD Student, Department of Atomic & Molecular Physics, L.G-01<br>Academic Block-05, MIT Campus, Manipal Academy of Higher Education<br>Manipal - 576104, Karnataka, India |
| Mobile | : | +91-9483322603 |
| Email | : | ndprajna@gmail.com |
| Affiliation | : | Dept of Atomic & Molecular Physics, Manipal Academy of Higher Education |
| Co Author(s) | : | Rajeev Kumar Sinha, Santhosh Chidangil, Tom Devasia |

# EFFECT OF ZINC OXIDE NANOPARTICLES LOADING ON ELECTRICAL CONDUCTIVE PROPERTIES OF POLYVINYL ALCOHOL-POLYANILINE POLYMER FILMS

Pratibha S K*[1], Sunil Meti[2], R. H. Fattepur[1]and Veerabhadragouda B. Patil[3]
[1*]C. N. R. Rao research centre, Bagalkot, Karnataka, India, 587101
1 Raichur University, Raichur, Karnataka, India, 584101
[2] Department of Metallurgical and Materials Engineering, National Institute of Technology Karnataka, Surathkal, India 575025
[3]Institute of Energetic Materials, University of Pardubice, Pardubice II. Czech Republic
Address for correspondence: pratibharamgeri@gmail.com

Polyvinyl alcohol-Polyaniline composite films with different amounts of zinc oxide (ZnO) were prepared by in situ polymerization followed by film casting and drying. The polyvinyl alcohol (PVA) and Polyaniline (PANI) concentration was kept constant with varying ZnO concentration (0.2%, 0.4%, 0.6% and 1%). The samples, ZnO and PPZ, were characterized by X-Ray Diffractometry (XRD), Field Emission Scanning Electron Microscopy (FESEM), Fourier Transform Infrared Spectroscopy (FTIR), Differential Scanning Calorimetry (DSC), Thermo-Gravimetric Analyzer (TGA), UV-Visible spectroscopy and Impedance analyzer techniques. XRD patterns confirmed the formation of ZnO nanoparticles and PPZ films. The FESEM results show morphology of the ZnO and PPZ films. The FTIR results show the peaks corresponding to the formation of PPZ films. The DSC and TGA spectra predict the thermal characteristics of the PPZ films. The UV-Vis spectra show the absorption peaks of PPZ. The electrical conductivity plots obtained from the impedance analyzer between frequency ranges of 10 Hz to 100 kHz show that the increase in concentration and temperature of the samples show the higher conductivity of the PPZ films. For 1% ZnO concentration at 150 ˚C, the AC conductivity of PPZ1 is 20.06 **S/m**, **which is very high**. Such conductivity behaviour samples render the applicability of the PPZ films.

**Keywords:** Co-precipitation method, ZnO nanoflakes, electrical conductivity, ZnO morphology, film stability

**POS-73**

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|---|---|---|
| **Poster Presenter** | : | **Pratibha. S. Kanavi** |
| Address | : | Near Bus Stand PG, Department of Physics<br>Bagalkot - 587101, Karnataka, India |
| Mobile | : | +91-8867167853 |
| Email | : | pratibharamgeri@gmail.com |
| Affiliation | : | Basaveshwar Science College |
| Co Author(s) | : | Dr.R.H.Fattepur, Dr.Sunil Meti, Veerabhadragouda.B. Patil |

# IDENTIFICATION OF UNUSUALLY LOW GLASS TRANSITION TEMPERATURE IN POLYAMIDE-6 NANOFIBRES

S. Minu*, R. Ramani**, N. Jana, R. Indu Shekar and T. M. Kotresh
Defence Bio-Engineering and Electromedical Laboratory (DEBEL), DRDO,
ADE Campus, C. V. Raman Nagar, Bangalore - 560 093

Polymeric nanofibres, characterized by their sub-micron diameter, small nanofibrous pore size, high surface area to volume ratio, light weight and vast potential for surface functionalization, find application in myriads of fields such as tissue engineering, drug delivery, filtration, interleaves in FRPC, etc. The glass transition temperature ($T_g$) of a polymer is an important parameter for processing them into finished products and should be applicable even when they are in nanofibre form. Having polar groups in their structure and superior fibre forming ability, Polyamide-6 nanofibres (PA-6-NF) have gained importance. Generally, spinning of PA-6-NF from the virgin polymer involves its dissolution in acidic solvents. The resultant $T_g$ of PA-6 upon nanofibre formation remains unexplored. Although couple of research works report the $T_g$ of PA-6-NF to be around 50-65 °C, the study is based only on conventional DSC measurement where the endotherm due to associated moisture results to erroneous conclusions. Motivated by this lacuna in establishing the true $T_g$ of PA-6-NF, we have spun PA-6-NF using Needleless electrospinning machine and obtained nanofibres of diameter 170-200 nm using PA-6 solution of two different concentrations. Given the delicate structure of nanofibres, it was a challenging task to study their thermo-mechanical properties. We have successfully carried out the low temperature DMTA measurements of PA-6-NF and determined their $T_g$ in an unequivocal manner. A significant drop in $T_g$ of ca. 80 °C has been found when PA-6 changes from its virgin form to nanofibre form. This enormous drop in $T_g$ is attributed to reduction in molecular weight of PA-6 upon treatment with acidic solvents which has been identified by MALDI-TOF measurements and supplemented by UV-Vis, FTIR and Dielectric studies. It is opined that the identified $T_g$ and the resulting molecular structure of PA-6-NF would be of immense help in applications like nanofilters and nanofibre interleaved FRPCs.

*Presenting Author
**Corresponding Author: rramani.debel@gov.in

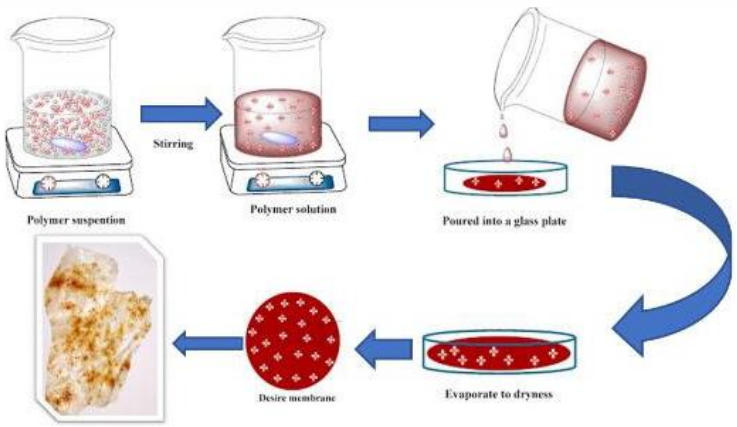
**POS-74**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Minu S.** |
| Address | : | Defence Bio-Engineering and Electromedical Laboratory (DEBEL)<br>DRDO, ADE Campus, C. V. Raman Nagar, Bangalore - 560093, Karnataka, India |
| Mobile | : | +91-9964137838 |
| Email | : | minu.6468@gmail.com |
| Affiliation | : | Defence Bio-Engineering and Electromedical Laboratory (DEBEL), DRDO |
| Co Author(s) | : | Nirban Jana, Dr. R. Indu Shekar, Dr. T. M. Kotresh and Dr. R. Ramani |

# RE-DESIGNING THE FOOD PACKING TOOL BY REINFORCING WITH THE BIO-DEGRADABLE COMPOSITE

**Rubalya Valantina.S1*, Arockia Jayalatha. K2**
1Department of Physics, SEEE, SASTRA Deemed University, Thanjavur - 613 401, India
2School of Electrical & Electronics Engineering (SEEE), SASTRA Deemed University, Thanjavur, India

In this Fast-Food era, the usage of food wrapping material has become inevitable. In practice, most of the food packaging materials used are made up of aluminium foil or synthetic polymer which leads to serious health issues to human, and are not environment friendly. This synthetic polymer package could be replaced with a biodegradable polymer which would retain the food quality and also, to enhance the food's self- life. The present study is to develop a packaging film that are biodegradable, antimicrobial, antifungal rich with antioxidants in preserving food. The film was fabricated by casting the mixed composites of TiO2 (nanoparticle), pomegranate peel powder (biopolymer), and polymer material (Agar-agar/polyethylene terephthalate (PET)). The nanoparticles of TiO2 were characterised by Scanning Electron Microscopy (SEM), X-ray diffraction (XRD) and the Fourier Transform Infrared Radiation (FTIR). From SEM analysis, the particle size of TiO2 was observed to be between 61.43nm to 98nm and from XRD study the tetragonal phase of TiO2 was confirmed (JCPDS 21-1272). The peaks of the FTIR spectra indicates the stretching and bending vibrations of Ti - O bonds and Ti -O - Ti bonds. The treated pomegranate peel powder was blended with TiO2 (3:1).The surface texture of the mixture was analyzed by SEM analysis and the increase of active surface area (increased particle size up to 115 nm) was observed which will enhance the efficient packaging application. In addition, the morphological study illustrate the agglomeration between the nanoparticle and biopolymer which can retain the heat capacity of the food stored. Henceforth, the proposed film would be a better candidate for an efficient bio-compatible packaging.




**POS-75**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Rubalya Valantina.S** |
| Address | : | Shanmugha Arts, Science, Technology & Research Academy Deemed University, Thanjavur - 613401, Tamilnadu, India |
| Mobile | : | +91-9003308470 |
| Email | : | rvalantina@eee.sastra.edu |
| Affiliation | : | SASTRA Deemed University |
| Co Author(s) | : | Arockia Jayalatha. K |

# MORPHOLOGICALLY TUNED SELF-ASSEMBLED NANOSTRUCTURES: THEIR IMPACT ON CELLULAR INTERNALIZATION EFFICIENCY AND ANTI-CANCER DRUG DELIVERY

**Sonika Chibh and Jiban Jyoti Panda***
Institute of Nano Science and Technology, Mohali, Punjab, Sector 81, India

Flourishing since years, self-assembly driven nanostructures are rationally designed with great potential as diagnostic or therapeutic delivery vehicles. Various studies have demonstrated that slight change in the morphology of the nanostructures greatly impact the extent and rate of their cellular internalization efficiency. However, precisely controlling the structural morphology of these nanostructures using different parameters continues to be a key challenge. For this aim, we have tried to develop morphologically controlled ***single amino-acid based bowl-shaped nanostructures using microfluidic*** based platform as stimuli responsive therapeutic delivery vehicle in anti-cancer therapy. We further tried to also explore ***dipeptide-based pH and redox responsive nanoparticles*** as anti-cancer drug delivery nanosystems. Moreover, we had also tried to understand the cellular internalization behaviour of morphologically different multi-stimuli responsive ***1D and 2D nanostructures originated from a single tetrapeptide molecule***. Hence, taking advantage of our morphologically different particles emanating from the same peptide monomer, we ventured on to further explore the intra-cellular fate of our nanostructures. Overall, these studies provide initial cues to prepare environment responsive shape shifting peptide-nano assemblies. These studies also provide unique opportunities for undermining specific design criteria to control cellular fate and internalization efficiency of the nanostructures as drug delivery vehicles.

**POS-76**

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|---|---|---|
| **Poster Presenter** | **:** | **Sonika Chibh** |
| Address | : | Institute of Nano Science and Technology Mohali, Sector 81<br>Mohali Punjab - 140306, India |
| Mobile | : | +91-9876911629 |
| Email | : | sonika.ph16241@inst.ac.in |
| Affiliation | : | Institute of Nano Science and Technology Mohali, Punjab, India |

# URANIUM PHTHALOCYANINE ANCHORED WITH ACID FUNCTIONALIZED MWCNT AS AN EFFICIENT ELECTROCATALYST FOR OXYGEN EVOLUTION REACTION

**Giddaerappa, Lokesh Koodlur Sannegowda**
Department of Studies in Chemistry, Vijayanagara Sri Krishnadevaraya University, Cantonment, Vinayakanagara, Ballari-583105, Karnataka, India
Email - giddaerappa1234@gmail.com

Designing of Non-precious electrocatalyst for the oxygen evolution reaction (OER) is leads to development in the field of water electrolysis to reach sustainable energy demands. The OER electrocatalysts which is having larger porous space and higher surface area for reacting active sites to reach lesser overpotential is still a critical challenging process. Herein we prepared hybrid composite material with organic macrocycle Uranium phthalocyanine complex with acid functionalized Multi walled carbon nanotube (MWCNT) for the electrochemical production of oxygen. The non- nobel Uranium tetra[4-(2-{(E)-[(4bromophenyl)imino]methyl}phenoxy)] phthalocyanine (UTBrImPc) was synthesized via two step process of imine and oxy-bridging linkage. The synthesized ligands and phthalocyanine macrocycle were characterized by various spectroscopic techniques like FT-IR, NMR, Mass, UV-Visible, Powder X-Ray and TGA technique. The UTBrImPc/ MWCNT/GCE composite electrode was fabricated by dropcasting on nickel foam and utilized as OER electrocatalyst to reduce the overpotential in 1M KOH solution. Impressingly, The developed hybrid composite electrode parades overpotential of 368 (± 3) mV at a current density of 10 $mAcm^{-2}$. Also the electrode sustains long term stability during 5 and half hours by chronoamperometric method. The achieved results recommend that the collusive mixture with acid functionalized MWCNT influence the better electrocatalytic activity in the direction of OER.

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**POS-77**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Giddaerappa** |
| Address | : | Research Scholar, Department of Chemistry, VSK University<br>Ballari - 583105, Karnataka, India |
| Mobile | : | +91-8722194650 |
| Email | : | giddaerappa1234@gmail.com |
| Affiliation | : | Vijayanagara Shri krishnadevaraya University, Ballari, Karnataka |
| Co Author(s) | : | Prof. K S Lokesh |

# ELECTROSPUN NANOSTRUCTURED MAGNESIUM OXIDE FOR THE DETECTION OF VOLATILE ORGANIC COMPOUNDS

**K. Sri Varshini, B. Susithra, B. G. Jeyaprakash, D. Balamurugan***

*Functional Nanomaterials Lab, Department of Physics, School of Electrical & Electronics Engineering, SASTRA Deemed to be University, Thanjavur, Tamilnadu - 613401, INDIA.*

**Corresponding author: balamurugan@eee.sastra.edu*

Nanofibers are a special kind of nanostructures that are primarily one-dimensional and have immense applications in gas sensors and electronic devices. In this work, Magnesium Oxide based nanograins were prepared through electrospinning technique followed by calcination. The varying electric field, the distance of collector plate, polyvinyl alcohol and metal salt concentration were optimised to obtain beads free MgO/PVA nanofibers. A 12 wt% of PVA (Mw = 1,25,000 gm/mol) and 5 wt% of Magnesium acetate tetrahydrate ($Mg(CH_3COO)_2 \cdot 4H_2O$) were mixed in 20 ml of deionised water and stirred in the water bath at 85 °C for 4 h. The solution is taken in a Holmarc Make (Model: HO-SPLF-01C ) syringe pump, and 7 kV is applied to its needle with the help of high power voltage source (Royal Enterprises, Model: HVPS30). The distance of 7 cm between the syringe pump needle and the aluminium collector affixed with glass substrate of 2.5 $cm^2$ area was fixed such that the field is maintained as 1 kV/cm. The polymer precursor solution is spun for 6 h. Then the deposited fibers on the glass substrate were vacuum annealed at 50 °C for 1 h followed by calcined at 450 °C in a muffle furnace for 24 h to obtain one dimensional like arrangement of MgO nanograins. The morphological study of prepared PVA/MgO is shown in fig.1 (a-c) [1]. The obtained MgO nanograins were tested for different volatile organic compounds such as ammonia, ethanol, acetone, formaldehyde, xylene, and benzene by chemiresistor method at ambient and elevated temperatures. Among many, the prepared MgO nanograins shows a better response to formaldehyde vapour. The sensitivity and specificity of the obtained MgO nanograins were studied and analysed [2].

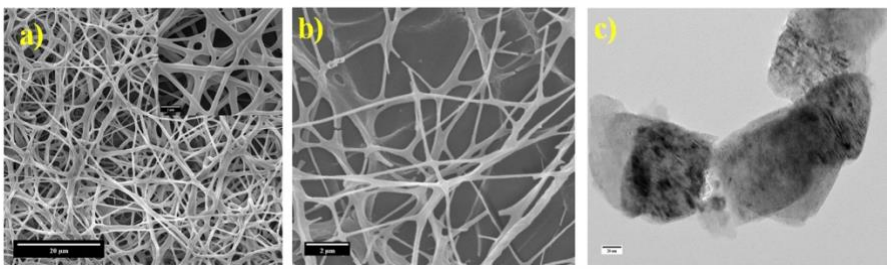


Fig. 1. SEM images of the (a) PVA/MgO nanofibers vacuum annealed at 50 °C, (b) calcination at 450 °C and (c) TEM images of MgO nanograins.

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**POS-78**

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|---|---|---|
| **Poster Presenter** | : | **K. Sri Varshini** |
| Address | : | Room No. 113, Functional Nanomaterials Lab, ASK-II<br>SASTRA Deemed to be University, Thanjavur - 613401, Tamil Nadu, India |
| Mobile | : | +91-9025205095 |
| Email | : | srivarshini@sastra.ac.in |
| Affiliation | : | SASTRA Deemed to be University |
| Co Author(s) | : | B. Susithra, B.G. Jeyaprakash and D. Balamurugan |

# GREEN SYNTHESIS, CHARACTERIZATION & EVALUATION OF BORON AND SULPHUR NANO FERTILIZERS TO ENHANCE THE GROWTH & PRODUCTIVITY OF SUNFLOWER (*HELIANTHUS ANNUUS* L.)

The synthesis of nano (0-100 nm) fertilizers using plant extract is termed as green synthesis and found to enhance the yield in crops. In this context studies of both lab and field experiments, are conducted to optimize the concentration of green synthesised nano boron and sulphur on growth and productivity of sunflower. A lab experiment was conducted during 2018 to synthesise nano boron using *Cassia fistula* leaf extractant and nano sulphur using *Simarouba glauca* leaf extractant. Green synthesised nano particles were characterised using Particle size analyser, Atomic force microscope and Scanning electron microscope. A field experiment was conducted at Zonal Agricultural Research Station, UAS, Bangalore during *Rabi* 2019-20 and 2020-21 in randomized complete block design with the factorial concept (Factor-I: seed priming and Factor-II: foliar application of green synthesised and commercially available nano boron and sulphur fertilisers with different concentrations) with three replications. Pooled data (2019 and 2020) reveals that significantly higher growth parameters *viz*., number of green leaves (13.12 plant$^{-1}$), root to shoot ratio (0.208), stem girth (3.73 cm) and total dry matter production (154 g plant$^{-1}$) at harvest stage were recorded in 1500 ppm green synthesised nano boron seed priming treatment. Application of green synthesised nano sulphur (600 ppm) + nano boron (1500 ppm) as foliar application at ray floret stage recorded significantly higher head weight (91.2 g plant$^{-1}$), head diameter (17.82 cm) and pollen fertility (94.8 %). Among interactions, seed priming with 1500 ppm nano boron nitride + foliar application of 600 ppm nano sulphur + 1500 ppm nano boron nitride green synthesised fertilisers recorded significantly higher seed yield (3588 kg ha$^{-1}$) and oil content (43.6 %). The same combination also recorded higher economics *viz*., gross returns (161438 ₹ ha$^{-1}$), net returns (110798 ₹ ha$^{-1}$) and B: C ratio (3.19).

