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# **Photonics for health care**

**by**

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## Photonics for health care

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Light has been used for the diagnosis and therapy from time immemorial. However, it is only in recent times that it has become possible to carry out a comprehensive analysis of the information content of the light scattered or re-emitted from the tissue. This has been facilitated by the large information processing capability of the present-day computers, the advances in optical instrumentation and the availability of the advanced light sources, like lasers. This has led to the development of optical techniques for high resolution biomedical imaging and quantitative, sensitive, non-invasive diagnosis. Optical techniques are already being used to image microstructure in living tissue with resolution down to a few  $\mu\text{m}$  whereas with other frontline biomedical imaging techniques like MRI, CT scan, ultra-sonography etc., it becomes difficult to achieve resolution better than 100  $\mu\text{m}$ . Optical spectroscopy of elastically and inelastically scattered light from tissue is facilitating in-situ non-invasive diagnosis with no potential adverse effects associated with the use of ionising radiation. Optical techniques are also enabling label-free biosensing and molecular imaging of live cells. Advancements in light sources and other associated technologies have also given a major boost to the use of light in therapy. In addition to the well-established use of lasers for minimally invasive surgical applications, there has also been an increasing interest in the use of photo-activated drugs for the treatment of cancer because of the high selectivity it offers. Photodynamic therapy is also expected to help inactivate antibiotic resistant bacteria and promote healing of infected or chronic wounds. A large amount of literature also exists on the therapeutic effects of photoexcitation of endogenous photosensitisers. A better understanding of these effects should prove extremely valuable as it appears to have the potential to offer a rather simple and inexpensive approach for management of diseases, promote healing of wounds and relieve pain. All these advancements hold considerable promise to lead to the development of diagnostic and therapeutic modalities that can be used in a low resource setting. This is important as it can help to provide comprehensive medical care to a large population in developing countries that live away from major cities where the well-equipped hospitals tend to be located.

In the present talk I shall provide a brief overview of the use of photonics for biomedical imaging, diagnostic and therapeutic applications and highlight some of the work carried out by me and my colleagues in these areas while I was working at the Raja Ramanna Centre for Advanced Technology, Indore. The way forward in the Indian context will also be addressed.

## SECTION OF PHYSICAL SCIENCES

**Recent contributions of National Physical Laboratory in strengthening the National Quality-infrastructure**

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A quality-infrastructure of a Nation is comprised of internationally recognized metrology, standards and accreditation, which essentially is the basic enabling system of a nation for providing the conformity assessment (calibration and testing, certification and inspection). A robust quality infrastructure is built on a technical hierarchy and is essential for forming effective national policies and their implementation, to attract foreign investments, industrial development, international trading of products, food safety, environment and climate change, health, and efficient utilization of natural and human resources. As a result, a strong quality infrastructure contributes to the national economy and brings prosperity, health and well-being.

In this talk, I will present recent contributions made by National Physical Laboratory - the National Metrology Institute of the country, in establishing several primary/national measurements essential for the national quality-infrastructure. Some of these include: Generation of Indian Standard Time (IST) with 7 ns accuracies using primary atomic clocks and its dissemination to ISRO for the desi-GPS (NAViC) applications, development of various Indian certified reference materials - trademarked as Bhartiya NirdehakDravya (BND®) in the areas of water, gas, cement, petroleum, gold, coal etc, primary standards for the calibrations of air pollutants, biomedical equipment, fluid flow, etc.

