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Indo-Hungarian Symposium on Recent Advances in Chemistry and Biology - Abstracts

***Organized by**: Department of Chemistry, Miranda House, University of Delhi, Delhi, India in association with Department of Pharmaceutical Chemistry, University of Debrecen, Debrecen, Hungary*

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The science at the interface of chemistry and biology is progressing at a very fast pace and bringing about new developments in the discovery of modern new therapeutics and diagnostics. The developments in core chemistry research has always influenced the advances in biological developments and vice-versa. Understanding and knowing the new advances in interface science has been important for research community to furtherance of newer research.

The main objective of the one-day Indo-Hungarian symposium was to sensitize and stimulate young minds and create awareness among young research scholars and scientists to bring out the best among the various frontiers of chemical and biological sciences. The following main topics were covered during the symposium; Organic Synthesis, Medicinal Chemistry, Catalysis, Drug Delivery, Peptide Synthesis, Nanobiotechnology, Carbohydrate Chemistry. This symposium brought together the undergraduate, postgraduate students, doctoral students and faculty members on a common platform to deliberate and discuss recent advances in chemical and biological research. The symposium played an important role in apprising students of the latest development in their discipline. The organising committee strived to make sure that the researchers get chance to present their idea and research work in the symposium. The speakers from India and Hungary discussed the chemistry biology developments at length.

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Approaches to New Drug Discovery – Bugs to Super bugs and Antibiotics to Protein Antibiotics – A Fight for the Survival

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Considering the alarming rise in the incidence of bacterial resistance to known antibiotics, we are almost back into the pre-antibiotics era. On the one hand, the conventional methods of drug design backed by a lot of new data and new knowledge should be continued while on the other, the protein based therapeutics must be developed. In this regard, the proteins of the innate immune system which provide the first line of defense against infecting microbes could be probed. These proteins recognize the conserved motifs that are present on the cell walls of bacteria. Thus, the success of the innate immune system depends on the affinity of the proteins of innate immune system towards the bacterial cell wall molecules. The conserved motifs of microbial cell walls are called pathogen associated molecular patterns (PAMPs) that include the well-known peptidoglycans (PGN) and lipopolysaccharides (LPS) of Gram-negative bacteria, PGN and lipoteichoic acid (LTA) of the Gram-positive bacteria and mycolic acid (MA) and other fatty acids of *Mycobacterium tuberculosis*. These PAMPs are classified into two groups: (i) those which contain glycan moieties such PGN, LPS, LTA etc. and (ii) those that are derivatives of fatty acids such as MA. Therefore, there should be two independent binding sites for the two different types of PAMPs. The PAMPs are specifically recognized by innate immunity molecules which are historically known as peptidoglycan recognition proteins (PGRPs). These proteins bind to PAMPs with significant affinities and neutralize the infecting pathogens through a variety of actions. There are four types of PGRPs in mammals including humans, PGRP-L (MW = 90kDa), PGRP-Iα and Iβ (MW = 45kDa) and PGRP-S (MW =

21kDa). PGRP-S represents the domain that has the binding site for PAMPs. The binding affinities of PGRP-S and structures of unbound and bound PGRP-S from various species showed that the protein from camel has considerably higher affinity than those of other animals including humans. The epidemiological data indicate that the camels have the lowest rates of infections. Structurally, PGRP-S from camel exists in the form of a dimer whereas the human protein acts as a monomer. There are only a few sequence differences in the proteins from two species which are responsible for dimerization of camel protein. As a result of dimerization, a deep binding cleft is formed in the camel protein whereas only a shallow cleft is present in the case of human monomeric protein. Because of dimerization, the potency of camel protein is much higher than the same protein from other species. Thus, if camel protein is used or a suitably mutated human protein is prepared and used, the fight against bacterial infection will improve.

The mechanism of action of PGRP-S involves an effective sequestration of bacteria which results in the killing of bacteria. Since PGRP-S interacts with bacterial cell wall, the kinetics of bacterial cell death appears to be similar to those antibiotics which inhibit the biosynthesis of PGN. Due to this similarity, PGRP-S is suggested to be termed as **"protein antibiotics"** and since they bind to bacterial cell wall molecules the issues of side effects and resistance will not arise and if the potencies are high, the invading bacteria can be tackled rapidly.

From Glycopeptide Antibiotics to Nucleoside Analogs: Pieces of Medicinal Chemistry Research at University of Debrecen

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As a result of a systematic study on lipophilic derivatives of aglycons of teicoplanin, vancomycin and ristocetin, a series of new compounds have been synthesized. Many of them possess high activity against multiresistant bacteria as well as against influenza viruses.[1]

New osteoadsorptive fluoroquinolone hydroxybis phosphonates have been prepared and their adsorption on bone models has been studied.

A disaccharide analog containing a locked carba sugar has been synthesized from gallic acid.

Synthesis of a new family of nucleosides called tricyclanos has been performed bearing a new heterotricycle.[2]

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Thiol-Ene Reactions on Unsaturated Carbohydrates and Nucleosides

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Over the last decade, the photoinduced thiol-ene coupling, where a reactive thiyl radical undergoes an addition reaction onto a terminal alkene to furnish a thioether linkage, has been recognized as a robust ligation tool possessing many of the attributes of click chemistry. The reaction is insensitive to water and oxygen, requires very mild conditions, proceeds with exquisite regioselectivity and high yields and shows tolerance to a wide range of functional groups. The great synthetic potential of this metal-free reaction has been amply demonstrated in areas of polymer chemistry and material sciences, and in the field of bioorganic chemistry.[1]

We have investigated the addition of thiol-containing peptides and sugars to 2-acetoxy-D-glucal as a method for the synthesis of S-linked disaccharides and glycoconjugates with exclusive 1,2-cis-α-selectivity.[2] The reaction has been extended to 2-acetamido-D-glucal and a range of 2-acetoxy-D- and L-glycals.

Various sugar derived alkenes with exo- and endocyclic double bonds have been employed as acceptor substrates in the thiol-ene chemistry to produce thio-linked or sulfur-carbon-bridged disaccharides and glycoconjugates with high stereoselectivity.[3]

A low-temperature-photoinduced thiol-ene click reaction has been proved as a mild and efficient method for the synthesis of sugar modified nucleosides.[4]

In this lecture, our recent work in the field of thiol-ene chemistry will be presented.

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Malaria Drug Discovery: Challenges and Opportunities

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Plasmodium sporozoites are introduced in the vertebrate host by the infectious mosquito bite. In the vertebrate host invasion of the hepatocytes is the first step towards developing the

malaria disease. Sporozoites invade hepatocyte and transform into exo-erythrocytic forms that reside in a parasitophorous vacuole. Malaria disease symptoms are caused by the blood stage infection. Reports suggest resistance to most of the drugs in use against the malaria. Resistance is also emerging towards Artemisinin, the only effective anti-malarial drug at present. My talk will focus on various pathways that we have targeted in malaria parasites and the inhibitors that we have identified.