**POS-79**

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|---|---|---|
| **Poster Presenter** | : | **Pruthviraj N.** |
| Address | : | Dr. Pruthviraj, N. Senior Research Fellow AICRP on Weed Management<br>UAS, GKVK, Bangalore - 560065, Karnataka, India |
| Mobile | : | +91-8105243012 |
| Email | : | pruthvikannahatti@gmail.com |
| Affiliation | : | University Of Agricultural Sciences, Bangalore |
| Co Author(s) | : | Dr. Geetha, K.N. |

# COMPARATIVE STUDY OF PURE AND POLYMER COATED RARE EARTH OXIDE NANOPARTICLES FOR OPTOELECTRONIC APPLICATIONS

Kartik G[a], Sunitha D V[a]*, Mahipal Ranot[a], A. P. Gnana Prakash[b]
[a]Department of Physics, School of Applied Sciences, REVA University, Bengaluru, Karnataka, India
[b] Department of Studies in Physics, University of Mysore, Manasagangotri, Mysuru, Karnataka, India
(*Corresponding Author: Dr.Sunitha D V; E-mail: sunitha.dv@reva.edu.in; Mob: +91-7760884884)

Pure and Polyvinylpyrrolidone (PVP) encapsulated dysprosium oxide ($Dy_2O_3$) nanoparticles was prepared using low temperature self- ignited solution combustion synthesis (SCS). The formation of pure cubic phase $Dy_2O_3$ sample was confirmed by using powder X-ray diffraction (PXRD). The average particle size was estimated using Debye Scherrer formula was ~46 nm. Fourier transform infrared spectroscopic (FTIR) studies carried out exhibited absorption peaks at 573 $cm^{-1}$ is associated with the vibration of the Dy-O bond, 1300-1500 $cm^{-1}$ corresponds to $CO_3^{-2}$ anion groups. Non-uniform spherical particles were observed from scanning electron microscope (SEM) images. Tauc and Wood plot was used to determine the optical energy band gap and was found to be in the range 4.43-5.21 eV. Further, dosimetric properties of the material were studied for gamma irradiated pure and PVP coated samples. The glow curve exhibited simple glow curve structure having a glow peak temperature 325˚C .The glow curve exhibited linear behavior over the dose range 1 kGy to 50 kGy due to radiative recombination of electron and holes. The variation of glow curve nature was also recorded with variable heating rate and observed that the glow peak temperature shift towards higher temperature side and intensity decreases. Further, the fading characterization and trapping parameter were estimated to explore the possible utilization of the pure and PVP encapsulated particles for dosimetric applications.

**POS-80**

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|---|---|---|
| **Poster Presenter** | : | **Kartik Gopal** |
| Address | : | Reva University, Rukmini Knowledge Park Kattigenahalli, Yelahanka Bangalore- 560064, Karnataka, India |
| Tel | : | +91-80-46966966 |
| Mobile | : | +91-8310338261 |
| Email | : | kartikgopal8@gmail.com |
| Affiliation | : | Reva University |
| Co Author(s) | : | Dr. D V Sunitha, Mahipal Ranot, A.P. Gnana Prakash |

# NICKEL FOAM-SUPPORTED POLYMERIC COBALT (II) PHTHALOCYANINE AS AN EFFICIENT ELECTROCATALYST FOR OXYGEN EVOLUTION REACTION

Shantharaja, Lokesh Koodlur Sannegowda*
*Department of Studies in Chemistry, Vijayanagara Sri Krishnadevaraya University, Vinayakanagara, Cantonment, Ballari-583105, Karnataka, India,

The oxygen evolution reaction (OER) from water electrolysis is a sluggish, slow reaction with higher overpotential even using precious catalysts. Inorder to decrease the cost and increase the efficiency of OER, lot of research related to non-precious and organic based easily synthesizable catalysts is underway. Herein, Cobalt (II) phthalocyanine polymer (*poly*-Co(II)TPzPyCPc), was employed as a low cost organic based catalyst for OER. The cobalt phthalocyanine polymer is coated on Ni foam and is used as OER catalyst. The designed electrode exhibited an overpotential of 289 mV (±2 mV) at the current density of 10 mA $cm^{-2}$. Furthermore, CoPc polymer is mixed with $IrO_2$, displayed surprisingly excellentOER activity. This composite shows lesser over potential of 270 mV (±1 mV) and higher current density. The stability studies showed synthesized CoPc polymer and composite catalysts are stable and can be successfully employed for OER studies.

**Keywords:** Polymer phthalocyanine, FTIR, Oxygen evolution reaction (OER), & Nickel-Foam Electrode.

**POS-81**

| | | |
|---|---|---|
| **Poster Presenter** | **:** | **Shantharaja** |
| Address | : | C/o Dr. K S Lokesh Department of Chemistry Science Block VSK University Ballari - 583104, Karnataka India |
| Mobile | : | +91-9036359876 |
| Email | : | Shantharajachemistry@gmail.com |
| Affiliation | : | VSK University Bellari Karnataka India |
| Co Author(s) | : | Dr. K S Lokesh |

# TREATMENT OF MILK PROCESSING INDUSTRY EFFLUENT VIA CHITOSAN-TITANIUM DIOXIDE NANOADSORBENT COATED SAND

Dinesha, B. L.,[1] Sharanagouda Hiregoudar[1]. Udaykumar Nidoni[2]. Vijayakumar Hiremath[1] and Manjunath, B[1]

[1]Centre for Nanotechnology, College of Agricultural Engineering, University of Agricultural Sciences, Raichur- 584 104, Karnataka, India

[2]Department of Processing and Food Engineering, College of Agricultural Engineering, University of Agricultural Sciences, Raichur - 584 104, Karnataka, India

*E-mail: dinirbdgtc@gmail.com

To improve the production of chitosan titanium dioxide nano-adsorbent coated sand ($CTiO_2$-CS) for treating milk processing effluent. Sand without coating was compared to titanium dioxide nano-adsorbent ($CTiO_2$-CS) and chitosan titanium dioxide nanoadsorbent in particle size ($CTiO_2$-CS). BOD and COD reduction efficiency (percent RE) were studied in batch adsorption experiments. We achieved the maximum percent RE of BOD and COD with 1.5 M coating, 120 min contact time, pH 6, and initial BOD/COD concentrations of 900 mg/L and 8000 mg/L. On average, synthetic effluent had 96.76 percent RE and real effluent 94.89 percent. Similarly, the percent RE of COD was found to be 86.76 for synthetic effluent and 83.96 for real effluent at optimised treatment combinations. Pseudo-first-order and Freundlich models fit best for organic pollutant adsorptions. After four cycles, the CTiO2-CS was the most regenerable. Given its superior adsorption capacity, CTiO2-CS can replace commercial carbon in MPIE treatments.

**Keywords:** Batch adsorption, Calcination, Milk processing industry, Nano-adsorbent coated sand, Synthetic and real effluent, Titanium dioxide

**POS-82**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Dinesha B L** |
| Address | : | Centre for Nanotechnology, College of Agricultural Engineering<br>University of Agricultural Sciences, Raichur - 584104, Karnataka, India |
| Mobile | : | +91-9900960821 |
| Email | : | dinirbdgtc@gmail.com |
| Affiliation | : | College of Agricultural Engg, University of Agricultural Sciences, Raichur |
| Co Author(s) | : | Sharanagouda Hiregoudar, Udaykumar Nidoni,<br>Vijayakumar Hiremath, Manjunath, B |

# PULLULAN BASED NANOCARRIER FOR NUCLEIC ACID DELIVERY AND FREE RADICAL SCAVENGING

Mohammed Rashad P and Rekha M R
Division of Bio surface Technology, Biomedical Technology wing, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, Kerala

**Background:** Nanomedicine is now a well established field and is widely explored for various therapeutic applications. However nanoparticle mediated toxicity is a matter of concern. Nanocarriers owing to its small dimensions are highly reactive to cell components and is known to generate free radicals which lead to detrimental effects**.** Polyethyleneimine (PEI) - β cyclodextrin (CD) conjugates were developed which can simultaneously function as a nucleic acid and drug delivery system. Quercetin was the chosen drug which have also antoxidant potential along with other properties such as anticancer effect.

**Methods:** following the carbonyl diimidazole chemistry, conjugates of Pullulan-PEI and Pulluan - PEI - β CD (PPEICD) were synthesized. Amount of free primary amino groups and amount of PEI remaining after conjugation were determined using TNBS and Copper sulphate test and the extent of conjugation was analysed. Nanoplexes of Pullan-PEI and PPEICD with ctDNA were prepared and size and zeta analysis was studied. Cytotoxicity studies were carried out by MTT assay on L929 cells. Quercetin was loaded in the nanoplexes of PPEICD/ctDNA and the free radical scavenging study was monitored using DPPH assay.

**Results:** The TNBS assay and copper sulphate assay result indicated that the free amino groups has reduced in Pullulan-PEI when comparing with PEI and in PPEICD when comparing with Pullulan-PEI. The result assures the effective conjugation of β-CD to pullan-PEI conjugates. Nanoplex analysis has shown that for PPEICD- ct DNA (3:1) has come within the range for 105 nm size and 14.4 mv zeta. Cytocompatibility studies by MTT assay demonstrated high cell viability with PPEI conjugates in comparison with PEI which is cytotoxic. Quercetin loaded the nanoplexes of PPEICD/ctDNA have shown free radical scavenging capacity at various ratios ranging upto 50% at 5:1 ratio.

**Conclusion:** The conjugated cyclodextrin Pullan-PEI nano system could be a promising advance in the Qu drug delivery system. PPEICD was found to be more compatible than PEI. The β-CD provides the space for the inclusion of the drug Qu. PPEICD conjugate has proved to act as carrier for the drug Quercetin. Qu can also be considered as a potential antioxidant for radical scavenging. This study might contribute to the use of nano-carriers for the drug delivery system and effect of drug loaded for the scavenging studies.

**POS-83**

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| **Poster Presenter** | : | **Mohammed Rashad P** |
| Address | : | BST Laboratory, Division of Bio Surface Technology, Biomedical Technology Wing, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum - 695011, Kerala, India |
| Mobile | : | +91-8448723494 |
| Email | : | rashad.pullisseeri@gmail.com |
| Affiliation | : | SCTIMST Trivandrum |

# DISPERSION OF $Co_3O_4$ ON $CeO_2$ NANOROD REDUCES $Ce^{4+}$ TO $Ce^{3+}$ FOR EFFECTIVE SYNTHESIS OF DIMETHYL CARBONATE FROM $CO_2$: INTEGRATED DFT & EXPERIMENTAL STUDY

Nagendra Kulal[a], Soumya S. Bhat[b], Vithobha Hugar[a], Seung-Cheol Lee[b], Satadeep Bhattacharjee[b], Rajappan Vetrivel[a] and Ganapati V. Shanbhag[a]*

[a]*Materials Science and Catalysis Division, Poornaprajna Institute of Scientific Research (PPISR), Bidalur, Devanahalli, Bengaluru-562164, Karnataka, India*

[b]*Indo-Korea Science and Technology Center (IKST), Bengaluru- 560065, India*

***Corresponding author: shanbhag@poornaprajna.org**

$CO_2$ capture and conversion are seen as potential ways of reducing its emissions to the atmosphere. Dimethyl carbonate (DMC) synthesized from $CO_2$ and methanol has many applications as a methylating/carbonylating agent for replacement of toxic reagents such as dimethyl sulfate and phosgene [1]. DMC is also used as a fuel additive because of its high-octane number and oxygen content. For its synthesis, the oxygen deficient site on the catalyst has a strong impact on the activation of $CO_2$ [2]. In this work, newly formulated $Co_3O_4/CeO_2$ nanorod catalyst exhibits multiple reduction behavior as cobalt metal species differ in the strength of their interaction with $CeO_2$. This causes the surface reduction from $Ce^{4+}$ to $Ce^{3+}$ in solid solution Co-O-Ce. The dispersion of $Co_3O_4$ enhanced the formation of oxygen deficient site as revealed by XPS, $H_2$-TPR and $CO_2$-chemisorption. The non-precious $Co_3O_4/CeO_2$ nanorod was recognized as a potential catalyst for promoting $Ce^{4+}$ to $Ce^{3+}$ for $CO_2$ activation and dimethyl carbonate synthesis (81.5% of yield). DMC yield increased in the order; $Co_2O_3$ < $CeO_2$ bulk < $CeO_2$ cube < $CeO_2$ nanorod < $Co_3O_4/CeO_2$ nanorod, which followed the trend of capacity of $CO_2$ adsorption. Energetics of oxygen vacancy formation of low index surfaces of $CeO_2$ was determined with first-principles calculations based on density functional theory (DFT). Results disclosed the $Ce^{4+}$ to $Ce^{3+}$ formation energy of $CeO_2$ nanorod due to Co substitution and corroborated the experimental results. Further, calculations provide the details of the effect of Co substitution on the electronic structure of reduced $CeO_2$ surfaces. Estimated $CO_2$ adsorption energy indicates (110) as the most active surface for activation of $CO_2$.

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**POS-84**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Nagendra Kulal** |
| Address | : | Post: Bidalur, Ta: Devanahalli,<br>Bengaluru - 562164, Karnataka, India |
| Mobile | : | +91-8660648760 |
| Email | : | nagendra@poornaprajna.org |
| Affiliation | : | Poornaprajna Institute of Scientific Research (PPISR) |
| Co Author(s) | : | Soumya S. Bhat, Vithobha Hugar, Seung-Cheol Lee<br>Satadeep Bhattacharjee and Dr. Ganapati V. Shanbhag |

# NANOFIBER BASED APPROACH FOR UTERINE AND PERIPHERAL NERVE TISSUE ENGINEERING

Srividya H, Aishwarya Nagarajan, Dr. Manasa Nune*
Manipal Institute of Regenerative Medicine, Manipal Academy of Higher Education, Bengaluru

- Scaffolds are important physical structures in tissue engineering that facilitate cell adhesion, proliferation, and differentiation, ultimately leading to tissue regeneration. To optimize in growing cells and to promote tissue regeneration, choosing the right biomaterial is a critical step when designing a scaffold. Poly(-caprolactone) (PCL) is a biocompatible and biodegradable synthetic polymer with low cytotoxicity that is widely used in a variety of applications. The scaffolds must closely resemble the extracellular matrix (ECM) found in tissue, so an electrospinning process is used to create nanofibrous structures that closely resemble collagen found in the ECM. PCL is electrospun into a nanofibrous scaffold by optimizing various solution and process parameters.

- **Uterine tissue Engineering** -PCL is further surface modified by aminolysis (APCL) and then conjugated with two distinct sugars, Maltose (MPCL) and Galactose (GPCL). Physicochemical and biological qualitative and quantitative assays were performed to assess the modified PCL nanofibers and their interaction with primary uterine fibroblasts (HUF).

- **Peripheral nerve tissue engineering** — The nanofiber scaffolds were fabricated using polycaprolactone (PCL), multiwalled carbon nanotubes (MWCNT) and Graphene oxide (GO) by electrospinning technique and thus creating a microenvironment that mimics the ECM and providing electrical conductivity features to promote nerve regeneration. Schwann cells shown better compatibility with the above scaffolds .

**POS-85**

| | | |
|---|---|---|
| **Poster Presenter** | **:** | **Aishwarya Nagarajan** |
| Address | : | GKVK Post, Bellary Road, Allalasandra, Yelahanka<br>Bengaluru - 560065, Karnataka, India |
| Mobile | : | +91-7550061610 |
| Email | : | nagarajanaishwarya1998@gmail.com |
| Affiliation | : | Manipal Institute of Regenerative Medicine |
| Co Author(s) | : | Srividya Hanuman and Dr. Manasa Nune |

# PREPARATION AND CHARACTERIZATION OF POSITIVE CONTRAST AGENT ENCAPSULATED LIPOSOMAL CARRIER SYSTEM

Sathyasivam Kaviarasi, Uma Maheswari Krishnan*
*Centre for Nanotechnology & Advanced Biomaterials, ABCDE Innovation centre, School of Arts, Sciences, Humanities and Education,*
*SASTRA Deemed University, Thanjavur-613401, Tamil Nadu, India*
kavinmozhi373@gmail.com

**Background:** One of the most essential considerations in the treatment of neurological disorders, namely cerebral stroke, is the ability to observe the diseased region with high resolution and sensitivity that serves as an accurate diagnosis for the desired therapeutic outcome. Clinicians use Magnetic Resonance Imaging (MRI) as their chief diagnostic tool as it allows them to visualise even tiny and deeper abnormalities. In order to differentiate healthy tissue from diseased site, contrast agents are used. However, to reduce the neuro- and nephro-toxic effects due to gadolinium retention in the body, there is a need to develop compatible novel contrast agents with better contrast efficiency.

**Objective:** The present work attempts to develop and characterize a positive contrast agent loaded liposome for imaging

**Results:** Gadolinium-coordinated quercetin was synthesized and showed better contrast property. The prepared contrast agent was encapsulated into a liposomal carrier and was characterized for its structure, cytocompatibility, morphological and magnetic contrast properties.

**Conclusion:** We believe that this novel polyphenol-based gadolinium chelate can replace conventional contrast agents. Incorporation of therapeutic entities into the carrier can extend its application to a theranostic entity for treating cerebral stroke.

**Keywords**: Liposome, Magnetic resonance imaging, Gadolinium based contrast agents, Nanocarrier, Flavonoid

**Acknowledgement:** The author wish to acknowledge Department of Science and Technology (DST/INT/JSPS/P-221/2016), Science and Engineering Research Board (CRG/2019/007008), Council of Scientific & Industrial Research (09/1095(0050)/19-EMR-I) and SASTRA Deemed university for infrastructure and funding.

**POS-86**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Sathiyasivam Kaviarasi** |
| Address | : | Thirumalaisamudram, Thanjavur - 613001, Tamilnadu, India |
| Mobile | : | +91-8489262708 |
| Email | : | kavinmozhi373@gmail.com |
| Affiliation | : | SASTRA Deemed to be University |

# NANOSTRUCTURED HYBRID LIPID CAPSULES AS A NEXT GENERATION PLATFORM FOR BREAST CANCER THERAPEUTICS

*Suparna Mercy Basu*[1], Sunil Kumar Yadava[1,2], Meenakshi Chauhan[1], Jyotsnendu Giri[1]
[1] Department of Biomedical Engineering, Indian Institute of Technology, Hyderabad, India
[2] Department of Chemistry and Biotechnology, Georgia Institute of Technology, Atlanta, USA

Co-eradication of cancer stem cells (CSCs) along with cancer cells have emerged as an immediate necessity to combat the rapid progression, therapeutic resistance, and relapse of cancer. Effective chemotherapeutics still lack success owing to poor pharmacokinetics, low solubility and undesirable side effects. To this extent, various nanodelivery systems are developed and in clinical practice to proffer targeted delivery and better outcomes. Curcumin (CMN) has been well established for anticancer activity against a variety of cancers with an ability to eliminate CSCs. In spite of its extensive therapeutic potential, clinical applicability is impeded due to its highly hydrophobic nature. A novel drug delivery system denoted as nanostructured hybrid lipid capsules (nHLCs) was developed by us for improving payload delivery[1]. In this study, we developed CMN-loaded nanostructure hybrid lipid capsules using our low-temperature method. CMN-nHLCs show a controlled release of CMN from nHLCs at 37 °C and long-term storage stability at 4 °C. CMN-nHLCs show ~2.5-fold enhanced anticancer efficacy compared to free CMN in breast cancer cells (non-bCSCs) and breast cancer stem-like cells (bCSCs) and cause significant reduction in their mammosphere size/number and stemness. nHLCs provide improved physicochemical properties of CMN and superior anticancer efficacy by co-eradiating both non-bCSCs and bCSCs, suggesting a promising candidature of CMN-nHLCs for breast cancer treatment.

