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Abstracts – Indo-Portuguese Workshop on Emerging Trends of Nanotechnology in Chemistry and Biology (INCB-2016)

Organized by: *Department of Chemistry Hansraj College & Deshbandhu College, University of Delhi, Delhi, INDIA in association with CQM, University da Madeira, PORTUGAL*

February 12-13, 2016

Indo-Portuguese Workshop on Emerging Trends of Nanotechnology in Chemistry and Biology (INCB-2016) is being organized within the framework of the bilateral research cooperation between India (INT/Portugal/P-17/2013) and Portugal (FCT/DST 2013/2015 – Ref.441.00). The Department of Science and Technology (DST), Ministry of Science & Technology of India and the Foundation for Science and Technology (FCT), Ministry of Science, Technology & Higher Education are the nodal agencies to implement the programme in India and Portugal on the respective sides. The concept of nanotechnology has gained major attention in recent years due to its significant role in the field of medical sciences and technology. Nanotechnology comprises structural manipulations at the nanoscale and is already being used in products in its passive form, such as cosmetics and sunscreens. One area of nanotechnology that holds the promise of affording the great benefits for society is medicine. Nanotechnology is already being employed for more effective drug delivery systems, which ultimately increases the efficacy of drugs. This workshop is of multidisciplinary nature and covers the various disciplines of science and is intended to expose for the first time in a joint workshop, students and faculty members to the thrust areas of research with emphasis on indigenous problems. The workshop aims to create awareness among young research scholars and scientists from all over the world in the area of nanotechnology. The main objective of the two-day Indo-Portuguese workshop is to sensitize and stimulate the young minds to bring out the best among the various frontiers of nanoscience. This meeting will be able to bring together the undergraduate, postgraduate students, doctoral students and faculty members on a common platform to deliberate and discuss nanoscience.

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ORAL PRESENTATIONS

Nano-particles in Targeted and Controlled Drug Delivery

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Over recent years development in targeted and controlled release of drugs with the help of nano-particles is become a highly interesting topic of research in medical sciences. Using nano-particles, it is possible to achieve improved delivery of poorly water-soluble drugs by increase the total surface area of the drugs to faster dissolution in blood stream. These carriers are designed with specific properties i.e. independence in environments, selective at the pharmacological sites, physiochemical parameters such as pH, monomer concentration, ionic strength as well as surface charge, particle size and molecular weight are important for drug delivery. Controlled Drug Delivery System (CDDS)

ensures the direct treatment at the disease site with low doses and less side effects. It is very much beneficial in colon diseases and gives suitable absorption site for protein and peptide drugs. To get the above advantages from CDDS, different types of nano-particles are manufactured and used in medical sciences. These might be responsive polymers, multifunctional mesoporous silica, human serum albumin (HSA) and are used as nano-particles in targeted and controlled release of drugs in diverse diseases. This paper is going to give an overview by summarizing the information on various types of nano-particles which are being used in targeted and controlled release of drugs.

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Synthesis, structural characterization and electrochemical studies of hybrid membrane

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The inorganic-organic hybrid membrane was synthesized by sol-gel method and characterized via Scanning electron microscopy (SEM), X-ray diffraction (XRD), Fourier transformed infrared (FTIR), and Thermogravimetric analysis (TGA). The membrane was found to be crystalline in nature with consistent arrangement of particles and no indication of visible cracks. The membrane potentials measured across the hybrid membrane in contact with electrolytes (KCl, NaCl and LiCl), have been found to increase with decrease in concentrations. The observed membrane potential values of the ion-exchange composite membrane for various electrolytes followed the order LiCl < NaCl < KCl, and the membrane was found to be cation-selective. Furthermore, the structural characterization and electrochemical studies of stable membranes may be used for the desalination of saline water and separation of toxic metal ions form waste water.

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Biosynthesis of silver nanoparticles for their biomedical applications

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Synthesis of silver nanoparticles is of much interest to the scientific community because of their wide range of applications. Generally, nanoparticles are prepared by a variety of chemical and physical methods which are quite expensive and potentially hazardous to the environment. The development of biologically-inspired experimental processes for the syntheses of nanoparticles is evolving an alternative to the conventional methods. In this study, rapid, simple approach was applied for synthesis of silver nanoparticles using *Azadirachta indica* aqueous leaf extract. The plant extract acts both as reducing agent as well as capping agent. UV-Visible spectrophotometer confirms the formation of nanoparticles. Synthesis of silver nanoparticle was confirmed by the colour change of solution from colourless to brown. The synthesised silver nanoparticles were found to be of average 34nm as analysed by using DLS and TEM. The silver nanoparticles showed antibacterial activities against both gram positive (*S. aureus*) and gram negative (*E. coli*) microorganisms) for their future applications in biomedicines especially for the treatment of wounds. Results confirmed this protocol as simple, rapid, one step, eco-friendly, non-toxic and an alternative to conventional physical/chemical methods.

A one pot synthesis of 7-amino-4-methyl coumarin *via* smiles rearrangement, characterization and quantum-chemical studies

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Amino coumarins have interesting therapeutic and industrial uses. Several methods have been explored for the direct conversion of phenols to anilines, as phenols are more readily available. Conversion of phenols to amines through one pot Smiles rearrangement have been reported but the conversion of hydroxyl coumarin to amino derivative still remains a synthetic challenge. Converting the 7-hydroxy coumarin to 7-amino derivative is usually a multistep reaction but a new option has been explored introducing an amino group to the coumarin ring via one pot Smiles rearrangement of 7-hydroxy-4-methyl coumarin. The resulting amine can be converted into a new Schiff's base and can also act as a versatile intermediate for further synthetic transformation. The electronic and molecular properties have been calculated using the DFT with B3LYP. The possible places of electrophilic attack and hydrogen bond formation have been predicted using Paboon analysis.

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Tetragonal tungsten bronze pure and modified tantalates: A study on promising future electrical nano-materials

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Tetragonal Tungsten-Bronze (TTB) structured alkaline earth metal doped tantalate $Sr_{0.5}Ba_{0.5}Ta_2O_6$ (SBT50) was synthesized in a 1D structure by citrate-nitrate gel route. Powders obtained at different temperatures were analyzed by X-ray diffraction (XRD) and revealed the formation of TTB structure at 1100°C. Also, FT-IR, FT-Raman, UV-vis and photoluminescence spectroscopy were used to identify the structure and properties of powders. Microstructural characterization was done using transmission electron microscopy (TEM) which showed the nanorods with a diameter size of 200 nm in powders. The maximum dielectric constant (ε) has been observed to be 2400 at 1 kHz. The T_c was found to be ~444-449°C and ferroelectric relaxor like behavior was observed.

Liposome Mediated Delivery of Monensin in combination with Potent Antimalarials for the Treatment of Malaria.

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Chemotherapy is the only treatment option for malaria due to lack of efficient vaccine candidates.Evolution of clinical resistant malarial parasites to existing antimalarial drugs has led to search for new antimalarials and combination chemotherapies. The anticoccidial drug monensinis a lysosomotropic agent, has strong antimalarial activity on multiple life cycle stages. We have developed a liposome-based drug deliveryof monensin and evaluated its antimalarial activity in lipid formulations of soya phosphatidylcholine (SPC) cholesterol (Chol) containing either stearylamine (SA) or phosphatidic acid (PA) and different densities of Distearoyl phosphatidylethanolamine-methoxy-polyethylene glycol 2000 (DSPE-mPEG-2000). Liposomes exhibited spherical shape, with size ranging from 90 to 120nm, as measured by dynamic light scattering and high resolution electron microscopy.The developed liposomal formulationsof monensin were found to be more effective than a comparable dose of free monensin in *Plasmodium falciparum* (3D7) cultures and established mice models of *Plasmodium berghei* strains NK65 and ANKA.Monensin in long-circulating liposomes of stearylamine with 5mol% DSPE-mPEG-2000 in combination with potent antimalarials resulted in enhanced killing of parasites, prevented parasite recrudescence, and improved survival. Our liposomal formulations containing stearylamine with DSPE-mPEG-2000 may provide a novel strategy to deliver potent hydrophobicantimalarials in combination with antimalarials, to overcome drug resistance in *P. falciparum* and prevent malaria relapse.

Ormosil–Iron oxide nanocomposites for magnetically targeted drug delivery

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Magnetic nanocomposite consist of iron oxide core modified with covalently linked ormosil (organically modified silica) that are colloidally stable in water and their characteristics make them suitable for applications such as bioseparations , magnetic resonance imaging, contrast agent in magnetic drug targeted delivery and for the treatment of cancer through magnetic fluid hyperthermia. In our present study, citric acid coated iron oxide nanoparticle were synthesized through the thermal decomposition method and whereas ormosil using micro emulsion method. The amide linkage between the ormosil and magnetic nanoparticle was obtained through carbodiimide activation under the condition which promotes nanocomposite stability. Magnetic measurement carried out using vibrating sample magnetometer (VSM) indicates that the particle is superparamagnetic in nature. Measurements of hydrodynamic diameter and zeta potential using dynamic light scattering (DLS) coupled with field emission scanning electron microscopy (FESEM) measurement indicated that ormosil covalently bound nanoparticle are not agglomerated and consist of single primary particle. This nanocomposite will be used for encapsulation of active agents like drugs for targeted delivery. Environmental protection has become more and more important for human being and some toxic, stable dye molecules like methyl orange etc. are dangerous to the environment. These nanocomposites also possess a good and versatile adsorption capacity for the dyes and are rapidly extracted from water by magnetic attraction and therefore behave as good regenerative adsorbent.

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Synthesis and SAR study of antioxidant potential of polyhydroxycoumarin derivatives

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Antioxidants, the compounds that can delay or inhibit lipid oxidation, when added to foods can minimize rancidity, and retard the formation of toxic oxidation products. *In vivo*, lipid oxidation is associated with damage to a wide range of molecular species including lipids, nucleic acids, carbohydrates, and proteins which cause various diseases in the human body.[1]

Hydroxycoumarins are known to possess antioxidant activity.[2,3] Our group has beeninvolved in the synthesis and antioxidant study

of a wide variety of compounds.[4]Herein, we have synthesized different di- and trihydroxycoumarins and compared their antioxidant potential using DPPH, ABTS and *in vitro* lipid peroxidation inhibition assays. In all of the studied assays, most of these newly synthesized compounds exhibit 3-4 fold higher antioxidant activity as compared to the standard "Trolox".The synthesis and antioxidant activity results will be presented during workshop.

