In this key-note address, I will discuss about the different forms of graphenes, their various ways of synthesis, general nature and characteristics and unusual properties. Graphene can be substituted and functionalized using a large number of dopants and substitutents, some of the doping and substitution process will be shown. Graphene can form composite with a variety of other components in order to introduce some special characteristics suitable for a wide range of application. A few examples of application of graphene based materials will be discussed, including some carried out in our lab.
Started my journey early morning on 5th November, 1968 in a proud beggar family of a small village called Patna, East Midnapur, West Bengal as my father, uncle and grand-mother were daily labour at that time. But, when I opened my little eyes in my mother’s lap there was no light and no family members except my mother and grandmother or I can say it was a completely black color around me. At that auspicious moment I did not have any other options, so I loved black color, which is carbon in other spiritual word. This carbon tends to get a bad reputation these days, but I think it is an amazing material. It plays a huge role in the world we live in, from the carbon dioxide in the air to the graphite in our pencil, to the diamond in the jewelry, to our body, you’ll find its figure print everywhere, just try to open your eyes. In the earth’s crust, it is the 15th most abundant element and fourth most abundant universal element by mass after oxygen, hydrogen and helium. Can you believe that there is another carbon material apart from the traditional graphite/diamond that is stronger than steel, unbreakably elastic, resistant to chemicals and high temperature, a better conductor of electricity than silver, and a better heat conductor than diamond? So, nanotechnologists have been fascinated with potential of this material in all fields starting from aerospace to medical. Currently these carbon powders are incorporated in diverse commercial products ranging from rechargeable batteries, automotive parts, and sporting goods to boat hulls and water filters including supercapacitors, actuators, and lightweight electromagnetic shields. Hope to see much more applications in the next decade. Enjoy a huge range of interesting facts of this amazing carbon material that finally leads to M/S Nanosrishti Technologies Private Limited at Indian Institute of Technology Kanpur, Uttar Pradesh.
Nanoscience and nanotechnology can address one of the greatest challenges in the post-genomic era of the 21st century – making the essential connections between structure and function of biomolecules at the micro/nanoscale to human physiology and pathophysiology at the macroscale. To meet these challenges, the field of biomedical nanotechnology has undergone exponential growth during the last decay. Technologies such as nanostructured biomaterials for nanoprobes for cellular targeting, and drug delivery, biointegration of small molecules promise to transform the world of biochemistry and medicine.

Recently, we have introduced a novel group of ionomer nanoparticles wherein nanoparticles are formed through the electrostatic interactions of poly(ethylene glycol), (PEG), based copolymers (random and hyperbranched) and oppositely charged surfactants, DNA and peptides. In such complexes, the charged groups of the surfactants, DNA, and peptides are bound to the units of the polyelectrolyte segment of the copolymers that neutralizes the charges of the copolymers yielding nanoparticles. The particles however remain soluble due to the lyophilizing effect of the nonionic segment, PEG, of the polymer. The morphology of these nanoparticles varies depending on the structure of the components. All these water-soluble systems have a hydrophobic core, which is used to deliver hydrophobic drug molecules or contain drugs or DNA molecules, surrounded by a water-soluble polymer shell. Application of such nanoparticles will be comprehensively discussed.
INTERACTION OF COMPLEX CARBOHYDRATES AND PROTEINS

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Complex carbohydrates, an integral part of cell-surface glycoconjugates, are recognized as molecules with enormous coding capacity of meaningful messages in the form of their varied monosaccharide units, linkages and branching pattern. They can act as receptors for indigenous proteins as well as proteins from external sources, e.g., bacteria and viruses. Being highly specific, protein-oligosaccharide interaction involves all the common elements of molecular recognition, namely, hydrogen bonds, dispersion forces and hydrophobic packing. Oligosaccharides, though mainly bound through the terminal monosaccharides to the protein binding sites often show enhanced affinity compared to their mono- and disaccharide counterparts. Reason for such enhanced affinity will be discussed for mannose-binding proteins. A class of complex oligosaccharide occurs as attachments to Anti-freeze proteins and modifies their ice-binding surface. Our recent work in this area will also be discussed.
The copolymer functionalized multiwalled carbon nanotubes have been prepared by controlled method of graft copolymerization using binary mixture of N-alkyl acrylamide and acrylic acid monomers. The extent of graft copolymerization has been evaluated at fixed and variable feed compositions. The acrylic acid has played a significant role in controlling the activity of N-alkyl acrylamide for graft copolymerization on multiwalled carbon nanotubes in comparison to individual graft copolymerization of N-alkyl acrylamide without using acrylic acid. The controlled method of graft copolymerization of N-alkyl acrylamide in presence of acrylic acid has produced grafted copolymers chains with significantly high molecular weight and low molecular weight dispersity. The resultant copolymer grafted multiwalled carbon nanotubes were found to be highly dispersed in aqueous media in comparison to pristine multiwalled carbon nanotubes. The grafted poly(N-alkyl acrylamide-co-acrylic acid) chains were characterized for their structures by FT-IR technique and thermal stability was evaluated by thermogravimetric method of analysis. Poly(N-alkyl acrylamide-co-acrylic acid) modified multiwalled carbon nanotubes were subsequently used in controlling the sensitivity and selectivity of glassy carbon electrode for detection of biomolecule in presence and absence of interfering ascorbic acid. The surface modification of glassy carbon electrode has shown a significant improvement in working range of glassy carbon electrode and response time in comparison to unmodified electrode. The role of grafted chains in controlling the sensitivity of electrode for detection of biomolecule would be interpreted in terms of surface interactions of biomolecule at the interface.
Trace amounts of metallic toxicant can, therefore, be quantified by coupling a preliminary preconcentration system to a sensitive, selective detection/estimation technique [1]. Literature describes various and most commonly employed methods for sample clea
up step, including liquid–liquid extraction (LLE) either by anion exchange [2] or cation exchange process, solid-phase extraction (SPE) [3, 4], extraction chromatography [2] etc. Among various other techniques [1], solid phase extraction (SPE), the most promising alternative, has garnered much attention [2] for its unique selectivity, flexibility, eco-friendliness, simplicity, and time-cost effectiveness [3]. A commonly used SP extractor, SG has a poor selectivity and irreversible nature of binding with the metal ions; it works at high pH (>7.5) where it gets hydrolyzed [4]. So, Functionalized silica gel (FSG) comprising of a selective chelating ligand (X) with greater selectivity is a necessity [5]. It (FSG-X) is obtained either by coating FSG with high molecular mass liquid cation exchanger (HMLCE) [3,5] (where, hydrophobic interaction, a physical type of force exists between FSG and X) or, FSG gets chemically bonded with a selective chelating agent (e.g., DPTH, XO, EBT, PAN etc.) through a suitable bridging component (viz. APMS, mercapto-PMS, etc.) [4]. However, for the former case the cross-linking activities of bridging component (DMDCS) increase the size of FSG (Scheme 1 (eq. 1)) and its surface activity declines to a moderate level [4, 6]. Here, dimethyldichlorosilane (DMDCS) amid Si(OH)₄ enhances the size of FSG by catenation through its cross linking (silanization; Scheme 1) [6-8].
In the second type of synthesis, it needs complicated steps with stringent reaction conditions (refluxing: 24-90h, starring, repetitive filtrations, inert atmosphere, vacuum, costly and hazardous chemicals) to have the FSG [4, 6, 9]. In our present work, without any stringent reaction condition like refluxing, silica surface has been functionalized by nitroaniline to have the FSG through an instantaneous reaction using DMDCS as a bridging component. Here, DMDCS, being sandwiched between the SG and m-nitroaniline, simply acts as a bridging component and impedes catenation any further (Scheme 1 (eq. 2)). Finally, EBT was immobilized on this FSG by diazo coupling reaction and produces the resin (FSG-EBT). The synthesized resin (deep black colored) mass was sequentially washed with 6 mol L\(^{-1}\) HNO\(_3\). Along with its good extractor qualities [like high Pore Volume, PV: 0.374689 cm\(^3\) g\(^{-1}\); Surface Area, SA: 330.968 m\(^2\) g\(^{-1}\); BTC (Q\(_0\) = 476.7 µmol g\(^{-1}\)); Column efficiency, CE: 296 and Preconcentration Factor, PF: 120.20±0.04; reusability >1000 cycles; and faster rate of sorption-desorption], FSG-EBT possesses well demarcated spatial placement of HOMO-LUMO with a suitable band gap (\(\eta\): 7.1471 eV). Here, HOMO-LUMO is well separated. The present work reports the systematic studies on extraction, separation and preconcentration of Th(IV), U(VI), Zr(IV), Ce(IV) and Cr(III) amid several other foreign ions using EBT anchored \(\{\text{SiO}_2\}_n\) 3-D microarray. The effect of various sorption parameters, such as pH, concentration, temperature, sample volume, flow-rate and co-existing foreign ions were investigated. Quantitative sorption was ensured at solution pH: 6.0–6.5 for Th(IV), Ce(IV), Cr(III) and pH: 2.75–3.0 for Zr(IV), U(VI) couple. Analysis on extracted species and extraction sites reveals that \([\text{Th}_4(\mu^2{-}\text{OH})_8(\text{H}_2\text{O})_4]^{8+}\), \([\text{Ce}_6(\mu^2{-}\text{OH})_{12}(\text{H}_2\text{O})_3]^{12+}\), \([\text{Cr}_3(\mu^2{-}\text{OH})_8(\text{H}_2\text{O})_5]^{5+}\), \([\text{UO}_2]_3(\mu^2{-}\text{OH})_5(\text{H}_2\text{O})_3]^{+}\) and \([\text{Zr}_4(\mu^2{-}\text{OH})_8(\text{H}_2\text{O})_0.5]^{8+}\) for the respective metal ions get extracted at HOMO of the extractor. HOMO-{metal ion species} was found to be 1:1 complexation. Sorption was endothermic, entropy-gaining, instantaneous and spontaneous in nature. A density functional theory (DFT) calculation has been performed to analyze the 3-D structure and electronic distribution of the synthesized extractor [11].