**Keywords**: nanostructured hybrid lipid capsules, curcumin, breast cancer, cancer stem cells

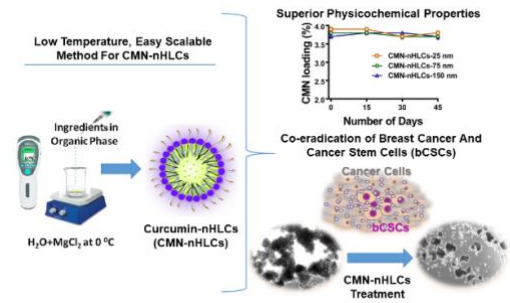


**Figure 2**: Schematic illustration for the preparation of nano-structured hybrid lipid capsules (nHLCs). Data showing the physicochemical properties of nHLCs followed by the eradication of breast cancer stem cells by curcumin loaded nHLCs.

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**POS-87**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Suparna Mercy Basu** |
| Address | : | IIT Hyderabad, Hyderabad - 502284, Telangana, India |
| Mobile | : | +91-9831366516 |
| Email | : | suparnabasu29@gmail.com |
| Affiliation | : | Indian Institute of Technology Hyderabad |
| Co Author(s) | : | Sunil Kumar Yadava, Meenakshi Chauhan, Jyotsnendu Giri |

# POLYHYDROXYBUTYRATE (PHB), A GREEN PLASTIC: TOWARDS AN ECO-FRIENDLY ENVIRONMENT

A. Dhawan[*1], P.K. Manna[1], H.B. Bohidar[1], R. Choudhary[1], M. Goel[1], R. Williams[2], F. Pfeffer[2], C. Smith[2], A.K. Dinda[3], P. P. Singh[*1]

1 *TERI Deakin Nanobiotechnology Centre, TERI Gram, Gwal Pahari, Gurugram, India*
*2 Deakin University, Faculty of Health, Australia*
*3 All India Institute of Medical Sciences, New Delhi, India*
E-mail: aksha.dhawan@teri.res.in, pushplata.singh@teri.res.in

Conventional plastics jeopardize marine and terrestrial ecosystems by degrading into micro-plastics, releasing toxic chemicals, and choking the wildlife. In this study, an alternative biodegradable polymer that is Polyhydroxybutyrate (PHB) having the similar properties to the synthetic plastic was derived from the microorganisms. It presents great potential for applications in biomedical, agricultural, and packaging areas. Referred to as green plastics, these are produced intracellularly by bacteria under the nutrient(s) limiting conditions. This work focussed on screening various in-house bacterial strains by Nile blue A staining, Gas chromatography-mass spectroscopy and Transmission electron microscopy (TEM) for their potential to produce PHB. The selected gram-negative bacteria species showed the promising results as it accumulated the PHB up to 80% subsequent to culture optimization. The extracted polymer obtained by the green method was analysed using Gas chromatography-mass spectroscopy (GCMS), Fourier transform-infrared and UV-visible spectroscopy (UV-Vis). These characterizations confirmed the presence of the PHB polymer. The mechanical analysis by Universal Testing Machine (UTM) and the thermal analysis by Differential Scanning Calorimetry (DSC) indicated that it can be used as an alternative to traditional plastics. Further, for the feasible biopolymer production, agro-waste can be used as the potential carbon source. This study has the scope for the emergence of an eco-friendly environment in near future.

**Keywords:** Biodegradable polymer, PHB, Biomedical, Agriculture, Eco-friendly environment

**POS-88**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Aksha Dhawan** |
| Address | : | TERI Gram Gurgaon - Faridabad Road, Opposite Pathways School<br>Gwal Pahari, Gurugram - 122102, Haryana, India |
| Mobile | : | +91-9990351913 |
| Email | : | aksha.dhawan@teri.res.in |
| Affiliation | : | TERI Deakin Nanobiotechnology Center |

# NANOSTRUCTURE HYBRID LIPID CAPSULES (NHLCS) FOR ERADICATING GLIOBLASTOMA AND GLIOBLASTOMA STEM CELLS

Uzma Hasan[1,2], Meenakshi Chauhan[2], Suparna Mercy Basu[2], Jyotsnendu Giri[2*]
[1]*Department of Biotechnology, Indian Institute of Technology, Hyderabad-502285, India*
[2]*Department of Biomedical Engineering, Indian Institute of Technology, Hyderabad-502285, India*
*Email: bo17resch11005@iith.ac.in*

Glioblastoma (GBM) is regarded as highly aggressive and most lethal human cancers characterized by poor survival and high rate of recurrence due to presence of MDR in GBM cell and glioblastoma stem cells (GSC). For effective treatment of glioblastoma and to reduce the chances of recurrence, it is important to block or reduce MDR and simultaneously kill GBM and GSCs. A novel small molecule inhibitor, reversan, has been used to block transporters associated with multi-drug resistance (MDR). Regorafenib, a multi-kinase inhibitor, targets Ras/Raf/MEK/ERK pathways and alters the tumor microenvironment by regulating neoangiogenesis through inhibition of vascular endothelial growth factor (VEGF) receptors. Regorafenib has recently been in clinical trials for the treatment of recurrent GBM. However, lack of cancer cell specificity and off target toxicity hinders its efficacy. Nano drug delivery systems have advantage for selective delivery of drugs to the tumor site. In this regard, lipid nanostructures provide better biocompatibility as they have minimum influence on the extracellular/intracellular environment.

Herein, we have modified lipid nano-carrier to developed nanostructure hybrid lipid capsules (nHLCs) which offer superior biocompatibility and efficient drug retention. The physiochemical properties of nHLCs, such as, particle size, zeta potential, encapsulation efficiency, stability and drug release were determined. Uptake of these nanoparticles, size 75nm, was confirmed using Dil-loaded nHLCs in U251MG GBM cells. Cytotoxicity of regorafenib loaded nHLCs (RF-nHLCs) was determined in U251MG GBM cells and Glioblastoma derived stem cells (GSCs). Both GBM and GSCs were pre-treated for 7hr with reversan, followed by treatment with drug loaded particles for 24 and 48hr. Reversal of MDR was affirmed by flow cytometry analysis and fluorescence microscopy, whereas, therapeutic efficacy of RF-nHLCs, in killing both GBM and GSC, was ascertained by RT-PCR and flow cytometry.

Overall, the unique physiochemical properties of nHLCs provides an efficient system for selective delivery and killing of both GBM and GSCs. In addition to that, reversal of MDR can enhance the process and can serve for efficient cancer therapy.

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2. K. Khaddour, T. M. Johanns, G. Ansstas Pharmaceuticals (Basel). 2020 Nov; 13(11): 389

**POS-89**

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|---|---|---|
| **Poster Presenter** | : | **Uzma Hasan** |
| Address | : | 518, Acad block A, IIT Hyderabad<br>Sangareddy - 502285, Telangana, India |
| Mobile | : | +91-9178635198 |
| Email | : | bo17resch11005@iith.ac.in |
| Affiliation | : | Indian Institute of Technology, Hyderabad |
| Co Author(s) | : | Meenakshi Chauhan, Suparna Mercy Basu, Jyotsnendu Giri |

# ROS RESPONSIVE POLYMER COATED MAGNETIC NANOPARTICLES FOR MULTIMODAL SYNERGISTIC CANCER THERAPY

M. Chauhan [1*], S.M. Basu[1], J.Giri [1]
[1] Department of Biomedical Engineering, Indian Institute of Technology, Hyderabad-502285, India

Cancer treatment using smart NPs has become a promising strategy; because of site-specific accumulation (EPR effect), targeted drug delivery system, microenvironment targeting, and stimuli-responsive release of nanoparticles (NPs). Additionally, hyperthermia with chemotherapy in the form of nano-drug delivery system became a promising strategy to efficiently overcome cancer and cancer reoccurrence. Hyperthermia refers to a slight rise in temperature, i.e., 40- 45°C, which cause cancer cells damage and, therefore, increases vascular perfusion and oxygenation and activates immunological responses, ultimately instigate change in the extracellular microenvironment of cancer cell, leads to enhance the effect of chemotherapy. Herein, we have developed NPs composed of polypropylene sulfide (PPS), ROS (reactive oxygen species) responsive polymer as core coated with Pluronic F127 as surfactant and iron NPs encapsulated in the core. PPS core is hydrophobic and capable of encapsulating multiple anticancer drugs like doxorubicin or paclitaxel drug in core along with hydrophobic magnetic NPs (MNPs) for magnetic hyperthymia therapy. We optimized these NPs for hyperthymia application and drug delivery system. Synthesized NPs were ~70 nm in size and found to be stable in 4˚C for more than 45 days. In normal physiological conditions, the release was obtained ~20 %, however, in an oxidative condition and low pH (cancer micro-environment), more than 70 % drug released was obtained in 72 hrs. SAR obtained was nearly 150 W/kg at a concentration of 2mg/ml and the particles achieved a temperature of 43 C within 10 min. Synthesized NPs are biocompatible up to 1mg/ml concentration in Human fibroblast with enhanced anticancer activity in cancer cells in the presence of a combination of hyperthermia and chemotherapy compared to only chemotherapy therapy. In conclusion, the developed formulation will be a promising platform for drug delivery and hyperthermia application synergistically while overcoming the limitation of individual drug & iron nanoparticles. **Keywords**: Magnetic nanoparticles, iron oxide, Polypropylene sulfide (PPS), Hyperthermia, Doxorubicin, Oxidative (ROS) sensitive cancer therapy.

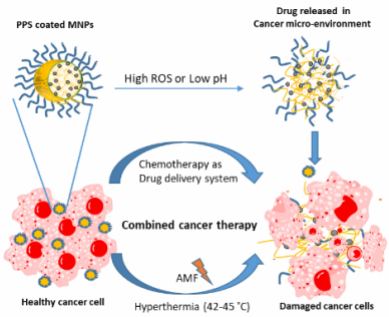


**Figure 3**: Schematic representation of PPS coated MNPs for combined cancer therapy using chemotherapy and hyperthermia simultaneously.

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**POS-90**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Meenakshi Chauhan** |
| Address | : | J-526, Kandi, IIT Hyderabad, Hyderabad - 502285, Telangana, India |
| Mobile | : | +91-9459859120 |
| Email | : | bm17resch11009@iith.ac.in |
| Affiliation | : | IIT Hyderabad |
| Co Author(s) | : | Suparna Mercy Basu, Jyotsnendu Giri |

# APPLICATION OF ZNO NANOPARTICLES IN IMPROVING SEEDLING ESTABLISHMENT OF LEGUME AND NON-LEGUME FIELD CROPS

P. SARAVANANE[1], M. DJANAGUIRAMAN[2], T. RAMANADANE[3], K .RAJA[4] AND S. NADARADJAN[5]
[1]Department of Agronomy, Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal, Puducherry U.T- 609 603, India
[2]Department of Crop Physiology, Tamil Nadu Agricultural University, Coimbatore-641003
[3]Department of Plant Breeding Genetics, Seed Technology Unit, Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal, Puducherry U.T- 609 603, India
[4]Department of Nano Science & Technology, Tamil Nadu Agricultural University, Coimbatore-641003
[5]Department of Plant Breeding genetics, Crop Physiology Unit, Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal, Puducherry U.T- 609 603, India
*Email*: psaravanane@rediffmail.com

Legume and non-legume field crops are important component of major agricultural systems in tropics and sub-tropics. Sesame (non-legume) and blackgram (legume) grown in the marginal and sub-marginal lands of tropics and sub-tropics, has problem in establishment under field condition due to poor seed quality. One of the opportunities to improve seed germination and seedling establishment is the use of nanoparticles. A study was conducted to evaluate the effects of zinc oxide nanoparticles (ZnO NPs) on seed germination, and seedling vigour of sesame (*Sesamum indicum* L.) and blackgram (*Vigna mungo* L.). Zinc oxide nanoparticles were synthesized through the green synthesis method by using zinc acetate as precursor and *Tridax procumbens* leaf extract as reductant. The result of the study indicated that the size of the ZnO NPs was 94 nm with the maximum absorbance peak at 298 nm. The SEM and TEM analysis indicates that ZnO NPs are spherical in shape. EDX confirms the purest form of Zn in ZnO NPs. The ZnO improved the seed germination and root growth of sesame compared to untreated control. Thus, it is evident that seed treatment with ZnO NPs can be a potential approach to improve the seedling establishment of sesame and blackgram.

**Keywords:** Blackgram, Seedling establishment, Sesame, ZnO nanoparticles

Application of ZnO nanoparticles in improving seedling establishment of legume and non-legume field crops

**POS-91**

| | | |
|---|---|---|
| **Poster Presenter** | : | **P. Saravanane** |
| Address | : | Department of Agronomy, Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal - 609603, Pondicherry, India |
| Mobile | : | +91-7010510632 |
| Email | : | agronshara@gmail.com |
| Affiliation | : | Pandit Jawaharlal Nehru College of Agriculture & Research Institute |
| Co Author(s) | : | M. Djanaguiraman, T. Ramanadane, K. Raja, S. Nadaradjan |

# WORK FUNCTION MODEL OF METALLIC NANOPARTICLES FOR MULTI DYE DEGRADATION FROM WASTE WATER: AN APPROACH TOWARDS ECOLOGICAL REMEDIATION

Aayasha Negi[1], Rahul Kumar Vishwakarma[1], Devendra Singh Negi[1]*
Department of Chemistry, H.N.B. Garhwal University (A Central University) Srinagar (Garhwal), Uttarakhand, PIN 246174, INDIA
Address of correspondence: aisha.negi04@gmail.com

At ambidient temperature an ecologically benign, easy and cost effective technique has been used to generate Ag, Cu, and ZnS-MNPs (Metal nanoparticles).This is an aqueous phase synthesis which does not involve any hazardous chemicals. Various analytical techniques UV-Vis, FT-IR, X-ray diffraction, Energy-dispersive X-ray spectroscopy and Transmission electron microscopy (TEM) were employed. The application of these MNPs as nanocatalyst was examined in the degradation of various dyes upon solar irradiation in the presence of sodium Borohydride ($NaBH_4$).The rate constant of deprivation of dyes were calculated and followed the pattern $k_{ZnS} > k_{Ag} > > k_{Cu}$. Catalytic activity discrepancies are caused by variances in the values of their work functions. The advantage of ZnS NPs over Ag and Cu in terms of catalytic activity is due to their lowest work function value.

**Keywords**: Green synthesis, Metal Nanoparticles, Catalytic efficacy, Dye deprivation.

**POS-92**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Aayasha Negi** |
| Address | : | Ganga Higher Studies Girls Hostel Chauras, Srinagar Uttarakhand, India |
| Mobile | : | +91-881212592 |
| Email | : | aisha.negi04@gmail.com |
| Affiliation | : | H.N.B.Garhwal University |
| Co Author(s) | : | Rahul Kumar Vishwakarma, Devendra Singh Negi |

# OVERVIEW ON METHODS TO OVERCOME OF DEGRADATION OF $CSPBBR_3$ PQDS IN WATER FOR BIO-MEDICAL APPLICATIONS

Sanjayan. C. G, Geetha R Balakrishna*
Centre for Nano & Material Sciences, Jain University, Bangalore 562 112
Corresponding author: br.geetha@jainuniversity.ac.in

Of all the quantum dots, $CsPbBr_3$ perovskite quantum dots (CPQDs) have been extensively studied for sensing because of their desired photophysical properties such as, optical absorption, high quantum yield and narrow emission bands. However, aqueous instability of these PQDs has limited its use in real time biological applications. So, there should be a understanding of this material's intrinsic behaviour towards the degradation of PQDs in water for developing a water stable perovskite probe for biomedical applications. Researches had developed a protective layer or shell by various strategies being implemented namely coating silica shells and developing polymer encapsulations to tweak its behaviour for water biomedical. A detailed track record against our focussed set of qualities for developing water stable CPQDs will help us look ahead in the right direction. It provides an assessment of figures of merit of these tweaked or stabilized CPQDs, to check the reliability of this material for biosensing in water. The insights offered here however opens scope, not only for developing various other water stable, lead free and double perovskites which are environmentally more benign and useful, but also would give perspectives to validate their developed schemes towards the use of these materials for biomedical applications.

**POS-93**

**Poster Presenter** : **Sanjayan C. G**
Address : Lab 423, Centre For Nano And Material Sciences
Ramanagar - 562112, Karnataka, India
Mobile : +91-9842560700

# BIOSYNTHESIS OF ZNO NANOPARTICLES FROM THE LEAF EXTRACT OF *CASSIA TORA* AND ITS ELECTROCHEMICAL STUDIES USING CYCLIC VOLTAMMETRY & EVALUATION OF ANTIMICROBIAL ACTIVITIES

**Mamata C. Naik [1], Jyothi H. Kini [1*], Kumaraswamy B.E.[2]**

1. Department of PG Studies and Research in Industrial Chemistry, Sir M.V. Govt. Science College, Bommanakatte, Bhadravathi - 577 302, Karnataka, India
2. Department of PG Studies and Research in Industrial Chemistry, Jnana Sahyadri, Kuvempu University, Shankaraghatta, Shivamogga, Karnataka, India

Email ID: mamataprabhugaonkar@gmail.com

The present work addresses non-toxic green synthesis of ZnO nanoparticles from the leaf extract of *Cassia tora* by bio-mediated approach using Zinc nitrate as a precursor. This plant mediated method was found to be simple, biocompatible, low cost, safe and environmentally benign. Leaf extract acts as reducing as well as stabilizing agent. The characterization of synthesized ZnO nanoparticles was done by X-ray diffraction (XRD), UV-visible spectroscopy, Fourier transform infrared spectroscopy (FTIR) and Scanning electron microscopy (SEM). The electrochemical response of Dopamine (DA) in buffer solution at pH 6.6 on the ZnO modified Glassy carbon electrode was determined by using cyclic voltametric technique at different scan rates. The ZnO modified Glassy carbon electrode showed excellent electrochemical enhancement of the peak current for Dopamine. Linear relationship between anodic and cathodic peak current v/s square root of scan rate was studied. The synthesized ZnO nanoparticles were also tested for their antimicrobial activity against Gram-positive and Gram-negative bacteria strains.

**POS-94**

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|---|---|---|
| **Poster Presenter** | : | **Mamata C. Naik** |
| Address | : | H. No. 65, Goankarwada, Pilgaon, Bicholim - 403504, Goa, India |
| Mobile | : | +91-9579630320 |
| Email | : | mamataprabhugaonkar@gmail.com |
| Affiliation | : | Sir M.V. Govt. Science College, Bommanakatte Bhadravathi - 577302, Karnataka, India |
| Co Author(s) | : | Dr. Jyothi H. Kini, Dr. B. E. Kumaraswamy |

# NANOSTRUCTURED ANTIMICROBIAL SURFACES FOR PREVENTING HOSPITAL ACQUIRED INFECTIONS

Naveen Bharadishettar, Udaya Bhat K
Department of Metallurgical and Materials Engineering, National Institute of Technology Karnataka Surathkal - 575025

Surface contamination by microbes leads to several detrimental consequences like hospital and device-associated infections. Antimicrobial copper coatings are rapidly emerging technology for global mitigation strategy in preventing healthcare-acquired infections (HAIs). Synergistic developments in materials science, biotechnology, chemistry, and environmental microbiology have promoted huge opportunities to design surfaces with antimicrobial properties. Particularly, advancements in materials science and chemistry have brought about a clear understanding of the mechanism of antimicrobial activity, microbe-surface interactions, and structure-property relationship. In this context, strategies for developing copper-based antimicrobial copper coatings are discussed in detail. Copper, unlike other antimicrobial materials, demonstrates rapid and high microbicidal efficacy due to its highest toxicity. Antimicrobial properties of copper coatings produced by various deposition methods including thermal spray technique, electrodeposition, electroless plating, chemical vapor deposition (CVD), physical vapor deposition (PVD), and sputtering techniques are compared to understand the mechanism of antimicrobial activity and surface-structure-property interactions. The coating produced using different processes did not produce similar properties. Also, process parameters often could be varied for any given coating process to impart a change in structure, topography, wettability, hardness, surface roughness, and adhesion strength. In turn, all of them affect antimicrobial activity.