**Quest for emissive organic solids and aggregates**

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Our group studies excited state processes in molecules [1–5] and materials [6–9]. In recent times, we have begun collaborative exploratory studies in biological systems [10, 11]. In this talk, we will focus on fluorogenic molecules which are inherently nonfluorescent or weakly fluorescent, but become strongly emissive as a result of chemical reaction or solidification. They find potential application in the fields of fluorescence sensing and organic electronics. Salophen is a fluorogenic Schiff base. Its fluorescence quantum yield and lifetime increase upon complexation. The extent of enhancement is significantly more in its monomeric  $\text{Al}^{3+}$  complex than in its dimeric  $\text{Zn}^{2+}$  complex (SalZn). The increase in fluorescence upon complexation is ascribed to the blocking of nonradiative channels associated with flexing motion of the molecule. This can be achieved in uncomplexed salophen in another way, by taking it in solid form or incorporating it in a solid matrix like polymethylmethacrylate (PMMA) [4]. Such enhancement of emission is also observed in the case of SalZn. Interestingly, a quenching of fluorescence is observed in the crystals of  $\text{SalAl}^+$ . These apparently conflicting trends have been rationalized in the light of the molecular arrangement of salophen and its complexes in a solid matrix

and in the pure solid forms. In the case of SalAl<sup>3+</sup>, X-ray crystal structure indicates the possibility of  $\pi$ - $\pi$  interaction between the planar ligands of two neighboring complex molecules, which could lead to aggregation-caused quenching (ACQ). This provides a justification for the lower emissivity of dimeric SalZn, as compared to monomeric SalAl<sup>3+</sup> in solution. In case of salophen, solidification is not associated with  $\pi$ - $\pi$  interaction and so, aggregation induced enhancement of emission (AIEE) is observed. Thus, the emissivity of salophen and its complexes is found to be governed by interplay of torsional motion and intermolecular interaction. Manipulation of these factors has been attempted by synthetic modification [12]. Introduction of alkoxy groups in salophen ring is found to alter not only the photophysics, but also molecular packing of the molecules in their crystals, leading to a higher emissivity of the Al<sup>3+</sup> complexes in their crystalline form.

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## SECTION OF PHYSICAL SCIENCES

**1. Synthesis and characterization of molecularly imprinted ferrite (SiO<sub>2</sub>@Fe<sub>2</sub>O<sub>3</sub>) nanomaterials for the removal of nickel (Ni<sup>2+</sup> ions) from aqueous solution**

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The study for the extraction of nickel from aqueous solution by applying surface modified Molecularly Imprinted (MI) ferrite nanomaterials as an adsorbent. The particle sizes reveal in the range of 20-24 nm calculated by X-ray diffraction method. Monodispersity of the nanoparticles was confirmed due to the size distribution of the particles by SEM analysis. The metal adsorption behavior (Ni<sup>2+</sup> ion adsorbed on the surface of silica-coated ferrite nanocomposites) characterized by Energy Dispersive X-ray (EDX) spectroscopy and Fourier Transform Infrared Spectroscopy (FTIR). Magnetic property was studied by VSM and the nanocomposites are found to be super paramagnetic at room temperature. Batch experiment conceded to study the adsorption kinetics and the adsorbent stability in the acidic and basic medium was an accessible mechanism of nickel adsorption by ferrite nanocomposites. Adsorption isotherms were well described by Langmuir equations with maximum adsorption capacity (q<sub>m</sub>)=2.64mol/g. The adsorption process establishes to be pH dependent (7.6), adsorbent dose (0.2g) and equilibrium could be attained within 15 minutes. All the reaction parameters were considered to complete the adsorption process; it conceded that 94% nickel adsorbed under different optimization conditions. The desorption study as well as its reusability and recyclability were accessible that indicates ferrite nanocomposites succeeding adequately.