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Nanoparticles formed through calcination of serpentine exhibit immunomodulatory potential

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In the present study, it was observed that calcination of Serpentine (CS), that used in various formulations of alternative system of medicine as tonic to vital organs and as anti-inflammatory agent leads to formation of nanoparticles. TEM analysis of the test CS revealed a presence of nanoparticles with an average size of 10-20 nm [≈ 26% of total material]. Characterization of CS using X-Ray diffraction analysis, atomic absorption spectroscopy, and CHNS analysis revealed that the CS contained silicates of magnesium, calcium, and iron as major minerals. Elemental composition and heavy metal analyses showed a presence of various inorganic elements\heavy metals, albeit at levels well below daily permissive intake values. To evaluate the immunostimulatory potential of CS in Swiss mice, oral administration of CS was done at 50, 75, 100, or 200 µg/kg body weight for 10 days. Enhanced levels of total IgG, IgG1, IgG2a, and IgG2b in ovalbumin-immunized mice as well as enhanced delayed-type hypersensitivity responses, ex vivo lymphocyte proliferation, and levels of TH1 (IL-2, IFN-γ) and TH2 (IL-4, IL-10) cytokines produced by cultured splenocytes was observed. The absorption of the dosed CS also activated peritoneal macrophages, as indicated by increases in phagocytic activity and in TLR-2, CD80, and CD86 expression. Histopathologic analysis of the liver, kidney, and spleen revealed no overt pathologies. Taken together, these results showed that the absorbed CS had a stimulatory effect on host cell-mediated immune responses. We surmise that the immunomodulatory effect of CS may have been due, in part, to the presence of nanoparticles that were readily absorbed and then assimilated into the hosts.

Membrane Separation Processes and Its Industrial Applications

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The development of ion exchange membrane some six decades ago opens the path for the membrane separation technology. Since then due to a whole lot of technological innovations, especially in the area of new materials, membrane technologies have been established as very effective and commercially attractive options for separation and purification processes. This articles describes different membrane processes in terms of their state of development and technical and economic relevance. Critical needs in terms of basic and applied research, product application, for further growth of the membrane industry are also covered.

Extreme dilute solutions involved in homoeopathy: Dilution effects & nano-scale properties

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Homoeopathy is a time-tested two-century old complete therapeutic system of medicine which works at reinforcing the body's own natural capacity. It is based on the "Law of Similars" and uses medicinal substances in weak or "infinitesimal doses". The remedies are made from plant, animal, mineral, metals and everything that the planet and universe provides in minute doses in order to avoid unpleasant side-effects. There are three essential processes involved in preparation of remedies Serial dilution, Succussion, and Trituration. Dilution is done to reduce the toxicity of the active material. To become homeopathic remedies, these active compounds are diluted hundreds and sometimes thousands of times. Insoluble homoeopathic remedies are prepared by Trituration. Homoeopathy, works opposite to the conventional medicine dose. It is sometimes suggested that it may have a placebo effect. There are some conventional drugs that have inverse, effects at lower doses too. The net vasodilator effect of adrenaline increases with more dilute doses of the drug.

Mathematical models based on Langmuir equation have been used to suggest that dilution in homoeopathic drugs may not be simply based on calculations using Avagadro's number but surface effects may play a very important role.[1] New findings indicate that the science of *homoeopathy* is a form of *nanomedicine*, with the medicines capable of initiating changes in the physiological and biochemical dynamics of the animal as a complex adaptive system. Preliminary studies carried out on these extremely dilute homoeopathic formulations indicate the presence of nano-particles. It is these nano particles which may be responsible for the medicinal properties of these drugs making them smart medicines. Further studies on various physicochemical properties and mathematics of dilution to elucidate this interesting behaviour of the homoeopathic formulations which many scientists are explaining on the basis of surface effects based on formation of nanoparticles are on.

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Excellent medicinal synthetic chemistry *via* ionic liquids in multicomponent fashion

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In last two decades Green Chemistry becomes an intriguing and more demanding science to produce outstanding results while preserving many safety concerns. It provides the revolutionary concept of environmentally benign synthetic procedures. In this perspective, ionic liquids have gained excellent reputation as a possible 'green' substitute to more volatile organic solvents. Their tunable polarity and recyclability potential along with negligible vapour pressure, wide liquid ranges circumvent many of the problems associated with common organic solvents. All these aspects promote the organic synthesis in Ionic liquids and extend its applicability in many other areas too. On the other hand Heterocyclic components are well known structural motifs in many pharmaceutically active substances and natural products. Their importance in medicinal chemistry accelerates their synthesis via greener and cost effective manner. In view of this, multicomponent reactions (MCRs) were found significant class of tandem reactions owe to their extremely flexible and selective nature which can be exploited for rapidly generating huge libraries of biologically important molecules. In the present work we collate the above mentioned understanding by synthesizing hexahydro-1*H*-quinazoline-2-thiones and aryl-14*H*-dibenzo[a,j]xanthenes. This fulfils our interest of the development of competent synthetic protocols for the synthesis of low molecular weight compounds by employing the catalytic potential of ionic liquid in MCRs following the green objectives for construction of heterocyclic rings. The quinazolines have already been found to possess potential antibacterial activity and can act as calcium antagonists, which make the current study significant for the medicinal synthetic chemists as well.

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Energy independence and thermoluminescence properties of Eu doped $BaSO_4$ nanophosphor

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In this work mainly the Thermoluminescence (TL) response of Eu doped BaSO4 nanophosphor to different energies of gamma radiation has been studied along with few other TL properties. Various kinetic parameters have also been determined for the glow curve structures of the given phosphor irradiated with the same dose but different energies of gamma. BaSO4 nanophosphor was prepared by the typical chemical co-precipitation method and characterized using X-ray diffraction (XRD). The sample was then divided into two different sets containing a number of packets. One of the sets was irradiated with a very wide range i.e. 10Gy to 2kGy of gamma using 1.25 MeV of Co-60, while the other set was irradiated with 1Gy to 300Gy of gamma using 662 KeV of Cs-137. Thus, both the sets where exposed to an overlapping range of gamma radiation from 10Gy to 300Gy for two different energies. It was observed that the shape of the glow curve remained remarkably similar for the two different energies of gamma radiation. Further, the TL response curve also showed no substantial variation in linearity by changing the energies of the gamma radiation. Therefore, it can be concluded that the given nanophosphor showed promising results as an energy independent TL phosphor. Furthermore, the current nanophosphor showed an outstanding linear TL response over an extremely broad range of gamma radiation with response remaining linear for a dose as high as 2kGy of gamma radiation.

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Spice mediated ecofriendly synthesis of silver nanoparticles and characterization

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Metallic nanoparticles have been extensively investigated due to their unique size-dependent properties which make them ideal for numerous applications including optical/chemical sensors, electronic devices, and catalysts. These nanoparticles exhibit unique physical, chemical and biological properties due to their high surface-to-volume ratio. In this work, the synthesis of stable silver nanoparticles by the bioreduction method was investigated. Aqueous extracts of the spices such as clove, cinnamon, cumin, black pepper and fennel seeds were used as reducing and stabilizing agents. The synthesised AgNPs were characterized by colour change, UV-Vis spectrophotometry , Tyndall effect, TEM and zeta potentiometry. The spectra exhibit a Surface Plasmon Resonance absorption band in the range of 416-431 nm confirming the size to be around 30 nm. The position of band did not change after one week, depicting the stability of prepared nanoparticles, although absorbance showed a red shift with decrease in the absorbance value. We have compared the reducing tendencies of all these extracts using same conditions and concentrations and found that clove is the strongest reducing agent.

Arylpiperidine and arylpiperazine linked chalcones as antimalarial agents

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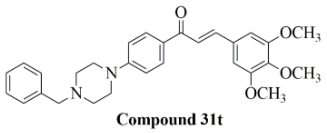
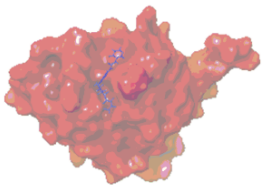
Never-ending efforts to develop new treatments for malaria targeting at the hemoglobin-degradation in the food vacuole of the parasite is of particular interest because it appears to be critical for the erythrocytic stage parasite development. Towards developing novel small molecules for inhibitors of hemoglobin degradation, in the present study, we assessed several piperidine and piperazine-based chalcones for anti-malarial activity against the chloroquine-susceptible *P. falciparum* 3D7 strain and inhibition of plasmepsin II and falcipain-2. Our molecules significantly inhabited activity of falcipain-2 and blocked the parasite growth. Among chalcones of piperidine and piperazine series, compound **31t** of piperazine series shows potent anti-malarial activity against *Plasmodium* parasite.



Compound 31t

IC50 values (μM)
***P.falciparum*: 1.6**
MCF-7 cells: 11.57
Hemolysis: 12.25
Selectivity index: 7.23
% inhibition of b-inhibition: 73 @ 25μM



The docked complex of the top hit compound 32 with falcipain-2

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Multifunctional nanomaterials and their applications

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Nanotechnology is one of the advancing areas of science. The designing of new multifunctional nanomaterials and their wider applications to meet out the challenges in areas like environmental issues, medicine, biotechnology, energy, textile, nutraceuticals, pharmaceuticals and semiconductors are to be explored further. The nanomaterials like nanocomposites, nanoparticles, nanowires, carbon nanotubes and graphene have emerged as a thrust areas of research. The synthesis and characterization of several multifunctional nanomaterials in current scenario seem useful because such materials with a massive surface area offer several potential applications in allied scientific disciplines. For example, the nanomaterials could act as biosensor, piezoelectric sensor, redox indicators, targeted drug delivery, nanothinfilms coating agents with effective molecular activities in a safer manner with minimum resources and experimental conditions. The nanomaterials like dendrimers, magnetic nanoparticles, metallic like lanthanide nanoparticles, ionic liquids are being considered useful materials so research work about their formulations and characterization seems effective. Especially the dendrimers with several core materials like trimesoyl chloride and melamine with branching molecules like dialkylmalonate (methyl, ethyl, propyl, butyl, pentyl etc.) are found effective drug vehicles and for trapping the free radicals. Similarly the ionic liquids with several ionic sites in single molecules have been effective non-volatile green solvents working at higher temperatures.