Protein prenylation is important for many cell functions. To inhibit prenylation we tested bisphosphonates. Bisphosphonates are potent low nM inhibitors of the enzyme farnesyl diphosphate synthase, which catalyzes the condensation of the isoprenoids dimethyl-allyl diphosphate and isopentenyl diphosphate, produced in the mevalonate pathway.

Fatty-acid synthesis in *P. falciparum* is localized in apicoplast, which is evolutionarily related to cyanobacteria. The striking differences in the organization of the FAS enzymes of *P. falciparum* and human host, make parasite FAS pathway enzymes potent targets for developing inhibitors against the malaria parasite. We explored the potential of triclosan in inhibiting liver-stage parasites.

Artemisinin-based combination therapy is currently recommended as first-line treatment of falciparum malaria in all patient populations. The artemisinins significantly reduce the parasite bio-burden in the first 24 – 48 h following treatment and are more potent than other available antimalarial agents. However, the current generation of artemisinin derivatives in clinical use are rapidly eliminated [t1/2 alpha = 2.61 hr; t1/2 beta = 4.34 hr;)] and are therefore unable to eradicate any residual parasites after the typical 3-day treatment regimen. Co-administration with partner drugs that have a longer duration of action is therefore suggested to offset parasite recrudescence after artemisinin dosing. Apicoplast of malarial parasite, *P. falciparum* is an essential organelle housing both the subunits of bacterial type gyrase enzyme (type II topoisomerase). I'll discuss about a combination therapy using a slow acting gyrase inhibitor.

Adventure with Alkynes: Modern Tool for the Construction of Small Heterocyclic Molecules (One Bullet More Than Hundred Targets)

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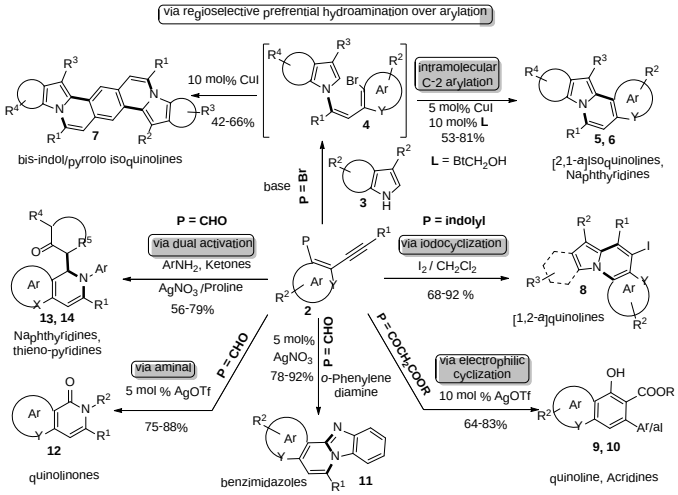
Synthesis of small heterocyclic molecules in terms of selectivity, operational simplicity, functional group tolerance and environmental sustainability are in constant demand as majority of drugs; drug-like compounds contain hetero atom at their core. In continuation of our interest in the synthesis of heterocycles using alkynes, we have successfully engineered the



synthesis of variety of biologically important heterocyclic scaffolds using electrophilic cyclization/hydroamination/and alkyne annulations.[1-7] In this presentation, I would like to discuss about our results in this chemistry.

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Dengue Virus: Is There Any Solution?

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DENV is a positive stranded RNA virus composed of three structural proteins which forms the components of virion and seven non-structural proteins which control various functions like viral replication, immunity and pathogenesis. There are five different serotypes of virus namely DENV-1 to DENV-5. So far, no vaccine with higher efficacy has been known for treating all serotypes of dengue. In the present study, comparative genomics of Dengue virus was conducted to explore potential candidates for novel vaccine targets. All ten proteins of all four

serotypes of dengue virus were downloaded and analyzed for conserved motifs using MEME software. Several B-cell epitopes were predicted using Immune Epitope Database B-cell prediction tool & Bepipred. Overlapping epitopes sequences were analyzed for surface accessibility and conservancy. Based on our studies, we could find several conserved epitopes which are antigenic in nature. Using *in silico* analysis, we could successfully obtain many conserved B-cell epitopes common to all serotypes of dengue virus, which seems promising for designing novel vaccine targets.

Synergistic Blending of High-valued Heterocycles Inhibits Growth of *Plasmodium falciparum* in Culture and *P. berghei* Infection in Mouse Model

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Malaria is a devastating infectious disease in humans, causing ~214 million clinical cases globally with 438,000 deaths per annum. Herein, we present a series of phthalimide (Pht) analogs, novelized with high-valued bioactive scaffolds was synthesized by means of click-chemistry under non-conventional microwave heating and evaluated as noteworthy growth inhibitors of *Plasmodium falciparum* (3D7 and W2) in culture. Three analogs showed highest activity to inhibit the growth of the parasite with IC_{50} values in submicromolar range. Structure-activity correlation indicated the necessity of unsubstituted triazoles and leucine linker to obtain maximal growth inhibition of the parasite. Notably, phthalimide analogs selectively inhibited the ring-stage growth and parasite maturation. Besides, they displayed synergistic interactions with chloroquine and dihydroartemisinin against parasite. Additional *in vivo* experiments using *P. berghei* infected mice showed that administration of analogs alone, as well as in combination with dihydroartemisinin, substantially reduced the parasite load. The high antimalarial activity of Pht analogs, coupled with low toxicity advocate their potential role as novel antimalarial agents, either as standalone or combination therapies.

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Identification of Counterfeits in Solid Form of Pharmaceutical Drugs through Forensic Chemistry

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All are knowledge about the counterfeits in currencies, coins, food product labels etc. but another counterfeiting is growing increasingly in drug and medicine world. The present study is focuses on pharmaceutical drug counterfeiting and its relevance in forensic chemistry. The counterfeit drugs are fake medicines that have similar appearance and physical form. They have the right active ingredients but wrong dosage. They are illegal drugs and harmful for hearth and may produce side effects.[1] In rural areas, the medical store gives some contribution for suggesting these illegal drugs to the patient and medical practitioner suggested fluently these drugs for greed. Only 5-10 % peoples checks the composition data of the drugs after buying. Only 35-40 % checks the manufacturing and expiry date before taking drugs in rural areas. The urban people are much more knowledgeable about fake drugs because they have internet facility to check instantly the company name as well as composition data and therapeutic dose etc suitable for disease control and they also concerned to the registered medical practitioner about the drugs before taking.

There are number of counterfeit or substandard pharmaceutical products that are fraudulently labeled and packed by unknown companies.[2] Forensic chemistry is a sub branch of forensic science deals with drugs, explosives etc. A forensic chemist can individualize and identified these illicit drugs and counterfeit medicines and can provide actual information regarding its composition and manufacturing through spectroscopic and chromatographic examination.[3]

Key words: *Drug, counterfeiting, dosage*

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A Sunlight Based Catalysts Application for Treatment of Textile Effluent

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Degradation of soluble organic dye pollutants present in textile effluent is a challenging task. We use photocatalyst based technology for degradation of organic dye pollutants. We also

established relation between different operating parameters like temperature, amount of the catalyst, Lamp light intensity, pH of the solution, amount of Pollutants, Sunlight intensity and rate of degradation. We observed that this ZnO catalyst have capability to degrade all organic dye including azo dyes pollutants along with bed smell of the effluent by Sunlight base Catalytic action. This technology has vast potential to apply for solution of real world water pollution problems and it will prove sustainable as the technology is based on sunlight. Due to heterogeneous nature of the catalyst, we can use same catalyst many times repeatedly. Technology does not produce secondary pollutants.