**2. Bioaccumulation of As and Pb in pot marigold grown in sewage irrigated soils of Allahabad**

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A pot experiment was conducted to observe the bioaccumulation of Arsenic (As) and Pb in *Calendula officinalis* L. (ornamental plant) grown in sewage irrigated soils of Allahabad. Four different sewage-discharge points (situated at Naini, Balua Ghat, Mumfordganj, and Daraganj regions of Allahabad) were selected for collecting sewage samples. The study revealed that different sewage-discharge points showed enrichment and bioaccumulation of heavy metals (As and Pb) in the soils and plants, respectively, in proportion with the degree of pollution or levels of heavy metals applied through the sewage water irrigation. Soils contained detectable amount of arsenic (0.005-0.08 mg<sup>-1</sup>, mostly below the permissible limit) and higher amount of Pb (6.00-7.50 mgkg<sup>-1</sup>), particularly in sewage-irrigated pots. Arsenic (As) content was found 0.05-0.20 mgkg<sup>-1</sup> and Pb ranged from 9.00-10.20 mgkg<sup>-1</sup> in the plants grown in sewage-irrigated soil. The study concluded that *Calendula* crop grown in sewage irrigated soils accumulated As and Pb which pose a potential for phytoremediation of As and Pb in the sewage irrigated soils.

**3. First assessment of heavy metals contamination in road dust and roadside soil of Suva city, Fiji**

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Studies have claimed the road dust and the roadside soil as potential banks of pollutants generally in urban areas. Thus, quantifying the concentrations of the heavy metals in urban area is a prerequisite for assessing pollution and their health effects. Hence, this study reports the concentration of the heavy metals such as Cd, Co, Cr, Ni, Cu, Pb, Zn and Fe in the road dust and the roadside soil of Suva city. The samples were collected at eighteen different locations around the Suva city with potential traffic influence and analysed. The respective heavy metals concentration in the road dust and the roadside soil samples of Suva city were: Cd (3.7 and 3.1 mg/kg), Co (35.0 and 33.2 mg/kg), Cr (40.0 and 34.0 mg/kg), Ni (54.3 and 32.4 mg/kg), Cu (172.3 and 265.7 mg/kg), Pb (71.0 and 59.3 mg/kg), Zn (685.0 and 507.0 mg/kg) and Fe (41,010.4 and 39,525.5 mg/kg), and showed the decreasing order as Fe>Zn>Cu>Pb>Ni>Cr>Co>Cd and Fe>Zn>Cu>Pb>Cr>Co>Ni>Cd for the road dust and the roadside soil, respectively. Furthermore, the mean values of the heavy metals surpassed their normal concentrations which confirmed anthropogenic influence while the concentrations of Zn, Cu and Cd in the road dust and the roadside soil of Suva exceeded their permissible limits. The geo-accumulation index ( $I_{geo}$ ) assessment of Suva city road dust indicated a non-polluted to moderate pollution by Cr, Ni, Cu and Pb while moderate pollution by Zn. The  $I_{geo}$  assessment of the roadside soil showed moderately polluted by Cu and Zn but no pollution due to rest of the studied heavy metals. Overall, the study indicated that the sampling locations at an industrial site of Suva city is highly predominated with almost all the studied heavy metals and is a concern to the general public who live and work within the vicinity of Walu Bay industrial area.

#### **4. Utilization of carbon dioxide for the selective synthesis of formic acid by molecular hydrogen at moderate temperature heterogeneously catalysed by rhodium-hydrotalcite**

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Carbon dioxide, a potential greenhouse gas produced mainly through the combustion of fossil fuels and deforestation, is significantly contributing to the global warming. Although many ways are proposed to curtail or dump its emission into the atmosphere, one of the attractive ways is to convert them into useful chemicals as it is available in plenty, cheap and a non-toxic C-1 resource. A rhodium hydrotalcite based catalyst (Rh-HT) was synthesized, characterized and investigated for hydrogenation of CO<sub>2</sub>. The catalyst was found to be efficient for the hydrogenation and selective formation of formic acid at moderate temperature without using any additional liquid base which is usually practiced in this reaction. The soft solid base HT had remarkably afforded to play the dual role of support as well as of base. In a typical employed reaction conditions at, 25 bar pressure of CO<sub>2</sub>, 25 bar pressure of H<sub>2</sub>, 60°C, and in a mixture of 50 mL methanol and 10 mL water as a solvent, 26 mol of formic acid was selectively obtained in 24 h. The effect of various parameters on the conversion and rate of the reaction, like amount of the catalyst, pressure, temperature, time and reaction volume at laboratory scale investigated in detail indicated that the performance of the catalyst effectively depended on all these studied parameters. The rate of the formation of formic acid was found to follow first order kinetic trend, towards lower amount of the catalyst up to 100 mg and pressures of CO<sub>2</sub> and H<sub>2</sub>. From temperature dependence of the rate of formation of formic acid, the activation parameters were evaluated. The presence of water, used in the solvent along with methanol, had effectively enhanced the performance of the catalyst. In the line of kinetic and experimental observations, mechanistic routes for hydrogenation of carbon dioxide to formic acid are proposed.