**KEYWORDS:** Facile synthesis of FSG-EBT, EBT anchored \(\{\text{SiO}_2\}_n\) 3-D microarray; Solid Phase Extraction; Break-through Capacity is a function of frontier orbitals; HOMO-{metal ion species} 1:1 complexation; Sequential separation of Th(IV), Ce(IV), Cr(III), Zr(IV), U(VI)
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PLASTIC WASTE: ITS DISPOSAL AND FUEL RECOVERY

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Plastic have been one of the materials with the fastest growth because of their wide range of applications due to versatility and relatively low cost. Since the duration of life of plastic products is relatively small, there is a vast plastic waste stream that reaches each year to the final recipient creating a serious environmental problem. Again, because disposal of post consumer plastics is increasingly being constrained by legislation and escalating costs, there is considerable demand for alternatives to disposal or land filling. To alleviate part our energy crisis and environmental degradation, it has become imperative to make use of appropriate technologies for recovery of resources from plastic waste. Among the other alternative available for plastic waste management are incineration, mechanical recycling and chemical recycling. Incineration which generates heat but is a worst option from global warming point of view. In different recycling technique chemical recycling found to be master technique for obtaining some value added products (fuel) and to reduce environmental impact. From chemical point of view, plastic wastes form a right choice for gasification/pyrolysis as the plastic wastes have high calorific value and simple chemical constituents of primary carbon and hydrogen. Pyrolysis which reduces a bulky high polluting waste while producing energy and/or valuable chemical compounds. Catalytic pyrolysis which represents an area of intense scientific and technological research with a great potential to absorb large volume of plastics waste. Plasma pyrolysis which works on zero emission philosophy can use various types of plastic waste. Pyrolysis by microwave is a recent technique offering variety of advantages. The present lecture finds the active research in the field of pyrolysis of plastic wastes and focuses on future work that require attention to bring these pyrolysis techniques to work on large scale to obtain some value added and to be ecofriendly with the environment. A 20 kg/hr capacity plasma arc pyrolyser for treatment of plastic waste as well as fuel recovery options from waste plastic has been indigenously designed, developed, installed and studied its performance at the Central Mechanical Engineering Research Institute (CSIR), Durgapur -that is also to be discussed in this lecture.
SENSORS DEVELOPED FROM BIO-BASED POLYMERS

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Development of simple chemical sensors both by impedance and fluorescence spectrometry for nitroaromatic and other hazardous chemicals from few novel bio-based polymers like polycurcumin methacrylate (PCUMA), polycurcumin acrylate (PCUA), Scutellarin-Hispulidulose- glycerol/Curcumin- glycerol and polymer composite of poly-glycerol acrylate with curcumin have find applications in recent days. The sensor system undergoes a remarkable fluorescence quenching and a drastic change in electrical properties in presence of the analytes under consideration. The polymers were characterized by spectroscopic methods and other analytical techniques. The polymers exhibit purely electronic conduction and was confirmed by Wagner polarization technique. Sensitivities of the polymers were observed by monitoring the impedance response and current-voltage characteristics in presence of the vapor of analytes. PCUMA showed one order decrease in log Z values in impedance measurements and 90.44% increase in current density in current-voltage characteristics in presence of picric acid. Similarly, the limit of detection for picric acid by Scutellarin- Hispulidulose- glycerol and Curcumin- glycerol are $9.1 \times 10^{-8}$ M and $6.03 \times 10^{-8}$ M respectively in aqueous medium. The fluorescence quenching efficiency of Scutellarin- Hispulidulose- glycerol has been found to be 99% while that for Curcumin- glycerol, it is 88.9% for 0.5 µM picric acid in aqueous state. In both the cases, the quenching is governed by FRET between the fluorophore and the quencher and the FRET efficiency has been found to be 0.968 and 0.792 respectively.

When the system is for the detection of 2-vinyl pyridine, the aqueous solution of the probe possesses two well resolved peaks at 301 nm and 357 nm at $\lambda_{ex}$ of 200 nm. Interestingly, the first peak undergoes 100% quenching in presence of 2-vinyl pyridine at a concentration of as low as 10 nM, while the intensity of the second peak gradually decreases with the increase in the concentration of the analyte. The limit of detection is about 10.39nM of 2-VP. The electrical properties are studied by monitoring dc current-voltage characteristics and ac impedance response in presence of saturated vapor of 2-vinyl pyridine. A very simple, low cost and room temperature operable device has been designed for the electrical measurements.
ADVANCE COAL CHARACTERIZATION

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Coal is a combustible sedimentary rock with high concentration of hydrocarbons. The classification of coal is made on the basis of rank: Anthracite, Bituminous, Sub-bituminous and lignite. Coal rank depends on the carbon content as well as the percentage of macerals present in coal matrix. The rank of the coal deposits is determined by the amount of heat and pressure that act on the plants covered by layer of dirt over millions of years. The rank of the coal indicates the progressive changes in carbon, volatile matter and probably ash and sulphur during coalification process.

Coal is highly heterogeneous in nature composed of organic and inorganic substances. It has been used as energy resources primarily for the production of heat and electricity. In addition coal is also extensively used for metallurgical processes. The inorganic content of coal called mineral matter is unwanted portion of coal that dilutes the heat values and provides a means of pollution. The organic contents of coal called macerals are the useful component of coal to participate in thermal and metallurgical processes. Therefore, characterization of coal is paramount important to understand the fundamental properties of coal. Thus, due to the complexity and heterogeneity in coal, it faces difficulties in characterization and correlation of the structures to its processing and conversion characteristics. However, no single analytical technique is useful for detail characterization of coal. It requires more number of analytical techniques to accurately predict its behaviour during combustion, gasification, coking and liquefaction process.

The topic presents brief discussion regarding various conventional analytical techniques for characterization of bulk coal to understand the implication of coal heterogeneity on these issues. Various analytical techniques like Proximate and Ultimate analysis, Ash Fusion Temperature, Petrographic analysis, Differential Thermal Analysis etc. will be discussed to study the detail characterization of coal.

Key Words: Coal Characterization, Mineral matter, Petrographic analysis

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Layered double hydroxides (LDHs) are a group of synthetic anionic clays, which are structurally related to brucite [Mg(OH)$_2$] in their layered structure. They have the general formula $[M^{2+}_{1-x}M^{3+}_x(OH)_2]^{x^+}[A^{n-}_{n/n}]^{x^-}mH_2O$, where $M^{2+}$ and $M^{3+}$ are bivalent and trivalent metal cations, and $A^{n-}$ is the anion compensating for the positive charge of the hydroxide layers. The structure of LDH contain stacked brucite-like $M^{2+}(OH)_2$ hydroxide layers in which isomorphous substitution of some of the $M^{2+}$ ions by the $M^{3+}$ ions leads to the generation of residual positive charges to the metal hydroxide framework. These residual positive charges are counterbalanced by the anions $(A^{n-})$ located interstitially. The unique structure, uniform distribution of different metal cations in the brucite layer, surface hydroxyl groups, flexible tunability, intercalated anions with interlayer spaces, and high chemical stability are some of the distinctive characteristics of this group of materials. They have well-defined structures and tailor made functionalities that provide special features to the material for their growing applications in various fields.

Synthetic layered double hydroxides find applications in catalysis, medical science, analytical science, environmental technologies and in the production of clean/green energy. The characteristics and various applications of layered double hydroxides will be discussed along with those developed in our laboratory for environmental and leather applications.
SOME NOVEL COPPER COMPLEXES: DNA AND HSA BINDING ASPECTS

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Small molecules rekindle renewed interest in recent years due to their applicability in various challenging fields like cancer therapy, microbial infections and molecular biology. In this perspective, investigation on the mode, mechanism, specificity and energy of the DNA interactions with small molecules under physiological condition is important. Accordingly, the small molecules serve as sequence specific and structure-selective binding agents for nucleic acids that increase further scope of research in genomic and medicinal chemistry[1]. The most abundant protein in human blood plasma is human serum albumin (HSA). HSA executes a plethora of crucial physiological functions aided by its enhanced solubility in blood plasma. It regulates osmotic blood pressure and helps in the storage, transportation, metabolism and distribution of biologically important compounds. Thus, HSA has relevance in molecular pharmacology and pharmacokinetics as well[2]. Copper, a bio essential trace element, is notable in this perspective. Copper complexes play a crucial role in different biological processes like electron transfer, DNA damage and as anticancer agents. These aspects kindled our interest to undertake the studies on the interaction of copper (II) complexes on DNA and HSA.


STATE-OF-THE-ART DEVULCANIZATION OF WASTE RUBBER PRODUCT

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More or less universally, bis(3-triethoxysilyl propyl) tetrasulfide (TESPT) has been used as a coupling agent during dispersion of silica filler in the virgin non polar rubber compound. It is for the first time that TESPT has been used a devulcanizing agent and so developed devulcanized rubber facilitates the silica dispersion in non-polar rubber compound without any coupling agent. A mechanism as regards how TESPT performs dual function has been proposed and validated in this work. It presents experimental results on the factors which control the extent of devulcanization of the devulcanized rubber. Precisely, the role of sol-gel content, inherent viscosity of sol rubber, crosslink density and degree of devulcanization was investigated as a function of devulcanization time and amount of TESPT, and optimization in terms of amount of TESPT and devulcanization time. By monitoring the extent of devulcanization TESPT concentration was optimized. To study the silica reinforcement, revulcanization of devulcanized rubber was carried out with silica filler and the curing characteristics of compounded devulcanized rubber were evaluated and found that the maximum torque increases with devulcanization time but optimum cure time decreases. The mechanical properties and thermogravimetry analysis of revulcanized rubber prepared from devulcanized rubber, clearly indicate that the optimum time for devulcanization is 40 min. Further, scanning electron microscopy (SEM) studies show the coherency and homogeneity of both de-and re-Vulc rubber material.

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Mass spectrometry has emerged as a fundamental tool in chemical and biological research. Due to its unprecedented sensitivity, accuracy, speed and quantitative capability, it has largely been employed in biomedical, forensic, pharmaceutical, environmental, toxicology, nucleic acids and many more fields of research. Basically, mass spectrometry determines compounds based on the mass (m) to charge (z) ratio. The mass spectrometer consists of ionization chamber, analyzer and detector. Each of the compounds needs to be ionized first for the analysis by mass spectrometer. In modern mass spectrometry, desorption and ionization are the terms coherently adjacent to each other for the real world sample ionization. Various sampling procedure could be used for the mass spectrometric detection of the real world sample. In order to remove the matrix effect, different extraction techniques like liquid-liquid extraction (LLE), solid phase extraction (SPE), single drop micro extraction (SDME) etc need to be applied during the sample preparation procedure. The application of mass spectrometry is enormous. It could be coupled with liquid chromatography system and can exactly quantify the different carcinogenic constituents in tobacco products. Using the similar procedure, it could be used for the post transcriptional modification study of RNA which has tremendous importance in gene regulation and disease identification. Identification of cancerous portion in operation theatre is a time consuming task using the presently available impregnated dye system. In recent developments, mass spectrometry in combination with statistical tools has successfully been used for the unambiguous and fast detection of cancerous and non-cancerous section in the living organisms. The presentation will demonstrate various recently developed ionization techniques, real world sampling procedure and its application from small organic molecules to large bio-molecules.

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EFFECT OF MODIFIED FLY ASH AS A FILLER ON PROPERTIES OF NYLON-6

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Fly ash (FA) waste by-products generated from combustion of coal in electric generating plants. Fly ash consists of inorganic, incombustible matter. They consist mostly of silicon oxide (SiO2) iron oxide (Fe₂O₃), and aluminium oxide (Al₂O₃). Fly ash poses severe environmental threat by contaminating the surrounding atmosphere and occupies huge land area for its dumping. Increasing production year by year, from the coal based electric generating plant, is posing a serious problem in terms of its safe disposal and utilization. The utilization of fly ash as filler material in polymer composites is considered important both economic and commercial point of view. Fly ash is used as reinforcing filler[7] in nylon-6. This paper deals with the effect of modified fly ash as filler on properties of nylon-6 composites. Fly ash treated with NaOH and HCL and characterized composites vibrations by XRD and Fourier Transform Infrared Spectroscopy (FTIR) and other properties include Mechanical Properties such as tensile strength, Impact strength and Flexural strength and Morphological properties (texture) such as SEM (Scanning Electron Microscopy). Test of all these properties will carry out on composite sample made of fly ash and nylon-6. These were made by twin screw extruder. These samples include the filler (Fly ash) content 0%, 10%, 20%, 30% and 40%. Strength level will increase with increase in percentage level.