Synthesis and studies of blue fluorescent cationic dendrimers

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Polyamidoamine (PAMAM) dendrimers are the family of dendrimers more extensively study over these last years with applications in different areas, particularly in the biomedical field. However, pure PAMAM dendrimers present several limitations regarding imaging applications such as weaker fluorescence. Nevertheless, some recent studies demonstrated that the fluorescent behavior of PAMAM dendrimers can be enhanced when treated under oxidizing conditions. In the current work, different generations of amine-terminated PAMAM dendrimers (G3, G4 and G5) were treated with ammonium persulfate (APS) and characterized by Nuclear Magnetic Resonance (NMR), Ultraviolet-Visible, Fluorescent and Infrared Spectroscopy (FTIR). The preliminary results show that the dendrimers treated with APS produce a very intense fluorescence and absorption compared to the pure dendrimer. The NMR spectrum revealed a shift of two peaks correspondent to the protons of the peripheral amines due to an electron-withdrawing effect from the terminal cationic amines which have been protonated by APS. In the FTIR it is possible to verify that the bands of methylene groups become weaker after modification with APS, the bands corresponding to amides I and II deviate slightly and the band related to the hydrogen bonded NH of the amide group it becomes broader due to overlap with the band of ammonium ions. And, when the solution of the APS-treated dendrimer is irradiated at 366 nm, it displays a blue color luminescence. Subsequently, others studies are being performed in order to understand the fluorescence behavior of these dendrimers treated with APS.

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Films based on DNA and PAMAM dendrimers for potential biomedical applications

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Deoxyribonucleic acid (DNA) is a crucial molecule for living beings and, due to its physical-chemical properties, can also be used in biomedical applications in different forms and for different purposes. DNA films are very well known due to their application in diagnostic devices and charge conductivity studies. This is only possible due to the fact that DNA is negatively charged and has base specificity. These films (in macro or nanoscale) can be prepared by several methods, such as: chemical immobilization on a surface (typically gold, polymer scaffolds, etc.), UV-radiation crosslinking and deposition by self-assembly through electrostatic interactions. Several classes of molecules have been used to interact with DNA like, for example, dendrimers. Dendrimers have gained great importance for being highly branched macromolecules (organized in generations), with a well-defined structure (convergent or divergent synthesis), uniform molecular weight (monodispersity) and high functionalization degree (surface groups). Particularly, polyamidoamine (PAMAM) dendrimers present amine groups on their surface that are protonated at physiological pH and thus, are capable of interacting with negatively charged molecules such as DNA. Here we propose a unique method to obtain a hybrid DNA film, considering only electrostatic interactions between the DNA and PAMAM dendrimers. To our knowledge, films of this type (transparent, resistant, flexible and relatively stable) have never been reported in the literature, neither the used self-assembly method. In the future, we intend to use these DNA films as drug/gene delivery platforms.

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Polyester dendrimers for dual gene and drug delivery - Preliminary results

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Over the last few decades, the interest around research in polymer synthesis has experienced a huge increase. Dendritic systems, in particular, have been the subject of great attention due to their versatility and wide range of applications in different fields and, particularly, in the biomedical domain. This is the case of poly(amidoamine) (PAMAM) dendrimers which are commercially available and are perhaps the most studied dendrimers family for this aim. On one hand, due to their special highly branched architecture, and multiple terminal functional groups (multivalency), they are promising candidates for establishing unique interactions with cells. On the other hand, they may possess some drawbacks, namely high cytotoxicity, and low solubility and biodegradability. To overcome this issues, other dendritic structures have been developed, such as dendrimers based on the 2,2-bismethylolpropionic acid (bis-MPA) monomer. Bis-MPA based systems exhibit more advantages when compared

with PAMAM dendrimers. For instance, low toxicity, biodegradability, and high water solubility. Nowadays, these bis-MPA dendritic systems are also commercially available and are being investigated for biological purposes. In the present work, bis-MPA dendrimers are being studied as possible vectors for drug and/or gene delivery. In a first approach, the dendrimers were modified by replacing the terminal hydroxyl groups by amines. Afterwards, the obtained dendrimers were characterized by ^{1}H NMR, ^{13}C NMR, and by the TNBS (2,4,6-Trinitrobenzene Sulfonic Acid) assay for evaluation of amine substitution at the surface. Other studies are ongoing, such as their degradation rate, size and zeta potential analysis, DNA complexation and cytotoxicity.

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Synthesis and characterization of a new family of poly(alkylidenamine)s dendrimers with different terminal groups

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Dendrimers have been widely studied due to their number of potential uses. They are well-defined, highly branched molecules, three-dimensional, synthetic nanostructures generally used for biomedical applications. Among these, dendrimers present excellent physiological stability, and can be encapsulated or conjugated with drugs. If negatively or neutral charged surfaces presents good biocompatibility, the positively charged surfaces normally reveals toxicity in cells. Polyamidoamine (PAMAM) and polypropyleneimine (PPI)-based dendrimers are the most extensively studied dendrimers for drug delivery. With this project, we aim to develop a new family of poly(alkylidenamine) dendrimers with different terminal groups including anionic groups, such as sulfonated and carboxylated terminations. In this work, the preliminary results on the preparation and characterization, by NMR and IR, of this poly(alkylidenamine)-based dendrimers having, at each generation, nitrile, amine, sulfonate and carboxylate terminal groups will be presented. The nitrile and amine terminal groups on the surface of dendrimers will serve to grow the dendrimer generation and will act as bridging groups for complexation of metallodrugs.

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Synthesis and characterization of Generation 0 and 1 of PAMAM dendrimers with hydroxyl terminal groups

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Dendrimers with different surface groups as well conjugated with a variety of ligands at their periphery could have pharmaceutical applications, including therapeutic, biomedical and diagnostic applications. The goal of this work was to synthetize and characterize two different dendrimers PAMAM based: G0, G1-$CO_2{}^t$Bu and G0, G1-OH. The generations 0 and 1 were used as building blocks for the synthesis, increasing the length of the lateral chains of the core by incorporating the *tert*-butyl ester and hydroxyl functional groups at the periphery of each dendrimer. The G0-$(OH)_8$ and G1-$(OH)_{16}$ dendrimers can be the precursors for the synthesis of the G0-$(CN)_8$ and G1-$(CN)_{16}$ dendrimers, respectively. The preparation of the dendrimers were accomplished by adapting the reported methodology of N. Jayaraman and T. R. Krishna, and N. Jayaraman and G. Jayaraman (amine → ester → alcohol) and their characterization was performed by using ^{1}H and ^{13}C-NMR, FTIR and MS structural techniques. The first functionalized PAMAM dendrimers, G0-$(CO_2{}^t\text{Bu})_8$ and G1-$(CO_2{}^t\text{Bu})_{16}$, were obtained with good yields, respectively 95% and 93% (6.75 g). G0-$(CO_2{}^t\text{Bu})_8$ was used to obtain G0-$(OH)_8$ with a low yield (ca.11%). The synthesis reaction of G1-$(OH)_{16}$ is ongoing.

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Synthesis, cytotoxicity and cellular uptake of PEGylated PAMAM dendrimers

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Poly(amidoamine) (PAMAM) dendrimers are the most investigated dendrimers for biomedical applications since they were among the first to be synthesized and be commercially available. Meanwhile, to improve their biological performance, several strategies have been explored such as their surface functionalization with polyethylene glycol (PEGylation) arms. PEGylation confers to the dendrimers a higher hydrophilicity and biocompatibility, as well as increased circulation times in the body since avoids their uptake by the mononuclear phagocyte system (stealthy dendrimers will be obtained) and increases their hydrodynamic diameter. The objective of this work was to assess the influence of PEGylation on the cytotoxicity and cellular uptake of PAMAM dendrimers. Generation 4 PAMAM dendrimers (G4) were conjugated with rhodamine B

isothiocyanate (RITC) and the resulting conjugate (G4-RITC) was characterized using NMR and UV-Vis spectroscopy. The G4-RITC was conjugated at feed ratios of 4, 8 and 12 PEGs per dendrimer. The PEGylated dendrimers were characterized by NMR. The effect of PEGylated dendrimers on the metabolic activity of cells was evaluated using the NIH 3T3 cell line. The cell viability was determined by the resazurin reduction assay. The cellular uptake of the different PEGylated dendrimers was studied by quantification of the fluorescence of rhodamine once inside cells. Our preliminary results pointed out that there seems to be a correlation between the number of PEG arms in the dendrimer scaffold and cytotoxicity. Cellular uptake was also dependent on the extent of PEGylation. In conclusion, the efficient synthesis and favorable biological properties make PEGylated dendrimers promising vehicles for drug/gene delivery for anticancer applications.

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Antibacterial activity, phytochemical screening and Antioxidant activity of stem of Syzygium cumini (Jamun tree)

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The parts of the *Syzygium cumini* tree have been known to possess a wide range of biological activities. The purpose of the present study was to investigate the antibacterial activity, phytochemical screening and the antioxidant activity of aqueous and alcoholic extracts of the bark of *Syzygium cumini*. The antibacterial activity was observed against two Gram-positive bacteria (*Bacillus amyloiquefaciens*, *Staphylococcus aureus*) & two Gram-negative bacteria *(Escherichia coli*, *Pseudomonas aeruginosa*) in its aqueous, ethanolic and methanolic extracts by agar well diffusion method, where maximum antibacterial activity was found to be present in the methanolic and ethanolic extract against *Bacillus amyloliquefaciens*. This was also observed that they has shown inhibitory effect against *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* in its ethanolic and methanolic extract, where as no antibacterial activity was found to be present in its aqueous extract. Phytochemical screening of aqueous, ethanolic & methanolic extract has revealed the presence of flavonoids. Antioxidant activity of present flavonoid was observed in order to estimate the Superoxide Dismutase, Catalase, Glutathione content, Glutathione S Transferase & Lipid Peroxidase i.e. Malondialdehyde (MDA) content in the aqueous and methanolic extract where methanolic extract has shown a high level of antioxidant activity. The present study suggests that the bark of *Syzygium cumini* can be utilized as a good antimicrobial and antioxidant agent.

Preparation and characterization of gold nanostructures with potential application in catalysis

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We have synthesized gold nanospheres (G1) using citrate reduction method, and gold nanorods (G2 and G3) via seed-mediated growth method using cetyl-trimethylammonium bromide (CTAB) as the surfactant. Hydrochloric acid and silver nitrate solutions have been used as additives to control the aspect ratio (length/diameter) of the G2 and G3. Their size and morphology have been elucidated using transmission electron microscopy (TEM) and dynamic light scattering (DLS). UV-visible absorption spectrophotometry results have shown that the localized surface plasmon resonance (LSPR) peaks of the G1 occur in the usual 530 nm range. In case of G2 and G3, the longitudinal LSPR peak could be tuned in the 620-810 nm range, as a function of their aspect ratio. These nanoparticles have been further characterized using energy dispersive spectroscopy (EDX) and X-ray diffraction (XRD. The catalytic properties of G1, G2 and G3, dispersed in aqueous medium, were then demonstrated via the reduction of rose bengal (RB), in the presence of sodium borohydride (NaBH4). This reaction was studied spectrophotometrically by monitoring the temporal change in absorption peak (at λmax = 545 nm) of RB. The degradation reaction follows first order kinetics and the rate constant k, calculated for G1, G2, G3 and uncatalyzed reactions are 16.67 × 10-3 S-1, 67.5 × 10-5 S-1 , 86.6 × 10-5 S-1 and 87.5 × 10-5 S-1 respectively; thus the rate constant follows the order kG1 > kG2 > kG3 > kuncat. Our results show that G3 and G2 are more promising for catalytic application as compared to G1.