**POS-95**

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| **Poster Presenter** | : | **Naveen Bharadishettar** |
| Address | : | Department of Metallurgical and Materials Engineering<br>National Institute of Technolgy Karnataka Surathkal PO<br>Srinivasnagar, Mangalore - 575025, Karnataka, India |
| Mobile | : | +91-9886228989 |
| Email | : | naveenbharadishettar@gmail.com |
| Affiliation | : | National Institute of Technology Karnataka Surathkal |
| Co Author(s) | : | Prof. Udaya Bhat K |

# ELECTROPHORETIC MOTION OF A WATER MICRODROPLET

I am pursuing PhD in Centre for Nanotechnology at IIT Guwahati in the field of microfluidics. I have done my bachelors in Mechanical Engineering followed by masters in Energy Engineering from Mumbai University. My present research work focuses on fundamentals and applications of external electric field in microchannel flows.

**POS-96**


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|---|---|---|
| **Poster Presenter** | : | **Chintak Kamalesh Parashar** |
| Address | : | 308, Siang Hostel, IIT Guwahati, Guwahati - 781039, Assam, India |
| Mobile | : | +91-9082907763 |
| Email | : | chintakparashar@gmail.com |
| Affiliation | : | IIT Guwahati |
| Co Author(s) | : | Dipankar Bandyopadhyay |

# 2D BOROCARBONITRIDES: TUNABLE ELECTRONIC PROPERTIES

**Rohit Attri**, M. B. Sreedhara, S. Roychowdhury, K. Biswas and C. N. R. Rao*
New Chemistry Unit, School of Advanced Materials (SAMat), Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru, Karnataka 560064

Two dimensional materials have received much attention in recent years owing to their fascinating properties in monolayer or few layers. The ability to tune the physical properties by tailoring the electronic structure has always interested researchers. Borocarbonitrides, BxCyNz, are 2D materials which allow tuning of electrical and optical properties from high bandgap (~5.9 eV) h-BN to low gap of graphene. 1 Thermal properties of BCN are expected to show ultra-low thermal conductivity than its analogues h-BN and graphene.2 The electrical and optical behavior was probed by depositing (BN)1-x(C)x thin films of varied chemical compositions using pulsed laser deposition (PLD) technique, and the thermal property was examined by synthesizing BCN nanosheets by solid-state reaction. Optical and electrical properties of these films show systematic changes in the band gap and the resistivity with composition. The optical and electrical properties of BCN show linear dependence with the composition. BCN nanosheets exhibit p-type semiconducting thermoelectric transport properties, and total thermal conductivity is found to be very low (0.58 to 1.86 W/mK) in 300- 573 K range. The ultra-low thermal conductivity and tunable electronic properties of BCN with composition can be shown to have potential applications in thermal management devices and tunable Opto-/nano-electronic devices, respectively, for sustainable future.

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**POS-97**

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|---|---|---|
| **Poster Presenter** | : | **Rohit** |
| Address | : | Nanolab, JNCASR, Bengaluru - 560064, Karnataka, India |
| Tel | : | +91-80-22082911 |
| Mobile | : | +91-9971981210 |
| Email | : | rohit@jncasr.ac.in |
| Affiliation | : | Jawaharlal Nehru Centre for Advanced Scientific Research |
| Co Author(s) | : | M. B. Sreedhara, S. Roychowdhury, Prof. Kanishka Biswas Prof. C.N.R. Rao, FRS |

# SYNTHESIS AND CHARACTERIZATION OF NANO-IRON FROM GREEN BIOMASS AND EVALUATION OF IT EFFECT ON AEROBIC RICE (*ORYZA SATIVA* L.)

Akshay Kumar, T. K[1]., H. M. Jayadeva[2] and Vinay Kumar, M[3]

Nanotechnology has vast number of opportunities in various disciplines and now in agriculture which can solve the problem of degradation of soil fertility through use of eco friendly green synthesized nanofertilizer. The nano iron fertilizer was synthesized using various biomass and synthesized nano iron (SNI) was characterized by UV-vis, partical size analysier, EDX, SEM and AFM instruements. SNI using Bidens Pilosa leaf extract shown UV- Vis analysis absorption peak at 319 nm and size of SNI was 63.99 nm . Laboratory seed germination experiment with sixteen treatments was laid out in CRD and replicated thrice. The results revealed that, seed priming with 1000 ppm of SNI for 30 minutes was recorded higher germination and seed vigour index. In field, 9 treatments were laid out in RCBD with three replications and the cultivar used was KMP-175. The results revealed that seed treatment with 1000 ppm of SNI for 30 minutes and foliar application of SNI at 800 ppm recorded higher growth and yield and with higher iron content in seeds.

**POS-98**


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|---|---|---|
| **Poster Presenter** | : | **Akshay Kumar, T. K.** |
| Address | : | Shabazar Mahadevnagar Sheik Roza Road<br>Kalaburagi - 585101, Karnataka, India |
| Mobile | : | +91-9972245897 |
| Email | : | akshaykurdekar777@gmail.com |
| Affiliation | : | University of Agricultural Sciences, Raichur |
| Co Author(s) | : | H. M. Jayadeva, Vinay Kumar, M |

# CHARGE-TRANSFER REGULATED VISIBLE LIGHT DRIVEN PHOTOCATALYTIC H2 PRODUCTION AND CO2 REDUCTION IN TETRATHIAFULVALENE BASED COORDINATION POLYMER GEL

**Parul Verma1**, Ashish Singh1, Faruk Ahamed Rahimi1, Pallavi Sarkar2, Sukhedu Nath3, Swapan Kumar Pati2, & Tapas Kumar Maji1*

1Molecular Materials Laboratory, Chemistry and Physics of Materials Unit, School of Advanced Materials (SAMat), Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bangalore, India

2Theoretical Sciences Unit, School of Advanced Materials (SAMat), Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bangalore, India

3Ultrafast Spectroscopic Section, Radiation & Photochemistry Division, Bhabha Atomic Research Centre, Mumbai, India

**Presenter- Parul Verma** (Molecular Materials Laboratory, Chemistry & Physics of Materials Unit, School of Advanced Materials (SAMat), Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bangalore- 560 064, India)

**Short Description of presentation (Abstract)** The much-needed renewable alternatives to fossil fuel can be achieved efficiently and sustainably by converting solar energy to fuels via hydrogen generation from water or CO2 reduction. Herein, a soft processable metal-organic hybrid material is developed and studied for photocatalytic activity towards H2 production and CO2 reduction to CO and CH4 under visible light as well as direct sunlight irradiation. A tetrapodal low molecular weight gelator (LMWG) is synthesized by integrating tetrathiafulvalene (TTF) and terpyridine (TPY) derivatives through amide linkages and results in TPY-TTF LMWG. The TPYTTF LMWG acts as a linker, and self-assembly of this gelator molecules with ZnII ions results in a coordination polymer gel (CPG); Zn-TPY-TTF. The Zn-TPY-TTF CPG shows high photocatalytic activity towards H2 production (530 µmol g-1h -1 ) and CO2 reduction to CO (438 µmol g-1h -1, selectivity >99%) regulated by charge-transfer interactions. Furthermore, in situ stabilization of Pt nanoparticles on CPG (Pt@Zn-TPY-TTF) enhances H2 evolution (14727 µmol g-1h -1). Importantly, Pt@Zn-TPY-TTF CPG produces CH4 (292 µmol g-1h -1, selectivity >97%) as CO2 reduction product instead of CO. The real-time CO2 reduction reaction is monitored by in situ DRIFT study, and the plausible mechanism is derived computationally. Paper published based on this study: Nat. Commun. 2021, 12, 7313. What will the audience take away from your presentation? • The audience will be able to understand how Gel-based soft processable material (i.e., Coordination Polymer Gel) can be utilized for photocatalytic application. • A novel approach for the development of photocatalyst material with earth-abundant metal ions. This approach can be further extended by designing new gelators molecules. The efficiency of CPG based material towards practical application is more promising compared to traditional solid-state catalysts in many aspects however it is still underexplored. • The main advantages of using gel-based material for photocatalysis will be explained in detail during this talk, such as, the 3D interconnect network morphology in hydrated self-assembly that enhances the diffusion of reactant towards the catalytic centers during the photocatalytic process. Biography of presenting author Dr. Parul Verma studied Chemistry at the Banaras Hindu University, INDIA and graduated as M.Sc. in 2014. She then joined the research group of Prof. Tapas K. Maji at the (Molecular Material Lab) JNCASR, Bangalore, INDIA for Ph. D. degree. She has finished her Ph. D. in Aug 2021 and currently working as a post-doctoral researcher at the same institute.

**Research interests**: Organic and Metal-Organic Hybrid 'Soft' Materials towards Hydrogen Production, Carbon dioxide Reduction and Optoelectronic Applications.

**POS-99**

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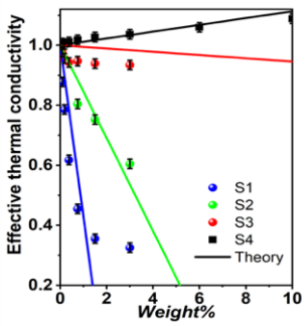
|---|---|---|
| **Poster Presenter** | **:** | **Parul Verma** |
| Address | : | Molecular Material Lab, CPMU, JNCASR<br>Bangalore - 560064, Karnataka, India |
| Mobile | : | +91-7892265388 |
| Email | : | parulisactsg@gmail.com |
| Affiliation | : | JNCASR |
| Co Author(s) | : | Ashish Singh, Faruk Ahamed Rahimi, Pallavi Sarkar, Prof Sukhendu Nath<br>Prof Swapan Kumar Pati, Prof Tapas Kumar Maji |

# SURFACTANT CONTRIBUTION TOWARDS HEAT TRANSFER IN FE OXIDE NANOFLUIDS

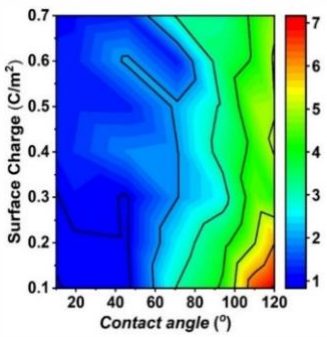
**Ajit Singh[1*], Ramanujan Lenin[1], Naimat Kalim Bari[1], Chirodeep bakli[2] and Chandan Bera[1]**
[1]*Institute of Nano Science and Technology, sector-81 Knowledge city Mohali Punjab-160062, India*
[2]*School of Energy Science and Engineering, Indian Institute of Technology Kharagpur-721302, India*
* E-mail Corresponding Author: chandan@inst.ac.in

Role of nanofluids in thermal management, exchange and insulations is gaining tremendous attention in biological and clinical applications. Surfactants on the nanoparticle surface play an important role in the dispersion and stability of the nanoparticles in fluid [1]. Hence to deepen the understanding role of surfactant associated with nanoparticles in different fluid medium it is essential to study their cumulative properties. In this work, monodispersed nanoparticles ($Fe_3O_4$) synthesized and stabilized with different surfactants (citric acid/oleic acid) and dispersed in different mediums (water/toluene) at different concentrations [2,3]. The thermal conductivity has been studied theoretically as well as experimentally using homemade measurement setup. Thermal conductivity of water is found to be reduced by 67% by adding nanoparticles coated with citric acid whereas 4% enhancement occurs for toluene when oleic acid-coated nanoparticles are added as shown in fig (a). In this work, increasing/decreasing of thermal conductivity has been related to surface properties of nanoparticles and polarity of the base fluid which has been supported by theoretical work as well in fig (b).

**(a)**




**(b)**

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**POS-100**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Ajit Singh** |
| Address | : | Sector 81, Knowledge city, SAS Nagar Mohali<br>Mohali - 140306, Punjab, India |
| Mobile | : | +91-7307398218 |
| Email | : | ajit.ph16228@inst.ac.in |
| Affiliation | : | Institute of Nano Science and Technology Mohali |

# SPINEL FERRITE NANOPARTICLES INCORPORATED ON MULTIPHASE $MOS_2$ ELECTROCATALYST FOR OXYGEN EVOLUTION REACTION

Merin Mary Sebastian, Nandakumar Kalarikkal, Alex Schechter
*Mahatma Gandhi University, Kerala, India, Ariel University, Israel*

Hydrogen electrolysis from water as a clean renewable energy is vastly studied for the past few decades, as an alternative carbon free fuel. Highly active catalysts are aggressively sought aim to lower the energy required to split water namely the hydrogen evolution reaction (HER) and even more so the anodic oxygen evolution reaction (OER). The 2H-phase $MoS_2$ suffers from limited active sites and low electroconductivity. In order to improve the catalytic activity,we have prepared and studied multiphase $MoS_2$, Nickel ferrite nanoparticles, and a hybrid of Nickel ferrite incorporated on $MoS_2$ (NFO-$MoS_2$)as a electrocatalysts for OER via a simple hydrothermal and sol gel methods. The combined phases of $MoS_2$ were identified by X-Ray Diffraction (XRD) and Raman spectroscopy. Electrochemical experiments, which include the polarization curves, and found that the electrocatalyst is highly efficient in Oxygen Evolution reaction which exhibits an overpotential of 330mV to reach 10mA/$cm^2$ which is comparable to the state- of-the art catalysts like $IrO_x$ . In addition, we will report the effect of KOH and anion adsorption on the catalytic activity of NFO-$MoS_2$ electrocatalyst.

**POS-101**

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| **Poster Presenter** | : | **Merin Mary Sebastian** |
| Address | : | School of Pure and Applied Physics Mahatma Gandhi University<br>Kottayam, Kerala - 686560, India |
| Mobile | : | +91-8281266325 |
| Email | : | merinmary002@gmail.com |
| Affiliation | : | Mahatma Gandhi University |
| Co Author(s) | : | Prof. (Dr). Nandakumar Kalarikkal, Prof. (Dr). Alex Schechter |

# EFFECT OF MN DOPED NI-CO MIXED OXIDE CATALYSTS ON UREA OXIDATION

S Santhosh[2], A Schechter[1*] and N Kalarikkal[2,3,4*]
[1]*Department of Chemical Sciences, Ariel University, Ariel 40 700, Israel*
[2]*International and Inter-University Centre for Nanoscience and Nanotechnology,*
[3]*School of Nanoscience and Nanotechnology,*
[4]*School of Pure and Applied Physics*
*Mahatma Gandhi University, Kottayam 686 560, Kerala, India*

Urea as a fuel for energy generation and storage has attracted increased attention, particularly in recent times, for it is stable, non-toxic, and abundantly available from nature. Urea possesses 10.1 wt% of hydrogen, which may be produced directly or indirectly. Nevertheless, the electrochemical oxidation of urea is generally sluggish and considered to be an inefficient process. However, inexpensive Ni-based catalysts have shown comparable urea oxidation activity to precious metals in an alkaline electrolyte, which steamed the use of this type of catalysts in Direct Urea Fuel Cell (DUFC) anodes. In the present study, we investigated urea oxidation on a novel three-dimensional transition metal-based catalyst. The mixed oxide catalyst synthesized using Manganese, Cobalt, and Nickel (Ni) were NiO, Mn-doped NiO, $Co_3O_4$, Mn-doped $Co_3O_4$, $NiCo_2O_4$ and Mn-doped $NiCo_2O_4$, utilizing a simple precipitation route for a comparative urea oxidation study. It was found that the Mn-doped $NiCo_2O_4$ catalyst exhibited the highest urea oxidation activity of 45.88 $mAcm^{-2}$ (at a potential of 1.30 V vs SHE), which is fifteen times higher than NiO and $Co_3O_4$ catalysts and twice that of bare $NiCo_2O_4$ spinel catalysts. Chronoamperometry curves of the Mn-doped $NiCo_2O_4$ catalyst demonstrated stable urea oxidation for over 2000 s. The significantly higher mass activity of Mn-doped $NiCo_2O_4$ catalyst is attributed to the least nano-crystallite size, better dispersion of Ni nuclei onto the spinel crystal matrix, enhanced Ni electrochemical active surface area, and lower bandgap, as observed in this study.

**POS-102**

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| **Poster Presenter** | : | **Shilpa Santhosh** |
| Address | : | International & Inter-University Centre for Nanoscience & Nanotechnology<br>Mahatma Gandhi University Kottayam - 686560, Kerala, India |
| Tel | : | +91-484-2424736 |
| Mobile | : | +91-9847977801 |
| Email | : | shilpas2296@gmail.com |
| Affiliation | : | International & Inter-University Centre for Nanoscience & Nanotechnology |
| Co Author(s) | : | Prof. (Dr.) Alex Schechter, Prof. (Dr.) Nandakumar Kalarikkal |

# STUDIES ON THE EVALUATION OF NANO UREA FOR SUSTAINABLE FINGER MILLET PRODUCTION AT KARAIKAL

S. RAJESHWARI and A.L. NARAYANAN
*Department of Agronomy, Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal UT of Puducherry*

Sustainable Agriculture plays a vital role in minimizing environmental pollution, thereby paves way for better yield through utilization of nano urea. Millet production has to be increased in the years to come to mitigate climate change concepts related to Sustainable Agriculture. Nano urea delivers nitrogen in regulated pattern by improving use efficiency for sustained production. Field experiment was conducted to study the performance of nano urea for sustainable finger millet production under All India Coordinated Small Millet Improvement Project with the guidance of Indian Institute Millet Research Hyderabad. The treatment included application of nano urea as seed treatment (1000 ml/ha of seeds), root dip (1000 ml/ha of seedlings), and foliar spray (500 ml/ha twice) in combination with 0%, 50% and 75% conventional urea, conventional (traditional) fertilizing method and without fertilizer application as control. The experiment was conducted in Randomized Block Design, replicated thrice. The results indicated that, plots receiving root dip of nano urea (1000 ml/ha) along with 50% and 75% recommended conventional urea showed higher economic yield (17.8 q/ha and 14.3 q/ha respectively). The yield obtained in root dip along with 50% conventional urea treatment showed around 56% higher yield compared to traditional method. Hence it can be concluded that root dip of nano urea (1000 ml/ha) may be recommended for sustainable finger millet production.

**Keywords:** Finger millet, Nano urea, Root dip, Conventional urea.

**POS-103**

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|---|---|---|
| **Poster Presenter** | : | **S. Rajeshwari** |
| Address | : | No. 6, First Cross, Shah Nagar, Thirunallar<br>Karaikal - 609607, Pondicherry, India |
| Mobile | : | +91-6385492779 |
| Email | : | rajeshwarisuresh98@gmail.com |
| Affiliation | : | Pandit Jawaharlal Nehru College of Agriculture & Research Institute<br>Karaikal UT of Puducherry |
| Co Author(s) | : | Dr. A.L. Narayanan |

# ROOM TEMPERATURE SOLID-LIQUID-SOLID CATION EXCHANGE IN $CSPBBR_3$ PEROVSKITE NANOCRYSTALS WITH COPPER

Fency Sunny[1], Subila K B[2*], NandakumarKalarikkal[1,3,4*]
[1]*International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam, Kerala, India*
[2]*School of Chemical Sciences, Mahatma Gandhi University, Kottayam, Kerala, India*
[3]*School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam, Kerala, India*
[4]*School of Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam, Kerala, India*
*Corresponding Author E-mail: nkkalarikkal@mgu.ac.in, subilakb@mgu.ac.in

Halide Perovskite materials have turned out to be a highly promising candidate for high efficiency solar cell (~25%) and LED applications in recent years owing to their excellent electrical, and optical properties. The issue overlaying the efficiency of these material-based devices is the toxic nature of lead and thermal instability of the material. The intrinsically soft ionic lattice structure of perovskites, facilitates both cation as well as anion exchange reactions, yieldingtuneable bandgaps, photophysical properties and different functional materials.In the present work, we have synthesised colloidal $CsPbBr_3$ perovskite nanocrystals and carried out a room temperature cation exchange process with copper bromide, furnishes copper (Cu) ions.