Keywords: Fly ash, Nylon-6, NaOH, HCL, tensile strength, flexural strength and impact strength.
UNPRECEDENTED CATALYTIC ACTIVITY OF BIOGENIC CuO-NANOPARTICLES IN N-ARYLATION OF AMIDES

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Anilide derivatives are found to possess a wide application in several research fields like synthetic organic chemistry, medicinal chemistry, biological chemistry etc. Usually these reactions are catalyzed by a variety of metals including Pd, Ni, and Fe, but low cost, easy availability and environmentally benign nature of Cu have made an attractive target as catalysts for performing C-N cross-coupling reactions. The major disadvantages associated with the homogeneous copper catalysts are the difficulties to recover and reuse for successive reaction cycles and the possibility of metal contamination with the end product. To overcome these problems, copper was immobilised on various supports to form the corresponding heterogeneous copper catalyst [1-4]. But, the chemically synthesized and expensive ligand system demands an alternative method where we can recycle the catalyst to develop catalytic systems and make it environment-friendly. Nanoparticles having high surface area and reactive morphologies provide the advantages of high atom efficiency, mild reaction condition, simplified isolation of products, and easy recovery and recyclability of the catalysts. Biogenic CuONPs have been synthesized using Ocimum sanctum leaf extract. The catalyst was characterised by SEM, TEM, EDAX, UV-Vis spectra, IR etc. The catalytic performance of the complex has been tested for the N-arylation of amides under mild reaction conditions. This protocol offers several advantages, like very low catalyst loading, high yield, clean reaction, recyclability of the catalyst and one-pot synthesis of anilides from amides.

\textbf{Keywords:} N-Arylation, amides, nanocatalyst.

\textbf{References:}

ENHANCED AND SYNERGISTIC CATALYSIS OF ONE-POT SYNTHESIZED PD-NI ALLOY NANOPARTICLES FOR ANODIC OXIDATION OF METHANOL IN ALKALI

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In search for cost effective catalysts capable to oxidize methanol efficiently, nearly mono dispersed Pd$_x$Ni$_y$ binary electro catalyst of varying mutual composition have been synthesized using classical wet chemical protocol in a single pot in absence of any capping agent. The obtained Pd$_x$Ni$_y$ nanoalloy is stable in dispersion and powder form. The X-ray diffraction, spectroscopic and microscopic studies reveal crystallites with diameter of ca 5nm are agglomerated in nearly spherical shape on the base carbon electrode. The synthesized material shows enhanced synergistic effect in catalysis of methanol oxidation reaction in alkali and the alloy containing 20 atom % of Ni seems to be the best for all the related fuels like methanol, formaldehyde, sodium formate. The C/Pd$_x$Ni$_y$ catalysts are significantly protected from CO poisoning, leading to the excellent electrocatalytic activity. Cyclic voltammograms of possible intermediates like formaldehyde and sodium formate and ex-situ FTIR and chromatographic studies of reaction products reveal that Ni accelerates formation of carbonate rather than formate elucidating the plausible mechanism of the reaction.


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ORAL PRESENTATION 03

FABRICATION OF SILVER-TETRACYANOQUINODIMETHANE NANORODS ARRAYS FOR FIELD EMISSION APPLICATION

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Field assisted electron emission or cold cathode emission from metals and semiconductors have attracted wide attention of researchers over the past few years. Though inorganic semiconductors have been considered as appropriate substitutes to CNTs for field emission (FE) microelectronic devices, however, the high-temperature synthesis protocol that is not conducive to the emission cathode fabrication and FE device packaging often cast a shadow of these nanostructures. Organic charge transfer complex have been intensely studied due to their ability to control the molecular structures for property optimization, easy to tune band-gap as well as conductivity and thus opening new applications arena. For field assisted electron emission phenomena, some of the detrimental factors are the work function, geometry and conductivity of nanostructures emitters. Low work function is beneficial for electron tunneling from materials to vacuum, sharp geometry is effective to amplify the applied electric field at the emitter tip and high conductivity ensures less resistive loss during electron movement through the materials when it passes from cathode to emission tip. Metal-TCNQ (TCNQ= 7,7’,8,8’-Tetracyanoquinodimethane) possess all these beneficial features whereas one or more are absent in other conducting organic materials like Tris (8-hydroxyquinoline) aluminum (Alq3), anthracene, copper hexadecafluorophthalocyanine (F\textsubscript{16}CuPc), copper 5,15,16,16-tetracyano-6,13-pentacenequinodimethane (CuTCPQ) copper...
phthalocyanine (CuPc), polythiophyne, copper/silver tetrafluoro tetracyanoquinodimethane (CuTCNQF₄ and AgTCNQF₄) and etc. [1-5]. Further, AgTCNQ nanoforms have garnered traction among the researchers due to their semiconducting properties as well as on/off switching characteristics. Furthermore, peculiar feature of ultra-fast impedance switching from high to low state with the application of electric field within a few nanoseconds, highlight their prospect as cold cathode emission. These features have encouraged their choice as the fitting substitute of conventional electron emitter.

In this work, we have developed a facile way for the fabrication of AgTCNQ nanorods (NRs) arrays on flexible carbon cloth substrate by tuning the reaction temperature and investigated their field-emission (FE) properties. FE results show that the AgTCNQ CT complex nanostructures are excellent candidates for field-emission cold cathodes.

References:

POLYCYCLOPROPENE BASED POLYMERIC LADDERPHANES

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Living ROMPs of norbornenes and cyclobutenes having 5,6-endofused N-arylpyrrolidine catalyzed by the Grubb’s catalyst or Schrock’s catalyst give isotactic single stranded
polynorbornenes and polycyclobutenes where all pendants aligned coherently toward the same
direction.\textsuperscript{1} Polynorbornenes and polycyclobutenes having different kinds of ending groups have
been demonstrated to be useful for catalysis, light harvesting and photo induced electron transfer,
ion conductivity, and optoelectronic applications.\textsuperscript{2} Moving towards cyclopropene will brings the
joy and challenges in ROMP process, due to high ring strain (ca. 228 kJ mol\textsuperscript{-1}) and more S-
character (vinyl C: sp\textsuperscript{1.19} ; other C: sp\textsuperscript{2.68}).\textsuperscript{3,4} The distance separating adjacent pendants in
polycyclopropenes would therefore be shorter than that in polynorbornenes and even than
polycyclobutenes. Accordingly, interactions between pendants in polycyclopropenes would be
different from those in polynorbornenes or polycyclobutenes. Therefore introduction of a
congener of norbornene and cyclobutene, cyclopropene fused with N-arylpyrrolidine will open a
new arena in template assisted duplex polymer synthesis.

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\end{enumerate}
A REUSABLE POLYANILINE SUPPORTED SILVER NANOCOMPOSITE (MPANI/Ag) FOR ACYLATION OF AMINES, ALCOHOLS AND THIOPHENOLS UNDER SOLVENT FREE CONDITION


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A mesoporous polyaniline/silver (mPANI/Ag) nanocomposite has been prepared using mesoporous organic polymer polyaniline with silver nitrate via radical polymerization of aniline monomer in the presence of hydrochloric acid. The mPANI/Ag nanocomposite has been characterized by powder XRD, TEM, EDX, FT-IR and UV-vis. Nanocomposites formed by metal nanoparticles (NPs) dispersed in electrically conducting polymer, polyaniline, are expected to display several synergistic properties between the polymer and the metal nanoparticles, making them potential candidates for application in several fields such as catalysis [1-3] and others. Polyaniline (PANI) is a conducting polymer of particular interest, due to its ease of preparation, high conductivity and good environmental stability. The choice of Ag in our work is mainly guided by its highest electrical conductivity among all the metals as well as its enhanced catalytic activity [4].

So in our study, we attempt to use mPANI/Ag as a potential catalyst for various organic reactions like acylation of amines, alcohols and thiophenols using acetic acid as acylating agent. This catalyst can be easily separated by using a simple filtration technique and can be reused five times without significant loss of catalytic activity [5].

Keywords: Acylation, alcohols, amines, nanocatalyst, thiophenols.

References:
ORAL PRESENTATION 06

REUSABLE NOBLE METAL NANOPARTICLES GRAFTED ONTO MESOPOROUS POLYMELAMINE FORMALDEHYDE AS CATALYSTS FOR HMF TO DFF CONVERSION AND OXIDATIVE ESTERIFICATION

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Mesoporous polymelamine formaldehyde (mPMF) has been synthesized and characterized. Noble metal nanoparticles (Ag and Ru) was grafted onto mPMF to get the catalysts and AgNPs@mPMF and Ru0@mPMF. The catalysts are well characterized by powder X-ray diffraction (XRD), high-resolution transmission electron microscopy (HRTEM), UV-vis diffuse reflection spectroscopy (DRS), X-ray photoelectron spectroscopy (XPS) analysis, Raman spectroscopy and N2 adsorption study. The catalytic performance of AgNPs@mPMF has been tested for aerobic oxidative esterification of activated alcohols. Ru0@mPMF can effectively catalyse selective oxidation of 5-hydroxymethylfurfural (HMF) to 2,5-diformylfuran (DFF). Both the catalysts can be reused at least six times.
Melamine and paraformaldehyde were mixed with dimethyl sulfoxide (DMSO) and heated in
the oven to 170 °C for 72h. The resulting solid (mPMF) was washed and dried. The mPMF
was dispersed in prepared TRIS-stabilized Ag-NPs and stirred for 1h at room temperature
and mPMF-Ag⁰ was obtained (Scheme-1) [1]. For the synthesis of Ru⁰@mPMF, mPMF in
water was stirred with RuCl₃ at room temperature for 10 h. It was then evaporated to dryness
in a rotary evaporator. Ethylene glycol solution was added to the dry composite. It was then
refluxed at 180 °C for 6 h. When solid settled down, it was washed with distilled water. Then
the solution was filtered and washed with methanol and distilled water (Scheme-2)[2]. The
obtained material was dried for 12 h at 60°C.

Scheme 1 : Catalyst preparation and aerobic oxidative esterification reaction
For aerobic oxidative esterification of activated alcohols, the benzylic alcohols with electron-
donating and electron-withdrawing groups gave excellent yields of products. Sterically more
hindered ortho-substituted alcohols also gave excellent results under the same reaction
conditions.

Scheme 2 : Catalyst preparation and HMF to DFF conversion
The Ru@mPMF catalyst was excellent for selective oxidation of 5-hydroxymethylfurfural (HMF) to 2,5-diformylfuran (DFF) in toluene under oxygen atmosphere with high yield. 