Key Words: *ZnO, Organic pollutants, Photocatalytic, Non-Biodegradable, Azo Dyes*

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Synthesis and Characterization of Ce-Bearing Solid Base Catalyst and its Application in Henry Reaction

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Henry reaction plays a very important role in Carbon-Carbon bond formation.[1] Nitroalkanes are useful intermediates for the synthesis of valuable chemicals- like (S)-propanolol or (S)-(-) pindolol, ezomycin, tunicamycin Douglas Fir Tussock moth and cyclopeptide alkaloids. In last few decades, many methods were developed to carry out nitroaldol reaction (Henry reaction) using various methods. However, These are associated with some drawbacks like stoichiometric amounts of reagents were used, typical work-up procedures, lack of reusability large reaction time, acid required for neutralization of bases and condensation reaction which increased the cost of production[2] which needs to improvement *via* new methodology. Our aim is to develop a new solid base catalyst which can reduce the previous drawbacks. In results, we have synthesized magnesium and cesium hydroxide carbonate using co-precipitation. SEM, XRD, FTIR, TGA-DTA were used for the characterization of catalyst[3] (MgCe-HDC).

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Bioinspired Functionalized Melanin Nano-Variants with a Range of Properties Provide Effective Color Matched Photoprotection in Skin

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Melanin and related polydopamine hold great promise, however restricted fine-tunabilility limits their usefulness in biocompatible applications. In the present study, by taking a bio-mimetic approach, we synthesize peptide-derived melanin with a range of physicochemical properties. Characterization of these melanin polymers indicates that they exist as nano-range materials with distinct size-distribution, shapes and surface charges. These variants demonstrate similar absorption spectra, but have different optical properties that correlate with particle size. Our approach enables incorporation of chemical groups to create functionalized polyvalent organic nano-materials and enables customization of melanin. Further, we establish that these synthetic variants are efficiently taken up by the skin keratinocytes, display appreciable photo-protection with minimal cytotoxicity and thereby function as effective color matched photoprotective agents. In effect we demonstrate that an array of functionalized melanins with distinct properties could be synthesized using bioinspired green chemistry and these are of immense utility in generating customized melanin/polydopamine like materials.

Pharmacological Studies of Some Novel Organic Derivative of Bismuth

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The introduction of metal ions within biological macromolecules such as proteins and nucleic acids is a continuing area of research. The appearance of metal-containing macromolecules in the human body is extensive and includes such metals as iron (transferrin, hemoglobin), molybdenum (xanthine oxidase), vanadium (hemovanadin), zinc (carbonic anhydrase), and copper (hepatocuprein). It was recently found that organic derivatives of bismuth were active against the treatment of gastrointestinal disorders like dyspepsia, diarrhea and in peptic ulcers[1] along with *Helicobacter pylori* eradication therapy, and therefore promoted the microbial and pharmacological studies of various novel organic derivatives of bismuth.[1-3] There are some new organobismuth (III) and (V)

carboxylates were synthesized by reported methods and characterized for their structural and later on for pharmacological studies against different Microbes which are infectious in nature along with tumor cell line, in-vitro, and gastric ulcer caused by the induction of aspirin and ethanol on Sprague-Dawley rats (140-180g) using standard ranitidine. The results were amazing that organobismuth (III) carboxylates exhibit better activity in biological system. They generally interact with the receptor site of multienzyme complex responsible for the cytostatic and cytotoxic conditions and easily bind with nitrogen 7 positions of purine bases in DNA forming complex with DNA strands affecting replication and transcription and stop cell division and protein synthesis and suppress the growth of tumor cells. It was known that aspirin caused mucosal damage by interrupting the synthesis of prostaglandin and increasing acid secretion and back diffusion of H^+ ions, which results in overproduction of leucotrienes and other products of 5-lipoxygenase pathway. Hence the protective action of these compounds against aspirin-induced gastric ulcer could possibly be due to its inhibitory effect on 5-lipoxygenase enzyme pathway. In case of ethanol induced ulcer which is predominantly occurs at glandular part of stomach was reported to stimulate the formation of leucotrienes C-4, mast cell secretary products and reactive oxygen species, which results in the damage of gastric mucosa of rat. The organobismuth (III) carboxylates possibly play an important role in inhibition of these pathways and shows better activity.

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Poster Presentations

Pharmacophore Modeling, Atom Based 3D-QSAR, Virtual Screening and Molecular Docking Studies for Inducible Nitric Oxide Synthase Inhibitors

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Nitric oxide (NO) is an important signaling molecule and a cytotoxic agent. Synthesis of NO is catalysed by isoforms of nitric oxide synthase (NOS) enzyme i.e. neuronal NOS (nNOS), endothelial NOS (eNOS) and inducible NOS (iNOS). Excessive production of NO by iNOS has been found to be associated with various pathological conditions. Thus, development of iNOS inhibitors is highly desirable. The other two isoforms (nNOS and eNOS) are important in various physiological processes, the aim is therefore to design iNOS specific inhibitors. But, designing of specific inhibitors presents a big challenge as the active sites of all the three isozymes have high degree of amino acid and structural conservation. Studies on quinazoline and aminopyridine inhibitors have shown that their potency and selectivity for iNOS and have revealed a new strategy 'anchored plasticity approach' for designing more inhibitors. In the present work, in order to get an insight into the binding mode and structural basis for these inhibitors, a pharmacophore model was developed by analysing three, four and five featured common pharmacophore hypotheses, found using tree-based partitioning algorithm. A 3D-QSAR model was generated for each of these hypotheses and the best results were obtained for the four featured, containing a hydrogen bond acceptor, hydrophobic group, positively charged group and an aromatic ring. Good regression coefficient was obtained for both test set molecules ($Q^2 > 0.5$) and training set molecules ($R^2 > 0.6$). The Pearson-R value and root mean square error (RMSE) also lie in the desirable range. The model also exhibits a high degree of confidence and a good external validation. The QSAR model so developed was further used in pharmacophore-based virtual screening. The present work provides a structural framework for elucidating the structure-activity relationship of these inhibitors and is also expected to provide valuable information when designing novel iNOS inhibitors.