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Thermoluminescence characteristic of nanocrystalline $BaSO_4$ doped with Europium

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$BaSO_4$ nanophosphor doped with Europium has been studied by primarily varying the concentration of the dopant Eu (0.05, 0.1, 0.2, 0.5 and 1 mol %). A comparative study of the given nanophosphor has also been done with a standard dosimetry material i.e. TLD-100. Firstly, a number of samples were prepared

by the chemical co-precipitation method. The whole lot was then compared to TLD-100 for its TL (thermoluminescence) sensitivity property. $BaSO_4$:Eu (0.2 mol%) showed the highest sensitivity out of the lot. It was also found that when compared to the standard TLD-100 in its useful range, BaSO4:Eu (0.2 mol%) showed higher sensitivity of about 2.46 times that of the Standard TLD-100. Almost all the samples of $BaSO_4$:Eu showed a remarkable linear TL response for a broad range of doses i.e. 10Gy to 2kGy. Further, the comparative study with the standard material revealed that the current optimized phosphor shows an improved TL sensitivity and a phenomenal linear response curve over an incredibly wide range of doses for gamma radiation (Co-60). Lastly, the optimized sample has been characterized by X-ray Diffraction (XRD) and Transmission Electron Microscopy (TEM) and its trapping parameters have been calculated to further understand the type of traps present in it.

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Incorporation of algae (Scendesmus rubescens) on graphene oxide (GO) nanosheets for decolourization of RGB-Red

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Releasing of textile dyes into water bodies is a major environmental issue. Colour removal in particular has recently become one of major scientific interest, as indicated by the multitude of related research reports. The application of nanomaterials in water treatment has attracted significant attention recently. We report a facile technique for the synthesis of algae – GO nanocomposites using chemical reduction. The synthesized nanocomposite was characterized using Scanning Electron Microscopy (SEM) and Fourier Transform Infrared Spectroscopy (FTIR). The optimization was done by varying the concentration of algae-GO nanocomposite. The performance of algae *Scenedesmus rubescens* – graphene oxide nanosheets (algae – GO) was monitored in terms of RGB-Red dye removal from aqueous solution. The results indicated 83% decolourization of dye RGB-Red using algae - GO nanocomposite while *Scenedesmus rubescens* and GO sheets alone showed 60% and 65% decolourization in 3 hours, respectively. The enhanced decolourization capability of the algae – GO nanocomposite renders it practically useful for the treatment of wastewater containing dyes.

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Thermoluminescence properties of $K_2Ca_2(SO_4)_3$:Cu, $K_2Ca_2(SO_4)_3$:Mg, $K_2Ca_2(SO_4)_3$: Cu, Mg Nanophosphors and their Comparison in Terms of TL Intensity

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The technique of thermoluminescence (TL) is commonly used in dose measurement of ionizing radiations like X-rays and gamma rays. In this study nanocrystalline $K_2Ca_2(SO_4)_3$:Cu, $K_2Ca_2(SO_4)_3$:Mg and cCu,Mg were prepared by co-precipitation method and were further annealed at 700 °C for two hours. The concentrations of the dopants Cu and Mg (Cu alone, Mg alone and Cu, Mg co-doped) were 0.1 mol % in each of the sample (0.1 % mol in Cu alone, 0.1% mol in Mg alone and 0.05% mol of each Cu and Mg in Cu,Mg co-doped). The samples were irradiated by gamma radiation over a dose range of 10Gy to 2kGy. The TL glow curves of the irradiated samples were recorded and studied on Harshaw TLD Reader 3500. Glow curves of irradiated samples reveal that the sample which is co-doped with Cu,Mg shows more intense peak at 120 °C as compared with the other samples. The sample which is doped with Mg alone shows a major peak at 116 °C and another peak of low intensity at 163 °C. The corresponding peak intensities for sample doped with Cu alone are 116 °C (major peak) and 168oC respectively. The overall intensity of the sample doped with Mg is greater than the Cu-doped sample. However, the peak intensity of co-doped sample is found to be greater than the other two samples (~13 times that of Cu and ~3 times that of Mg doped samples). The co-doped sample seems to be a promising TL material for dosimetry of ionizing radiations, however, a more advanced study is required to ascertain this speculation. It is worth mentioning here that similar studieson $K_2Ca_2(SO_4)_3$ have been done in the past by a few groups however with different dopants.

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Isolation and characterization of Gram negative bacteria from *In vitro* culture of brahmi plant

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Brahmi is a very important plant to improve the memory and intellect. Its tissue culture has shown various strategies to propagate the plant in vitro where some microbial contamination found to be observed in it's loose. The purpose of the study was to isolate, indentify, molecularly characterized and multi drug resistance gram-negative microbe from contaminated plant tissue culture bottles of Brahmi callus so that they can be prevented by treating specific media of plant tissue culture through different extracts of leaf of neem plant. Gram negative bacteria was observed on differential media and molecularly charachterized by 16S rRNA gene sequencing whose accession number has been achieved by NCBI-GenBank, after submitting its sequence i.e. Enterobacter cloacae KU350623 and Myroides odoratimimus KU382740. For its prevention and cure, multi drugs resistance was observed against these gram-negative bacteria by agar well diffusion method. Plant tissue culture MS media was supplemented with the aqueous and alcoholic extracts of neem leaf in order to control its contamination as an anti-contaminator. This study suggest to use neem leaf extracts supplementation to control and cure the in-vitro bacterial contamination acquired during in-vitro culture of Bacopa monniera as an anti-contaminator.

Comparative genomics of dengue virus to explore potential candidates for novel drug targets

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Dengue is the most devastating arthropod born viral disease that has spread to many tropical and subtropical areas, causing sudden fever and acute pains in the joints. It is a rising global problem in today's world and kills millions each year. The countries target by this disease mainly includes –China, Indonesia, Sri Lanka, India, Pakistan, Thailand and Malaysia. Dengue viruses are of the genus Flavivirus and family Flaviviridae. The flaviviruses are lipid-enveloped, positive-strand RNA viruses. The basic structure of a single dengue virus includes three structural proteins (C, prM, E) and seven non-structural proteins like NS1, NS2a, NS2b, NS3, NS4a, NS4b, NS5 which control various functions like replication. E and NS1 have a role in protective immunity. There are four different serotypes of virus DENV-1 to DENV-4. Each serotype has at least four genotypes each. In the present study, comparative genomics of Dengue virus was conducted to explore potential candidates for novel drug targets. For this purpose, all ten genes of all serotypes of dengue virus were downloaded for comparative analysis. Individual gene sequences were used to create a phylogenetic tree using MEGA6.06 . Some of the sequences form the various clades of phylogenetic tree were then randomly selected and analysed for conserved motifs using MEME software. Motif comparison was then performed to obtain the motifs common to the various serotypes. Furthermore, these motifs were compared to the epitopes of dengue virus reported earlier. Once the common epitope for all serotypes will be obtained, Computer-aided drug designing (CADD) will be performed for finding potential novel drug targets for all the serotypes.

Chitosan based nanoparticle of cytarabine (Cyt-Np) for drug delivery

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The novel structural and physical properties of biodegradable nanometer-sized particles are attracting immense interests from pharmaceuticals for the targeted delivery of anticancer drugs and imaging contrast agents. Nanoconstructs act as a smart multifunctional tool to provide a targeted delivery system and allowing easy detection of malignant cells, bringing a radical change in the medical manifestations. Nanoparticles have advanced delivery through enhanced permeability to the tumor sites. Drugs attached or encapsulated are delivered at higher concentrations to the site of action and are protected from fast excretion. Cytarabine, an anti-cancer drug acts on rapidly dividing cells and inhibits DNA synthesis at S-phase of cell cycle. The drugs, with poor solubility, permeability, rapid metabolism and elimination, or require continuous dosages for a longer period of time, could be encapsulated in a protected sheath or fast delivery vehicle without any chemical modification in drug structure. Cytarabine is a highly polar water soluble nucleoside. Chitosan based nanoparticles of cytarabine (Cyt-NP) were prepared by using sodium tripolyphosphate as cross-linking agent. Transmission Electron and Scanning Electron Microscopy characterized the particle size and spherical shape. The drug entrapment efficiency of the nanoparticles having the same ratio of polymer and drug (1:1) was about 89.6%. The physical stability of the nanoparticles was good as studied over a period of 4 weeks. Using an MTT cytotoxicity assay, it was observed that Cyt-NP is able to specifically deliver Cytarabine into KB cancer cells without harming co-cultured normal cells. This agent Cyt-NP was

tested for the ability to induce cytotoxicity in the KB cancer cell line using both an assay of mitochondrial activity (in a MTT assay) and a clonogenic assay. IC50 for Cyt-NP was 15 µM as compared to 100 µM for Cyt. A direct correlation was found between MTT assay and clonogenic assay. These results were correlated with the DNA ladder and Flow cytometry analysis, which revealed the same pattern of apoptosis at IC50 for 12 h and 24 h treatment. In order to determine whether the initial cell death observed in KB cancer cells exposed to free Cyt and Cyt-NP could be due to apoptosis, AO/EB staining was carried out and the samples were analyzed under a fluorescence microscope. Images reveal a significant increase in the number of apoptotic cells in KB cell line. Collectively, these results imply that the use of Cyt-NP may be an effective form of chemotherapy that does not cause unwanted injury to normal tissues.

Haematological and biochemical anomalies in heteropneustes fossilis (bloch) induced by stress due to nickel chloride

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The increasing use of heavy metals in various industries has lead to an increase in their environmental burden. Nickel represents a good example of a metal which is being widely used in modern technologies, such as nickel plating, ceramics, production of electrodes for making nickel-cadmium batteries, oil refining, and production of wrought stainless steel, nickel based alloys and also in large power units. The accelerated consumption of nickel-containing products, nickel compounds is being continuously released into the environment at all stages of production and utilization. Nickel is added to aquatic environment from these and other sources and is a cause of stress on aquatic life including fish. The fish exposed to stress due to nickel chloride showed statistically highly significant ($p<.001$) decrease in amount of haemoglobin, total plasma proteins and serum albumins. The biochemical parameters, such as blood sugar, blood urea, S.G.O.T., S.G.P.T., and lactic dehydrogenase were found highly significant ($p<.001$) increase due to stress of nickel chloride.