The XRD spectra confirms cubic crystal structure and a variation in crystalline size was observed on increasing the amount of Cu ions. The optical absorption and Photoluminescence (PL) studies show a striking variation in the spectral properties of $CsPbBr_3$ nanocrystals with an increasing concentration of Copper ions. The PL quantum yield has reduced from 90% to 20% also,the lifetime measurementsindicate a rapid decrease in lifetimewith the additionof Cu of about 5 wt%and subsequentlya rise in the lifetime components was observed on further increasing the amount of Cu, can be attributed to the formation of a new materials upon cation exchange.

**Keywords:** Lead-Halide Perovskites; Optical absorbance; Photoluminescence; Lifetime measurements.

**POS-104**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Fency Sunny** |
| Address | : | Research Scholar, IIUCNN, M G University<br>Athirumpuzha - 686560, Kerala, India |
| Mobile | : | +91-9526205488 |
| Email | : | fencysunny@gmail.com |
| Affiliation | : | IIUCNN, M G University |
| Co Author(s) | : | Dr. Subila K.B, Prof. Nandakumar Kalarikkal |

# PHOTOPHYSICAL AND CHARGE TRANSFER PROPERTIES OF ENGINEERED METAL OXIDE AND METAL NANOCLUSTER HYBRID

Fadeela Chundekat Ummer[a], Nandakumar Kalarikkal [b, *]
[a] International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam, Kerala-686560, India
[b] School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam, Kerala-686560, India
*cufadeelah@mgu.ac.in

In this work, we investigated the photophysical properties of metal oxide-metal nanocluster (MO-MNC) hybrids with special reference to its optical properties. As prepared MO-MNC hybrid shows superior optical properties. The prepared metal nanoclusters show characteristic excitation dependent luminescence. The MO-MNC hybrid system shows a significant photoluminescence quenching owing to the charge transfer from MNC to MO. The charge transfer properties were investigated with respect to photoluminescence life time analysis using TCSPC. The mechanism of quenching is determined as a conclusion from Stern-Volmer Plot. The entire system is characteristics were studied using UV-Visible absorbance, Photoluminescence, FTIR, and DLS.

**Keywords:** Metal nanoclusters, Metal-oxides, Photophysical properties,Charge transfer

**POS-105**

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|---|---|---|
| **Poster Presenter** | : | **Fadeela Chundekat Ummer** |
| Address | : | IIUCNN, Mahatma Gandhi University<br>Kottayam - 680560, Kerala, India |
| Mobile | : | +91-7994423664 |
| Email | : | cufadeelah@mgu.ac.in |

# DETECTION OF NITROBENZENE IN PRISTINE AND METAL FUNCTIONALISED 2D $VSE_2$ MONOLAYER (TMDC): A DENSITY FUNCTIONAL THEORY STUDY

*Seetha Lakshmy[a], Gopal Sanyal[b], Anthara Vaidyanathan[c], Nandakumar Kalarikkal[d] and Brahmananda Chakraborthy[e]*

[a]International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam, Kerala 686 560, India

[b]Mechanical Metallurgy Division, Bhabha Atomic Research Centre, Trombay, Mumbai, 400085, India

[c]Department of Chemistry, RamnarainRuia Autonomous College, Mumbai, 400019, India

[d]School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam, Kerala 686 560, India

[e]High Pressure &Synchroton Radiation Physics Division, Bhabha Atomic Research Centre, Trombay, Mumbai, 400085, India

An efficient and reusable sensor for detecting nitrobenzene (NB) is of urgent necessity due to its high noxiousness and hazardous properties[1]. We explore the transition metal (TM) functionalised 1T $VSe_2$ (where TM = Ag, Au, Pd and Ti) for its capability to sense NB by investigations. The grassroots mechanism for the interaction of TM on $VSe_2$ and the detailed study of NB adsorption on TM decorated $VSe_2$ is investigated by examining the orbital interactions, the density of states, and charge transfer analyses. The potential applicability of the sensor material concerning the stability and rapid recovery has also been investigated by ab initio Molecular Dynamics simulations and recovery time calculations [2]. Metals got bonded on $VSe_2$ due to charge transfer from metal to $VSe_2$. The adsorption of NB on $VSe_2$ and metal-doped $VSe_2$ is due to charge gain by the NB molecules. From the adsorption energy and charge transfer analysis, we predict that Pd decorated $VSe_2$ is the best system among the four metals on $VSe_2$ considered. Pd is bonded strongly on $VSe_2$ with a binding energy of -2.5 eV, and the $VSe_2$+Pd system is stable at room temperature, as seen from Ab-initio MD simulations. NB is adsorbed on $VSe_2$+Pd with suitable adsorption energy of -0.77 eV due to charge transfer of 0.17e from Pd 4d orbitals to 2p orbitals of O atoms of NB. From our extensive analysis, we firmly believe that Pd decorated $VSe_2$ is a promising NB sensing material that may be fabricated experimentally.

**Keywords** 2D transition metal dichalcogenides, VSe2, First-principles Density functional theory, Nitrobenzene, Sensing

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[2] H Zhang, F Huang, B Gilbert, JFJTJoPCB Banfield (2003) Molecular dynamics simulations, thermodynamic analysis, and experimental study of phase stability of zinc sulfide nanoparticles. 107: 13051-13060.

**POS-106**

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|---|---|---|
| **Poster Presenter** | : | **Seetha Lakshmy** |
| Address | : | Mandanath House Kanjiramattom P.O, Ernakulam - 682315, Kerala, India |
| Mobile | : | +91-9745080271 |
| Email | : | seethalakshmy2015@mgu.ac.in |
| Affiliation | : | International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam - 686560, Kerala, India |
| Co Author(s) | : | Gopal Sanyal, Anthara Vaidyanathan, Nandakumar Kalarikkal Brahmananda Chakraborthy |

# VERTICALLY GRAPHENE SHEETS - $TIO_2$ HYBRIDS FOR ENHANCED PHOTOCATALYSIS MECHANISM

Bosely Anne Bose[1], Smooni Anna[2], Abhijit Saha[3], Nandakumar Kalarikkal[1]
[1]School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam-686 560, Kerala, India
[2]International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam-686 560, Kerala, India
[3]UGC DAE CSR, Kolkata Centre, Kolkata-700098, West Bengal, India
Corresponding author: nkkalarikkal@mgu.ac.in

Vertically aligned graphene nanosheets (VGNs) have been successfully synthesised through a catalyst-free direct synthesis on a substrate by a facile and effective one-step hydrothermal approach. From the Scanning electron microscope observation, it is clear that graphene nanosheets are assembled into 3D porous architectures and uniformly deposited on substrate. On the substrate, VGNs were obtained under addition of alkaline medium even at low graphene oxide (GO) concentration. The VGNs-$TiO_2$ hybrids have also been developed which will have large surface area for adsorption of many pollutants' trough the electrostatic attraction and π- π interaction. The chemical composition and structural properties of the as synthesized samples were analysed with the help of Raman and FTIR spectroscopy and XRD technique. The morphological characterizations have been performed using FESEM analyses. The dye absorption studies are also studied

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[3] S. Shuang, Ruitao Lv, Xiaoyang Cui,aet al. **RSC Adv., l8,**(2018), 5784-5791

**POS-107**

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|---|---|---|
| **Poster Presenter** | : | **Bosely Anne Bose** |
| Address | : | School of Pure and Applied Physics, Mahatma Gandhi University Kottayam - 686560, Kerala, India |
| Mobile | : | +91-8281336177 |
| Email | : | boselybose@gmail.com |
| Affiliation | : | School of Pure and Applied Physics, Mahatma Gandhi University |
| Co Author(s) | : | Smooni Anna, Abhijit Saha, Nandakumar Kalarikkal |

# INVESTIGATIONS ON THE MULTIFERROIC PROPERTIES OF P (VDF-TRFE) / FERRITE SELF-STANDING FILMS

M T Rahul1, B Raneesh1, Nandakumar Kalarikkal2
1Department of Physics, Catholicate College, Pathanamthitta, Kerala-689 645, India
2School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam 686 560, India

Composite materials developed using poly(vinylidene fluoride trifluoroethylene) (P(VDF-TrFE)) and magnetic ceramics found substantial research attention due to their room-temperature multiferroics properties. Since the copolymer, P(VDF-TrFE) crystallizes mainly in the ferroelectric β configuration exhibits promising ferroelectric and piezoelectric characteristics. The use of the magnetic filler in the P(VDF-TrFE) matrix introduces magnetic ordering in the developed composites. In the present study, we have developed spinel ferrite nanoparticles loaded P(VDF-TrFE) films by a simple approach and studied their multifunctional properties. Interestingly, the developed composite samples exhibit room-temperature multiferroic nature and the strength of the coupling between the ferroelectric and magnetic orderings is greatly depends on the availability of the magnetic ceramic in the P(VDF-TrFE) matrix. Apart from the magnetoelectric property, dielectric constants of the composites were found to improve with ferrite nanoparticles loading. The use of polymer for developing the multiferroics also brings flexibility in the developed systems which is also beneficial for the device development.

**Keywords:** P(VDF-TrFE), Spinel ferrite, Composites, Multiferroics

**References**

1. P Martins et. al., Adv. Funct. Mater. 2013, 23, 3371-3385.
2. Sobi K Chacko et. al., New J. Chem., 2020

**POS-108**

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|---|---|---|
| **Poster Presenter** | : | **M T Rahul** |
| Address | : | Department of Physics, Catholicate College<br>Pathanamthitta - 689645, Kerala, India |
| Mobile | : | +91-9497326972 |
| Email | : | rahulmt05@gmail.com |
| Affiliation | : | Catholicate College, Pathanamthitta |

# UNRAVELING THE EFFECTUAL BINDING POTENTIAL OF CARBON NANOTUBES AND NORFULLERENE AGAINST MULTIPLE TARGETS OF SARS-COV-2 BY COMPUTATIONAL MODELING & VIRTUAL SCREENING

1,2 Sinosh Skariyachan*, 2Dharshini Gopal, 3Akshay Uttarkar, 3Vidya Niranjan
1Department of Microbiology, St. Pius X College Rajapuram, Kasaragod, Kerala, India
2Department of Bioinformatics, Manipal School of Life Sciences, Manipal Academy of Higher Education, Manipal, India
3Department of Biotechnology, RV College of Engineering, Bengaluru, Karnataka, India
*Corresponding author: sinoshmicro@stpius.ac.in, sinoshskariya@gmail.com

COVID-19 became a potential healthcare concern and the latest variants of SARS CoV-2 resulted in massive transmission of the diseases. Though several vaccines are available, no potential drug candidates developed yet. Thus, the present study aimed to predict the possibility of carbon-based nanoparticles as the probable drug candidates towards the selected targets of SARS-CoV-2. The 3D structures of carbon-based nanoparticles such as nanotubes and nanofullerene were predicted computationally, and the effectual binding of these nanoparticles to spike glycoprotein, main protease, papain-like protease, and RNA binding domain of the nucleocapsid proteins of SARS-CoV-2 was also predicted by molecular docking. The interaction stability of the best-docked complex was further validated by molecular dynamic (MD) simulations. The pharmacophoric features and ADMET properties of the carbon nanomaterials were predicted. This study revealed that carbon fullerene and nanotube showed potential effectual binding with the prioritized multi-targets of SARS-CoV-2. The study further depicted that carbon nanotube showed better effectual binding to the selected targets than carbon fullerene. The dynamic simulation studies revealed that the binding of nanoparticles with selected targets was stable throughout the interaction trajectories. Thus, the present study illustrated that carbon nanotubes and fullerene can be effective binders against several targets of SARS-CoV-2, and the study can be scaled up in experimental level to validate the hypothesis and design novel nanomaterial-based drug formulations against SARS-CoV-2. Keywords: COVID-19, SARS-CoV-2, Multiple targets, Carbon nanotubes, Carbon norfullerene, Effectual binding

**POS-109**

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|---|---|---|
| **Poster Presenter** | : | **Dr. Sinosh Skariyachan** |
| Address | : | Assistant Professor Department of Microbiology, St. Pius X College Rajapuram (A Govt Aided College Affiliated to Kannur University, Kerala) Kasaragod - 671532, Kerala, India |
| Mobile | : | +91-9739654015 |
| Email | : | sinoshmicro@stpius.ac.in |
| Affiliation | : | St. Pius X College, Rajapuram, Kasaragod, Kerala |
| Co Author(s) | : | Dharshini Gopal, Akshay Uttarkar, Vidya Niranjan |

# SYNTHESIS AND CHARACTERISATION OF $ER_3FE_5O_{12}$ INCORPORATED PVDF-HFP POLYMER NANOCOMPOSITE FILMS FOR MULTIFUNCTIONAL APPLICATIONS

**Sobi K Chacko[1], B Raneesh[1] and Karthik Vinodan[1]**

[1]Department of Physics, Catholicate College, Pathanamthitta, Kerala-689 645, India

Polymer based magneto electric materials have potential application in the field of next generation device fabrication due to its light weight, high flexibility, improved dielectric properties and superior illustrative nature. Here we report the fabrication of free standing self -polarised films of Erbium Iron Garnet (**$Er_3Fe_5O_{12}$**-EIG) nanoparticles incorporated Polyvinylidene fluoride co-hexafluoropropylene (**PVDF-HFP)** prepared using a simple solvent casting method. Role of EIG nanoparticles in the electroactive nucleation of PVDF-HFP has been studied using X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR) technique. Morphological changes in the prepared polymer nanocomposite films samples has been analysed using Field emission scanning electron microscope (FESEM). A noticeable enhancement in the dielectric constant has been observed for the EIG loaded polymer nanocomposite films.The ferroelectric properties of the prepared PVDF-HFP/EIG films have been analysed by P-E measurements and the composite films show remarkable improvement in the maximum polarisation.

**POS-110**

| | | |
|---|---|---|
| **Poster Presenter** | **:** | **Sobi K. Chacko** |
| Address | : | Department of Physics Catholicate College<br>Pathanamthitta - 689645, Kerala, India |
| Mobile | : | +91-9400705885 |
| Email | : | sobikchacko@gmail.com |
| Affiliation | : | Catholicate College Pathanamthitta |
| Co Author(s) | : | B Raneesh, Karthik Vinodan |

# STRUCTURAL, DIELECTRIC AND MAGNETOELECTRIC PROPERTIES OF MODIFIED PVDF-FERRITE POLYMER NANOCOMPOSITES

Bhadrapriya B C1, Rahul M T2, Nandakumar Kalarikkal1* 1 School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam-686560, Kerala, India
2Catholicate college, Pathanamthitta-689645, Kerala, India
*Corresponding author: nkkalarikkal@mgu.ac.in

Poly(vinylidene fluoride) (PVDF) is a ferroelectric polymer having good dielectric properties, physical and chemical resistance and biocompatibility. Among the five different phases of PVDF, β, γ and δ are the polar phases among which β-phase has the highest polarity 1 . Several methods have been explored by the researchers to enhance the electroactive phase content in PVDF including electrical poling, mechanical stretching, electrospinning, inclusion of nanofillers, hydrated salts etc. Magnetoelectric polymer nanocomposites combining ferroelectric polymers and magnetostrictive fillers have drawn significant interest due to their multifunctionality and flexibility 2 . Here we report the synthesis of PVDF nanofibers modified with hydrated cobalt nitrate salt and incorporated with ferrite nanoparticles.

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**POS-111**

| | | |
|---|---|---|
| **Poster Presenter** | **:** | **Bhadrapriya B C** |
| Address | : | Mahatma Gandhi University<br>Kottayam - 686560, Kerala, India |
| Mobile | : | +91-8281129438 |
| Email | : | bcbhadrapriya@gmail.com |
| Affiliation | : | School of Pure and Applied Physics |
| Co Author(s) | : | Rahul M T, Nandakumar Kalarikkal |

# LUMINESCENT GOLD NANODOTS FOR ADVANCED BIOIMAGING APPLICATIONS

***Raji Vijayamma[a], Sreelakshmi K.P[b]., Nandakumar Kalarikkal[b]***

[a]International and Inter University Centre for Nanoscience and Nanotechnology, [b]School of Pure and Applied Physics,
Mahatma Gandhi University, Kottayam, Kerala, India PIN- 686560
Email: rakhiraj09@gmail.com

Gold nanoparticles (AuNPs) and gold nanoclusters (AuNCs) have received a lot of attention in nanotechnology, compared with other materials. Fluorescent gold nanoclusters (AuNCs) have emerged as a novel kind of promising fluorescent probe for high-performance sensors and bioimaging because of their advantageous photophysical properties, as compared to small-molecule dyes, fluorescent proteins, and quantum dots. AuNCs can be synthesized by using different ligands such as glutathione, dendrimers, polymers, and protein; and as-prepared AuNCs based on different synthetic methods have various fluorescence quantum yield (QY). The main objective of the proposed study is to develop a biocompatible imaging tool for early diagnosis of cancer without any adverse effects. Both the safety assessment and therapeutic efficiency of nanoparticles are crucially important for their applications in biomedicine. For both aspects, it is necessary to address some basic questions about how the biological molecules or cells interact with NPs. The proposed study comprises biosynthesis of gold nanoclusters by using biomolecules such as Glutathione and Bovine Serum Albumin (BSA) as ligands and further bioconjugation of the materials using folic acid/Vitamin B12. Followed by biosynthesis, we have done different characterization studies such as, UV-Visible, FTIR, Dynamic Light Scattering, photoluminescence and morphology by AFM and TEM.

**POS-112**

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|---|---|---|
| **Poster Presenter** | **:** | **Raji Vijayamma** |
| Address | : | IIUCNN, Mahatma Gandhi University, PD Hills P.O. Kottayam - 686560, Kerala, India |
| Mobile | : | +91-9447712540 |
| Email | : | rakhiraj09@gmail.com |
| Affiliation | : | International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University |
| Co Author(s) | : | Sreelakshmi, Nandakumar Kalarikkal |

# SYNTHESIS AND CHARACTERIZATION OF ZNO NANOPARTICLES FROM THE SEED EXTRACT OF *CASSIA TORA* AND THE STUDY OF ELECTROCHEMICAL BEHAVIOR OF DOPAMINE USING ZNO NANOPARTICLES

**Jyothi H. Kini [1], Mamata Prabhugaonkar[2],**
[1]Department of PG Studies and Research in Industrial Chemistry, Sir M.V. Govt. Science College, Bommanakatte, Bhadravathi - 577 302, Karnataka, India
[2]Post-Graduate Department of Chemistry, St. Xavier's College, Mapusa-Goa, India
Email ID: jyothirshenoy@gmail.com

Green synthesis of ZnO nanoparticles was made from the seed extract of *Cassia tora* using bio-synthetic approach. The phytochemicals present in the *Cassia tora* seed extract contain bio essential flavonoids, which imparts biocompatible and electrochemical properties to the synthesized nano particles. In the synthesis, Zinc nitrate was taken as a precursor. This plant mediated method was found to be simple, cost effective, safe and environmentally benign. Seed extract acts as reducing as well as stabilizing agent. The characterization of synthesized ZnO nanoparticles was done by X-ray diffraction (XRD), UV-visible spectroscopy, Fourier transform infrared spectroscopy (FTIR) and Scanning electron microscopy (SEM). The electrochemical response of Dopamine (DA) in buffer solution on the ZnO modified Glassy carbon electrode was determined by using cyclic voltametric technique at different scan rates. The ZnO modified Glassy carbon electrode showed excellent electrochemical enhancement of the peak current for Dopamine. Linear relationship between anodic and cathodic peak current v/s square root of scan rate was studied.