Nano Zero Valent Iron Impregnated Graphene Oxide: An Efficient Absorbent for Removal of Mercury from Water

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Adsorbents with high surface area and low density are always preferable for removal of toxicants. Graphene oxide (GO) has many oxygen containing functional groups such as epoxy, hydroxyl, and carboxylic group, along with high surface area which are appropriate for removal of toxicants. Nano zerovalent iron (nZVI) has the ability to reduce organic and inorganic pollutants. nZVI has been impregnated on graphene oxide to provide a better absorbent for detoxification of pollutant. The purpose of the work was to develop a low cost efficient absorbent for removal of toxicants. In this work, nZVI impregnated grapheme oxide (nZVI-GO) were prepared successfully without utilization of any toxic chemicals and characterized it using various techniques. Kinetic studies were carried out for removal of as Hg (II) using graphite, graphite oxide, graphene oxide and nZVI-GO from aqueous solution. Result indicated that nZVI-GO is more efficient absorbent for removal of Hg (II). Kinetic study indicated that the adsorption behavior of nZVI-GO composite could be well described by the pseudo- second- order kinetic equation. The maximum adsorption capacity of nZVI-GO composite was found to be 113.77 mg g^{-1} for removal of Hg (II).

Determination of Adulteration in Different Food Stuff

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In the current era, India is facing the problem of food adulteration. Food Adulteration causes various health problems like blood pressure, sugar, acidity, cancer, etc. Adulteration is addition of another substance to a food item in order to increase its quantity in raw form or prepared form, which may result in the loss of actual quality of the food item. These substances may be other available food items or non food items.

We can see effects of adulteration on human health which leads to the chronic health problems such as acidity, vomiting, ulcers in intestine, food poisoning, liver disorders, etc. Food colors that are added to the food items can be the reason of liver damage, allergies and lots more. Thus, food adulteration can bring down one's health and affects the quality of life. Some examples of food adulteration are chalk in salt, urea in milk, brick powder in red chili powder, metanil yellow in turmeric powder etc. These impurities decrease the nutritional value in food items.

Bio-analytical Tool to Detect Plant Growth Promoting Rhizobacteria from rhizospheric Soil

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Plant growth promoting rhizobacteria (PGPR) represent a wide variety of soil bacteria which, when grown in association with a host plant, result in stimulation of growth of their host. In this study, we identify the PGPR from rhizospheric soil of rice even at very low bacterial concentration using bio-analytical techniques. The isolated bacteria were grown on nutrient media and then obtained bacterial cells were targeted to bio sensing activity by application of bio-functionalized platinum nanoparticles (Pt NPs). The bacterial cell, *Bacillus subtilis* was successfully identified from rhizospheric soil of rice as loaded to mass spectrometric instrument based biomarker protein peaks. This bio-analytical technique is simple and highly sensitive, and easily enrich to protein profiles even at low bacterial concentrations. Therefore, this technique provides novel mode to rapidly identify the specific PGPR strains from real sample.

Synthesis and Characterization of Mixed Magnesium Hydroxide and Cerium dioxide: its Application in Organic Reactions

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The carbon-carbon, carbon-nitrogen bond formation are the most interesting topic in organic chemistry. Imines have plays important role as intermediates for organic transformation like reduction, addition, intermediates in the synthesis of pharmaceutical, natural product, non-natural amino acids, medicinal compounds, heterocycles and so on.[1] Imines formation has been reported in literature using various methods like stoichiometric oxidants (N-tert-butylphenylsulfinimidoyl chloride, o-iodoxybenzoic acid), metal catalyst, quinone, condensation, azeotropic distillation, using a basic solid catalyst (hydrotalcite).[2] Our aim is to develop a new solid base catalyst which can perform the imines bond formation and Knoevenagel condensations. Mixed magnesium hydroxide cerium dioxide (MgCe-HDO) was prepared using co-precipitation method. MgCe-HD was characterized by various techniques i.e. scanning electron microscope (SEM), X-Ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), differential thermal analysis (DTA) and thermo-gravimetric analysis (TGA).

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Adsorptive Removal of Organic Contaminates from Water using TiO_2-Graphene Oxide Nanocomposite

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The potential of TiO_2-Graphene oxide for removal of toxic dye bromophenol blue (BPB) which contaminates water has been explored. For this purpose, TiO_2-Graphene oxide has been synthesized and characterized using SEM (Scanning electron microscopy), TEM (Transmission electron microscopy), FTIR (Fourier transform Infrared spectroscopy), Raman and XRD (X-ray diffraction) and Brunauer-Emmet-Teller (BET) surface area analyzer. TiO_2-Graphene oxide has been used as an adsorbent for the removal of BPB and the adsorption was studied using Langmuir, and Freundlich adsorption isotherms. Adsorption isotherm study indicated that the distribution of dye into the adsorbent follows Langmuir isotherm model and monolayer adsorption occurs. Pseudo second order model best explained the kinetics of BPB. Maximum adsorption capacity observed was 231.11 mg g^{-1}.

Food Enzymes

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The secretion of digestive enzymes in human beings declines with age and is the cause of many serious health problems. Minerals and vitamins are required for enzyme activity; deficiency of these nutrients in the diet prevents the normal functioning of enzymes which have been synthesized by the body. Cooking, canning and pasteurization denature the enzymes present in food. Enzymes present in the food we eat are referred to as food enzymes, in contrast to the enzymes synthesized by the body, namely the digestive enzymes. The average diet is almost devoid of food enzymes. The most important enzymes required for digesting food are amylase, protease and lipase. Additionally, catalase, dehydrogenase, nuclease, oxidase and phosphatase play important roles in digesting food.

Fresh fruits, salads, and sprouted beans and grains are rich in enzymes. Germinating grains and seed, and radish are rich in amylase. The protease content of kiwi, papaya and pineapple[1] fruits, figs and ginger is high. Nuts and seeds have abundant lipase. Water-melon seeds[2] and legume seeds[3] are rich in urease. Young leaves of radish and spinach can be eaten raw; the leaves contain catalase.[4] Cheese, soy sauce and yogurt are some common cultured/ fermented foods: these are not only rich in probiotics but also contain large quantities of enzymes. Raw honey and bee pollen are good sources of enzymes.

This paper emphasizes the importance of including high-enzyme foods in the diet to facilitate the digestion process. These foods not only augment the enzymes required for digesting food by being a rich source of food enzymes[5] but also boost the enzymes secreted by the body by providing the essential minerals and vitamins needed for the functioning of digestive enzymes. Thus, the overall catalytic action on the food consumed gets improved. Rather than totally depend on enzyme supplements commercially available in the form of tablets and syrups, it would be a good option to increase the intake of food items rich in the valuable food enzymes on a daily basis.

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Green Synthesis of ZnO Nanoparticles by using Jasminum and Allium Cepa and their Photocatalytic and Anti-bacterial activity

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This paper presents photocatalytic activity and anti-bacterial activity of ZnO nanoparticles (NPs) synthesized by using extract of flower of ***Jasminum (Jasmine)*** and ***Allium cepa (bulb Onion)***. The zinc sulphate (0.2 M), sodium hydroxide (0.2M) and definite volume of extract of flower of Jasminum of *Allium cepa* (1,3,5 and 10 mL in 100 mL of total solution) have been used as initial precursors. The nanoparticles have been characterized by Scanning electron microscopy (SEM), Energy dispersive X-ray spectroscopy (EDS), Field- Emission Scanning Electron Microscopy (FE-SEM) and Transmission electron microscopy (TEM) for analyze elemental analysis, particle size and morphology respectively.