The catalyst was effectively recycled up to 5 times without any significant loss in its activity and selectivity for formic acid.

## 5. Physico-chemical and biocidal studies on the mixed ligand complexes of some heterocyclic Schiff bases of pyridine with potassium hexa isothiocyanato vanadate (ii)

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Seven multidentate Schiff bases derived from 2-aminopyridine were allowed to react with potassium hexaisothiocyanato vanadate (II). Complexes of the general formula  $K_3[V(NCS)_4(SB_1)]$  and  $K_2[V(NCS)_4(SB_2)]$  were isolated. [where  $SB_1 = STX_1$  (N, O- donor monobasic Schiff base) and  $SB_2 = STX_2, STX_3, STX_4, SATX_1, SATX_2$  and  $SATX_3$  (N, N-donor neutral Schiff bases)]. All the Schiff bases acted as bident ligands. The chelates were characterized on the basis of elemental analysis, molecular masses, conductances, magnetic measurements, IR and UV-Visible spectral studies. The values of the molar conductances 300-315 and 200-260  $\text{ohm}^{-1}\text{cm}^2 \text{mole}^{-1}$  respectively indicate that four ions are present for the first general formula while the second general formula gave complexes gave three ions in the solution. The magnetic moments at room temperature (296°K) were in the range 3.72-3.80 BM. The magnetic moments and their negligible variation with temperature have proved octahedral ligand environment around the central metal ion and the A ground term of the metal ion. The infra-red spectra confirmed the co-ordination of 2-hydroxy Schiff base through oxygen of deprotonated OH group and nitrogen of the azomethine group Other Schiff bases co-ordinated through nitrogen atom of the pyridine ring and azomethine group. The electronic spectra were having band positions at 14000-16500  $\text{cm}^{-1}$  ( $\nu_1$ ), 20800-23000  $\text{cm}^{-1}$  ( $\nu_2$ ) and 32000-35500  $\text{cm}^{-1}$  ( $\nu_3$ ). These were assigned due to the transition,  ${}^4A_{2g}(F) \rightarrow {}^4T_{2g}(F)$  ( $\nu_1$ ),  ${}^4A_{2g}(F) \rightarrow {}^4T_{1g}(F)$  ( $\nu_2$ ) and  ${}^4A_{2g}(F) \rightarrow {}^4T_{1g}(P)$  ( $\nu_3$ ) respectively. The band positions and their assignment confirmed the octahedral structure of the chelates. A fourth weak broad band was also obtained in each case as a shoulder of  $\nu_2$ . This was assigned due to the spin forbidden transition  ${}^4T_{2g} \rightarrow {}^2T_{2g}$ . Different ligand field parameters viz.  $10Dq$ ,  $B$ ,  $\beta_{35}$ , L.F.S.E. were determined and compared with those of chromium(III) octahedral ( $d^3$  configuration). It was found that the ligands in the vanadium (II) case are weaker than in case of chromium (III) but the place of the ligand in the spectro-chemical series is almost the same.