**Keywords:** Ag and Ru nanocatalysts, esterification reaction, HMF to DFF, mesoporous poly-melamine-formaldehyde, recyclable catalyst

Reference


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**ORAL PRESENTATION 07**

**COPPER OXIDE DECORATED REDUCED GRAPHENE OXIDE AS AN ELECTROCATALYST FOR ELECTRO-OXIDATION OF METHANOL**

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Copper oxide (CuO) nanoparticles decorated on surface of reduced graphene oxide (rGO) are prepared through a simple hydrothermal approach without using any reducing agents and utilized for methanol electro-oxidation. The synthesized nanocomposites were characterized by using several spectroscopic and analytical techniques. The calcined nanocomposite (CuO-rGO_{calcined}) undergoes irreversible methanol oxidation and exhibits a less positive anodic peak (0.72 V) than that of CuO (0.75 V) in alkaline medium. Moreover, the peak current density at the CuO-rGO_{calcined} is 2.4 times higher than that of CuO. The stability of the CuO-rGO_{calcined} electrode was further investigated for 100 continuous cycles. The CuO-rGO_{calcined} nanocomposite featuring low-cost, high durability and low onset potential exhibits a superior catalytic activity for methanol electro-oxidation.
Keywords: Copper oxide, reduced graphene oxide, nanocomposite, methanol electro-oxidation

Inorganic organic nanocomposite materials have immense potential. It enhances the mechanical, thermal and chemical stability, catalytic activity, optical activity, toughness and has wide range of application [1]. In recent years, polymer electrolyte membrane fuel cell (PEMFC) has gained great research interest as alternative energy resources. In electrical devices, stationary power generators, portable devices and in many other fields PEMFC are widely used [2]. In PEMFC, Proton conducting polymeric membrane is mainly used as electrolyte. Nanocomposition of the proton conducting polymeric membranes with inorganic nanoparticles leads to better performance in the PEMFC. In inorganic –organic polymeric membranes, the inorganic nanoparticles are dispersed in the organic polymeric matrices. In
PEMFC, different membranes are used for different temperature range operation. For low temperature (<100°C), sulfonated polyether ether ketone (SPEEK) and polyvinyl alcohol (PVA) can be used, whereas for high temperature, polybenzimidazole (PBI) is used. Performance in the fuel cell varies with the proton conductivity.

References:

Acknowledgement: The financial assistance from University Grants Commission (UGC), India and from NMRL, DRDO, India are gratefully acknowledged.

ORAL PRESENTATION 09

DEVELOPMENT OF BIOBASED POLYURETHANE THROUGH NONISOCYANATE ROUTE

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Fully bio- and CO₂- sourced non-isocyanate polyurethanes (NIPUs) were synthesized by reaction of carbonated sunflower oil (CSO) with different diamine to synthesize thermoplastic NIPUs. Carbonated vegetable oils were first obtained by metal-free coupling reactions of CO₂ with epoxidized soybean oils under conditions (Tempr=130°C, Press=50bar) and complete characterization by FTIR. In a second step, bio based NIPUs were produced by reacting cyclo-carbonated oil with different diamine like ethylenediamine, hexamethylenediamine and isophorone diamine at CSO/amine molar ratio of 1:0.75, 1:1, 1:2. It was found that along with urethane formation, the amine group reacted with ester groups to form amides and NIPU based on isophorone diamine showed high glass transition temperature (Tg).

Key words: sunflower oil; nonisocyanate; polyurethane; diamine
HEMOGLOBINOPATHIES IN INDIA: PREVENTION, CONTROL AND FUTURE DIRECTIONS

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Hemoglobinopathies are a group of inherited genetic disorders seen mostly as moderate to severe forms of hemolytic anaemia caused due to mutataions in the globin chains of the hemoglobin molecule. Among these hereditary hematologic disorders, β thalassaemia and structural variants like HbD, HbE and HbS are of major public health importance. β thalassaemia is spread in almost all states and population groups of India with an estimated 4% carrier prevalence rate that translates to approximately 40 million carriers at a national level. Moreover, approximately more than 10,000 new thalassaemic major births occur annually thus compounding the disease burden. The prevalence varies in different states ranging from 17% in Gujarath to very low incidences in states like Kerala. On the contrary, the prevalence of abnormal genes (HbD, HbE, HbS) are mostly restricted to certain ethnic and geographical groups within India with varying incidence rates. HbD Punjab occurs in North Western regions with carrier prevalence of 0-10%. HbE is a hallmark of eastern and north-eastern parts with carrier prevalence of 5-50% and HbS is mostly confined to central and southern India with the highest prevalence (30%) observed in central India. Importantly, very high rate of HbS prevalence is found mostly among the underprivileged and socio-economically backward classes who are poor and cannot afford treatment. The sickle cell gene alone is more virulent when compared with HbD and HbE as it causes a lifetime of unbearable pain and sever complications. The combination of thalassaemia gene with structurally abnormal genes (compound heterozygotes) is severe and complicated as thalassaemia major. Rapid industrialization and economic development has affected population demography in India leading to large-scale migrations and movement of people seeking jobs and changing settlements leading to increased detection chances for compound heterozygotes. Moreover with improvement in molecular detection techniques the likelihood of detecting new mutations and newer compound heterozygotes are higher which are likely to increase the genetic disease burden on society. The number of hemoglobinopathy sufferers in
India are likely to be very high as more than one million people are affected by sickle cell anaemia alone. The national data on mortality and morbidity is inadequate and many cases remain undiagnosed. Many couples become aware of the genetic disease carrier state only after the birth of an affected child. Therefore, lack of awareness, non-availability of simple and reliable diagnostic tests, absence of specialized centers addressing medico-social aspects of the disease, ignorance of both general public and medical fraternity constitutes the major factors that prevent a proper control and intervention program for the disease. Historically, hemoglobinopathies have been prevalent in India for the last several thousand years and knowledge about its existence developed only in the second half of the 20th century. It is a collective social, ethical medical need to take the corrective steps now on a priority basis to tackle this problem with the medical scientist taking the lead in formulating national policies to prevent birth of children with major hemoglobinopathy disorders. This is possible through establishment of community control programme centers in the beginning in high risk and endemic areas.

A NOVEL POLYANILINE NANOTUBE/EXPANDED GRAPHITE COMPOSITE FOR APPLICATION IN METHANOL SENSING.

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Due to its intrinsic conducting nature, polyaniline (PANI) has found application as a methanol vapor sensor. In this work, a novel PANI nanotube/expanded graphite (PANI nanotube/EG) composite was fabricated and used as methanol sensing element which could detect. Initially, PANI nanotubes were prepared by oxidation of aniline with ammonium peroxy disulphate in acidic medium. Compared to PANI nanoparticles prepared by a different route, the PANI nanotubes displayed a superior electrical conductivity of 1.61 S/cm to that of 0.44 S/cm for PANI nanoparticles. Based on these initial results, the PANI nanotubes were used for preparing PANI nanotube/EG composites of different mass ratios by polymerization reaction of aniline in the presence of EG. The synthesis of the nanocomposite was confirmed by Fourier transform infra-red spectroscopy (FTIR), X-ray diffraction (XRD) and scanning electron microscopy (SEM) techniques. The conductivity, as measured by a four-probe
technique, was found to be 199.04 Scm⁻¹ for the PANI nanotube/EG composite having a mass ratio of 0.6. Both the PANI nanotubes and the PANI nanotube/EG composite were investigated as methanol vapor sensors at different concentrations (50, 100, 150, 200 and 250 ppm) of methanol solutions prepared in double distilled water. On exposure to methanol vapors in an air tight environment, the sensing elements showed a change in its electrical resistance. The response of the materials showed an increase on increasing the concentration of methanol solutions. However, on comparing both the sensing elements, it was observed that the presence of EG in PANI nanotube/EG composite increased its sensitivity towards methanol vapors of concentration as low as 50 ppm as compared to that of the pure PANI nanotubes. The response time of the sensor was also very fast at approximately 60 s. Thus, PANI nanotube/EG composite has the potential to be used as a methanol sensing element in future.

Fig: Response of PANI nanotube/EG composite and PANI nanotubes towards methanol vapors.
STABILITY OF DOXYCYCLINE HYDROCHLORIDE -VITAMIN B₂ COMPLEX IN AQUEOUS ETHANOL MEDIUM OF VARYING COMPOSITION AND TEMPERATURE

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Charge transfer (CT) complex between Doxycycline hydrochloride and electron acceptor riboflavin (vitamin B₂) has been shown in aqueous ethanol medium. The enthalpy and entropy of formation of the complex between riboflavin and doxycycline hydrochloride have been determined by estimating the formation constant (K) spectrophotometrically at five different temperatures in pure water. Pronounced effect of dielectric constant of the medium on the magnitude of K has been observed by determining K in aqueous ethanol mixtures of varying compositions. This has been rationalized in terms of ionic dissociation of the hydrochloride (DH⁺Cl⁻), hydrolysis of the cation DH⁺ and complexation of the free base D with riboflavin.

REGIOSELECTIVE FUSION OF AROMATIC DI-AMINES TO COORDINATED 2-(PHENYLAZO)PYRIDINE. AN APPROACH TO THE SYNTHESIS OF NEW LIGANDS WITH LARGE DENTICITY

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Chemical transformations of organic substrates, coordinated to transition metal ions are important as these provide facile synthesis of many novel molecules that are otherwise difficult or even impossible to synthesize by conventional synthetic procedures. In these reactions the metal ions act as mediator, which in fact forms the basis of homogeneous catalysis. Transition metal promoted organic transformations in the context of synthesis of
new ligands particularly having large denticity so that these can bind several metal ions to form polymetallic systems. Such polymetallic systems are expected to produce electronically coupled materials. The synthesis of a series of tridentate N-donors by regioselective amine fusion reaction to coordinated 2-(phenylazo)pyridine are already reported. Successful design and synthesis of new N-donor multidentate bridging ligands have also been achieved by using this same strategy where aromatic diamines (e.g., 1,2-diaminobenzene, 2,6-diaminopyridine, benzidine) are used as precursors. All these free ligands are successfully isolated and characterized. The resultant compounds contain a free amine function, which might be useful for further expansion of denticity of the ligands. It may be noted here that 1,2-diaminobenzene has been known as a chelating ligand whereas benzidine behaves as a bridging ligand. The coordination of 2,6-diaminopyridine is virtually unknown and trimetallic coordination may be expected as is observed in case of 2,2'-dipyridylamine. In this reaction one of the two amine functions of the di-amine reagent is fused regioselectively to ortho-carbon (with respect to the azo group) of the pendant phenyl ring of coordinated 2-(phenylazo)pyridine to yield new anionic polydentate N-donor ligands. The second amine function remains pendant and does not take part in the fusion reaction.