Algae Mediated Synthesis of Hybrid Photocatalysts (Ba/TiO_2 Nanocomposite) for the Degradation of Textile Dye under Visible Light

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The textile industries utilize a wide variety of chemicals and dyestuffs, most of which are discharged as wastewater. These textile dyes have complicated constitution, low biodegradability and high chemical stability in water. Photocatalysis has gained a lot of attention for the degradation of toxic organic pollutants due to its potential to catalyze toxicants using solar light and atmospheric oxygen as an energy source and oxidant respectively. TiO_2 is considered as one of the most inexpensive, non-toxic and stable semiconductor; an ideal candidate for photocatalysis. But due to its poor absorption of visible light and rapid electron hole recombination rate, its application as a photocatalyst is limited. Therefore, doping of metal in TiO_2 nanoparticles is required. The present work demonstrates the successful synthesis of Barium (Ba) doped TiO_2 nanocomposite using green algae; an eco-friendly biological route. To the best of our knowledge, we, for the first time report the synthesis of TiO_2 nanoparticles using green algal extract. The photocatalytic activity of synthesized nanocomposite has been investigated for the degradation of Crystal Violet dye under visible light. The structural and morphological properties of Ba/TiO_2 nanocomposite has been studied by using X-ray diffraction (XRD), Scanning electron microscopy (SEM) and Fourier transform infrared spectroscopy (FTIR), while the optical characterization has been done one via UV and Photo luminescence (PL). The enhanced photocatalytic activity of Ba/Tio_2 nanocomposite suggests its application towards wastewater treatment.

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An Environmentally Benign Approach to Synthesize Silver Nanoparticles using *Epipremnum aureum* Leaf Extract and its Interaction Studies with Calf Thymus DNA

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The synthesis of noble metal nanoparticles and their binding studies with DNA have drawn considerable attention of researchers for past few years, due to their diverse biological and biomedical applications. More reliable, cost-effective, non-hazardous and ecofriendly methods for the synthesis of nanoparticles need to be developed. In the present work, quick, simple and green method was employed to synthesize silver nanoparticles using *Epipremnum aureum* leaves extract. UV-Visible studies showed the characteristic peak of silver nanoparticles at 420 nm. FT-IR studies were carried out to identify the functional groups present in plant extract responsible for reduction of Ag^+ to Ag^0. Hydrodynamic size of the nanoparticles thus formed was identified by the Dynamic Light Scattering (DLS) experiment. TEM studies were performed to find out the shape and size of nanoparticles. Present work also explores and unravels the interaction of silver nanoparticles with Calf Thymus DNA (CT-DNA) using various techniques like UV-Visible spectroscopy, UV-Thermal denaturation studies, Circular Dichroism studies and Agarose gel electrophoresis. The association constant of silver nanoparticles with that of CT-DNA was calculated from the UV-Visible spectroscopy results. Fluorescence emission studies were also done at 293K and 303K using Acridine Orange dye and thermodynamic parameters of DNA binding were calculated. We are aiming here to standardize the size of nanoparticles, buffer and salt conditions, so that the nanoparticles could interact effectively with DNA molecule at physiological conditions. We believe that these experimental observations may facilitate our understanding about their further application in effective gene delivery and biosensing.

Synthesis and Anti-malarial Activity Evaluation of Piperidine and Piperazine Based Chalcones

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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 inhibited 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.

Key words: *Anti-malarial Activity, Chalcone, Molecular Docking, Plasmepsins Falcipains, Plasmodium Falciparum*
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PDE4 Inhibitor 33-SDS-LR is a Novel Anti-inflammatory Agent

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PDE4 is the main cAMP degrading enzyme present in immune cells like basophils, eosinophils, macrophages, dendritic cells and T cells. PDE4 is associated with the pathogenesis of various diseases like asthma, psoriasis, atopic dermatitis, COPD, systemic lupus erythematosis, rheumatoid arthritis and ankylosing spondylitis. Roflumilast, apremilast and crisbarole are the FDA approved PDE4 inhibitors used in the treatment of some inflammatory and autoimmune diseases. Unfortunately, the use of PDE4 inhibitors have been compromised by side effects such as nausea and emesis and so clinical use of PDE4 inhibitors is still limited. In search of new PDE4 inhibitors our lab discovered novel PDE4 inhibitor 33-SDS-LR showing PDE4 inhibition with an enzymatic IC_{50} value of 200 nM. Next we explored 33-SDS-LR for further studies in cell based assays were it increased the cellular cAMP levels in MCF 7 cells with a maximum increase at 30 µM. Furthermore 33-SDS-LR was explored for anti-inflammatory studies in RAW 264.7 macrophages. 33-SDS-LR inhibited the lipopolysacharide (1µg/mL) and interferon gamma (20ng/mL) induced production of TNFα, IL1β, NO and iNOS expression in RAW264.7 macrophages. Next 33-SDS-LR was explored for its role in T cell mediated immune response. 33-SDS-LR inhibited the Concanavalin A (5µg/mL) induced T cell proliferation with a maximum inhibition at 30 µM. Stastical analyses were done by using Graphpad prism software and by using one way ANOVA. P value less than 0.05 were considered.

Effect of Chemical Chaperone on Natively Unfolded Protein α-casein

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Osmolytes also known as chemical chaperones are found ubiquitously in wide variety of organisms from bacteria to higher animals. These small low molecular weight organic compounds are divided into three main classes: polyols and sugars, amino acids and their derivatives, and methylamines. They stabilize proteins, prevent aggregation, correct temperature sensitive mutants, promote protein folding and offset denaturing effect of urea/GdmCl. Most of these observations involve osmolytes and well folded globular proteins. However, cells of all organisms contain proteins which are natively unfolded and are involved in various important biological functions like cell signaling, cell cycle, cell regulation etc. Using various spectroscopic techniques, we observed effect of one of the most important osmolyte present in almost all organisms on intrinsically disordered protein α-casein. We found that this osmolyte leads to compaction of α-casein without any structure formation resulting in loss of activity. We, further observed that loss of chaperone activity was not due to aggregation as found in case of other osmolyte-IDP interactions but due to compaction (loss of intrinsic disorder).

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Utilization of Feldspar in Pottery Industries of Khurja (Bulandshahr), Uttar Pradesh, India

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This paper presents the utilization of Feldspar in field of pottery Industries in Khurja, Bulandshahr, Uttar Pradesh, India, by visiting various potteries of Khurja and having conversation with the employees working in Pottery Industries. We know that, the Feldspar generally used in ceramic, glass, painting color & in many more things but still there is lot of scope of the utilization of feldspar in different industries such as medical. Nowadays many deformities in a human body are cured by physiotherapy and lots of medicines, but in future feldspar can be used to make supportive elements to cure such deformities.