Prospects of using nanoparticles in intravesical BCG immunotherapy of bladder cancer

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Bladder cancer (BC) is the ninth most common malignancy and deadly cancer worldwide with no improvement in associated mortality since 1975. BC is more of a concern for developing countries as it is the costliest cancer to treat on a per capita basis. Approximately 75% of all newly diagnosed BCs are non-muscle invasive bladder cancer (NMIBC). The first line treatment for NMIBC is transurethral resection of bladder tumor (TURBT) followed by intravesical instillation of immunotherapeutic or chemotherapeutic agents to destroy residual tumor cells. Various clinical studies have demonstrated that intravesical immunotherapy with Bacillus Calmette-Guerin (BCG), a live attenuated vaccine for Tuberculosis (TB), is more promising in the prophylaxis and treatment of NMIBC than most chemotherapeutic agents. Despite its potency, BCG immunotherapy provokes local and in rare instances, life-threatening systemic side effects. Other major challenge in clinical research is the failure to reduce the rate of recurrence and progression as seen in > 40% of NMIBC cases. Recently, cationic chitosan nanoparticles encapsulating BCG were reported to have potential antitumor efficacy in terms of survival rate and tumor regression in rat model of bladder tumor than BCG. Since an immunodominant mycobacterial antigen, ESAT-6 has been shown to enhance immunogenicity of BCG in an in vivo model, we suggest the evaluation of antitumor efficacy of lipid nanoparticles encapsulating recombinant BCG overexpressing ESAT-6 antigen. Furthermore, the therapy can be targeted specifically to tumor cells by coating these nanoparticles with antibodies towards tumor associated antigens like MUC-1.

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Synthesis and biomedicinal perspective of some new organometallics of Group 15 elements As, Sb, Bi

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Some novel organometallics of Group 15 elements As, Sb, Bi in +3 oxidation states of the type RM(III) L2 where 'R' represent for phenyl group and 'L' represents the corresponding carboxylate ligands, were synthesized by the method reported earlier and further characterized by M.P., elemental analysis and IR, NMR spectral analysis along with their biomedicinal and gastroprotective studies. The antimicrobial studies were carried out against different bacterial and fungal strain of pathogenic nature, while the in-vitro anti-tumor activity of these compounds was screened against human breast (MCF-7) and mammary cancer (EVSA-7) cell line. It was found that these compounds have shown potentiality as antitumor and antimicrobial agents. The compounds were also tested for gastroprotective (anti-ulcer) activity in rats using standard methods and it was found that these

compounds exhibit higher activity than the standard ranitidine when the tests were carried out with aspirin (ASP) induced and moderate activity was seen when the tests were done with ethanol (EtOH) induced.

Synthesis of copper and copper oxides nanoparticales *via* electrochemical route and its electrocatalytic and photocatalytic applications

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Copper and copper oxides (Cu2O) nanoparticles were synthesized by electrochemical route using the Tri-Sodium Citrate 2.55 mM (TSC) as a capping and reducing agent. The synthesis was done at 15 V, 373K in presence of pH 4.22 using copper rod as a working electrode and Platinum wire as a reference electrode .The electrochemical set up was kept in air as well as under inert Nitrogen-purged conditions. Cu nanoparticles were synthesized in large-scale for the first time by direct dissolution of Cu2+ into the solution of capping agent from copper electrode in the electrochemical cell. Nanoparticles were characterized by using, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), and X-ray diffraction (XRD) techniques. High resolution TEM pictures showed the formation of different shape of nanostructured rod , and star-shape respectively. The length of Copper rods were obtained from 56.9 nm to 61.9 nm and width of nanorods, from 8.11 nm to 9.57 nm respectively . This new kind of synthesis method shows the excellent stability compared with that of another chemical method of copper nanoparticles. These nanorods were used in electro-oxidation of Methanol and photocatalytic degradation of methyl orange. Methanol oxidizes completely in CO2 and H2O.

Bioinspired synthesis of nanobioglass materials and their applications

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Bioinspired synthesis draws its fascination/interest from nature around us. Nature is abound of mechanically strong biomaterials such as bones, teeth, eggshells, horns, antlers, silk whose both structural and functional aspects are controlled by it. We are interested in translating bioinspired processes into nanobioglass material for bone regeneration specifically functional calcium rich materials. Our approach focuses on examining the efficiency of organic molecules to act as a template in the in vitro mineralization to form hierarchical structures. In the bio-inspired method, organic template molecules are well known to retain their originality and induce crystallization of inorganic molecules from the solution phase in ambient conditions. The bio-inspired procedure works at low processing temperature without the necessity of using harmful toxic chemicals, thus attracts much attention due to economic and environmental benefits. Herein, bioglass has been synthesized using various organic templates namely ct-DNA, PAMAM dendrimer and CTAB. The resulted bioglass materials were characterized by XRD, SEM, TEM and BET. Interestingly the obtained bioglass showed difference in hierarchical nanostructure based on the organic template molecules. The bioactivity of the material has been observed through the formation of hydroxyapatite, a natural constituent of bone, on immersion in simulated body fluid. Beyond bone formation, it also possesses versatile application in the field of biomedicine. Its application as a nanocarrier in the field of gene and drug delivery has been explored. Additionally, it is competent to be doped with transition metal ions to strengthen its mechanical property and impart anti-bacterial activity.

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Green synthesis of silver nanoparticles and its anti-microbial properties

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In recent years nanotechnology, has gained increasing acceptance in health care, agriculture, cosmetics, chemical and food industries, drug and gene delivery. Nanoparticles are minute particles in a size range of 1-100nm and exhibit unique properties. Nanoparticles can have varied sources such as metals and fibres. Silver nanoparticles (AgNPs) have been particularly useful. Several methods like reduction in solutions, chemical and photochemical reactions in reverse micelles, thermal decomposition of silver compounds, radiation assisted, sonochemical, electrochemical and microwave assisted methods are in use for the synthesis of silver nanoparticles. Green chemistry offers alternative environmentally benign methods for nanoparticles synthesis. Green synthesis of silver nanoparticles involve reduced use of toxic and hazardous chemicals, wastes to minimize the negative effects of chemicals and subsequent processes. Because of their environment benefits, cost effectiveness and non-toxic qualities synthesis employing phytochemical extracts are gaining popularity. Silver nanoparticles are used extensively as anti-microbial, anti-bacterial, anti-malarial and anti-proliferative agents. Here, we present recent trends in synthesis of AgNPs via green synthetic protocols employing different plant extracts and their parts, its significant antibacterial activity against both gram positive and gram negative bacterial strains, varied efficacies based on different size range and their application as anti-bacterial and anti-microbial agents.

A Catalyst-free microwave-assisted synthesis of 2,3-disubstituted-2,3-dihydroquinazolin-4(1*H*)-ones: X-ray crystal structures and fluorescence properties

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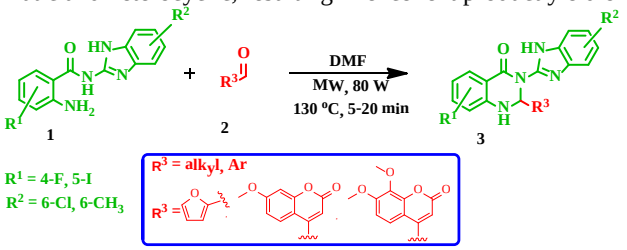
An efficient, microwave assisted and catalyst free method has been developed for the synthesis of 2,3-disubstituted-2,3-dihydroquinazolin-4(1H)-ones by condensing 2-amino-N-(1H-benzo[d]imidazol-2-yl)benzamides with aldehydes. This approach is applicable to a wide variety of aldehydes such as aliphatic, aromatic and heterocyclic, resulting in excellent product yield of



the targeted compounds. Fluorescence study was carried out for the synthesized molecules. The X-ray crystal structures of few compounds have been reported which are stabilized by secondary non-covalent interaction such as hydrogen bonding and provides supramolecular architecture.

Novel protein conjugate of tobacco stem for anti-aging

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Protein was isolated from the dried powder of stem of Nicotiana tabacum. Protein was purified by acetone precipitation and quantification of protein by Bradford method which revealed the presence of higher concentration of protein in dried tobacco stem. Antibacterial sensitivity test was done by both agar disc diffusion method and agar well diffusion method. Tobacco stem protein has shown significant zone of inhibition against both gram positive bacteria i.e. Bacillus amyloliquefaciens & Staphylococcus aureus and gram negative bacteria i.e. Escherichia coli & Pseudomonas aeruginosa. Antioxidant activity of the protein was analyzed by estimation of SOD, Catalse activity which was found significant. Glutathione s transferase, Glutathione and Lipid peroxidation was found to be high to combat ROS activity. Total antioxidant capacity was also observed by Rapid Blot DPPH Scan assay and has shown strong free radical scavenging activity. Quantitative estimation of DPPH radical scavenging in tobacco stem protein was found inhibiting 75% in its crude protein extract. As per the data observed encapsulation of protein on nanoparticle (Nanoprotein conjugate) and formulation of nanoprotein conjugate in cream/gel based formation can work as a very good anti-aging drug.

Superabsorbent polymers based on polyasapartic acid synthesized by different monomer - A comparative study

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Polyamino acids have been in focus for varied applications viz. drug delivery systems, tissue engineering applications, etc. Polyasparatic acids (PASP) have been explored as anti-scaling agents replacing polyacrylates. The market for superabsorbents is dominated by polyacrylates and polyacrylamide and their copolymers. A step towards biodegradability especially for their application in disposable medical products viz. diapers, wound dressings have led to development of different polymers be graft polymers, co-polymers and interpenetrating polymers. In this study PASP based superabsorbent polymer SAPs have been prepared by using different monomer like acrylic acid and 2-acrylamido-2-methylpropane sulfonic acid. The results have been optimized used different crosslinker concentration to achieve maximum swelling polymer. The synthesized SAP have been characterized by using various techniques namely swelling ratio under different conditions (physiological fluids, varying pH), absorbency under load (AUL). The synthesized Polymeric material is also characterized by the physiochemical techniques like FTIR, NMR and SEM. Each monomer gave interesting characteristics w.r.t to swelling , surface morphology, chemical composition. The polymer with maximum swelling can be used in the treatment of chronic wounds.