**POS-113**

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|---|---|---|
| **Poster Presenter** | : | **Dr. Jyothi Kini H.** |
| Address | : | Department of PG studies and Research in Industrial Chemistry<br>Sir M.V. Govt. Science College, Bommanakatte, Bhadravathi<br>Shivamogga - 577302, Karnataka, India |
| Tel | : | +91-8282-270296 |
| Mobile | : | +91-8618081529 |
| Email | : | jyothirshenoy@gmail.com |
| Affiliation | : | Sir M.V. Govt Science College, Bhadravathi |
| Co Author(s) | : | Mrs. Mamata Prabhugaonkar |

# NANOTECH USED FOR PROSTHETICS

**What is nanotechnology?**
Nanotechnology is science engineering and physics which is conducted in a nanoscale which helps us to innovate things at the smallest scale, which is limited to our measurement of technology.

**Where is it used?**
Nanotech is one aspect which is being used in many areas such as information technology, homeland security, medicine, transportation, energy, food safety, & environmental science, among many others.

One such thriving area is biomedical engineering field, such as making prosthetics for human beings and resolving the various issues which we are currently facing in an efficient way. These include the innovations related to human parts such as the artificial arm, leg, skin, retina which can be in turn used to create prosthetics for animals too. This is one among many areas where the nanotechnology plays a pivotal role in the evolution of mankind moving forward in the foreseeable future.

**Why I chose this topic?**
We usually come across many people who have been veterans in wars and even people who have met with road accidents. This often is a common state of limited access to the technology at the macroscopic scale. This is where the role of nanotechnology comes into picture. I choose this topic as a source of learning to create a solution not only for the veterans but also on a small scale for many other facets in our lives. Apart from this, we can also go ahead leaps and bounds in the efficiency of the use of natural materials by decreasing the size of materials without losing any significance which in turn contributes in the betterment of our planet Earth.

My interests in nanotechnology have been since the commencement of my high school which gave rise to the questions which I had in this field. I intend on putting in more efforts to get the vital insights in this technology which in turn will help me apply it in biomedical field to contribute to the mankind and improving on the sustainability of life.

**POS-114**

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|---|---|---|
| **Poster Presenter** | : | **Naleen Venkatesh** |
| Address | : | #264, 4th Cross, 12th Main Lal Bahadur Sastry Nagar, Anjanapura 10th Block, Bangalore - 560108, Karnataka, India |
| Mobile | : | +91-8123252136 |
| Email | : | naleenspes@gmail.com |
| Affiliation | : | ACS College of Engineering |
| Co Author(s) | : | Ananya R |

# COMPOSITES OF SURFACE MODIFIED AGAVE AMERICANA FIBERS AND SILVER NANO PARTICLES FOR REMOVAL OF METHYLENE DYE FROM WATER

Shikha Dogra and Dr. Ashvinder Kumar
Department of Chemistry, Sri Sai University, Palampur (H.P.) India 176061

Nowadays, water contamination is a serious issue all over the world, dyes used in textile industries and the industrial wastes are the main source of such contamination. Rapid growth in industrial development has resulted in the generation of a wide range of harmful toxic pollutants such as dyes, heavy metals, cleansers, acids etc. Dyes are the significant class of contaminants which are tremendously used in several industries like plastic, paint, pharmaceuticals, textiles etc. Several conventional methods such as coagulation, flocculation, adsorption, etc. have been used for the elimination of dyes from wastewater. In present work, efforts were made to modify the surface of Agave americana fibers (AAFs) by utilizing a sequence of chemical techniques and their subsequent utilization as adsorbent to remove methylene blue dye from waste water. The surface modification of AAFs was carried out by utilizing polydopamine (PDA) coating agent, which were subsequently graft copolymerized with vinyl monomer acrylic acid (AAc), and finally doped with silver nano particles (AgNPs) to synthesize nano composites. The synthesized surface modified AAFs and nano composites were characterized by using SEM, FTIR and XRD technique and finally assessed for their potential in removal of dye from waste water. The grafting of PDA, polyacrylic acid, and silver nanoparticles onto the cellulosic fibre resulted in morphological changes and the formation of new bands in the FTIR spectra of the grafted samples. Thus, confirming the grafting of polydopamine, polyacrylic acid and silver nanoparticles onto the cellulosic fibre. Among different surface modified fibers, silver nanoparticles doped/polyacrylic acid/PDA/ Agave Americana composites have been found to have a high potential (91% removal efficiency) in removal of dye from wastewater.

**POS-115**

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|---|---|---|
| **Poster Presenter** | : | **Shikha Dogra** |
| Address | : | V. P. O Dharer Tehsil Baijnath District Kangra - 176125<br>Baijnath Himachal Pradesh, India |
| Tel | : | +91-78076-08144 |
| Mobile | : | +91-7807608144 |
| Email | : | shikhadogra392@gmail.com |
| Affiliation | : | Sri Sai University, Palampur |
| Co Author(s) | : | Shikha Dogra |

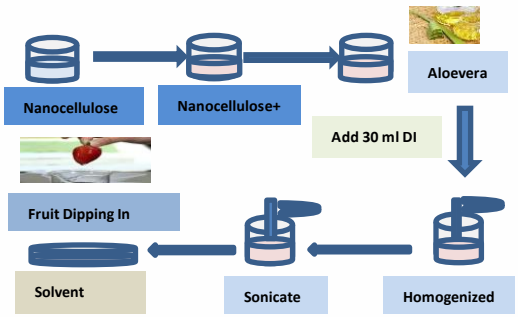
# EFFECT OF ALOE VERA INCORPORATED CHITOSAN /NANO CELLULOSE BASED EDIBLE COATING MATERIAL TO ENHANCE THE SHELF LIFE OF FRUITS AND VEGETABLES

Anjumol K.S[a,b], Aiswarya P.R[b], Shabna P.S[c], Sneha Sabu Mathew[d], Blessy Joseph[e], Abhimanyu Tharayil[d], Hanna J Maria[d], Petr Spatenka[a], Sabu Thomas [b,d,e].

[a]Department of Materials Engineering Czek Technical University, Prague
[b]School of Chemical Sciences Mahatma Gandhi University, Kottayam 686560, Kerala, India
[c]Department of Polymer Engineering School of Technology and AppliedSciences, Center for Professional and Advanced Studies Pullarikkunnu Kottayam Kerala India 686041
[d]School of Energy Materials, Mahatma Gandhi University, Kottayam 686560, Kerala, India
[e]Department of Chemical Sciences, University of Johannesberg, P.O.Box 17011,Doornfontein,201,Johannesberg,South Africa
[f]International & Interuniversity Centre for Nanoscience & Nanotechnology, Mahatma Gandhi University Kottayam 686560, Kerala, India

Healthy and good quality food with lesser synthetic preservatives have a great demand nowadays. To increase the quality of food a lot of chemicals are used that have antibacterial properties but might create health issues in the long run. A bio based edible coating thus becomes a necessity to increase the food quality there by improving the quality of human life[1]. Chitosan, nanocellulose and aloe vera composite can be used as an alternative to synthetic plastic-based fruit coating. Chitosan has antimicrobial properties against bacteria and molds. Nanocellulose reinforces the matrix chitosan and together forms an effective bio composite for edible coating[2]. This work involves the development of edible coatings based on Chitosan and nanocellulose. Aloe vera known for its antioxidant and antimicrobial property has been proposed as an active ingredient that can be incorporated into the biodegradable film[3]. Varying volumes of aloe vera (0.25ml, 0.35ml, 0.5ml and 2.5ml) were added to fabricate nanocomposite films by solvent casting. Transparent films were obtained and the morphology was analysed using SEM. The incorporation of aloe vera was confirmed from FTIR. UV-visible spectroscopy studies clearly show reduction in light transmittance for the nanocomposites films containing aloe vera. The contact angle studies showed increase in hydrophobicity initially. Maximum tensile strength was obtained with 0.25ml of aloe vera. The potential use of nanocomposite solution as edible films was demonstrated in green chillies which showed lower weight loss after 3-days when compared with uncoated chillies. Chitosan/nanocellulose nanocomposites enriched with aloe vera has been proposed as a potential edible food coating material.

Schematic diagram for the preparation of edible coating films with aloe vera added as additive.

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**POS-116**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Anjumol K.S.** |
| Address | : | Mahatma Gandhi University Priyadarshini Hills<br>Kottayam - 686560, Kerala, India |
| Mobile | : | +91-9645457542 |
| Email | : | anju.amks96@gmail.com |
| Affiliation | : | School of Energy Materials, Mahatma Gandhi University |
| Co Author(s) | : | Aiswarya P.R, Shabna P.S, Sneha Sabu Mathew, Blessy Joseph |

# MORPHOLOGICAL ANALYSIS OF SUSTAINABLE NANOCOMPOSITES OF NANOCELLULOSE AND NATURAL RUBBER

Milanta Tom[1], Sabu Thomas[1], Jozef Haponiuk[2], P.K. Mohamed[3]
[1]*School of Energy Materials, Mahatma Gandhi University, Kottayam, Kerala, India*
[2]*Gdansk University of Technology, Poland*
[3]*Apollo Tyres Ltd.*
*E-mail: milantaann10@gmail.com*

Sustainable nanocomposites with their elite properties attract great interest in scientific research and industry. The investigation of nanocellulose reinforced elastomers has intensified these years, facilitating its use in developing high-performance products. The use of nanocellulose as a reinforcing filler will decrease the reliance on conventional fossil fuel based filler in rubber industry. Morphological analysis of nanocomposites can be considered as a prediction tool for its performance. Atomic force microscopy (AFM) is an excellent tool to study morphology and texture of nanocomposites. In this study we are utilizing AFM to understand the dispersion of the nanofiller, its interaction between the matrix and the effect of nanofillers on the surface texture of nanocomposites. The amplitude parameters give information about statistical average values, shape of the histogram heights and other extreme properties. This study enables more comprehensive understanding of nanocomposites. The commercial exploitation of natural and abundantly available polymers is sure to open new horizons in interdisciplinary science and technology.

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**POS-117**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Milanta Tom** |
| Address | : | School of Energy Materials Mahatma Gandhi University<br>Kottayam - 686560, Kerala, India |
| Mobile | : | +91-9544120399 |
| Email | : | milantaann10@gmail.com |
| Affiliation | : | School of Energy Materials, Mahatma Gandhi University, Kottayam |
| Co Author(s) | : | Prof. Sabu Thomas, P.K. Mohamed, Jozef Haponiuk |

# NANOSECOND OPTICAL NONLINEARITY IN SILVER DECORATED GRAPHENE OXIDE NANOHYBRID FABRICATED VIA LASER ABLATION

Parvathy Nancy2, 4, Sabu Thomas2, 3, 4, Nandakumar Kalarikkal1, 2, 4 1
School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam-686560, Kerala, India
2 International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam-686560, Kerala, India
3 School of Chemical Science, Mahatma Gandhi University, Kottayam-686560, Kerala, India
4 School of Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam-686560, Kerala, India
E-mail: nkkalarikkal@mgu.ac.in

Unlike the traditional methods, herein, we report a laser-assisted green synthesis of silver nanoparticles that are anchored onto graphene oxide (GO) surface by a single step reaction via laser ablation using second & third harmonics of an Nd:YAG laser. Natural graphite powder was used to synthesize GO with modified Hummers' method [1]. The nonlinear optical properties of silver-nanoparticle decorated multilayered graphene oxide hybrid have been investigated in the nanosecond time scale by Z-scan technique. The enhancement in NLO properties in GO-Ag nanohybrid may be attributed to the complex energy band structures which promote resonant transition to the conduction band via surface Plasmon resonance (SPR) at low lase r intensities and excited state transition (ESA) to the conduction band of GO at higher intensities [2, 3]. Along with it, the photo-generated charge carriers in the conduction band of silver or the increase in defect states during the formation of GO-Ag nanohybrid may contribute to ESA. Open aperture Z-scan measurement indicates reverse saturable absorption (RSA) [4] behavior of the synthesized nanohybrid which is a clear indication of its optical limiting (OL) ability.

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[2] Kumar et al. Appl. Phys. Lett, 95, p 191911, (2009)
[3] Gu et al. Appl. Phys. Lett, 92, p 091118, (2008)
[4] Lim et al. Nat. Photon, 5, p 554, (2011)

**POS-118**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Dr. Parvathy Nancy** |
| Address | : | Post Doctoral Fellow, International and Inter University Centre for Nanoscience and Nanotechnology (IIUCNN) Mahatma Gandhi University, Kottayam - 686560, Kerala, India |
| Mobile | : | +91-9747638599 |
| Email | : | parvathy88.nancy@gmail.com |
| Affiliation | : | Mahatma Gandhi University, Kottayam,Kerala |
| Co Author(s) | : | Prof. Nandakumar Kalarikkal, Prof.Sabu Thomas |

# IRON OXIDE NANOPARTICLES EFFECTS ON SEED GERMINATION AND PLANT GROWTH IN CAPSICUM ANNUM L, (CHILLI) AND S. MELONGENIUM (BRINJAL)

**Sushma shree. K[1] and Shankramma Kalikeri***

[1]* Department of Water and Health, JSS Academy of Higher Education and Research Sri Shivarathreeshwara Nagara, Mysuru - 570 015 Karnataka, INDIA

*Corresponding author Email: shankrutk@jssuni.edu.in: shannkrutk@gmail.com

Nanotechnology is a rapidly evolving scientific field. This is attributable to the high expectations that have been put on nanotechnology's accomplishments in different areas of life. The impact of NPs on plant growth is restricted. Phyto-nanotechnology, or the application of nanotechnology to plant systems, has gotten a lot of press in recent years. Phyto-nanotechnology allows for the targeted application of nanomaterials to agricultural crops and other plants, potentially improving or adding plant functions, as well as environmental monitoring and pollution resistance. Furthermore, nanomaterial has, as unique carriers of agrochemicals; allow site-targeted, regulated nutrient delivery with improved crop safety. Nano tools, such as Nano biosensors, promote the production of high-tech agricultural farms because of their direct and planned applications in the precise management and control of inputs (fertilizers, pesticides, herbicides). Despite these promising prospects, obstacles remain, such as the effects of various plant cellular structures on nanomaterial delivery and the induction of various levels of phytotoxicity in plants. Present work will discuss the promising applications like seed germination and crop improves in this context, as well as our perspectives on this complex and exciting field.

**Keywords:** Iron Nanoparticles; Plant's extract; *Capsicum annuum L.* (Chilli) and *S. melongena* (Brinjal)

**POS-119**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Sushma Shree K** |
| Address | : | Kilarlahalli Post Pavagoda Tumkur, Karnataka, India |
| Mobile | : | +91-8105587170 |
| Email | : | ksushma.21012@gmail.com |
| Affiliation | : | JSS Academic higher education and Research, Mysuru |
| Co Author(s) | : | Sushma shree. K, Shankramma Kalikeri |

# SMART NANOCONTAINER-BASED ENVIRONMENT FRIENDLY PROTECTIVE COATINGS ON MILD STEEL

Aarti Gautam[1,2#], K.V. Gobi[2] and R. Subasri[1]
[1]Centre for Sol-Gel Coatings, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Balapur, Hyderabad - 500 005
[2] Department of Chemistry, National Institute of Technology, Warangal - 506 004
#- Presenting author, Email id: aartigautam1993@gmail.com

In the research area of corrosion prevention and control, eco-friendly sol-gel coatings on mild steel have shown a significant rise. In this context, sustained release-based sol-gel coatings containing inhibitor loaded smart nanocontainers are promising for prolonging the corrosion protection of mild steel. The purpose of this study was to investigate the self-repairing ability of the functionalized sol-gel coatings. For this, corrosion inhibitor benzotriazole was loaded into the polyelectrolyte multi-layered layer-by-layer nanocontainers and halloysite nanotubes. Inhibitor loaded nanocontainers were characterized using SEM, TEM, XRD, and BET pore volume analysis. Zeta potential was measured for layer-by-layer nanocontainers to confirm the deposition of each polyelectrolyte layer. The inhibitor loaded nanocontainers were dispersed into the sol-gel matrix and deposited on mild steel substrates by dip coating followed by curing. The anticorrosion performance of sol-gel coatings was evaluated using electrochemical studies in 3.5 wt% NaCl solution. Self-repairing ability of the coatings was studied using scanning vibrating electrode technique. The results revealed that the coatings derived using halloysite nanotubes as the nanocontainers exhibited higher self-repairing corrosion protection when compared to coatings based on polyelectrolyte multi-layered layer-by-layer based nanocontainers.

***Keywords:*** *Smart Nanocontainers; Environment Friendly; Protective Coatings; Mild steel*

**POS-120**

| | | |
|---|---|---|
| **Poster Presenter :** | **Aarti Gautam** | |
| Address | : | H. No. 8-93/1, Sai Nagar Colony, Road No.5, Phase-2<br>Balapur, Hyderabad - 500005, Telangana, India |
| Tel | : | +91-40-24452504 |
| Mobile | : | +91-8077013529 |
| Email | : | aartigautam1993@gmail.com |
| Affiliation | : | Centre for Sol-Gel Coatings, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Balapur, Hyderabad |
| Co Author(s) | : | K. V. Gobi, R. Subasri |

# NOVEL SPINEL NANOPARTICLES BASED ABSORBER COATED RECEIVER TUBES FOR CONCENTRATED SOLAR THERMAL INDUSTRIAL APPLICATIONS

K.K.Phani Kumar, M.Prasad Shiva, S.R.Atchuta and S.Sakthivel
Centre for Solar Energy Materials, International Advanced Research Centre for Powder Metallurgy and New Materials, Balapur PO, Hyderabad-500 005, India

Solar thermal conversion technology plays a prominent role in converting solar energy to heat energy due to its wide range of applications. Solar selective absorber coatings (SSACs) on the receiver tube are an essential component in solar thermal systems to attain high photo-thermal conversion efficiency. SSAC helps to absorb solar radiation incident on its surface by its high absorption in the active solar region (0.3 - 2.5 µm) and restricts the heat lost by low thermal emissivity (2.5 -25 µm). SSACs with thermal, mechanical and corrosion stability at operating temperatures (<500 °C) can improve the performance of the solar thermal system. We developed transition metal oxide (spinel)-based cost-effective SSACs on the substrate (SS 304) using the wet chemical and dip coating techniques. Developed tandem SSAC's shows selective nature of high solar absorptance, $\alpha$ = 0.95 and emittance, $\varepsilon$ = 0.15. These SSACs on SS 304 showed thermal stability (up to 500 °C for 250hrs), good adhesion and wide angular solar absorptance. It upscaled the development of SSACs on SS 304 tubes from lab scale to prototype level with uniform properties by cost-effective wet chemical and dip-coating process. 2-meter long non-evacuated receiver tubes were developed to carry out the performance studies in comparison with commercially procured non-evacuated receivers by using the parabolic trough test rig facility.