Cancer Antigen Identification and Optimization: A Potent Vaccine Candidate against Cancer using Immunoinformatics

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Cancer is a formidable disease and resulted in the leading cause of death worldwide. In the field of cancer biology, one of the revolutionary areas is cancer immunoinformatics, where immunologists are using the computational algorithms to understand the cancer immunological pathways and cancer biological networks. Cancer immunoinformatics mainly deals with the developments of the Immunotherapeutics targeting the responsible tumor genes, tumor proteins, and linked regulatory pathways, which made possible to access the unprecedented information of whole genome data, proteome data, and detailed sequence analysis, to identify the potential vaccine candidate for a wide range of the human leukocyte antigens allotypes. Here in our study, we have designed the potential vaccine candidate using immunoinformatics via retrieval of tumor responsible protein and identification of B-cell and T-cell epitopic region by employing the immunological databases and computational servers. After that, a molecular docking study was performed to analyze the binding of the epitopic region of tumor protein with specific receptor protein. Our results showed a potent vaccine candidate "KIIDLVHLL" designed out of top ten epitope epitopes predicted using five different algorithms. Furthermore, epitope was validated with molecular docking and resulted in strong binding with HLA-A*0201 with docking score -780.6 kcal/mol. Lead epitope showed the remarkable result with strong interactions (hydrogen bonds and hydrophobic interactions), the radius of gyration score of 23.0777 Å, world population coverage of 39.08% by immune epitope database and TAP affinity IC_{50} value of 2039.65 nm. This study paves way to potential vaccine candidate for prevention of cancer.

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Synthesis and Characterization of Ce-Bearing Solid Base Catalyst and its Application in Suzuki-Miyaura Reaction

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The Suzuki-Miyaura reaction is one of the important reactions in organic chemistry. Biaryls have good applications in various areas like preparation of materials, bioactive molecules, herbicides, natural products, antirheumatic, antitumor, and antihypertensive agents and conducting polymers. Suzuki-Miyaura reaction usually proceeds by using phosphine-based palladium catalysts, palladium nanoparticle, microwave technology, nucleophilic carbene ligands, and so on. These methods have used homogeneous bases and various solvents which increase the cost of production. Therefore, any methodology or catalytic route which eliminates the homogenous base and can be performed in the green solvent, the the cost of production will be reduced.[1-4]

We have synthesized MgCe-HDC using co-precipitation method.[5] $Pd(OAc)_2(PPh_3)_2$ supported on mixed magnesium hydroxide and cerium carbonate hydroxide $Pd(OAc)_2(PPh_3)_2$/MgCe-HDC) was synthesized.[6] $Pd(OAc)_2(PPh_3)_2$/MgCe-HDC was characterized with various techniques i.e. Scanning electron microscope (SEM), X-Ray Diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), Differential thermal analysis (DTA), Thermo-gravimetric analysis (TGA) and employed in Suzuki-Miyaura reaction

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A Novel Protein from *Withania somnifera* Suppresses Human Breast Cancer Cells by Inducing Apoptosis as well as Cell Cycle Arrest

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Since the introduction of human insulin a recombinant therapeutic protein, pharmaceutical proteins have emerged dramatically both in number as well as frequency. Therapeutic proteins showed noteworthy potential in every field of medicine. Protein pharmaceuticals possess promising therapeutic potential in the treatment of several diseases as they show high activity, low toxicity, target specificity and minimal non-specific interactions. Keeping this in mind, an integrated approach was devised to purification, structural characterization and pharmacological activity of the protein from *Withania somnifera*. In this study, a novel protein with a molecular mass of 40 kDa was purified and investigated for its cytotoxic properties against human MDA-MB-231 breast cancer cells. Cell cycle of MDA-MB-231 breast cancer cells was found to be arrested in G2 phase. Identification of the protein was carried out by MALDI-TOF/MS using peptide mass fingerprinting method. Further, the purified protein was characterized for its secondary structural elements using Circular Dichroism spectropolarimetry.

Synthesis of some new organometallics of Group 15 elements As, Sb, Bi; Biomedicinal perspective

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Some novel organometallics of Group 15 elements As, Sb, Bi in (III) oxidation states of the type RML_2 ($C_{20}H_{13}O_4F_2As$, $C_{20}H_{11}O_4F_4As$, $C_{20}H_{13}O_4F_2Sb$, $C_{20}H_{11}O_4F_4Sb$, $C_{20}H_{13}O_4F_2Bi$, $C_{20}H_{11}O_4F_4Bi$) 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 pathogenic 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, Characterization and Antitubercular Activity of Novel 2, 5-dimethyl-4-(aryl or hetero aryl) Substituted Aniline-1, 3-oxazole Derivatives

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Tuberculosis treatment remains a challenge that requires new antitubercular agents due to the emergence of multidrug-resistant Mycobacterium strains. This paper describes the synthesis, characterization and the antitubercular activity of some new 2, 5-dimethyl-4-(aryl or hetero aryl) substituted aniline-1, 3-oxazole derivatives, which were synthesized by the C-N coupling (Buchwald coupling) reaction. This reaction involve coupling of 4-(4-bromophenyl)-2, 5-dimethyloxazole [obtained by the bromination reaction of 1-(4-bromophenyl) propan-1-one and further cyclisation reaction with acetamide under microwave] with substituted aryl or hetero aryl amine in presence of tris(dibenzylideneacetone)dipalladium (0), BINAP and cesium carbonate in toluene. All the synthesized compounds were characterized by elemental analysis, ^{1}H NMR and LCMS and also screened for their in- vitro antitubercular activity against Mycobacterium tuberculosis.

Use of Glaze in the Ceramic Industry and its Health Risk

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In field of ceramic industry, the most pots are glazed, i.e. they are covered by a thin coating of glaze. This can be for aesthetic or for practical reasons, usually both. It is particularly important for pots holding food. The glaze usually has three main components: silicon dioxide, aluminum oxide and fluxes. In addition, it is common to include transition metal oxides to provide color to the glaze causing water molecules to move faster, the hot handle on the earthenware cup indicates the presence of free, mobile water molecules.

The pot is first fired to about 1000 °C to produce what is known as "Biscuit ware" with very slight further shrinkage. Biscuit ware is quite strong and porous. It readily absorbs water and dries again very easily. It is glazed by spreading a suspension of the glaze solids in water over the pot by pouring, dipping or spraying.

The important mineral in potter I crystallographic studies have established that the clay minerals are composed of sheets of tetrahedral silica dioxide (SiO_2) and octahedral aluminum oxide (Al_2O_3) linked through bridging oxygen atoms. All human activities involve some levels of risk or danger. In that respect, pottery can be dangerous, however that risk is fairly low.