![Chemical Structures](attachment:image.png)

**ORAL PRESENTATION 14**

SYNTHESIS OF CARBOXYMETHYLCELLULOSE-G-POLY(ACRYLIC ACID)/OMMT-BASED HYDROGEL FOR THE IN VITRO CONTROLLED RELEASE OF INSULIN AND VITAMIN B₁₂

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We have synthesized a pH-sensitive composite hydrogel composed of Carboxymethylcellulose-g-poly (acrylic acid)/OMMT (organically modified Montmorillonite clay) using ammonium peroxodisulfate (APS) as an initiator and N,N'-
methylenebisacrylamide (MBA) as crosslinker. Optimization of characteristic properties of
the polymeric hydrogel is performed by changing different parameters including initiator
concentration, concentration of cross linker, and concentration of the fillers. FTIR spectra
proved that partially neutralised acrylic acid is grafted onto CMC backbone and OMMT
participated in the polymerisation. The surface morphology of the composite hydrogel was
characterized by SEM. The retention and uniform dispersion of OMMT in the nanocomposite
hydrogel was confirmed by XRD. Thermal properties were studied varying concentrations of
different parameters. Swelling and water retention properties of the prepared hydrogel were
studied. pH-sensitivity was investigated and the application of this hydrogel in control release
of insulin in artificial gastric fluid (AGF) and in artificial intestinal fluid (AIF) is evaluated.
The same is used for investigating release of vitamin B₁₂ in same environment for
comparative study and efficiency.

KEYWORDS: Hydrogel, stimuli responsive hydrogel, CMC, AA, clay, pH-sensitivity,
controlled release.

GOLD(III)-DIACETYL-1,3,5-TRIAZA-7-PHOSPHAADA MANTANE (DAPTA)-
ARYLAZO-IMIDAZOLE COMPLEXES : SYNTHESIS AND SPECTROSCOPIC
STUDY

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Darenbergs´s group has been active in the investigation of the different facets of PTA due to
its utility as a water-soluble ligand and in efforts to explore the unique chemistry of this
ligand. Further, PTA has been investigated in many different areas such as photoluminecence
of gold(I) phosphine complexes and intermolecular hydrogen-metal interactions as well as its
use as a precursor to other novel phosphine amine compounds and ligands. One commonly
used strategy to impart water-solubility to a given metal complex involves the use of those
selected for this study: 1,3,5-triaza-7-phosphaadamantane (PTA); 3,7-diacetyl-1,3,7-triaza-5-
phosphabicyclo [3.3.1] nonane (DAPTA); monosulfonated triphenylphosphine (TPPMS);
disulfonated triphenylphosphine (TPPDS); trisulfonated triphenylphosphin (TPPTS).
Reaction of [Au(DAPTA)(Cl)] with RaaiR in CH2Cl2 medium following ligand addition leads to [Au(DAPTA)(RaaiR)](Cl) [ RaaiR = p-R-C6H4-N=N-C3H2-NN-1-R', (I-3), abbreviated as N,N'-chelator, where N(imidazole) and N(azo) represent N and N', respectively; R = H (a), Me (b), Cl (c) and R' = Me (1), CH2CH3 (2), CH2Ph (3).]. The 1H NMR spectral measurements in D2O suggest methylene, –CH2–, in RaaiEt gives a complex AB type multiplet while in RaaiCH2Ph it shows AB type quartets. 13C NMR spectrum in D2O suggest the molecular skeleton. In the 1H-1H COSY spectrum in D2O as well as contour peaks in the 1H-13C HMQC spectrum in D2O assign the solution structure.

ORAL PRESENTATION 16

PREPARATION OF A MICROENCAPSULATION BASED SELF-HEALING METHYL METHACRYLATE-GLYCIDYL METHACRYLATE COPOLYMER, POLY (MMA-CO-GMA) BY ATOM TRANSFER RADICAL POLYMERIZATION

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Self-healable Methylmethacrylate-Glycidyl methacrylate copolymer was fabricated with embedded diethylenetriamine(DETA) encapsulated poly(methylmethacrylate) microcapsules. Atom Transfer Radical Polymerization (ATRP) was used to synthesize the matrix polymer using ethyl α-Bromo isobutyrate as the initiator. Microcapsules containing triamine hardener with polymethyl methacrylate (PMMA) as the shell was synthesized using a water-oil-water emulsion solvent evaporation method. The microcapsules were introduced into the living co-polymer to study the healing effects. The so prepared co-polymer matrix retains living characteristics, so it can initiate a healing reaction when the encapsulated hardener reaches the matrix due to formation or extension of a crack and thus healing the system covalently.

Keywords: ATRP, Poly(methylmethacrylate) microcapsules, PMMA, GMA, co-polymer, self-healing polymer
A COST EFFECTIVE HYDROGEN GENERATION BY USING GRAPHENE BASED MONO-METALLIC CATALYST: SYNTHESIS, CHARACTERIZATION AND COMPARISON OF G-Pt, G-Co NANO CATALYSTS

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The use of Graphene as a support material for the dispersion of metal nanoparticles provides new ways to develop advanced electro-catalyst materials for Hydrogen generation from Sodium Borohydride [1-4]. In this present study, two different graphene based mono-metallic catalysts namely Graphene-Cobalt (G-Co), Graphene-Platinum (G-Pt) were synthesized, characterized using XRD, FTIR, SEM, HRTEM, EDAX and Cyclic voltammetry(CV) analysis and tested for hydrogen generation.

In this study, Improved method was employed to prepare Graphite Oxide (GO). G-Pt, G-Co, nanocatalysts were synthesized by using Polyol method. The prepared sample was characterized using High resolution transmission electron microscopy (HRTEM), SAED, FTIR, XRD and mass absorption spectroscopy. HRTEM analysis and selected area electron
Diffraction (SAED) analysis confirmed the ordered crystal structure of graphene nanosheets. The G-Co, and G-Pt catalysts were deposited as films onto carbon Toray paper by drop cast method. The electrochemically active surface area (ECSA) of G-Co and G-Pt were estimated using cyclic voltammetry. Synthesized G-Co, G-Pt nano-catalysts were tested for hydrogen generation from hydrolysis of Sodium Borohydride. The effect of amount of catalysts and temperature on the rate of hydrogen generation was also studied.

Among the two catalysts higher metal loaded G-Co exhibits the higher catalytic activity shows in figure.1. The evaluated value of activation energy of the catalytic hydrolysis using G-Co and G-Pt are almost same, i.e. 41.77kJ mol$^{-1}$ and 41.22 kJ mol$^{-1}$.

Keywords: Hydrogen generation, Graphene, Graphene based catalyst, Sodium borohydride

![Figure.1 Comparision Performance curve at different temp](image)

Acknowledgments

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References

CONTROLLING THE MORPHOLOGY OF SnO$_2$ NANOSTRUCTURES BY A POLYACRYLAMIDE ASSISTED CALCINATION METHOD

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Oxide nanostructures are attracting a great attention to both theoretical and experimental researchers for their distinctive and fascinating properties compared to their bulk counterparts. As physical, chemical, electronic, optical, magnetic, and catalytic properties of nanomaterials highly depend on their shape, size, composition and crystallinity, controlled growth or fabrication of nanostructures with desired shape and size have attracted a great deal of interest for the last few years. Tin Oxide (SnO$_2$) has potential applications in several areas like optical waveguides, solar cells, Li-ion batteries heater applications, UV photodetectors and gas sensors as it is a low-cost, n-type semiconductor with wide band gap (E$_g$ = 3.6 eV). Though miscellaneous low dimensional nanostructured materials such as nanoparticles (NPs), nanorods$^2$, nanocubes, nanowires, nanorings, nanoribbon, nanobelts, nanotubes etc. have been synthesized by various methods using hydrothermal / solvothermal, laser ablation, soft solution, Liquid Phase Deposition (LPD), thermal decomposition, sonochemical, template etc.; there is still no reports on synthesis of SnO$_2$ nanocubes with tunable dimension by wet chemical methods. Apart from these applications, nanocubes may be used as building blocks for micron size architectures. In the present work, SnO$_2$ superstructures like microcube, plate, bar etc. are formed by aggregation of SnO$_2$ nanocubes which act as building block using polyacrylamide (PAM) in a simple calcinations technique. The SnO$_2$ nanoparticles grow preferentially along {110} direction during calcinations at low temperature and form nanocubes bounded by thermodynamically most stable (110) planes. At lower calcination temperature ($t_c$~510K) the size of the nanocube is limited to 40-50nm due to capping by PAM. In the second step, at higher temperature (~ 615k) thermal degradation of PAM occurs; consequently, nanocubes come close together and self assembled to form superstructures in the shape of microcubes, microrods or microplates. The absorption spectra are combination of three peaks (350nm, 297nm and 244nm) due band edge absorption, presence of hydroxyl ions attached to the nanocrystals and formation of SnO$_2$@c composites.
The intensity of the photoluminescence spectra decreases with more luminescence centers are formed and decrease in trapping centers.

EFFECT OF TYPE AND CONCENTRATION OF CROSSLINERS ON POLYVINYL ALCOHOL MEMBRANES FOR PERVAPORATIVE DEHYDRATION OF IPA

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Organic macromolecules containing various functional groups can be suitably used as membrane material for membrane based dehydration of several water-organic binary mixtures. Polyvinyl alcohol (PVA), a highly hydrophilic polymer has been extensively studied for dehydration of several organic intermediates. However, the membranes made from this polymer were found to show extensive swelling in aqueous solution because of its high polarity. Crosslinking of PVA reduces swelling and improves water selectivity. However the permeability properties of the membrane strongly depend on the type and amount of crosslinker. Crosslinked PVA membranes can be suitably used for dehydration of different important organic intermediates like IPA using a low energy separation process called pervaporation. Unlike distillation this separation process can be performed at low temperature using atmospheric pressure on the feed side and low pressure on the downstream side of the membrane. In this study four different kinds of crosslinked PVA membranes were prepared by crosslinking PVA with four different types of crosslinkers i.e., glutaraldehyde (GLU), oxalic acid (OA), dimethylol urea (DMU) and tetra ethyl ortho silicate (TEOS) and designated as PGLU, POA, PDMU and PTEOS, respectively. All these four types of crosslinkers were used at 2, 4 and 6 wt% concentrations (with respect to the polymer) to produce 12 different membranes. These membranes were first used for separation of azeotropic feed concentration of IPA in water (87.7 wt% IPA in water) by pervaporation. Among all these membranes PVA membrane crosslinked with 2 wt% GLU (with respect to
PVA), i.e., PGLU2 was found to show optimum flux and water selectivity (79.75 g/m² h and 45.23, respectively, at 40°C) for separation of this IPA–water azeotropic mixture. This membrane was finally used for pervaporative dehydration of IPA-water mixture at different feed concentrations and temperatures. All these membranes were characterized by FT-IR, XRD, DTA-TGA and mechanical properties.