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A solid base catalyst synthesized from fly ash for Claisen-Schmidt condensation reaction

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Using Fly ash as the silica source, the solid base catalyst was synthesized by loading MgCa oxides on fly ash surface via co-precipitation method. The structure and the state of metal ions were investigated through the analyses of XRD, SEM-EDX, and FT-IR. The overall local environment of metal ion in the fly ash was investigated by Fourier-transform infrared spectroscopy and the results indicated the presence of metal ions in the framework. The loading of metal ion on silica surface of fly ash generates basicity in the catalyst, which was confirmed by using the catalyst in Claisen-Schmidt condensation reaction. The reaction conditions were optimized for maximum conversion of desired product. The Ca-Mg/fly ash catalyst exhibited high activity and the reactivity. This excellent activity shows that the catalyst has sufficient basic sites both on the surface and in the bulk, responsible for the catalytic activity. The catalyst could be easily recovered and reused giving similar conversion up to three reaction cycles indicating its stability under experimental conditions.

"Herbal Cosmetics" with anticancer and antimicrobial properties

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Cosmetics are substances used to enhance the appearance of the human body. Cosmetics include skin-care creams, lotions, powders, perfumes, lipsticks, nail polish, eye and facial makeup, hair colours and gels etc. In order to meet the standards of today's world, new technologies are being employed to get quick results. Some of the chemicals used in these technologies are harmful and can even cause serious threatening diseases. Since we cannot avoid completely the use of cosmetics it is better to use some herbal alternatives. The natural pigments are widely used as coloring agents in dyeing, printing, food, textile, pharmaceutical and cosmetic industries. These colorants posses various biological activities such as antioxidant, antimicrobial activity, anti-coagulating activity. In addition, natural pigments are also used in the treatments of tumor and cancer. In this paper we report the use of natural colouring matter from different natural products such as Arnebia nobilis to prepare antimicrobial and anticancer cosmetics.

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A new class of potent bis heterocycles as antibacterial and antifungal drug agents

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Due to increasing antibiotic resistance of bacterial pathogens, synthesis of new, active chemotherapeutics is one of the main challenges for current medicinal chemistry. Bis-heterocycles separated with a suitable spacer constitute another important class of compounds with antitumor and antimicrobial activities, based on the DNA binding affinity and enzyme inhibiting actions. We have also synthesized similar kind of bis compounds in the past containing different linkers which showed promising activity. In continuation with this work, we design and synthesize new bis compounds containing bio active spiro compounds on indolyl systems joined to small N heterocyclic base *via* >N-$(CH_2)_n$-N< linker. Also, compounds possessing two heterocycles when joined *via* >N-(CH2)n-N< linker and containing one spiro carbon have been reported to be biologically active in literature. Thus, we tried to conceive the importance of indole, pyrazoline, thiazolidine and various heterocyclic amines in a single molecule by molecular modification, in a hope that this new resultant compound might possess biological activity of varied nature. All the newly 15 synthesized compounds were evaluated for their antimicrobial activities in *vitro* against three Gram-positive bacteria (*Staphylococcus aureus*, *Bacillus subtilis* and *Staphylococcus epidermis*), four Gram-negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhi*, and *Klebsiella pneumonia*) as well as four fungi (*Aspergillus niger*, *Aspergillus fumigatus*, *Aspergillus flavus*, and *Candida albicans*) using Cup plate method. Results showed that bis spiro-indoles exhibited stronger antibacterial and anti-fungal efficiency than their corresponding mono spiro-indoles which makes them good candidates to become an alternative to commonly used drugs.

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Silver chalcogenide nanoparticles for their catalytic and biomedical applications

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Metal nanoparticles (NPs) are currently the focus of intensive research because of their unique applications toward biology, catalysis, and nanotechnology. Silver NPs display many unique physiochemical properties that can differ quite extensively from the properties of the corresponding bulk material. Recently, nanocrystals of silver chalcogenides are attracting significant attention due to their wide applications in solar cells, light-emitting diodes, thin-film transistors, photocatalysis, and biomedical studies. The wide applications of silver chalcogenides are profited from the progress in the synthesis of new nanostructured materials of varied sizes and morphologies. Hence, herein, we present the critical review of synthetic methodology of silver-chalcogenide nanoparticles. The catalytic and biomedical applications of silver chalcogenides nanoparticles will also be presented.

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Self assembly of short G-rich repeats into G-wire a higher order DNA structure: Role in targeted drug delivery

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G-wires long, continuous G-quadruplexes are a promising element for use in nanotechnology, particularly in molecular electronics. We studied the structures of two G-rich oligonucleotides with different number and position of Gs, one is telomeric DNA oligonucleotide 5′-G_4TG_4-3′ (Tet1.5) and another is 5′-$G_2AG_5AG_2$-3′(11Pu) located in 3′-UTR region of c-jun protooncogene. We used circular dichroism, and UV-thermal melting to determine the topology of the target sequences. CD results shows that in aqueous solutions containing mono- and divalent cations self-assembles both DNA target sequences into high-molecular weight species that spontaneously assembles into large superstructures. Our CD results clearly show that 10 mM $MgCl_2$ self assembles 11Pu into large superstructures mainly liquid crystal. The type and concentration of the cation present in solution determine which conformation (Tet1.5) and (11Pu) will adopt. The effects of K^+ and Mg^{2+} on the aggregation of this oligomer appear to be synergistic. The presence of $MgCl_2$ alone or with K^+ induced aggregates. To determine whether other divalent cations like affect the aggregation of (11Pu) rudimentary studies were made with Ca^{2+}. The results indicate these ions are not effective in promoting aggregate formation by the oligomer in solutions with K^+. These insights may be employed to design G quadruplex- based nanowires or more complex architectures responsive to specific cations that may have tremendous material and biological applications.

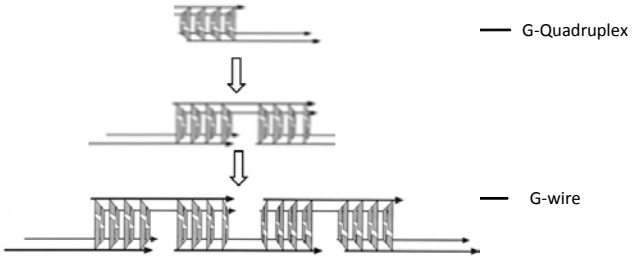

Figure 1: Schematic representation of G-quartet assembly into higher order structures of DNA.

Polysaccharide based graft copolymer as a low cost adsorbent for the removal of methylene blue and congo red dyes

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Water pollution due to release of industrial wastewater has already become a serious problem. Almost every industry uses dyes to colour their products and residual and unspent dyes are discharged into the environment, particularly aquatic environment. The presence of dye in aquatic environment is of great concern due to their adverse effect on animals and humans. Because dyes are almost invariably toxic, their removal from effluent stream is ecologically necessary. Although some existing technologies may have certain efficiency in the removal of dyes, their initial and operational costs are so great, that they constitute an inhibition to dyeing and finishing industries. On the other hand low cost technologies do not allow a wishful colour removal or have certain disadvantages. Hence research has been directed to the materials and procedures for dye removal that will combine effectiveness and cheapness. Recently, there has been a resurgence of interest in natural flocculants/coagulants for wastewater treatment in developing countries .Natural polymers, mainly, polysaccharides and modified natural polymers are becoming popular in water treatment, as they are biodegradable, easily available and usually nontoxic. In the present study Biodegradable polysaccharide based graft copolymer used for removal of dyes from wastewater containing methylene blue and congo red.

Transition metal based spinel oxide-graphene nanoribbon composites for removal of pesticide from water

Indu Arora, Parvinder Kaur

Water is the most essential requirement for the well being of human and animal health. However, our water resources suffer from undesirable discharge of non-biodegradable wastes such as pesticides. Commercially more than 100,000 varieties of pesticides are available and 10-15% of the used pesticides pollute the water through effluents. Due to the complex structure of the pesticides derived from different functional groups, they are resistant to decomposition on exposure to light, water and many other chemicals. Most of these pesticides are toxic and after release into water, they may get converted into carcinogenic amines having lethal effect on the flora and fauna of the ecosystem. Consequently, their degradation via reliable and sensitive approach i.e. photocatalytic process is of practical significance. Photocatalytic degradation of pesticides using graphene, TiO_2 and other composites are attracting research interest for water purification. However, the need of ultraviolet (UV) light for activating the photocatalysts impedes their utility. As a result, more efforts have been done to exploit new photocatalysts, which are photo catalytically active under visible light irradiation, as it comprises major portion of the solar light on earth. In order to achieve this visible light absorption, researchers have recently moved towards a new class of material, spinel oxides or more precisely bimetallic spinel oxides and their graphene supported composites as these provides efficient charge transfer kinetics. The main drawback associated with the existing photocatalysts is their less adsorption capacity which resulted in fast electron-hole recombination. Optimized band gap which lies in the region of visible range of solar spectrum is also a vital requirement for highly efficient and economical water purification. We in our work aim at purifying the water by removal of pesticides with enhanced efficiency by utilizing visible radiation from sunlight. Combining the photocatalytical activity of transition metal based spinel oxide with high absorption efficiency of GNR will produce a superior photocatalyst for pesticide degradation. Fabricated photocatalyst will undergo visible light driven photocatalysis with expectedly high distribution coefficient.

Chalcones as antitubercular drugs: Binding studies with bovine serum albumin

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According to World Health Organization, about 2 million people die of tuberculosis (TB) annually. The emergence of new cases, an increased incidence of multi drug resistant strains of *M. tuberculosis* and the adverse effects of existing first and second line antitubercular drugs have led to renewed interest in natural products with the hope of discovering new antitubercular leads. Various chalcones have been shown to exhibit excellent anti-tubercular properties. However, their bio distribution studies are not available. This paper tries to study this aspect. A library of chalcones was developed. After optimising their geometries, all the compounds were ranked on the basis of their binding free energies calculated using *in silico* methods and the top ranking compounds were then synthesised in the laboratory. These compounds were used for ligand binding interaction studies with Bovine Serum Albumin (BSA) under physiological conditions, using fluorescence and molecular docking methods. A concomitant increase in the absorbance of BSA at 278 nm was observed on increasing the ligand concentration, with no shift in λ_{max}. This indicates that upon addition of the synthesised ligands, the microenvironment around tryptophan residues remained unchanged. The binding constants obtained were suggestive of moderate binding of lignads with BSA. On addition of chalcone derivates, λ_{max} for BSA exhibited a red shift, suggestive of an increase in the polarity of the microenvironment around the tryptophan residues. This could be due to the loss of the compact structure of hydrophobic sub domain IIA where tryptophan-214 is placed.