Extraction of China Clay from Waste Material Released From Ceramic Industries, and Benefits of China Clay for Humans

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The purpose of the work at exploitation of the ceramic waste material of China clay by the ceramic industries in Khurja. Khurja pottery is traditional Indian pottery work manufactured in Khurja of the Bulandshahr district in Uttar Pradesh state, India. It is listed at item 178 as "Khurja Pottery" of the GI Act 1999 of the Government of India with registration confirmed by the Controller General of Patents Designs and Trademarks. We know the China clay is very useful for human in various forms as on skin treatment: 1- Detox and Purify - Kaolin clay has the remarkable ability to draw out impurities from the skin. Dirt and germs are pulled from pores leaving them cleansed and unclogged which reduce blackheads and acne. 2 - Underarm Superstar: As well as drawing out impurities Kaolin clay does a great job absorbing sweat and neutralizing body odors. This

makes it the perfect addition in natural deodorant to help keep you dry and stink free. 3 - Balance Skin Oils: If you have oily skin the absorbing properties of Kaolin can go a long way as they will soak up excess oils on the skin surface. If excess sebum is being produced, using Kaolin Clay will help reduce and balance its production. 4 - Cleanse all Skin Types: This clay contains minerals and phyto-nutrients and we have already established that it removes toxins, dead skin, and excess oil from the skin surface. What makes Kaolin Clay so special is that it's the most gentle of the clays and is effective on all skin types including people with extremely sensitive skin. 5 - Healing Properties: In addition to beautification Kaolin has also been used effectively to treat muscle soreness, pain, inflammation, bruises, minor cuts, and bug bites. It is able to do all this because it improves blood circulation to the skin which promotes healing. 6 - It's an Exfoliate: Even though it is a very fine, soft powder, Kaolin does have a slightly abrasive texture. This makes it perfect for getting rid of flaky, dead skin leaving behind just soft radiant skin. For On Hair, in form of Hair and Scalp Protector: Kaolin Clay is excellent on your hair (or beard) because it will remove dirt from the scalp but won't strip it of its natural oils. While it gently cleans the scalp it will also increase circulation and help strengthen the ever important roots. Hair gets cleansed, but also gets moisturized to prevent brittleness and breakage.

In all over India, there are many types of clay available these days and all have significant health benefits but what makes Kaolin so special is how gentle it is. This makes it usable by pretty much anyone, which will no doubt excite those individuals that struggle with skin sensitivities. We love Kaolin Clay so much we use it in our Hair Clay, Pre-shave oils, as well as our natural deodorants. As our product lines expand, I'm sure you'll see even more of this amazing ingredient.

Anticancerous Compounds in *Mentha* Species

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The drugs of natural origin have always been in great demand due to their less toxicity and side effects. *Mentha* is genus with 25-30 species belonging to the family Lamiaceae. *Mentha piperita* L. (commonly called as peppermint), is an important medicinal plant. The bioactive compounds present in the plant have strong antiviral, antimicrobial and antioxidant properties. Mentha oil is chemically very complex with large amount of variation. The important phytochemicals present in the peppermint oil are menthol (most abundant, up to 50%), menthofuran, menthyl acetate, menthone,1.8-cineole, perillyl alcohol, pulegone, beta-pinene, limonene, and beta-caryophyllene. Studies are being carried out by various researchers to evaluate their anti-cancer potential. The flavonoids apigenin and luteolin, triterpene ursolic acid and, carotenoid beta-carotene have been found to possess anti-cancer properties. It has been shown by scientists at CIMAP that colon cancer line can be killed by L-Menthol obtained from Mentha plant. The chemical compounds of the plant have the potential to inhibit the division of cancer cells and their spread to other parts of the body. This indicates that peppermint can be used in anti-cancer drugs. The plant is easily available, in large quantities, and isolation of L-menthol from it is cost-effective. The common side effects of chemotherapy in cancer patients are vomiting and nausea. Some reports have shown that these symptoms can be alleviated with peppermint. There is a need to carry out more research work on Mentha so that bioactive constituents present in it can serve as lead molecule(s) in discovering the drugs against the deadly disease of cancer.

Targeting Breast Cancer Stem Cells by Modulation of Indoleaminedioxygenase Pathway using Small Molecule Inhibitors

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Indoleamine-pyrrole 2,3-dioxygenase (IDO or INDO EC 1.13.11.52) is an intracelluler heme-containing enzyme that in humans is encoded by the IDO1 gene. Recent evidence has demonstrated that the functionally active IDO protein is expressed in a wide variety of human malignancies including Breast Cancer. Chemotherapy and radiation therapy are the commonly employed methods for cancer treatment. The common problem associated with the chemo and radiotherapy is the tumor relapse, chemo resistance and tumor metastasis. Tumor metastasis and recurrence has been mainly attributed to Cancer Stem Cells (CSCs), which are a subset of Cancer cells that could self-renew continually and could differentiate into bulk tumor cells. With this approach, we screened a library of compounds for their ability to target indoleaminedioxygenase pathway and reduce stemness in triple negative breast cancer cell lines MDA-MB-231 and SUM159 respectively. A semi-synthetic compound IIIM 152 was identified to significantly target indoleaminedioxygenase pathway and reduce the cancer stem cell-like population. IIM152 treatment reduced the expression of stem cell markers, OCT4 and SOX2 in MDA-MB-231, SUM159 breast cancer cell line. Further studies revealed that it significantly reduced the breast cancer stem cells by evaluation the C44+/CD24-, Aldehyde dehydrogenase (ALDH) expression. IIIM 152 treatment was observed to down-regulate the number and size of mammospheres in MDAMMB231 and SUM159 Cells. In conclusion, our studies demonstrate IIIM152 is a promising lead against cancer metastasis, where detailed preclinical studies need to be done.

Glucosinolates: A Potential Target for Metabolic Engineering in Plants

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Glucosinolates are sulfur- and nitrogen-containing secondary metabolites common in the order Brassicales that includes Brassicaceae (crucifers) and related plant families. In plants, they coexist with an endogenous thioglucosidase (EC 3.2.1.147) called myrosinase, though glucosinolates are stored in the vacuoles of S-cells and myrosinase in separate but adjacent cells. Upon plant tissue disruption, glucosinolates are released at the damage site and become hydrolyzed by myrosinase. The chemical nature of the hydrolysis products depends on the structure of the glucosinolate side chain, plant species and reaction conditions. Glucosinolates and their hydrolysis products are frequently studied as plant defense system against insects, herbivores and certain microbial pathogens. Besides, they serve as attractants to insects feeding specially on crucifers. In some *Brassica* vegetables such as cauliflower, Brussels sprouts, cabbage and broccoli, glucosinolate degradation products, especially isothiocyanates have been shown to have anticarcinogenic properties. The level and composition of glucosinolates in plants reflect both genetic and environmental factors as some glucosinolates are constitutively present and others can be induced. There is a strong interest in being able to alter levels of specific glucosinolates in crop plants as certain glucosinolates have desirable properties in flavor, protection from insect, bio-fumigation, and cancer prevention, whereas others have undesirable properties. Metabolic engineering of glucosinolate profiles gives a tool to alter the concentrations of not only specific endogenous glucosinolates, but also to introduce novel glucosinolates not normally present in nature. This opens up a possibility of future metabolic engineering of the glucosinolate metabolism pathway for benefit of human beings.