**Keywords:** Polyvinyl alcohol; crosslinker; sorption; pervaporation; membrane

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**ORAL PRESENTATION 20**

**AN EFFICIENT AND HIGHLY STABLE QUASI SOLID STATE DYE SENSITIZED SOLAR CELL BASED ON POLYMETHYL METHACRYLATE (PMMA)/POLYANILINE NANOTUBE (PANI-NT) GEL ELECTROLYTE**

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A novel polymer gel electrolyte (PGE) based on polymethyl methacrylate (PMMA)/polyaniline nanotube (PANI-NT) with LiI/I₂ as a redox couple and 4-tertbutylpyridine as additive was prepared in a solvent mixture of N-methyl 2-pyrrolidone (NMP) and acetonitrile. PMMA and PANI-NT were characterized using Fourier transform infrared spectroscopy (FTIR). Different amounts of PANI-NT were used to optimize the ionic conductivity of the polymer gel electrolyte. The introduction of PANI-NT in the PMMA based gel electrolyte enhanced the ionic conductivity of the gel electrolyte. This was confirmed by computing the ionic conductivities using electrochemical impedance spectroscopy (EIS). The surface morphology of gel electrolytes were studied using scanning electron microscopy (SEM). A series of Dye sensitized solar cells (DSSCs) were fabricated employing gel electrolytes with different weight percentages of PANI-NT. The cell performance of the optimized DSSC was investigated by current density vs. voltage (J-V) characteristics. The optimized system exhibited an open circuit voltage of 0.756 V, short circuit current density of 9.80 mA cm⁻², fill factor of 0.68 and the photo-conversion efficiency of 5.11% under irradiation of 100 mW cm⁻² and air mass (AM) 1.5. EIS was used to study the charge transfer processes in the DSSCs under irradiation. The increment of
PANI-NT in the PMMA based gel electrolytes reduces the charge transfer ($R_{ct}$) process, resulting enhancement of the device efficiency. The long term stability study of the DSSCs shows that the PMMA/PANI-NT based gel electrolyte have commendable durability as compared to the liquid electrolyte.

**ORAL PRESENTATION 21**

**DIHYDROPYRIMIDONES AS NOVEL BIOACTIVE AGENTS**

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**INTRODUCTION:**

Dihydropyrimidones (DHPMs) have a wide range of synthetic importance due to the six diversity points around the heterocyclic core. Over the years they have also emerged as novel antibacterial, antiviral and antitumour agents$^1$. More recently they have have been shown to function as calcium channel blockers (CCBs)$^2$.

The present study demonstrates how functionalisation of different points on the heterocyclic scaffold can lead to diverse range of biologically activities by these DHPM analogues.

**FUNCTIONALISATION TECHNIQUES:**

In the initial stages, regioselective N1-alkylation of 3,4-dihydropyrimidin-2(1H)-ones using a very efficient mild base Cs$_2$CO$_3$ and alkyl halides at room temperature was done which provided for the first time a simple, inexpensive way of N1-alkylation with high yields and excellent regioselectivity. In this context, it is worth mentioning that this achievement of regioselectivity is otherwise difficult because of the small difference in acidity of N1 and N3 hydrogens.
Fig 1: Regioselective N1 alkylation method and single crystal x-ray structure of 1.1a (R) isomer.

Table 1: Preparation of Substituted DHPMs

<table>
<thead>
<tr>
<th>Entry</th>
<th>DHPM</th>
<th>R'X</th>
<th>Reaction time (h)</th>
<th>Additive</th>
<th>N1-alkyl DHPM</th>
<th>Yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 (R' = H)</td>
<td>CH₃</td>
<td>17</td>
<td></td>
<td>1.1a</td>
<td>94</td>
</tr>
<tr>
<td>2</td>
<td>2 (R' = p-Cl)</td>
<td>C₆H₅Cl</td>
<td>24</td>
<td>Bu₃Sn</td>
<td>2.1b</td>
<td>73</td>
</tr>
<tr>
<td>3</td>
<td>3 (R' = m-NO₂)</td>
<td>CH₃</td>
<td>24</td>
<td>Bu₃Sn</td>
<td>3.1a</td>
<td>90</td>
</tr>
</tbody>
</table>

* Only 1.1 eq of Cs₂CO₃ was used and 5% dialkylated product was obtained.

All compounds were characterised according to standard procedures.
BIOLOGICAL ACTIVITIES STUDIED:
The inhibitory activities of the unsubstituted DHPMs and N1-alkylDHPMs were examined on Mg dependent Ca-ATPase according to the previously established procedures. Among all DHPM derivatives, compound 1 to 6 were found to be most potent in their inhibitory action. They differ only in the aromatic nucleus present at C-4 position of the heterocyclic core. The IC$_{50}$ values are listed in the Table 2.

Table 2: Study of IC$_{50}$ of substituted DHPMs:

<table>
<thead>
<tr>
<th>Entry</th>
<th>DHPM derivatives</th>
<th>Entry</th>
<th>DHPM derivatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>H</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>p-Cl</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>m-NO$_2$</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>m-Cl</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>o-Cl</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6.</td>
<td>p-OH</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

$^*$ IC$_{50}$ is the concentration (in $\mu$M) of inhibitors at which half the maximal inhibitory effect is achieved.

RECENT FOCUS:
Researchers of the group have studied that T lymphocytes play a crucial role in the host immune response to cancer. Accumulating evidences suggest that patients with advanced cancer show impairment in lymphocyte activation resulting in immune dysfunction. Indeed, malignant cells often use a variety of mechanisms to evade destruction offered by the immune system. The effect that progressively growing tumor has on the immune response presents is an important challenge to the success of T cell-based immunotherapy and cancer vaccines. Therefore, therapeutic approaches that can protect the immune system in cancer patients may enhance the immune competence and increase their survival.

From Table 2, the dihydropyrimidone derivative, ethyl-4-(3-nitro)-phenyl6-methyl-2-oxo-1,2,3,4-tetrahydropyrimidine-5-carboxylate (nifetepimine) (compound 3) was chosen as a candidate which inhibited Ca-ATPase (SERCA variant) as a probable candidate for immunotherapy since it possessed lowest IC$_{50}$ value. It was found that tumours jeopardize normal functioning of Ca-ATPase leading to reduced anti-tumour immunity. That is, in tumour bearing cells, Ca2+-ATPse is upregulated leading to calcium stress and cell death.
When the human peripheral blood mononuclear cells as well as the purified CD4+ T cells were cultured in the presence of nifetepimine doses up to 75 μM produced no significant cell death. Further results demonstrate that down-modulation of SERCA3 expression by nifetepimine ensured CD4+ T cell survival both in vitro and in vivo experimental models. Thus it could be proved for the first time that nifetepimine-mediated immune restoration from tumor-induced immune suppression and this also suggests the role of nifetepimine as a possible therapeutic agent with a strong immunomodulatory effect, which can be used to treat patients with cancer.

References:
An effective self assembly method was used to synthesize hybrid nanocomposites of TiO\(_2\) nanoparticles on graphene oxide (GO) sheets for application in Dye Sensitized Solar Cells (DSSCs). The successful incorporation of TiO\(_2\) on the GO sheets was confirmed by X-ray diffraction (XRD), Energy Dispersive X-ray spectrum (EDX) Raman and UV-Visible spectroscopy. The morphology and size of the TiO\(_2\) nanoparticles on the GO sheets were analyzed by scanning electron microscope (SEM) and transmission electron microscopic (TEM) analysis. This manuscript is concerned with the effects of different GO contents of the photoanode on the energy conversion efficiency of the PVA gel electrolyte based DSSCs. DSSCs based on GO@TiO\(_2\) nanocomposite photoanode with an optimum concentration of GO content of 2.5 wt\% showed a short circuit current density (J\(_{sc}\)) of 7.67mAcm\(^{-2}\), an open circuit voltage (V\(_{oc}\)) of 0.76V and photo conversion efficiency of 3.97\% which is much higher than that of the pure TiO\(_2\) nanoparticles.

Bornite (Cu\(_5\)FeS\(_4\)) has attracted interest as a potential photovoltaic material, due to their efficient light absorbance and electronic properties. Presences of earth abundant metal ions
(Cu, Fe) make Bornite a low cost alternative for various I–III–VI systems. It has also a tuneable electrical and magnetic property due to existence of both the metal ion in the same crystal structure. In this report the synthesis of novel Cu₃FeS₄ and its possible application in metal-semiconductor (MS) junction have been demonstrated. In our study, a hydrothermal chelation method at 150° C was introduced to synthesize the Cu₃FeS₄ nanoparticles. Citric acid was used as a chelating agent. The structural, optical and electrical characterization of the as synthesized material was performed. From Powder X-ray diffraction pattern, JCPDS card no: 73-1667 approves the synthesize material as Cu₃FeS₄ with phase purity. The particle size (~ 17.62 nm) was computed with the help of Scherrer’s formulation. The FESEM micrograph demonstrates that the synthesized Cu₃FeS₄ flower shaped micro-architecture consist of nano-flakes were successfully fabricated by the hydrothermal chelation method. The optical band gap energy (=1.7 eV) was calculated from UV-vis spectra and depicts its potentiality in photovoltaic (PV) application. We have fabricated the Al/Cu₃FeS₄/ITO sandwiched structure and the electrical properties were performed by applying a bias voltage (-2 V to +2 V) between two electrodes (Al and ITO). The I–V measurements were recorded with a Keithley 2400 Sourcemeter under dark and photo illumination condition. The room temperature photo conductivity and dark conductivity was measured as 19.56×10⁻⁶ Scm⁻¹ and 8.773×10⁻⁶ Scm⁻¹ respectively. The on/off ratio of the device was measured as 43.79 and 14.47 under photo and dark condition. The photosensitivity was found to be in the order of 2.12 and the Ideality Factor (I.F) was computed as 1.8576 and 2.5480 under photo and dark condition respectively. The barrier height and series resistance was calculated 0.27 eV, 70.12 ohm and 0.29 eV, 138.23 ohm under photo and dark condition respectively.

ORAL PRESENTATION 24

FRACTAL KINETICS OF RADIATION INDUCED COLOUR CENTRES
FORMATION OF HIGH PHOSPHORUS DOPED OPTICAL FIBRE GLASS

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Glass doped with different materials like Ge, P, Al and rare earth materials are now a days of great interest of research because of its potential applicability in different fields specially optical fibre[1]. Among the doped glass high phosphorus doped glass proved its potential
applicability in the field of radiation sensor as dosimeter both in glass and optical fibre [2]. The application of this kind of glass as well as optical fibre depends on its colour centres produced during radiation. The proper knowledge of radiation induced colour centres formation and recombination mechanism within the glass will help to improve its quality as sensor. High phosphorus doped glass formed paramagnetic defect centres (colour centres) during radiation which are $\text{PO}_3^{2-}$ (Phosphoryl), $\text{PO}_4^4-$ (Phosphoranyl), $\text{PO}_2^{2-}$ (Phosphinyl), $\text{PO}_4^{2-}$ radicals, SiE$^+$ and phosphorous-oxygen’s-hole centre (POHC). The decay kinetics of radiation-induced attenuation in optical fibres has been variously fitted by power laws, high-order kinetic solutions ($n>2$) or more ad hoc expressions. In high phosphorous doped optical fibre POHC are mainly responsible defect for radiation induced loss. The high phosphorous doped fibres employed in this study with pure silica claddings and polymer protective jackets.