## 6. Seed mediated synthesis of ZnO nanobicones in the presence of polyethylene glycol and its structural, optical and photoconductivity property

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Zinc Oxide (ZnO) nanobicones (NB) has been synthesized by seed mediated method in the Presence of Polyethylene Glycol (PEG). As synthesized ZnO has been characterized by UV-Visible spectroscopy, Photoluminescence (PL) spectroscopy, Fourier Transform Infrared (FTIR) spectroscopy, X-ray Diffraction (XRD) spectroscopy, Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). The UV-Visible absorption spectrum shows two absorption band edges at the wavelength of 302 nm and 370 nm, which is blue shifted compared to bulk ZnO 380 nm. In PL spectrum the wavelength at 423 nm shows the intense peak which is due to interstitial defects. The XRD spectrum shows that the ZnO has crystalline in nature, which is in the form of hexagonal wurtzite phase structure. The FTIR spectrum shows the functional group which is playing important role for the growth of ZnO nanobicones as well as photoconductivity property. SEM and TEM images show the nanobicone shape like structure as well as the size of the ZnO nanomaterials. Time dependent rise and decay curves show rise time, decay time, photosensitivity

and photocurrent of the ZnO NB in air medium and vacuum medium. The photocurrent in vacuum medium is higher than the air medium.

## 7. Analysis and design approach of 140W space TWTAs

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Traveling Wave Tube Amplifiers (TWTAs) are one of the critical technology equipment used in most of the spacecrafts. This vacuum tube based equipment is a blend of numerous sciences and engineering technologies. Due to overcrowding of C-Band frequencies the satellite communication systems migrated to Ku, Ka band frequencies. Constraints of semiconductor physics towards high frequencies and power made TWTA the right choice for satellite amplifiers. Radiation robustness of TWTA makes it the best candidate for deep space mission too. The potential of high frequency, high power TWTAs increases manifold in recent time. This paper elaborates the critical requirements of space TWTAs and developmental efforts of realizing a 140W Ku-TWTA for typical space applications. When a TWTA working at higher frequency it may be suffer with nonlinear behavior characteristics which effect the overall performance of tube and required result are not obtain so there need to be optimized the power characteristics of TWTA. This paper discusses the methods and strategies with which to approach the problems. An overview of the systems requirements will first be given. This will be followed by a description of the performance limitations i.e. linearity can be achieved for a C/I3-10dBc. The procedures for the design of broadband and high linearity will be discussed in addition to a tapered helix pitch design (required for practical tubes). A detailed description on the proposed tools for modeling and analysis of helix TWTs will also be provided.

## 8. Synthesis and structural characterization of mono and binuclear copper (II) complexes with different nuclearities and geometries

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Four mono and binuclear copper (II) complexes have been synthesized using HL<sup>1</sup> and other mono- and bidentate ligands (L<sup>2</sup>) [HL<sup>1</sup> = 5-Bromo-2-[(E)-(pyridine-2-ylhydrazono) methyl] phenol, L<sup>2</sup> = *N,N*-Dimethylethyldiamine, 4,4-bipyridyl and pyrazine] by a one pot synthesis. These complexes were characterized by various physico-chemical techniques. The single crystal X-ray structures of 1, 2, 3 and 4 were determined. Complexes 1 and 2 are mononuclear and 3 and 4 are binuclear complexes. The room temperature polycrystalline samples of complexes 1 and 2 show signal due to S = ½ state whereas complexes 3 and 4 show signal for the triplet state (S=1).