**POS-121**

| | | |
|---|---|---|
| **Poster Presenter** | : | **K. K. Phani Kumar** |
| Address | : | Senior Research Fellow, Centre for Solar Energy Materials<br>International Advanced Research Centre for Powder Metallurgy and<br>New Materials, Balapur PO, Hyderabad - 500005, Telangana, India |
| Mobile | : | +91-9505454500 |
| Email | : | karthikphani8493@gmail.com |
| Affiliation | : | International Advanced Research Centre for Powder Metallurgy & New Materials |
| Co Author(s) | : | M. Shiva Prasad, S. R. Atchuta, S. Sakthivel |

BENGALURU INDIA NANO March 7-9 2022

NANOTECH FOR SUSTAINABLE FUTURE

# AN INNOVATIVE IDEOLOGY AND A DEVELOPMENTAL SUSTAINABILITY RELATED TO APPLIED SCIENCES NANOTECHNOLOGY AND ITS PERSPECTIVES FOR INTERACTIONS OF HUMAN WELFARE (AN EASY TACKLING AND A KNOWLEDGE GAINING REVIEW ASPECTS AND ITS SIGNIFICANCE). JUST ENJOY THE GAME WITH SOME CODES, NUMBERS

R. Srinivasa, Biology Senior Grade Lecturer,
Narayana Intensive Medical and IIT Academy, Narayana PU College, BLR- KMH and RMN Branch,
Bengaluru-560043.
Email:vasavenu28@gmail.com. Phone No: 9148584632

Science in latin means scientia or knowledge.The principle of science is marking a departure of bookish learning which continues to shape our system and causes a gap between college home and community inculcating creativity and initiative is possible if we perceive and treat children as participants in learning not as receivers of a fixed body of knowledge where syllabus designers of life sciences have tried to address the problem of greater consideration for the child psychology giving high priority and space to opportunities for contemplations and wondering discussions in small groups activities requiring hands on experience through a novel mind trickling plot related to nanotechnology in sustainable future recent developments and its significance is discussed like a game making children life at college at all levels a happy experience rather than a source of stress or boredom which gives a more hope to encourage more and more goal achievers to reach great heights which plays a very important role in inclusive development of monitoring their curriculum and also research and development through a creative and innovative mechanism.

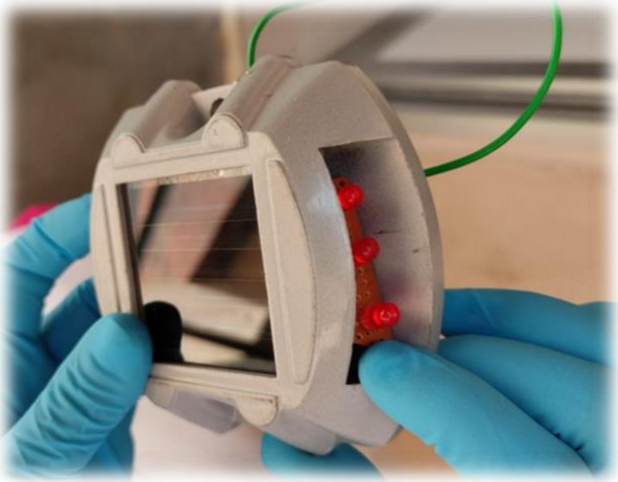
**Keywords**: improvement, innovative, Nanotechnology, future, tools

**POS-122**

| | | |
|---|---|---|
| **Poster Presenter** | : | **R Srinivasa** |
| Address | : | 2/61 Sree Venugopala Swamy Temple Lingarajapuram<br>Bengaluru - 560084, Karnataka, India |
| Tel | : | +91-80-25446366 |
| Mobile | : | +91-9148584632 |
| Email | : | vasavenu28@gmail.com |
| Affiliation | : | Narayana Intensive Medical and IIT Academy |

# LARGE AREA PEROVSKITE MODULES WITH ENHANCED STABILITY FOR NICHE APPLICATIONS

After a decade of research in perovskite solar cells (PSCs) researchers all over the world are aiming for large area PSCs with real-time applications. Metal cathode, organic hole transporting material (HTM) based PSCs still face challenges such as processing cost and device instability. Carbon based PSCs (CPSCs) were introduced to overcome these shortcomings. Low temperature conducting carbon electrodes were developed for HTM and metal cathode free PSCs. Lab scale CPSCs (0.12cm$^2$) were fabricated with low temperature carbon electrodes and an efficiency of 12% was attained. The cells were further scaled up to fabricate mini modules, where 2 cells were connected in series to achieve voltage > 1.5V. Scribing for module fabrication was optimized further to fabricate minimodules with area > 9cm$^2$ where 6 cells are connected in series to attain voltage > 4.6V. As real-time application the modules were used to power LEDs in a road reflector and was successfully demonstrated in laboratory and outdoor conditions. Carbon based module exhibited enhanced photovoltaic performance and stability when compared to HTM free gold-based PSCs.



Road reflector powered by CPSC module

**POS-123**

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|---|---|---|
| **Poster Presenter** | : | **Reshma Dileep K** |
| Address | : | Balapur P.O., Hyderabad - 500005, Telangana, India |
| Mobile | : | +91-8848833703 |
| Email | : | reshmadileepk@gmail.com |
| Affiliation | : | International Advanced Research Center For Powder Metallurgy & New Materials (ARCI), Hyderabad |
| Co Author(s) | : | Dr.V.Ganapathy, Dr.R.Easwaramoorthy, Dr.Tata Narasinga Rao |

# MOTH PROOFING OF WOOL FABRIC USING NANO KAOLINITE

Woollen products are susceptible to the attack of wool moth. An attempt was made to impart anti moth property to woollen fabric using nano kaolinite, an aluminium silicate mineral based of natural origin. The treatment of nano kaolinite on wool fabric was conducted both at room temperature and 80 °C for the optimization of the process. The characterization of nano kaolinite as well as nano kaolinite-coated wool fabric was performed with various analytical techniques. Moth proofing performance of nano kaolinite-coated wool fabric against *Anthrenus verbasci* was investigated through assessing wool weight loss and number of moth alive after the incubation period of 15 days. It was found that 1.0% nano kaolinite treatment at room temperature treatment is found to be more effective than high-temperature treatment in terms of weight loss and mortality rate of wool moth. The concentration of nano kaolinite treatment is optimized to 1.0% level which results to moth mortality rate to 70% with less than 2.0% fabric weight loss. The results were compared with a commercial anti moth agent. In conclusion, the eco-friendly nano kaolinite-based moth repellent formulation may be a potential alternative for the existing toxic chemical formulations to woollens.

**POS-124**


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|---|---|---|
| **Poster Presenter** | : | **Seiko Jose** |
| Address | : | Avikanagar, Jaipur, Malpura - 304501, Rajasthan, India |
| Mobile | : | +91-8420075513 |
| Email | : | seiko_jose2005@yahoo.co.in |
| Affiliation | : | ICAR- Central Sheep and Wool Research Institute |
| Co Author(s) | : | Shanmugam Nachimuthu, Sekhar Das, Ajay Kumar |

# A BLEND OF NANOTECHNOLOGY AND FORENSIC SCIENCE: A COMPREHENSIVE REVIEW

Pragna M Shivannavar[1] Sharmila S[2] and Shankramma Kalikeri[1*]
*1* Division of Nanoscience and Technology, Department of Water and Health, School of Natural sciences, JSS Academy of Higher Education and Research Sri Shivarathreeshwara Nagara, Mysuru - 570 015 Karnataka, India*
*Corresponding author Email: shankrutk@jssuni.edu.in

Use of nanotechnology in the field of forensic science is gaining more importance in the present days. It will play a significant role in the future of forensic science by providing more selective and sensitive methods of detecting and revealing cases, as well as infallible evidence. Because nanomaterials have the ability to increase the detection limit at the nanoscale level[1]. It has a wide range of applications, including the detection of fingerprints, explosives, illegal drugs, dangerous compounds, and DNA samples. It is primarily used in the development of reactive materials, microchips, Nano sensors, nanomanipulators, and nano-imaging instruments for visualisation [2]. Nanotechnology contributes to the enhancement and improvement of currently existing and applied forensic techniques with high accuracy, sensitivity, and time requirements [2]. This study provides an overview of the application of nanotechnology in forensic science. This review focuses on the different types of Nanomaterials and their applications, as well as their developmental and implicational features in forensic research. It also provides insight into the future potential of a brilliant combination of nanotechnology and forensic science, resulting in improved scientific analysis.

**Keywords**: Nanomaterials, Forensics, Investigation, Applications and Evidences

E.g.-

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**POS-125**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Pragna M Shivannavar** |
| Address | : | #171, 5th A cross Nandagokula Layout, Ramsandra, Kengeri Hobli Sulikere Post, Bengaluru - 560060, Karnataka, India |
| Mobile | : | +91-8217316716 |
| Email | : | prax2912@gmail.com |
| Affiliation | : | JSS Academy of Higher Education & Research |
| Co Author(s) | : | Sharmila S, Shankramma Kalikeri |

# GALLIUM NITRIDE-BASED COMPOSITES FOR WASTEWATER TREATMENT: A REMEDIATION TOOL

Sakamuri Layasree[1], Lingaraju H G[1] and Shankramma Kalikeri[2*]
[1]Department of Environmental Science, School of Natural Sciences, JSS Academy of Higher Education and Research Sri Shivarathreeshwara Nagara Mysuru, Karnataka - 570015, India

[2*]Division of Nanoscience and Technology, Department of Water and Health, School of Life Sciences, JSS Academy of Higher Education & Research Sri Shivarathreeshwaranagara Mysuru, Karnataka - 570015, India
[*]**Corresponding author:** shankrutk@jssuni.edu.in

Wastewater is produced after the use of freshwater for a variety of purposes, which include leaching, washing, cleaning etc., so we have to provide clean water to meet human needs which is becoming a great challenge these days. The world's water supply is struggling to keep up with the rapidly growing demand which leads to the fierce competition and an unfair distribution of fresh water among the various sectors. Nanotechnology which led to many productive ways for wastewater treatment in accurate way on both large and small scale. So, now the best solution is wastewater Treatment by using Advanced Oxidation Process (AOP)method which is used to remove pollutes without any secondary pollutants from the wastewater and then convert into a fresh water to meet human needs. In this wastewater treatment we are using Gallium Nitride (GaN) as a catalyst because it is mechanically stable with narrow bandgap semiconductor Nanoparticle (Np) which helps in speeding up the treatment of this process.

**Keywords:** Photocatalysis; Gallium Nitride (GaN), Pollutants, Composites

**POS-126**

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|---|---|---|
| **Poster Presenter** | : | **Sakamuri Layasree** |
| Address | : | Sadashiv Nagar, 14th Cross, Siruguppa, Bellary District Mysuru - 572101, Karnataka, India |
| Mobile | : | +91-7680868851 |
| Email | : | slayachinnu@gmail.com |
| Affiliation | : | JSS Academic higher education and Research, Mysuru |
| Co Author(s) | : | Shankramma Kalikeri |

# DRUG DESIGNING AND DISCOVERY OF NEW DRUG ENTITIES BY THE STRUCTURE ACTIVITY RELATIONSHIP AND COMPUTER AIDED SAR BY TAKING CHROMONE MOIETY AS A LEAD

**Jyothi H. Kini [1], Swapna G[2].,**
1. Department of PG Studies and Research in Industrial Chemistry, Sir M.V. Govt. Science College, Bommanakatte, Bhadravathi - 577 302, Karnataka, India
2. Librarian, Department of Library, Sir M.V. Govt. Science College, Bommanakatte, Bhadravathi - 577 302, Karnataka, India
Email ID: jyothirshenoy@gmail.com

Generally, in drug discovery, drugs are not discovered but a prototype with a lead like or drug-like compounds are identified. A ***lead*** molecule is identified which satisfies the qualities like desired biological or pharmacological activity. Here the authors chosen a typical approach to identify a lead molecule, altering (tailoring) its structure properly to amplify the effective bio-activity and to minimize or eliminate the unwanted properties so that a lead is developed into a drug molecule. Here the authors chosen '***Chromone moiety***' as lead. The goal of drug developers is both to increase potency and decrease adverse effects, such as additive properties. This can be achieved by the comprehensive study of the structure-activity relationships (SAR) of some natural chromones which are previously tested and identified as biologically active molecules. The structures of natural chromones which are biologically active were compared with the structures of synthetic chromones of biological importance. This comprehensive study was made by the previously available data library. The Automation of process of devising newer chromone derivatives by comparing the structures of both natural and synthetic chromones and by using the data of structures of all the chromones like the chromones containing Nitrogen, Oxygen, Sulphur etc. Also, chromones containing different functional groups at different positions of natural as well as synthetic and also the data of biological activities of all the chromones make a big pool of database to study the SAR of all the chromones. To consolidate all the data and to obtain some fruitful outcome, we proposed a '***Software architecture'*** for designing novel chromone derivatives of required biological activities.

**POS-127**

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|---|---|---|
| **Poster Presenter** | : | **Dr. Jyothi Kini H.** |
| Address | : | Department of PG Studies and Research in Industrial Chemistry<br>Sir M.V.Govt. Science College, Bommanakatte, Bhadravathi<br>Shivamogga - 577302, Karnataka, India |
| Tel | : | +91-8282270296 |
| Mobile | : | +91-8618081529 |
| Email | : | jyothirshenoy@gmail.com |
| Affiliation | : | Sir M.V. Govt Science College, Bhadravathi |
| Co Author(s) | : | Dr. Swapna G |

# SYNTHESIS AND CHARACTERIZATION OF NICKEL OXIDE NANOPARTICLES AND EVALUATION OF ANTIMICROBIAL ACTIVITIES

**Jyothi H. Kini *, Shishira C. Shetty, Mohiddin Khalendar Samad, Harshitha K. Mohammed Rahil, Prashanth A.M.**

Department of PG Studies and Research in Industrial Chemistry, Sir M.V. Govt. Science College, Bommanakatte, Bhadravathi - 577 302, Karnataka, India

Email ID: jyothirshenoy@gmail.com

Synthesis of Nickel oxide nanoparticles was made from the Nickel nitrate 10mmol. was taken as a precursor. A series of NiO nanoparticles were synthesized using 4:1 (sodium hydroxide: Nickel nitrate). The NiO-Nps were synthesized using the ratios 3:2, 2:3, and 1:4. This method was simple and yield effective. Sodium hydroxide acts as reducing as well as precipitating agent. The characterization of synthesized silver nanoparticles was done by UV-visible spectroscopy and Scanning electron microscopy (SEM). The synthesized Ag-nanoparticles were evaluated for anti-microbial activities. The disc diffusion method was adopted and zones of inhibition of synthesized NiONPs against bacterial and fungal pathogens were studied.

**Keywords**: synthesis of nanoparticles, Nickel Nanoparticles, Antimicrobial activities

**POS-128**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Shishira C. Shetty** |
| Address | : | Department of PG Studies and Research in Industrial Chemistry<br>Sir M.V.Govt. Science College, Bommanakatte, Bhadravathi<br>Shivamogga - 577302, Karnataka, India |
| Tel | : | +91-77608-91953 |
| Mobile | : | +91-9482192391 |
| Email | : | jyothirshenoy@gmail.com |
| Affiliation | : | Sir M.V. Govt Science College, Bhadravathi |
| Co Author(s) | : | Mohiddin Khalendar Samad, Harshitha K., Mohammed Rahil, Prashanth A.M. |

# CHEMICAL SYNTHESIS OF COPPER-CHITOSAN NANOPARTICLES AND THEIR BIOLOGICAL ACTIVITY

**Chandranayaka, S.[1], Mahadevakumar, S.[2], Sushmitha, S.[1], Anusha N.[1], Divya, V.[1]**
[1]Department of Studies in Biotechnology, University of Mysore, Manasagangotri, Mysore-570006, India; [2]Department of Studies and Research in Microbiology, Karnataka State Open University, Mukthagangotri, Mysuru - 570006, Karnataka, India Email: moonnayak@gmail.com

Pearl millet is an important crop with potentially tremendous, but under-explored source of nutraceuticals as compared to other regularly consumed cereals. Downy mildew disease caused by fungus Sclerospora. In the current agricultural scenario, the extensive use of agrochemicals for disease control has polluted not only the top soil, but also groundwater and irrationally posed danger to living systems and environmental conditions. Nanotechnology is becoming increasingly important for the agricultural sector due to its potential in improving plant growth, protection, pathogen detection, and pesticide/herbicide residue detection. Therefore, the present study, synthesized chitosan based nanoparticles such as Cu-chitosan nanoparticles. The formation of nanoparticle was observed by the peak at 536 nm using UV-Vis spectroscopy. The Energy-dispersive X-ray spectroscopy (EDS) and SEM analysis showed a homogenous copper-rich composition of metal nanoparticles. The X-ray diffraction (XRD) analysis confirmed the presence of copper nanoparticle with crystalline nature. The synthesized Cu-chitosan nanoparticle was evaluated against Gram-positive (*Staphylococcus aureus*) and Gram-negative (*Escherichia coli*) bacteria. The biosynthesized Cu-Chitosan NPs showed good antibacterial and antifungal activities. AgNPs effectively inhibited the bacterial growth in a dose-dependent manner and presented as good antifungal agents towards the growth of *Aspergillus niger* and *A. flavus* and Fusarium sp..

**POS-129**

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|---|---|---|
| **Poster Presenter** | : | **Sushmitha S** |
| Address | : | Pearl Millet Pathology Laboratory DOS in Applied Botany and Biotechnology University of Mysore Manasagangotri, Mysore - 570006, Karnataka, India |
| Mobile | : | +91-8892821805 |
| Email | : | sushmithagangatkar@gmail.com |
| Affiliation | : | University of Mysore |
| Co Author(s) | : | Mahadevakumar S, Anusha N, Divya V |

# SYNTHESIS AND CHARACTERIZATION OF SILICON DIOXIDE NANOPARTICLES AND THEIR EFFICACY IN INDUCING PROTECTION AGAINST PEARL MILLET DOWNY MILDEW PATHOGEN

**Sushmitha, S.[1], Anusha N.[1], Divya, V.[1], Yogitha, N.[1], Mahadevakumar, S.[2] and Chandranayaka, S.[1*]**

[1]Department of Studies in Biotechnology, University of Mysore, Manasagangotri, Mysore-570006, Karnataka, India;

[2]Department of Studies and Research in Microbiology, Karnataka State Open University, Mukthagangotri, Mysuru - 06; Email: moonnayak@gmail.com

A sequential method has been used, to prepare monodisperse and uniform -sized silica nanoparticles by sol-gel process where tetraethylorthosilicate (TEOS) as a precursor. The reagents ammonia, ethanol, water and TEOS were used and particle size was examined under scanning electron microscopy. By XRD measurement, a broad peak of pure amorphous nature is observed while FTIR analysis showed hygroscopic nature of particles. The compositional ratio of silicon and oxygen is analyzed by EDX and found to be satisfactory. The antimicrobial activity of synthesized sio2 was tested for gram negative bacteria like *Escherichia coli* and *Aspergillus niger*, Fusarium fungi.Sio2 treated seedlings responded to downy mildew infection with high lignification and callose deposition. Analysis of defense enzymes showed that Sio2 treatment significantly enhanced the activities of glucanase, peroxidase, phenylalanine ammonia-lyase, and polyphenol oxidase in comparison to untreated control.

**POS-130**

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| **Poster Presenter** | **:** | **Anusha N** |
| Address | : | Pearl Millet Pathology Laboratory DOS in Applied Botany and Biotechnology, University of Mysore Mysuru - 570006, Karnataka, India |
| Mobile | : | +91-9964402327 |
| Email | : | suhanamurthy1997@gmail.com |
| Affiliation | : | University of Mysore |

# GREEN SYNTHESIS OF SILVER NANOPARTICLES BY *CYTOBACILLUS FIRMUS* ISOLATED FROM THE STEM BARK OF *TERMINALIA ARJUNA* & THEIR ANTIMICROBIAL ACTIVITY AGAINST PEARL MILLET BLAST PATHOGEN *MAGNAPORTHE GRISEA*

**Sushmitha, S.[1], Anusha N.[1], Yogitha, N.[1], Mahadevakumar, S.[2] and Chandranayaka, S.[1*]**
[1]Department of Studies in Biotechnology, University of Mysore, Manasagangotri, Mysore-570006, Karnataka, India;
[2]Department of Studies and Research in Microbiology, Karnataka State Open University, Mukthagangotri, Mysuru - 06
**Email:** moonnayak@gmail.com

This work reports an eco-friendly synthesis of silver nanoparticles (AgNPs) using endophytic bacteria, *Cytobacillus firmus* isolated from the stem bark of *Terminalia arjuna* (Combretaceae). The synthesis of AgNPs was confirmed by visual observation as a change in color of the bacterial solution impregnated with silver. Further, the morphology of the AgNPs, average size, and presence of elemental silver were characterized by UV-Visible spectroscopy, scanning electron microscopy, and dynamic light scattering spectroscopy. The roles of endophytic secondary metabolites in the metal reduction, stabilization, and capping of silver nanoparticles were studied by qualitative FTIR spectral peaks. The antimicrobial ability of AgNPs was evaluated against Gram-positive (*Staphylococcus aureus*) and Gram-negative (Escherichia coli) bacteria and pearl millet blast disease-causing fungi (Magnaporthe grisea). The biosynthesized AgNPs showed good antibacterial and antifungal activities. AgNPs effectively inhibited the bacterial growth in a dose-dependent manner and presented as good antifungal agents towards the growth of Magnaporthe grisea.