We did the experiment by a suitable length wrapped around a test reel of 2.5 cm diameter and placed at the centre of the radiation field. The $^{60}$Co-gamma projector was used as a radiation source of average energy 1.25 MeV. To study the effect of dose rates on the fibre the dose rate was varied by changing the distance between the source and the fibre reel. Total dose was controlled by varying the exposure times for different dose rates. All the experiments were done at room temperature. The experimental result reveals that (i) the radiation induced loss of high phosphorous doped optical fibre is almost dose rate independent. (ii) The saturation loss are same at different dose rates. (iii) The radiation induced loss curve behaves straight line passing through the origin up to a certain cumulative dose and after that exponential decay saturation observed. In a conclusion we can say that the fractal kinetics observed at high dose rates in the presently investigated fibres revert to classical kinetics. But if classical kinetics truly rules this low-dose-rate regime, it would then follow that the underlying rate constants K must return to being independent of dose rate. And from our result it is clearly seen that up to a certain accumulated dose rate the induced loss is dose rate independent.

![Fig.1. Plot of radiation induced loss vs. Total absorbed dose](image-url)


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**ORAL PRESENTATION 25**

**EFFECT OF THE STRUCTURAL DIFFERENCE BETWEEN METHACRYLONITRILE AND ACRYLONITRILE IN THE POLYMERIZATION PROCESS INITIATED BY POTASSIUM PERSULPHATE AT 50°C IN AN INERT ATMOSPHERE OF NITROGEN GAS**

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The structural difference between the methacrylonitrile, [(CH$_2$=C(CH$_3$)CN)] and acrylonitrile, [CH$_2$=CH(CN)] is the replacement of the $\alpha$ hydrogen of acrylonitrile by a methyl group. Due to this structural difference the two monomers differ not only in their physical properties but also differ in their chemical properties during the polymerization processes. To find out whether the methyl substituent has any role to play on the Kinetics of aqueous and emulsion polymerization, a comparative study on the potassium pursulphate initiated aqueous polymerization of Methacrylonitrile (MAN) and Acrylonitrile (AN) monomers in presence and absence of Sodium Lauryl Sulphate (NaLS) in an inert atmosphere of Nitrogen gas has been investigated experimentally. The rates of polymerization under various conditions have been followed by the conventional gravimetric method. The molecular weights of the polymers have been estimated from the intrinsic viscosity data and also by the gel permeation chromatographic method as a function of monomer and initiator, potassium pursulphate (KPS) concentrations. It has been found that both in the MAN-KPS and AN-KPS systems, the injection of initiator late in a run increases the rate of aqueous polymerization but has no measurable effect on the viscosity average molecular weight ($\bar{M}_v$) of the polymers.
whereas the addition of extra amount of monomer late in a run increases both the rates of polymerization and the $\overline{M}_p$. The rate of the aqueous polymerization is higher in the AN-KPS system than that in MAN-KPS system. The particle size distribution has been measured by SALD-1000, Laser diffraction particles size analyzer (M/S Chemito, India). A mechanism has been suggested to explain the kinetic data.

**DIMENSIONALLY INTEGRATED $\alpha$-MnO$_2$/CARBON BLACK NANOCOMPOSITES AS PLATINUM FREE COUNTER ELECTRODE FOR DYE SENSITIZED SOLAR CELL**

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$\alpha$-MnO$_2$/carbon black nanocomposites were synthesized using hydrothermal method. The $\alpha$-MnO$_2$/carbon black (CB) nanocomposites was fabricated as counter electrode (CE) for Platinum (Pt) free DSSCs. Morphological study was carried out using scanning electron microscope (SEM) and transmission electron microscope (TEM). FTIR, Raman and XPS study substantiate well about the formation of nanocomposites. Brunauer–Emmett–Teller (BET) isotherm reveals the embedment of CB which enhances surface area of $\alpha$-MnO$_2$/CB nanocomposites. $\alpha$-MnO$_2$/CB nanocomposites as CE shows very good electrochemical and electrocatalytic activity. Their respective study was carried out using electrochemical impedance spectroscopy and cyclic voltammetry. However, better electrocatalytic activity and low charge transfer resistance ($R_{ct}$) of $\alpha$-MnO$_2$/CB nanocomposites as CE, imparts an improvement of photo conversion efficiency. The conversion efficiency ($\eta$) of 4.33% was achieved using $\alpha$-MnO$_2$-120/CB as DSSCs CE which is closely comparable to Platinum as CE.
STUDIES ON COMPOSITE REINFORCED WITH
TYPHA ELEPHANTIANA: A NEW SOURCE OF PLANT BASED FILLER

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\textsuperscript{b} Materials Science Centre, Indian Institute of Technology, Kharagpur 721 302 (India)
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Typha elephantiana, commonly known as Typha sp. grass (TP) is widely available across the globe and not yet utilized for any commercial applications. It’s tried to develop eco-friendly, but commercially viable composite using TP-filler in polypropylene (PP) matrix. The grass was collected directly from agricultural fields, washed and cleaned with distilled water, cut in pieces and dried in oven thoroughly. The dried TP-grass was crushed and converted in the powder form with the help of a high speed mixer. To establish compatibility and to develop inter-facial adhesion between the two phases, maleic anhydride grafted compatibilizer, PP-g-MA was used. PP / TP-filler composite was fabricated in a conventional melt mixer with variation in TP-filler from 10 phr to 60 phr and studied the effects in properties and performances. Spectroscopic study by FT-IR and morphological study by SEM suggest chemical interaction thereby strong adhesion between the two phases in the composite. Thermal analysis by TGA suggests minor deviation from the pure polymer at higher TP-filler loading. Mechanical properties reveal considerable improvements in tensile strength and Izod impact strength. Study by dynamic mechanical analysis (DMA) suggests increase in both storage modulus and loss modulus with increasing TP-filler loading, while no major deviation is observed in damping factor (tan δ). The processing behaviour of the composite in conventional thermoplastic machinery was also confirmed up to 60 phr of TP-filler loading. In conclusion, the composite was fabricated from environment friendly, cheap and easily available TP-fillers. The mechanical and other important properties were maintained at high filler loading is encouraging for commercial application. In a nut shell, the resulting composite is technically competitive, commercially viable and environment friendly. This new composite may find its application in automobile and decking sector parallel to natural fiber composite and wood plastic composite.
Key words: *Typha elephantiana*, green composite, thermo-gravimetric analysis, compatibilization, dynamic mechanical analysis.

**References:**


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**ORAL PRESENTATION 28**

**SEPARATION METHODS FOR PRODUCED WATER TREATMENT: A STUDY IN THE OIL FIELDS OF ASSAM.**

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Water is by far the largest volume byproduct or waste stream associated with oil and gas production. Oil field produced water contains substantial quantity of oil and Grease and other suspended particles and therefore, it cannot be disposed off directly or cannot be injected to the sub surface for secondary recovery purposes considering stringent disposal norms set by environmental regulation policies. The general objectives for operators treating produced water are: de-oiling (removal of dispersed oil and grease), desalination, removal of suspended particles and sand, removal of soluble organics, removal of dissolved gases, removal of naturally occurring radioactive materials (NORM), disinfection and softening (to remove
excess water hardness). Many separation techniques are applied in the oil fields to meet this objective. This study focuses on the assessment of the available separation methods applied in the various oil fields of Assam to meet the regulatory norms for disposal and also as a potential source of water for use in agriculture, industry etc. as Assam being most potential oil and gas producer in India. The study also highlights some of the advanced technologies that can be used to treat the produced water considering not only the safe disposal norms but also as a source of fresh water.

Keywords: Produced water, desalination, natural formation water

SYNTHESIS OF AN ENVIRONMENT FRIENDLY COMPOSITE AS A SOLUTION FOR SOLID WASTE DISPOSAL

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Fly ash is one of the residues created during the combustion of coal in coal-fired power plants which must be disposed of or recycled. Woven polypropylene fabrics are widely used, for example, in sacks for transportation of bulk materials in agriculture and construction. There are several important end-of-life issues with these and at present the majority of these sacks are landfilled. In the present study the shellac waste generated from the aleuritic acid industry, fly ash and used PP Sacks collected from a construction site have been used to form a sustainable, eco-efficient and economical composite. Mechanical properties of the composites were measured. The morphology of the composite was studied with the help of Scanning Electron Microscopy (SEM).

Keywords: shellac waste, fly ash, used PP Sacks, composite, characterization.
REVIEW ON SELF HEALING SMART COATING

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Metals are used extensively in modern society in a range of applications from infrastructure to aircraft to consumer products. The protection of metals, primarily from corrosion, has been an active area of materials science for many years. All metals undergo oxidation upon exposure to the environment. While many pure metals, such as aluminum, naturally develop protective oxides, industrial metals are usually alloys with heterogeneous microstructures that promote corrosion and inhibit paint adhesion. The development of such microstructures occurs due to precipitation of the alloying elements as intermetallic particles during fabrication. These particles have electrochemical properties that differ from those of the aluminum and so tend to drive localized corrosion. However, over the last 30 years, changing regulations governing both environmental issues and human health have driven even greater activity in this field. This review looks at current metal protection schemes, exploring the development of ‘green’ inhibitors and ‘self-healing’ paint films that have inbuilt capacity to maintain functionality. Inorganic and organic materials science has undergone rapid development in recent decades and this review looks at how some of those developments, particularly in encapsulation and polymer healing, can be applied to the design of new protective paint systems. In studies of self-healing, measuring the healing efficiency is important. The healing efficiency for bulk materials, from metals to polymers, is often measured in terms of mechanical performance. In coatings, regaining the protective functionality of the coating is most important. The healing efficiency can be measured using electrochemical techniques such as electrochemical impedance spectroscopy and the scanning vibrating electrode technique (SVET), which measure the degree of protection provided in a defect.

Now researchers are focusing on the development of smart coatings, which are new generation functional coatings with mimicking nature. Self-healing coating is one of the examples of smart coating.
MERICELLE TO VESICLE TRANSITIONS IN A MIXTURE OF CATIONIC GEMINI SURFACTANT WITH IMIDAZOLIUM BASED IONIC LIQUID: A PHYSICOCHEMICAL & SPECTROSCOPIC INVESTIGATION

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Abstract: The ionic liquid (IL) 1-butyl-3-methylimidazolium octyl sulfate, [C\textsubscript{4}mim]- [C\textsubscript{8}SO\textsubscript{4}] mediated micelle to vesicle transition in aqueous solution of a cationic Gemini surfactant (tetramethylene-1,4-bis(dimethylpentadecylammonium bromide) (14-5-14) has been investigated by applying dynamic light scattering (DLS), viscosity, steady state and time resolved fluorescence and HRTEM measurement for different mole fractions of IL i.e. (X_{IL} = 0.0, 0.1, 0.2, 0.3, 0.35, 0.4, 0.45, and 0.5). Phase transfer of the mixture can be visualized by optical micrographs and the turbidity of the mixed solution increases with increasing the mole fraction of IL and it is maximum at X_{IL} = 0.5. Steady state fluorescence anisotropy of DPH in the investigated solutions also increases with increasing the mole fraction of IL and the anisotropy value also indicates the transformation of a micelle (X_{IL}=0.1, and 0.2) to elongated micelle (X_{IL}=0.3, 0.35, and 0.4) to vesicle (X_{IL}=0.45, and 0.5). A viscosity peak has been observed at X_{IL}=0.3 indicating the formation of elongated micelle at intermediate stage of micelle to vesicle transition. The hydrodynamic diameter of the solution gradually increases with increasing the mole fraction of IL and the vesicular solution shows the apparent hydrodynamic diameter ~ 190 nm, corroborated by HRTEM measurement. The micropolarity and stability of the vesicular solution are also understood by using the Pyrene probe through I\textsubscript{1}/I\textsubscript{3} measurement and anisotropy measurements by using the DPH probe with various temperatures which indicates that it is stable within the biological temperature range. The steady state and time resolved fluorescence measurements have been carried out using C153, a 8 nm spectral shift occurs in the blue region indicating the residence of the probe in highly non polar region probably inside the hydrophobic bilayer of vesicle. The rotational relaxation time of the probe molecule C153 (Coumarin 153) gradually increases with
increasing the mole fraction of IL and the vesicular solution shows higher rotational relaxation time that means the probe molecule experiences more hindered environment.