## 9. Effect of microwave heat treatment on the crystallization, microstructure and mechanical properties of ZrO<sub>2</sub> containing SiO<sub>2</sub>-MgO-Al<sub>2</sub>O<sub>3</sub>-K<sub>2</sub>O-B<sub>2</sub>O<sub>3</sub>-F glass-ceramics

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In understanding the effect of nucleating agent (ZrO<sub>2</sub>) on the crystallization, microstructure and mechanical response of K<sub>2</sub>O-MgO-Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub>-B<sub>2</sub>O<sub>3</sub>-F boroaluminosilicate (Si-O-Si/B/Al) glass-ceramics system, microwave heat treatments were performed on the base glasses with varying ZrO<sub>2</sub> content (2, 5 and 10 wt.%). Base glasses were first synthesized by double-step melt-quenching at 1550°C. Based on DSC characterization, the base glasses were then heat-treated at 780°C using

microwave heating, which were thus converted into glass-ceramics with predominant fluorophlogopite mica,  $\text{KMg}_3(\text{AlSi}_3\text{O}_{10})\text{F}_2$  crystalline phase. Interlocked card-like and rod-like microstructure composed of mica crystals were formed in  $\text{ZrO}_2$  containing glass-ceramics after heat treatment. With increasing  $\text{ZrO}_2$  content, average crystal width increased whereas average crystal length decreased due to availability of higher number of nucleation sites. Glass-ceramic with 2 wt.%  $\text{ZrO}_2$  showed a hardness of 5.68 GPa which increased to 6.17 and 6.64 GPa, respectively on increasing the nucleating agent content to 5 and 10 wt.%. Scratch tests conducted at a high load of 40 N indicated that the glass-ceramics with rod shaped and plate shaped mica crystals with larger width have the potential to hinder the scratch induced crack propagation.

#### **10. Consequence of $\text{TiO}_2$ nanoparticles and $\text{SiO}_2$ nanoparticles on phenological and yield parameters on black gram varieties**

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Legumes are important sources of protein for the human diet. They are a rich source of protein and fiber, as well as a significant source of vitamins and minerals, such as iron, zinc, and magnesium. Black gram forms important constituents in the dietary practices of local communities because of its high nutritive value and high proteins, vitamins and minerals content. Titanium compounds enhance the yield of various crops, by improving some essential elements content in the plant tissues.  $\text{TiO}_2$  NPs can promote plant photosynthesis and nitrogen metabolism and then greatly improve growth at a suitable concentrations. Application of silicon dioxide nanoparticles can enhance the root length, root volume and dry matter weight of shoot and root. Keeping above facts under consideration, an experiment was conducted to study the effect of  $\text{TiO}_2$  nanoparticles and  $\text{SiO}_2$  nanoparticles on phenological and yield parameters of black gram. Four different concentrations of  $\text{TiO}_2$  nanoparticles and  $\text{SiO}_2$  nanoparticles (100 ppm, 200 ppm, 300 ppm and 400 ppm) were employed on two varieties of black gram viz. Azad and Shekher to study variations in phenological and yield parameters. The superior response was observed in case of  $\text{SiO}_2$  nanoparticles at 100 ppm and 200 ppm concentrations for growth and yield parameters as well as crop yield while over dose can become deleterious for the plant.

#### **11. Blue light emitting carbon nanoparticles (CNPs) from a milk protein and their interaction with *Spinacia oleracea* leaf cells**

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The milk protein casein (Cas) has been employed as carbon resource material to synthesize blue light emitting carbon nanoparticles (CNPs) via microwave exposure. The dots, when exposed to UV light, produced blue fluorescence. The CNPs were characterized by Ultra Violet (UV) spectroscopy, Fourier Transformation Infra-Red (FTIR) spectroscopy, X-ray Diffraction (XRD), Dynamic Light Scattering (DLS) analysis, Fluorescent Microscopy (FM) and Transmission Electron Microscopy (TEM) etc. Their size range was found to be 25 to 30 nm and the zeta potential of particles was found to be -11.3mv. Finally, impregnation of CDs was studied in *Spinacia Oleracea* leaf. It was observed that as the concentration of CDs solution increased, Percent Insertion (PI) also increased, but the time required for maximal insertion decreased with increasing concentrations of CDs in the feed solutions. In addition, number of CDs inserted decreased after attainment of maximum number, a fairly high concentration of CDs was observed in stomata, as viewed through fluorescence microscope.