Graphene based mixed matrix membrane: Water purification with enhanced fouling resistance

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Living systems; terrestrial, aquatic and aerial, have been affecting by water contaminants owing to urbanization and heavy industrialization which leads to extensive research in water purification. With technological advancements and escalating requirement of water quality, Membrane technology is proving an attractive key to quality water and its reuse. Membrane filtration allows water solvent but rejects solutes, gases, fluids and various particles present in the polluted water. Based on the pore sizes, membranes are of four types: microfiltration (MF), ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO) membranes. Among them, NF (pore size ~1 nm), newly introduced replaces RO (transport occurs via solution diffusion mechanism) and UF (separtion is governed by size exclusion) and hence also called as charged UF and low pressure RO system. Major problems still associated are, membrane fouling and their chemical stability. Enhanced fouling resistance would augment membrane efficiency by lengthening their active lifetime and diminishing their energy requirements. Work in this area has focused on surface modification of membranes in order to endow a highly stable and cost effective entity. With a view to develop nanofiltration membrane, we have been fabricating nanofiltration membrane of Graphene based ternary composite followed by their nanofiltration membrane for water sanitization. By standardizing the relative

content of constituents, the structure and additional functions of such membranes could be controlled separately. This integration provides strong enticement to polar water molecules and discards salts and other pollutants endowing an efficient mixed matrix membrane for sustainable water treatment technology.

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Nanotechnology: Leading in cancer chemotherapy

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Cancer has been a threat to human beings globally. Nanomaterials are similar in scale to biologic molecules and systems yet can be engineered to have various functions, nanotechnology is potentially useful for medical applications. The field of nanomedicine aims to use the properties and physical characteristics of nanomaterials for the diagnosis and treatment of diseases at the molecular level. Drug is wrapped in or adsorbed on surface of nanoparticles, when the specific targeting molecules combining with the receptor of cell surface, nano-drug is taken into cells, to achieve the safe and effective targeted drug delivery and gene therapy. To date, various nanodrug systems have been developed for different routes of administration, which include dendrimers, nanocrystals, emulsions, liposomes, solid lipid nanoparticles, micelles, and polymeric nanoparticles. Nanodrug systems have been employed to improve the efficacy, safety, physicochemical properties, and pharmacokinetic/ pharmacodynamic profile of pharmaceutical substances. In particular, functionalized nanodrug systems can offer enhanced bioavailability of orally taken drugs, prolonged half-life of injected drugs (by reducing immunogenicity), and targeted delivery to specific tissues. Literature shows that the targeted action of nanodrugs depends directly on the size of nanodrugs and the size and physiology of cancer cells. Thus, nanodrug systems might lower the frequency of administration while providing maximized pharmacological effects and minimized systemic side effects. The future of nanodrugs is quite bright and, hopefully, these will replace the conventional drugs within coming decades.

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Synthesis, characterizations of copper nanoparticles and their effects on seedling growth of plants

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A facile and sustainable chemical reduction approach towards the synthesis of copper, cuprous oxide (Cu_2O) and cupric oxide (CuO) nanoparticles (NPs) with different shapes and morphologies using 10 mM of copper sulphate ($CuSO_4.5H_2O$) and Hydrazine ,Ascorbic acid, Fructose and Sucrose as an additives are presented. Notably, following the same synthetic route, different shaped Cu_2O NPs are obtained simply by controlling the concentration of capping agent and other reducing agent. Nanoparticles were characterized by using UV–visible absorption spectroscopy, scanning electron microscopy (SEM), and X-ray diffraction (XRD) techniques. The effects of these synthesized nanoparticles on seedling growth of *Vigna radiata* (L.) *R. Wilczek* var. radiata (Mung bean) have been investigated under *in vitro* conditions. The copper nanoparticles are added in different concentrations viz. 10, 20, 50 and 100 ppm in to semi-solid Murashige and Skoog's nutrient medium. Sucrose at a concentration of 3% was incorporated as a carbon source and 0.8% agar was added for the solidification of the medium. The pH of the medium was adjusted to 5.8. The cultures were maintained in the culture room at a temperature of 26 ± 2^0C and illumination of 80 µ mol sec^{-1} m^{-2} of 8 hours light and 16 hours dark. The various parameters were determined like as percentage of seed germination, day of appearance of the radical, root length, number of root laterals day of emergence of leaves, no. of leaves, leaf characteristics and shoot length respectively. The observations shows that higher concentrations of nanoparticles are toxic to the growth of seedlings as the percentage of seed germination, root and shoot length was less as compared to the MS basal medium (medium without nanoparticles). Interestingly, a enhanced response was obtained at 20 ppm of Cu nanoparticles supplemented to the medium. The results indicates an negative effect of high concentrations and a positive effect of lower concentrations of nanoparticles added to the nutrient medium under axenic conditions.

Synthesis of copper nanoparticles and characterizations by using different techniques

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A facile and sustainable chemical reduction approach towards the synthesis of copper, cuprous oxide and (Cu_2O) nanoparticles (NPs) with different shapes and morphologies using 10 mM of copper sulphate ($CuSO_4.5H_2O$), 2.55 mM of tri-sodium citrate and 1 mL of Hydrazine at 373K. Nanoparticles were characterized by using UV–visible absorption spectroscopy, scanning electron microscopy (SEM), and Powder X-ray diffraction (PXRD) techniques. The 2θ peaks at 43.29°,50.43°,74.12°,89.92°and 95.13° belong to the fcc metallic Cu (JCPDS, PDF, File No. 04-0836). The other peaks in this diffraction pattern at 2θ values 29.55° and 36.41°, belong to Cu_2O (JCPDS, PDF, File No. 05-0667) for the the particles.

Flavonoids: Future prospects to shape up of healthy life by nanotecnology

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Plants are unique chemists, producing secondary chemicals of tremendous diversity in nature and properties, many of them are in use as drug or medicine ethanoformulation for curing several types of diseases. The flavonoids are major class of secondary metabolites present widely in all vascular plants. They possess wide variation in their molecular structure, have been recognised fully for their effective action as anti microbial, anticancerous, anti-inflammatory, antiallergic, antioxidant, free radical scavenger, against lipid peroxidation. Natural product chemistry is an interdisciplinary area of science concerned with the isolation , characterisation and determination of biological activity of constituents. The bioactivity depends upon degree of hydroxylation, methylation and glycosidic nature, conformation flexibility and water solubility. Many natural product have a strong therapeutic value, their poor solubility and bioavailability have limited their use. In the last few decades scientist have used nanoparticles delivered entities for the treatment and prevention of various disease. So for improving health care system several nanoparticle system have been used to aid in the formulation, encapsulation and release of of active compounds extracted or derived from natural resource.

Nanocomposites and food packaging: Risks and safety regulations

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Research and development in food nanoscience is the buzz word these days. The most active area in this interdisciplinary spectrum is food packaging. This is attributed to a greater willingness to embrace nanotechnology in “out of food” applications than those where nanoparticles are directly added to food. Besides nanoreinforcements, whose main role is to improve mechanical and barrier properties of polymers, there are nanostructures responsible for other applications related to food packaging. For example, when incorporated to polymer matrices, they may interact with the food and/or its surrounding environment, thus providing active or “smart” properties to packaging systems. These engineered nanomaterials when present in food packaging systems, are usually related either to improvements in food safety/stability or information about the safety/stability status of a product. However, the nanometric dimensions of these products may change or influence the physical, chemical, and biological aspects of the adjacent environment, including the in- vivo environment. We can presumably say that the greater chemical reactivity and bioavailability of nanomaterials may also result in greater toxicity of nanoparticles. The aim of this presentation is to discuss and comprehend the status of legislation from national governments of various states.

Assessment of cost effective commercial production of microalgae

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Microalgae has been considered as a very good feedstock for the extraction of various high and low value commercial products like agar, pigments, lipids, carbohydrates, etc. High biomass productivity is prerequisite for high rate of production of these commercial products and this productivity depends on various factors like basic nutrients, culture conditions, carbon sources, shaking period, etc. Optimum production conditions are not available in all commercial plants and thus it is very hard to make the whole process cost effective. In this study, microalgae *Chlorella minutissima* has been cultivated in various culture conditions and an innovative comparison has been made to explore alternative conditions that can make the whole process cost effective. This analysis provided various alternative conditions in which we can achieve high biomass productivity. This concept can be further explored for the personalised microalgae cultivation as per the need of individual customer by utilisation of the alternative conditions that are best suited economically.

Opioid receptors regulation and antinociception on chronic morphine treatment

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Morphine is one of the most effective analgesics which mediate its antinociception through μ opioid receptors. Moreover, its use in chronic pain is still limited due to side effects like tolerance development, physical dependence and withdrawal symptoms. Recent studies have shown that not only μ receptors, but δ opioid receptors also plays a critical role in morphine tolerance development. However, few reports are available which focus on regulation of κ and δ opioid receptors on morphine treatment and potentiate above fact. Continuing on same line of enquire, present study investigates the effect of chronic morphine treatment on its antinociception and expression of μ (MOR1), δ (DOR1) and κ (KOR1) receptors. Rats were treated with morphine and saline twice daily for 6 days and antinociception was measured by tail-flick test. Further, on each day, rats were sacrificed; brain and spinal cord were removed for total RNA and protein isolation which were quantified by real-time RTPCR and western blot analysis, respectively. Results revealed that chronic morphine exposure significantly ($p<0.001$) down-regulates MOR1 expression in both brain and lumbar region which coincides with behavioral signs of tolerance. However, DOR1 in both tissues showed steady up-regulation from day 2-5, after significant ($p<0.05$) down-regulation on day 1 and again reverts back on day 6. In KOR1, both mRNA and protein showed an irregular pattern in brain and lumbar. Finally, we conclude that expression of KOR1 and DOR1 were also affected by chronic morphine treatment along with MOR1which suggests that these receptors might also play crucial role in morphine tolerance.

Therapeutic effect of nanoparticles synthesized using *Plumbago zeylanica*

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Biotechnology combined with nanotechnology is playing an important role in today's medicinal world as the effective therapeutic agent can be customized for efficient action on the target site. These therapeutic agents are the nanoparticles which can be synthesized using plants. *P. zeylanica* is utilized for synthesis of silver nanoparticles. This plant is a medicinal herb form the family Plumbaginaceae and is used for a variety of therapeutic purposes. This plant contains various chemically important compounds like napthoquinones, flavonoids, terpenoids and steroids, many of them being responsible for several biodynamic activities. Silver nanoparticles synthesized by this plant will be used on various bacterial strains to check for antibacterial activity.