Casein Based Nano-Carrier for Effective and pH Sensitive Delivery of Doxorubicin

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The low specificity and high side effects of anti cancer drugs can be overcome by using targeted drug delivery systems. In our work a low-cost, facile method was used to synthesize Casein nanoparticles loaded with an anti cancer drug, Doxorubicin hydrochloride (Dox). Casein self assembles to form micelles in aqueous solution. Dox attaches to casein via non-covalent interactions. The binding was confirmed using Stern-Volmer equation. The particles were fabricated by adding excess of Ca^{2+} ions which interacts with the soluble casein present and brings it into the micellar framework giving denser particles and higher loading. The size and shape upon particle formation remains almost the same as that of the micelle. The release at pH 1 was comparatively higher than the physiological pH making this formulation potent for delivering drugs orally, which deposits at the stomach and the GI tract. The Dox attached with casein showed improved efficacy, *i.e.* better cyto-toxicity against PANC 1 cell lines as compared to the free drug of same concentration. The synthesized particles could be a promising candidate for oral delivery of anti-cancer drugs.

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Comparative Study of the Genotoxic Potential of Chitosan and Citrate Reduced Gold Nanoparticles towards calf thymus DNA: A Physicochemical Approach

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Gold nanoparticles (Au NPs) are increasingly used in various applications including biosensing, drug delivery, gene delivery etc., but little is known about the genotoxicity of different gold nanoparticles and their effects on the DNA. The objectives of the present study are to evaluate as well as to compare the toxicity of chitosan and citrate reduced gold nanoparticles towards calf thymus DNA, so as to demonstrate their applicability for gene delivery applications. The colloidal gold nanoparticles are synthesized by two different methods viz. green method using a biopolymer chitosan and chemical method using trisodium citrate dihydrate. These gold nanoparticles were further characterized for their characteristic signatures and size. Various techniques like UV-Vis absorption, UV-Thermal melting (T_m), Fluorescence, Circular Dichroism (CD) spectroscopy, Agarose gel electrophoresis and Hydrodynamic measurements have been exploited to understand the DNA-nanoparticle interactions. The UV-Visible absorption spectra and thermal melting curves of CT-DNA reflect significant and dissimilar modifications upon interaction with the gold nanoparticles indicating the effect of the agent, stabilizing the gold nanoparticles. Fluorescence emission studies were carried out at 293K and 303K using Acridine Orange to study the effect of gold nanoparticles as quencher. The results from agarose gel mobility experiments also provide suitable platform for the comparative study of interaction of nanoparticles with DNA. These physicochemical studies provide a specific and cost effective approach for understanding the genotoxic potential of different gold nanoparticles.

Biological Screening on the Basis of DFT Studies and Synthesis of Important bis Compounds with Disulphide Linkage

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Natural products such as curcumin from turmeric, polyphenol-catechins from green tea, genistein from soyabean, diallyldisulphide from garlic etc, have been proved to be helpful in regulation and treatment of various diseases.

Diallyl disulphide (DADS) is a naturally occurring sulphur based compound mainly obtained during distillation of garlic oil. It proves to be an important biolinker for various synthetic precursors majorly due to the presence of disulphide moiety. The weak S-S bonding in disulphide contributes to its increased reactivity useful for construction of new analogues also diversifying the biological action such as antiviral, antifungal and DNA binding properties.

Literature survey revealed its HDAC inhibitory activity along with various other useful applications in anti-microbial, anti-inflammatory, anticancer, anti-oxidant, antidiabetic and antihistaminic studies. Moreover, unnatural aromatic DADS derivatives are known to exhibit antihyperlipidemic, anticancer and antioxidant properties.

Inspired by all the above said varied biological importance of DADS and its derivatives we thought of synthesizing a library of unnatural bis compound linked *via* DADS moiety using less toxic or greener protocol. These compounds would have greater stability and more potency. Initially a dataset of unknown compounds was screened using DFT studies. Then comparing results with their known counterparts which provides useful relationship between the reactivity and nature of group attached. Further attempts were made to synthesize the screened compounds using different synthetic routes.

Study of Ceramic Potteries in Khurja (Uttar Pradesh) India and Adjoining Areas

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Ceramic pottery industry in Khurja is the most important source of employment for the local communities. The work presented in this study reviews various processes related to the ceramic industry in Khurja. This includes process of making pottery items, material used, fuel used etc. The use of hazardous chemicals such as heavy metals, silica and various coloring agents as well as related environmental and safety aspects are the key features of this study.

Ceramic craft is not only a unique traditional craft of the Indian civilization but is also an economically important industry in India. Professional as well as amateur practitioners of this craft have helped keep alive and carry forward the traditions of this art. Khurja, where ceramic pottery industry established its roots around 400 years ago, is a city in the state of Uttar Pradesh (UP), India. It is famous for its ceramic products such as kitchenware, pots and big vases used for decoration. These products, well recognized for their beautiful designs and imaginative creations from clay, are sold in India as well as exported to different parts of the world. The state government, in recognition of its economic potential, has supported the development of this craft.

Study of Ground Water Quality in Khurja and Adjoining Areas

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Khurja, well known for its pottery industry is a tehsil of district Bulandshahr (UP) near Delhi. District Bulandshahr is a well irrigated agricultural area with abundant water sources including river, canals, local canals and other water bodies. The study area is a part of the Ganges basin, which contains the largest river system on the subcontinent comprising of Ganga, Yamuna and their tributaries.

A comparative study of the quality of ground water samples from various potteries in Khurja, Industrial area Mooda Khera Khurja, and NREC College Khurja has been done in this work. Upper Ganga canal & some sub canals pass through Khurja but no major river crosses Khurja or its industrial area. A sub canal passes from the side of NREC College Khurja. The TDS of NERC College water sample is much less than that of the potteries and industrial area water samples. The hardness of water sample from NREC College Khurja is significantly less than that of the industrial area water samples. This study indicates that the groundwater from potteries and industrial area is not permissible for drinking purposes.

Lemon Juice: A Biocatalyst for the Synthesis of Coumarins

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Nowadays, organic research is mainly focused on the development of greener and environmentally benign processes which involve the use of alternative reaction media to replace toxic and expensive catalyst or volatile and hazardous solvents like benzene, toluene and methanol commonly used in organic synthesis. In recent years, fruit juice mainly lemon juice used as a biocatalyst in organic synthesis. Coumarin derivatives are natural products widely present in plant kingdom and their main applications are as fragrance, pharmaceuticals and agrochemical industry. Coumarins are basically synthesized by the Pechmann

reactions i.e. condensation of phenols with ß- ketoester in acidic media viz. H_2SO_4, $HClO_4$, P_2O_5 etc. But these reagents are required in excess and their corrosive nature makes them difficult to handle and formation side product is also a problem. Therefore a simple, efficient and green chemistry for one pot coumarin synthesis under mild conditions is required. The method shown here involves the condensation of substitution phenols with ß- ketoester in the presence of lemon juice act as biocatalyst in the synthesis of coumarins. Compounds were characterized by spectroscopic and analytical techniques. The compounds will be evaluated for their biological activity. The data will be presented in paper.