**POS-131**

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|---|---|---|
| **Poster Presenter** | : | **Yogitha N** |
| Address | : | Pearl Millet Pathology Laboratory DOS in Applied Botany and Biotechnology, University of Mysore Mysuru - 570006, Karnataka, India |
| Mobile | : | +91-9739774573 |
| Email | : | yogithanaven@gmail.com |
| Affiliation | : | University of Mysore |
| Co Author(s) | : | Sushmitha S, Anusha N, Mahadevakumar S |

# GREEN SYNTHESIS OF ZINC OXIDE NANOPARTICLES (ZNO NPS) FOR EFFECTIVE DEGRADATION OF DYE, POLYETHYLENE AND ANTIBACTERIAL PERFORMANCE IN WASTE WATER TREATMENT

**Sushmitha, S.[1], Anusha N.[1], Raneem, A.[1], Mahadevakumar, S.[2] and Chandranayaka, S.[1*]**
[1]Department of Studies in Biotechnology, University of Mysore, Manasagangotri, Mysore-570006, Karnataka, India;
[2]Department of Studies and Research in Microbiology, Karnataka State Open University, Mukthagangotri, Mysuru - 06; **Email:** moonnayak@gmail.com

At present, there is a vital need for river water purification by developing new approaches to eliminate bacterial biofilms, textile dyes, and Low-Density Polyethylene (LDPE) plastics that pose serious threats to human health and environmental health. The current work put forward the construction of an eco-friendly green strategy of Zinc oxide nanoparticles (ZnO NPs) was synthesized via Areca nut extract and subsequently used to tackle the challenges of water purification. Prepared nanoparticles were characterized by XRD, FT-IR, EDS, SEM, and UV-vis spectroscopy. The characteristic absorption band exhibited at 326 nm confirmed the formation of ZnO NPs. The biogenic ZnO NPs showed significant antibacterial activity among *E. coli* and *B. subtilis*. Among the E. coli at 50µg/mL concentration showed the highest inhibition of biofilm activity followed by the highest growth curve, cellular leakage, and potassium ion efflux. The degradation of Rhodamine-B (Rh-B), Methylene Blue (MB), and Nigrosine dyes under sunlight irradiation showed at different time intervals. Finally, the photocatalytic activity of LDPE-ZnONPs Nano composite film showed the highest degradation under solar light irradiation confirmed through photo induced weight loss, SEM, FTIR, and MALDI-TOF analysis. This study demonstrates ZnO NPs exhibit efficacy against biofilm formation, degradation of photocatalytic textile dyes, and low-density LDPE film under solar light irradiation which suits for the purification of water

**POS-132**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Raneem I** |
| Address | : | Pearl Millet Pathology Laboratory DOS in Applied Botany and Biotechnology, University of Mysore Mysuru - 570006, Karnataka, India |
| Mobile | : | +91-7022624746 |
| Email | : | raneemkhlel@gmail.com |
| Affiliation | : | University of Mysore |
| Co Author(s) | : | Sushmitha S, Anusha N, Mahadevakumar S |

# CARBON SOOT DERIVED FROM WASTED RUBBER: AN ADDITIVE IN LUBRICATING OIL FOR EFFICIENT FRICTION AND WEAR REDUCTION

N. Ravikiran[1,2], Balaji Padya[2], Ravi Kali[2], Vadali Venkata Satya Siva Srikanth[1]*, P.K Jain[2]*
[1]School of Engineering Sciences and Technology, University of Hyderabad, Hyderabad, India
[2] International Advanced Research Centre for Powder Metallurgy & New Materials, Hyderabad, India

Ball bearings have been used widely to reduce friction and support easy sliding of surfaces. In our study to replicate the ball bearing mechanism at nanoscale 50-100 nm-sized carbon soot particles with sphere-like morphology are prepared by regulated decomposition and subsequent heat-treatment of wasted rubber-tyre tubes. The waste rubber tubes pose threat to the environment as non-biodegradable landfill waste (polluting soil and water bodies). The crystallinity studies made using x-ray diffraction exhibited that the soot particles had a mixture of crystalline and amorphous carbon phases. Disordered graphitic layers in heliocentric arrangement were seen under TEM. The soot particles are dispersed in an additive-free base oil (BO), and the soot-based lubricant along with BO were studied using a rotational rheometer and a 4-ball tester for rheological and tribological properties respectively. The soot particles reduced the internal shear stress under applied the shear rate in the BO leading to reduction in viscosity but it improved the viscosity retention at higher temperatures. At room temperature, a reduction in coefficient of friction and wear scar diameter of ~9% and 16.55% were recorded. At higher temperature of 70 °C, a reduction in CoF and WSD of as high as 48.93% and 28.12% were recorded. Based on the observations, it is presumed that the soot particles acted like nano-bearings between the contacting surfaces producing a rolling effect that efficiently reduced friction and wear concerning the contacting surfaces.

**Keywords:** Carbon soot, friction, wear, lubrication, viscosity

*Corresponding author: pkjain@arci.res.in/kravi3249@gmail.com

**POS-133**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Nowduru Ravikiran** |
| Address | : | ARCI, Hyderabad - 500005, Telangana, India |
| Mobile | : | +91-8770848068 |
| Email | : | kravi3249@gmail.com |
| Affiliation | : | International Advanced Research Center for Powder Metallurgy and New Materials, Hyderabad |
| Co Author(s) | : | Dr. Balaji Padya, Dr. Ravi kali, Prof. Dr. Ing. V.V.S.S Srikanth, Dr. P.K Jain |

# NANOCOMPOSITE HYDROPHOBIC COATINGS: A PROMISING INTERVENTION AGAINST BACTERIAL INFECTIONS

Ramay Patra[1#], K R C Soma Raju[1], Susmita Chaudhuri[2], Prashant Garg[3], R Subasri[1]
[1]Centre for Sol-Gel Coatings, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Balapur, Hyderabad - 500 005
[2]Translational Health Science and Technology Institute (THSTI), Faridabad 121001, Haryana, India
[3]L.V. Prasad Eye Institute, Kallam Anji Reddy Campus, Hyderabad - 500034, Telangana, INDIA
[#]- presenting author Email Id: ramay240@gmail.com

Biofilm formation on any surface is preceded by initial attachment of planktonic bacteria, followed by its growth. Since, bacteria under biofilm are resistant to antibiotics as well as various conventional antibacterial interventions, there is an urgent need for novel strategies to prevent bacterial infections. A promising strategy would be the physicochemical modification of the surfaces to prevent the initial bacterial attachment. In the present study, two hydrophobic nano-composite coatings with different levels of hydrophobic properties were prepared and deposited on cover glass slips and contact lens case substrates made up of ABS (poly acrylonitrile butadiene styrene) polymer. One formulation exhibited only hydrophobic property and the other exhibited improved hydrophobicity. Microstructures of these coatings were analyzed through FESEM and percentage of biofilm inhibition was evaluated through crystal violet assay against *A. baumannii*, *P. aeruginosa* and *S. aureus* from ATCC strains and clinical isolates. ATCC strains are tested on cover glass slip and clinical isolates are tested on ABS coupons. The coating with improved hydrophobicity, possessing a hierarchical micro nano structure exhibited better biofilm inhibiting property with 52-88 % of inhibition when compared to hydrophobic coatings with 30-40 % of inhibition against tested bacteria.

**POS-134**

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|---|---|---|
| **Poster Presenter** | : | **Ramay Patra** |
| Address | : | Balapur, Hyderabad - 500097, Telangana, India |
| Mobile | : | +91-6370259998 |
| Email | : | ramay240@gmail.com |
| Affiliation | : | International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) |
| Co Author(s) | : | Mr. K R C Soma Raju, Dr. Susmita Chaudhuri, Dr. Prashant Garg Dr. R Subasri |

# CHITOSAN NANOPARTICLES HAVING HIGHER DEGREE OF ACETYLATION INDUCE RESISTANCE AGAINST PEARL MILLET DOWNY MILDEW THROUGH NITRIC OXIDE GENERATION

Chandranayaka, S.[1], Mahadevakumar, S.[1], Sushmitha, S.[1], Anusha, N. and Divya, V.[1]
[1]Department of Studies in Biotechnology, University of Mysore, Manasagangotri, Mysore, India;
[2]Department of Studies and Research in Microbiology, Karnataka State Open University, Mukthagangotri, Mysuru, Karnataka, India Email: moonnayak@gmail.com

Downy mildew of pearl millet caused by the biotrophic oomycete Sclerospora graminicola is the most devastating disease which impairs pearl millet production causing huge yield and monetary losses. Chitosan nanoparticles (CNP) were synthesized from low molecular weight chitosan having higher degree of acetylation was evaluated for their efficacy against downy mildew disease of pearl millet caused by Sclerospora graminicola. Laboratory studies showed that CNP seed treatment significantly enhanced pearl millet seed germination percentage and seedling vigor compared to the control. Seed treatment with CNP induced systemic and durable resistance and showed significant downy mildew protection under greenhouse conditions in comparison to the untreated control. Seed treatment with CNP showed changes in gene expression profiles wherein expression of genes of phenylalanine ammonia lyase, peroxidase, polyphenol oxidase, catalase and superoxide dismutase were highly upregulated. CNP treatment resulted in earlier and higher expression of the pathogenesis related proteins PR1 and PR5. Downy mildew protective effect offered by CNP was found to be modulated by nitric oxide and treatment with CNP along with NO inhibitors cPTIO completely abolished the gene expression of defense enzymes and PR proteins. Further, comparative analysis of CNP with Chitosan revealed that the very small dosage of CNP performed at par with recommended dose of Chitosan for downy mildew management.

**POS-135**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Dr. Mahadevakumar S** |
| Address | : | Assistant Professor, Department of Studies & Research in Microbiology<br>Karnataka State Open University, Mukthagangotri, Mysuru Karnataka, India |
| Mobile | : | +91-9743217220 |
| Email | : | mahadevakumars@gmail.com |
| Affiliation | : | Karnataka State Open University |
| Co Author(s) | : | Sushmitha S, Anusha N, Divya V |

# GRAPHENE OXIDE (GO) AND REDUCED GRAPHENE OXIDE (RGO) ITS SYNTHESIS AND APPLICATIONS

Sharmila S[1] Pragna M shivannavar[2] and Shankramma Kalikeri[1]*
1* Division of Nanoscience and Technology, Department of Water and Health, School of Natural sciences, JSS Academy of Higher Education and Research Sri Shivarathreeshwara Nagara, Mysuru - 570 015 Karnataka, India
*Corresponding author Email: shankrutk@jssuni.edu.in

Graphene has emerged as one of the most promising nanomaterials, due to its unique mix of amazing qualities, it is not only the thinnest but also one of the strongest materials; it conducts heat better than any other materials; it is an outstanding conductor of electricity; and it is optically clear but so dense that it is impermeable to gases. Graphene oxide-based nanomaterials, such as graphene oxide (GO) and reduced graphene oxide (rGO), have gained increasing interest in the many fields over the last decade, owing to its amazing mechanical, electrical, thermal, and barrier capabilities. GO and rGO have opened up new possibilities for gas barrier, membrane separation, and stimuli-response features due to their facile top-down manufacturing. We examine the most prevalent synthesis procedures for producing these graphene derivatives, describe how synthesis influences important material properties, and highlight several examples with unique and outstanding capabilities in this paper.

**Keywords:** Eco-friendly Synthesis, GO, rGO, Application

**POS-136**

**Poster Presenter** : **Sharmila S**
Address : Division of Nanoscience and Technology, Department of Water & Health
School of Natural Sciences, JSS Academy of Higher Education & Research
Sri Shivarathreeshwara Nagara, Mysuru - 570 015 Karnataka, India

# ONE-POT THREE-COMPONENT SYNTHESIS OF THIOETHER LINKED 4-HYDROXYCOUMARIN-BENZOTHIAZOLE DERIVATIVES UNDER AMBIENT CONDITION & EVALUATION OF THEIR BIOLOGICAL ACTIVITY

**Priya R. Kadam[a], Yadav D. Bodke[b*], Mamatha D. Naik[a], Nagaraja O[a], Manjunatha B[b]**

*[a]Department of P.G. Studies and Research in Industrial Chemistry, Jnana Sahyadri, Kuvempu University, Shankaraghatta, Shivamogga 577451, Karnataka, India.*

*[b]Department of P.G. Studies and Research in Chemistry, Jnana Sahyadri, Kuvempu University, Shankaraghatta, Shivamogga 577451, Karnataka, India.*

**Corresponding author e-mail: ydbodke@gmail.com*

An efficient and convenient method has been outlined for the synthesis of 3-[(1,3-benzothiazol-2-ylsulfanyl)(phenyl)methyl]-2H-chromen-4-ol derivatives via a one-pot three-component Knoevenagel condensation reaction between 4-hydroxycoumarin, substituted aldehyde, and 2-mercapto benzothiazole in the presence of 10 mol% L-proline as an efficient catalyst in ethanol. The structure of all the newly synthesized chromone derivatives was confirmed by different spectroscopic techniques like IR, 1H NMR, 13C NMR, and LC-MS. Further, all the derivatives were screened for their biological activities such as anti-mycobacterial activity, in vitro antioxidant activity, anticancer activity, and molecular docking studies.

**Keywords**: 4-Hydroxycoumarin, 2-Mercapto benzothiazole, L-proline, and biological activity.

**POS-137**

**Poster Presenter** : **Priya R. Kadam**

Address : Department of P.G. Studies and Research in Industrial Chemistry
Jnana Sahyadri, Kuvempu University, Shankaraghatta
Shivamogga - 577451, Karnataka, India

# A BIODEGRADABLE POLYMER-ASSISTED EFFICIENT AND UNIVERSAL EXFOLIATION ROUTE TO A STABLE FEW LAYER DISPERSION OF TRANSITION METAL DICHALCOGENIDES

Priyanka Yadav[1], Anirban Das[1,#], Manoj Kumar Sharma[1] Soumen Ash[1] and Ashok Kumar Ganguli[1,2]*
[1]Department of Chemistry, Indian Institute of Technology Delhi, New Delhi 110016, India
[2]Department of Materials Science and Engineering, Indian Institute of Technology Delhi, New Delhi 110016, India.[1,2]
ashok@chemistry.iitd.ac.in

Two dimensional materials have gained immense importance due to the unique physical and chemical properties as compared to bulk materials which can be correlated to their confined size in a plane. They possess potential applications in the field of lithium-ion batteries, photo catalysis, hydrogen storage, as well solid lubricants. Quasi two-dimensional transition metal dichalcogenides (2D-TMDs) with 1-5 layers have been obtained by developing an effective and highly efficient bio-based polymer-solvent system by mild ultrasonication. The hydroxypropyl cellulose (HPC)/1-Butanol (BuOH) system was determined to be an universal polymer-solvent system to effectively exfoliate the bulk transition metal dichalcogenides (TMDs) $MoS_2$, $TiS_2$, $WS_2$, $NbS_2$ and $MoSe_2$. The above process is significant as it is a room temperature liquid phase exfoliation method that leads to a stable dispersion of a few layer 2D-TMD having significant proportion of exfoliated material which remains stable in suspension for several months.

**POS-138**

**Poster Presenter** : **Priyanka Yadav**
Address : Department of Chemistry, Indian Institute of Technology Delhi
New Delhi - 110016, India

# DEVELOPMENT OF NANOTECH BASED COVID19 - ANTIGEN RAPID DETECTION TEST

**Chandranayaka, S.[1], Rangappa, K.S.[1], Mohana, C.D.[2], Venkataramana,[3] and Mahadevakumar S.[4],**
[1]Department of Studies in Biotechnology, University of Mysore, Manasagangotri, Mysore, India;
[2]Department of Studies in Molecular Biology, University of Mysore, Manasagangotri, Mysore;
[3]Lorven Biologic Pvt. L:td., BNR Building, Dulapally Road, Medchal-Malkajgiri District, Hyderabad, Telangana, India;
[4]Department of Studies and Research in Microbiology, Karnataka State Open University, Mukthagangotri, Mysuru - 570006, Karnataka, India.
Email: moonnayak@gmail.com

The University of Mysore-Lorven Biologics Pvt Ltd (***UOM-Lorven)*** One Step Novel Coronavirus (COVID-19) antigen Kit is a rapid and convenient immuno-chromatographic assay for the qualitative detection of COVID-19 antigen (viral nucleoprotein) from nasal swab, nasopharyngeal swab, endotracheal aspirate or Broncho alveolar lavage obtained from patient with signs and symptoms of respiratory infection. The device is designed to aid in rapid differential diagnosis of COVID-19 Virus infection. This assay provides only a preliminary result. Negative results should be confirmed by Real Time Reverse Transcriptase (RT)-PCR Diagnostic kit; they do not preclude COVID-19 Virus infection and should not be used as the sole basis for treatment or other management decisions. The test is intended for professional and laboratory use.

**POS-139**

| | | |
|---|---|---|
| **Poster Presenter** | : | **Dr. Chandranayaka S.** |
| Address | : | Department of Studies in Biotechnology, University of Mysore<br>Manasagangotri, Mysuru |
| Mobile | : | +91-9886640778 |
| Email | : | chandranayak@appbot.uni-mysore.ac.in and moonnayak@gmail.com |
| Affiliation | : | University of Mysore |
| Co Author(s) | : | Prof. K.S. Rangappa, Dr. C.D. Mohana, Dr. Venkataramana, Dr. Mahadevakumar S. |

# DIFFERENT BIOCL NANOSTRUCTURES BASED PMMA NANOCOMPOSITES

[a]Sakshi Sharma, Aman Deep Acharya and [b]Bhawna
[a]*School of Chemical Engineering and Physical Sciences, Lovely Professional University, Phagwara, Punjab*
[b]*Vikram University, Ujjain*

The Ellipsoid-like and Flower-like Bismuthoxychloride (BiOCl) 3D-hierarchical nanostructures (HNs) were successfully synthesized via Solvothermal and Sol-gel methods. The synthesized nano-structures then introduced into Polymethylmethacrylate (PMMA) via in-situ polymerization in order to develop a polymerbased nano-composite of thickness 50m. To examine the development of this polymer based nano-composites a comparative study on the distribution of two different shape and sized BiOCl incorporated PMMA carried out to study the various properties including poor heat resistant, brittleness and crystallinity.

***Keywords**: Bismuth oxychloride, polymethylmethacrylate, thermal properties, Hierarachical nanostructures, Solvothermal and Sol-gel method*

**POS-140**

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| **Poster Presenter** | : | **Sakshi Sharma** |
| Address | : | 115, Sanjay Gandhi Nagar, Industrial Area, Jalandhar City, Punjab |
| Mobile | : | +91-9041138624 |
| Email | : | sakshiupmanyu118@gmail.com |
| Affiliation | : | Lovely Professional University, Phagwara, Punjab |
| Co Author(s) | : | Dr. Aman Deep Acharya and Dr. Bhawna |