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Controlled aqueous phase synthesis of gold nanoparticles using fruit extract of *Momordica charantia*

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Gold nanoparticles (Au NPs) were synthesized using fruit peel extract of *Momordica charantia* which is commonly known as Bitter gourd. The extract contains compounds such as citric acid, flavanoids, phenols and volatile oil which not only act as a reducing agent for Au^{3+} but also as capping agent to prevent the aggregation of gold nanoparticles. The Au NPs of different sizes 20 nm, 50 nm and 75 nm are synthesized using aqueous phase green synthesis and characterized using UV-vis spectroscopic analysis and Dynamic Light Scattering (DLS). The size of these nanoparticles is dependent on the weight percentage of chloroauric acid. These are found to be highly monodispersed and can be potentially used as nontoxic therapeutic and imaging agent for various diseases.

Isolation, characterization and phylogenetic analysis of HCH (hexachlorocyclohexane) degrading linA (Dehydrochlorinase) and linB (Haloalkane Dehalogenase) gene variants from HCH contaminated soil

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One of the extensively used organochlorine insecticides is hexachlorocyclohexane (HCH) which is synthetically prepared and consists of eight stereoisomers; α- β-, γ-, δ-, ε-, ζ-, η- and θ-HCH. Out of all the isomers only γ -isomer (lindane) has

insecticidal property. This mixture of waste isomers is generally called as 'HCH muck' which is usually discarded either in open or sealed sites which gradually into formation of dumpsites.A site was selected with a heavy load of pesticide waste (HCH muck) discarded by the industry. The site is located near India Pesticides Limited (IPL) Chinhat, Lucknow.As a result of purification, HCH muck consisting of waste isomers has been dumped by the side of the site. The water flowing from the backyard of this factory accumulates in a nearby pond area. The HCH concentration was found to be 4.5 mg $kg^{-1}$of soil and 18 mg l^{-1} of water. Although α-HCH constitute 60-70% of the muck but β-HCH was predominant of all the isomers indicating slow or negligible degradation of this isomer.Since HCH degradation is mainly attributed by *lin* genes (*lin*dane degrading) and of all the *lin* genes reported so far, enzymes encoded by *linA*and *linB* genes are the key enzymes that initiate degradation of all HCH isomers. Thus the genes were cloned inframein pET14b expression vector and transformed in *E.coli* BL21 (DE3) host cells. *linA* and *linB* gene sequences thus obtained were translated and aligned. For *linA* gene, *LinA2* of *Sphingobiumindicum*B90A was used as prototype for comparison whereas LinB of *Sphingobium indicum* B90A and LinB of *Sphingobium japonicum* UT26 as prototype for *linB*gene. The amino acid alignment profile for LinAvariants indicated no change in the catalytic site in any of the variants but significant differences were observed which can alter the activity of the gene. Phylogenetic analysis depicted that LinA variants cluster among each other while the known LinA variants formed a separate clade. Only one LinB variant was observed that clustered with *Sphingobium*sp. P7, which has been isolated previously from HCH dumpsite, Lucknow and is reported for better degradation potential than *Sphingobiumindicum* B90A. It can be concluded that similar LinA and LinB variants with unique amino acid substitutions compared to the prototypes B90A, UT26, Sp+ are evolving at the HCH contaminated sites and can be studied for HCH degradation.

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Green synthesis of gold nanoparticles and their characterization

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Biocompatible gold nanoparticles have gained considerable attention in recent years for potential applications in different fields such as medicine, catalysis, electronics and biotechnology. This work is aimed at exploring the green synthesis of gold nanoparticles using cumin and fennel seeds as simple, non-toxic, eco-friendly 'green materials'. Cumin and fennel are herbaceous plant grown in Mediterranean climate and are known for their stimulant, antispasmodic, anti-inflammatory, antioxidant and carminative properties and help in digestion and maintain blood pressure. Cumin and Fennel's distinctive flavor and strong aroma are due to its essential oil content. Biocomponents not only reduce the Gold ions to nanoparticles but also stablise it.The growth of nanoparticles was monitored by UV-Vis spectrophotometer. The UV-Vis spectrum of Cumin and fennel-Au NPs showed a peak in the region 535and 540 nm corresponding to the surface Plasmon resonance band (SPR) of gold nanoparticles.

Peptide nanoarchitechures enriched with biomedical applications

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Peptide nanostructures have gained enough popularity due to their easy biocompatibility and numerous potential biomedical applications. An extensive research has been carried out towards the development of novel functionalized peptide-based self-assemblies with strong potential of applications such as cell encapsulation, stem cell differentiation, immune response and drug delivery. Besides, peptide-based self-assemblies are of much interest due to their low cost, specific molecular recognition, easy tailoring of their chemical and biological functionalities and also their biomimetic nature. Several peptide nanohydogels have been reported to possess strong biological applications and also used as encapsulating metrices for target drug delivery. An excellent model of self-assembly of functionalized hydroxyethylamine nanostructures has been synthesized and characterized by DLS, FTIR and TEM. Besides, the peptide nanostrucutres were evaluated for biophysical studies. The interestoing observations would be presented.

Green chemical approaches for clean green environment

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Over the past few decades, the chemistry community has been mobilized to develop new innovative approaches (in the form of reagents of methodologies) that are less hazardous to human health and the environment. This new approach has received extensive attention and goes by the name "Green Chemistry." Ever since its introduction in the early part of the 1990s, there has been significant and dramatic evidence to support the claim that Green Chemistry is an important area for science and technology to pursue for the benefit of the environment, the industry and the general public. Recently, there has been a renewed focus on the age-old pursuit of the researchers to develop novel organic

compounds of biological as well as industrial significance using environmentally benign catalytic processes which play an instrumental role in advancing the goals of green chemistry. Consequently, the efforts of the scientific community have been largely directed towards the design and development of superior catalytic systems that not only possess higher efficiency in terms of cost and reusability but also enable the sustainable, waste free organic synthesis. In fact, with the aid of greener protocols such as solvent free synthesis, microwave and ultrasound assisted synthesis, the field of catalysis science has witnessed a tremendous improvement as these technologies effectively work towards reducing waste, lowering cost, ensuring higher atom economy and accelerating product yield. The key focus of the presentation is to highlight the potential benefits of catalytic technologies in greening organic synthesis.

Therapeutic analysis of *Terminalia arjuna* plant extracts in combinations with different metal nanoparticles

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Arjuna is a 40-60 feet tall tree found in sub-himalayan, central and southern part of India. It is among the most valuable plants used in Unani, Ayurveda, Tibetian and Homopathy medicine. It bark is a rich source of flavinoids like arjunoline, ajunone, phytosterol, anti-oxidants as well as good source of minerals like copper, zinc, calcium. Its phytochemical constituents are effective in treating asthma, hypertension, ear infection, ulcer, liver problem and highly effective in LDL-cholestrol, ischemic heart diseases. A recent survey showed that 80% of world population is dependent on traditional herbal medicines especially India and China like developing countries. Different plant extracts of *Terminalia arjuna*has been used for the synthesis of different nanoparticles like gold nanoparticles, silver nanoparticles and magnetic iron nanoparticles. Thestudy evaluate the potential of plant extract in combinations with different metal nanoparticle in treatment of different disease. The present presentation is meant to discuss various metal nanoparticles synthesis and their characteristics obtained using extracts of *Terminalia arjuna*and progress towards pharmacological properties evaluation in extract combinations which are effective for controlling various kinds of ailments.

Nanomedicines: An Overview

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In the present era the substantial risk to all human being is the cancer which affected the large area of human population. Chemotherapeutic agents are not very successful due to its non-specific recognition between cancerous and normal cells resulting in suboptimal efficacy combined with toxic side effects. With the advent of nanostructures and nanomaterials in past few decades bring a revolution in the field of biomedical area.[1] The exploitation of unique properties of nanostructure and nanomaterialshas been done extensively to overcome many of the limitations common to the chemotherapeutic agents. Nanotechnology opens new avenues for synthesis of nanomedicines as well as their targeted drug delivery to the cells.[2] Nanoparticles facilitates and play a role of medium to deliver nanomedicine to the target tumor cells. A benefit of using nanoscale for medical technologies is that smaller devices are less invasive and can possibly be implanted inside the body as well as biochemical reaction times are much shorter. These devices are faster and more sensitive than typical drug delivery. Nanoparticle designed on the basis of variety of materials including lipid-based amphiphiles (liposomes),[3] metallic (gold, iron-oxide),[4] Carbon nanotubes[5] etc. Apart from benefit various harmful effect and hazards are also recognized for using nanomaterials as nanomedicine. Besides the potential beneficial use also attention is drawn towards how we should proceed and what are the measures by which we can reduce the toxic effect of nanomaterials. This presentation is to discuss these aspects and attempt to seek answer to future research

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Nano herbal drug delivery system: An effective tool for enhancing bioavailability of phytomedicines

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Phytomedicines have been widely used since ancient times due to their better therapeutic activity and less side effect as compared to allopathic drugs. However the constraints associated with these herbal drugs are their poor aqueous solubility, in vivo stability, poor permeation across the lipid membranes of the cells, high molecular size, and low systemic availability, resulting in loss of bioavailability and efficacy. To overcome these constraints, the biologically active ingredients of these herbal medicines also known as secondary metabolites such as flavonoides, terpenoides, tannins etc. need to be combined with nano-structured systems to enhance the efficacy of effective site specific delivery system. Nanotechnology has revolutionized the medical and pharmaceutical fields by providing various novel drug delivery systems such as efficient nanocarriers that include polymer conjugates, polymeric nanoparticles, carbon nanotubes, gold nanoparticles and lipid-based carriers that include both liposomes and micelles. Nanosystems can deliver the active constituents at an optimum concentration during the entire treatment period

reducing the required dose and side effects, and improving activity. So the nano herbal drug delivery systems have a potential future for enhancing the activity and overcoming the problems associated with medicinal plants and help to treat dangerous diseases like cancer, diabetes etc.

Microcapsule for increasing crop productivity: An emerging technology

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Nanotechnology has emerged as a promising field with potential role in agricultural sector to meet challenges of sustainability, food security and climate change. Nanoparticles with unique physical, chemical and mechanical properties act as a microcapsule for increased crop production, as diagnostic devices in environment remediation and plant breeding research. Recently, these nanoparticles have found immense potential as smart delivery systems for disease and pest control in plants, improved nutrient use efficiency, genetic transformation and food packaging industry. Advanced scientific research pertaining to these target specific nano sized particles would contribute to minimization of losses by precise application, better leaf coverage, controlled disease and increased yields through optimised nutrient and water management. Despite these prospective advantages, nanotechnology faces some constraints regarding the behaviour of nanomaterials on the biotic components and environment. Use of non toxic materials in nanoparticle preparation and bulk production of these particles would solve the problem to some extent. In this poster we have made an attempt to assess prospects of nanofabricated materials in the context of agricultural growth and development.