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ORAL PRESENTATION 32

ENVIRONMENTAL EFFECTS OF DIGHA DUE TO COASTAL EROSION AND ITS MITIGATION

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The problems of the coastal zone are unique due to the high density of population, loss of land due to coastal erosion, mining of beach sand for industrial purposes, drastic morphological and shoreline changes due to shore structures like harbor breakwaters, destruction and reclamation of wetland including mangroves, saline intrusion into the water, decreasing fish catch, development related degradation of the environment and violation of the provisions of Costal Regulating Zone. The coastal community is the only sector that periodically loses dwelling places due to erosion. The destruction of natural habitats in the form of reclamation of wetlands, cutting of mangroves and dumping of industrial and urban wastes worsens the plight of the coastal communities. Such a development took place without appropriate land use planning. The Geological Survey of India in its report on the Digha coastal belt pointed out that the active processes of erosion and accretion have been accelerated by several manmade interventions including removal of sand dunes, leading to mushrooming of construction near the coastline. The exact impact of tourism on the coastal belt of Digha cannot be quantified but, the continuing dumping of solid waste and raw sewage in the coastal water bear testimony to an alarming situation which increases with every tourist season. The Digha - Junput coastal tract is being eroded by sea-water resulting in lowering of the beach and recession of the bank. The rate of erosion has been found to be about 17 meters per year at some parts. Besides erosion, beach lowering (submergence) by about 15 to 20 cm per year appears to continue unabated (Bhattacharya S, 1992). Increasing pressure of human activities on the Hooghli unstable coastal zone has been assessed by IIT and GSI during last 15 years, but no effective action plan for controlling the phenomenon is yet visible. The researchers are trying to mitigate the problem which is increased day by day and find out a way to protect the coastal environment and coastal tourism properly.

Key Words: Coastal Erosion, environment, mitigation.
The paper deals with the assessment of nutritional status of the people of Sundarban, South 24 Parganas district of West Bengal. The assessment of the nutritional status involves various techniques. Proper evaluation demands a many angles approach, covering all the different stages in the natural history of nutritional diseases. The assessment methods include all the techniques like clinical examination, anthropometry, bio-chemical evaluation, functional assessment, assessment of dietary intake, vital and health statistics, ecological studies. Parameters like demography, socio-economic condition, literacy rate, food production, quantitative dietary intake, anthropometric measurements, physiological variables, percentage of haemoglobin concentration, intestinal parasite, arterial pressure, differential RBC count and such others were taken into consideration.

The overall picture in the case indicates that the people are in relatively good nutritional situation so far as dietary intake is concerned. Adequate amount of food intake has made impact on some of the anthropometric characters as well as their insides their body weight, weight–height index, body mass index, skin fold thickness, pignet index and percentage of haemoglobin concentration. On the basis of the economic status their per capita consumption of nutrients are sufficient for their sound health condition. Due to the good ecological zone, here available of sufficient amount of rice, different types of vegetables like potato, cabbages, ladies finger, bitter gourd, various kinds of pulses, roots and tubers, fish, crabs, honey, kaora, sundari-fruits etc. They are physically, mentally and socially well being as per our observations. Mainly, few women are suffering in iron deficiency-anaemia. Main problem of the studied area is the drinking water facilities, the scanty sanitary facilities may cause of diarrhoea, dysentery and giardiasis.

Key words: Sundarbans, haemoglobin, anaemia, kaora, sundari
VENOM CHEMISTRY: A REVIEW ON EFFECT OF SECRETED PHOSPHOLIPASES A2 ON SNAKE BITE VICTIMS.

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Every year 50,000 people die due to venomous snake bite. Snake venom is a composition of various proteins. Multiple Phospholipase A2 (PLA2) Isoenzymes found in single snake venom induce a variety of pharmacological effect. These multiple forms are formed by gene duplication and accelerated evolution of axon. The neuro- and myotoxicological signs and symptoms are clinical features of envenoming snake bite in many parts of the world. The toxins primarily responsible for the neuro and myotoxicity fall into one of the two categories-those that bind to and block the post- synaptic acetylcholine receptor (AchR) at the neuromuscular junction and neurotoxic phospholipasesA2 (PLA2) that bind to it and in the venom of many dangerous snakes. This review is to have brief idea about how these PLA2 effect in victims bitten by different venomous snakes.

MITIGATION OF ARSENIC FROM GROUND/SURFACE WATER BY LATERITE SOIL

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This article presents a brief overview of the scientific literature on existing technologies that are available for detecting and minimize of arsenic in ground/surface water. There are several technologies developed for removal of arsenic from ground water. The most common technologies are oxidation, in-situ oxidation, precipitation, passive-sedimentation, solar-oxidation, co-precipitation, adsorption, nano-filtration, ion-exchange process, membrane
technique, reverse-osmosis; electrodialysis etc. Membrane processes like Reverse Osmosis (RO) and Electro dialysis (ED) have now been used for the desalination of brackish and seawater. ED has become a unique operation for the separation of ionic substances from water. Although, both RO and ED is suitable for water treatment but it generates sludge which again creates environmental problem. As an alternative, the bipolar membrane process, a relatively new technology, for removal of arsenic, can convert different salt present in water into their respective acids and bases. Some compounds of iron such as zero valent iron, iron oxides and iron hydroxides are preferred for reduced arsenic; these adsorbents adsorb suspended particles which are present in ground water. Both are adsorbed onto a natural adsorbent which contains high concentration of iron due to affinity between arsenic ions and iron surface. Iron was impregnated into their porous composed of activated carbon, alumina, sand and laterite soils. The broad surface area and the stability indicate the efficiency of adsorbents to remove the arsenic from contaminated water. So their efficiency of adsorption is high.

**Keywords:** Drinking water treatment; arsenic; arsenic contamination; technology.

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**PERFORMANCE ADVANTAGES OF NANO-SILICA IN CONSTRUCTION FLOORING**

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**Introduction**

With the growing demand of construction industries world-wide, many organizations are either now starting or increasing their presence to cater to the demand for construction materials, be it mass concreting or waterproofing. This has led to the technological outburst in the field of construction &inspiring us to adapt to more sustainable from technology. In the field of concrete floor finishing the game changer technology of reactive colloidal silica has recently introduced in some advanced countries. Reactive colloidal silica is the purest form, most reactive advanced technology processed from silicates of 99.5% pure silica suspended in an ultra-low surface tension liquid. The silica in colloidal silica is amorphous and will not produce hazardous crystalline dust, with a pH similar to baking soda, it contains less than one half of one percent metallic salts and is far safer to handle than silicates.
New Technology
Through the development of better chemistry, new reactive colloidal silica technology overcomes the weakness of conventional concrete hardeners. Exhibiting a faster and more complete reaction with concrete, colloidal silica technology can now be found in a variety of concrete innovations. From densifiers to cleaners, the chemical makeup of this technology adds strength and durability more efficiently and effectively than hardeners of the past.

The Chemistry
As particle size of silica in colloidal silica is significantly smaller, hence it has huge surface area around 400 – 500 sq.mtr/gm and offer many more chemical reaction sites, making them more reactive than conventional silicate products like densifiers. These creates a larger reactive surface which increases the volume of calcium silicate hydrate (CSH), creating more CSH as it lowers the residual calcium hydroxide during and after hydration. As CSH acts as a binder and imparts strength in concrete, thus when colloidal silica is added in concrete at the time of placement, compressive strength is increased. When added after hydration, the concrete surface is ‘densified’, as silica penetrates the surface to bond to the silica and calcium hydroxide to create CSH.

Application advantages
As concrete is the first and foremost a structural material, it requires specific chemical treatments and mechanical processing to overcome its inherent limitations as a finished surface material in flooring. Its porosity makes it more prone to staining, its vulnerability to acid attack can cause surface etching, and its susceptibility to surface wear and dusting are natural characteristics of concrete that need to be considered for any finished protocol. Concrete hardeners, additives, and protectors are commonly used to help resolve these issues. Historically, design professionals have used silicates in flooring applications to densify and strengthen concrete, however, traditional silicates have many drawbacks including complicated application, whiting, and hazardous application byproducts.
In the overlay system, colloidal silica reacts with and densifies cementitious and non-cementitious surfaces where silicates fail. They react highly effectively with the lime in concrete, and bond to silica already in the slab. Reactive colloidal silica even bonds to decorative cementitious overlays that are low-lime and do not react with silicate densifiers.
Advantages of these colloidal silica based densifier are –

i) It delivers a denser, harder surface for polishing,
ii) It blocks efflorescence caused by moisture vapour transmission,
iii) It increases abrasion resistance of the concrete surface etc.
Colloidal silica also acts as a curing agent for a harder finished concrete floor surface. The colloidal silica is suspended in an aqueous phase and stabilized electrostatically. It is a concentrated mono-dispersion with particle size approximately from 5 to 100 nano meters in diameter. The very fine particle size distribution allows for rapid penetration and the irregular variations in the surface area make rapid bonding with calcium hydroxide in the concrete possible. It can be used over freshly-poured concrete slabs as soon as it sets, while the concrete is still wet. It will also perform brilliantly with concrete slabs that are decades old. Reactive colloidal silica even bonds to and hardens decorative cementitious overlays that are low-lime and do not react with silicate densifiers. The advantages of these floors w.r.t to conventional methods are-
  a) ease and speed of application; no overnight curing,
  b) deeper penetration,
  c) no whitening potential,
  d) no caustic gel to scrub off,
  e) non- hazardous,
  f) zero VOC – qualifies for LEED points and of course
  g) cost effective by cutting steps to finish the floor, reduces labour etc.

Conclusion
Exposed concrete flooring is becoming a popular choice for its beauty as well as cost advantage. Concrete can be finished with various colours, textures as well as various level of shine. Polished concrete floor offers a sense of design that can be both timeless and modern. The use of colloidal silica makes the process of polishing a concrete floor affordable as well as environmentally safe.