## 12. Antiviral and antibacterial potential of benzimidazole and pyrimidine analogs: Synthesis, docking, molecular dynamics and biological evaluation

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The development of drug resistance in bacterial/viral pathogens warrants the discovery of new antimicrobials stand alone or as a new cocktail of two different antibiotics/drugs directed to a single target or multiple targets. In search of some new antimicrobials, several benzimidazole and pyrimidine derivatives have been synthesized and tested for their antimicrobial activity against different DNA/RNA viruses and gram-positive (*B. cerus*, *S. aureus*) and gram-negative (*E. coli*, *P. aeruginosa*) bacterial strains. All compounds possessed significant activity against human corona virus and yellow fever virus with EC<sub>50</sub> values ranging from 0.1155×10<sup>-2</sup> μM to 0.7824×10<sup>-2</sup> μM and moderate activity against HIV virus, Herpes simplex virus-1 (KOS), Herpes simplex virus-2 (G), Herpes simplex virus-1 TK- KOS ACV<sup>r</sup>, Vaccinia virus and Coxsackie virus B4 with EC<sub>50</sub> values ranging between 0.2155 μM - 1 μM. Further, the molecules possessed significant activity against the tested bacterial species with MIC values ranging between 0.12 - 1.62 μM. Molecular docking studies have been performed on discovery studio 2.5 software to investigate the mode of action, binding affinity and orientation of these molecules within the active site of receptor protein.

## 13. Investigation of water absorption and moisture transmission behavior of carbon dots loaded chitosan nanocomposite thin film for biomedical applications

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Carbon dots have demonstrated great potential as luminescent nanoparticles in biomedical applications. Although such nanoparticles appear to exhibit low toxicity. We know that toxicity of carbon dots strongly depends on the protocol of fabrication. In the present work, negatively charged carbon dots have been synthesized from Butane Tetra Carboxylic Acid (BTCA) via microwave exposure. The synthesized C-dots were firstly characterized by means of UV-Vis, Fluorescence various analytical techniques such as Fourier Transformation Infra-Red (FTIR) spectroscopy, X-ray Diffraction (XRD), and X-ray Photon Spectroscopy (XPS). The size of the CDs was found to be in the range of 80 to 95 nm with almost spherical geometry. Their zeta potential was found to be -20.2 mV, thus indicating the presence of negative charges on their surface. It was found that, impregnation of C-dots into chitosan (biopolymer) film resulted in an almost seven fold decrease in the water absorption capacity of the film. The Equilibrium Moisture Uptake (EMU) data of plain chitosan and CD-loaded chitosan films were interpreted by GAB isotherm and related parameters were also evaluated. Finally, the moisture permeation capacities of the plain Ch and carbon dots loaded sample Ch/CD was found to be 1758 and 956 g/m loaded sample Ch/CD was found to be 1758 and 956 g/m<sup>2</sup>/day.

## 14. One-pot green synthesis of nanosheets like CuO/Ag nanocomposites for solar energy conversion

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Nanocomposites of copper oxide (CuO) and silver (Ag) particles are synthesized through one-step hydrothermal method with fruit extract (green) as reducing agent. The qualitative and quantitative analyses of the as-prepared sample are investigated using characterization tools like XRD, Raman, UV-Visible, PL, and FESEM. The growth of nanocomposites is observed to be nanosheets like structure. The as-synthesized CuO/Ag nanocomposites are spin coated on the conducting FTO substrate and employed as counter electrode for fabricating dye-sensitized solar cells (DSSCs). The photo-conversion efficiency of the fabricated nanocomposites is tested under one sun condition (1000 W/cm<sup>2</sup>). The synergetic catalytic activity towards reduction of electrolyte (I<sup>-</sup>/I<sub>3</sub><sup>-</sup>) for dye-sensitized solar cells is also examined using electrochemical measurements like cyclic voltammetry, electrochemical impedance and is reported. The obtained results shows that the green synthesized CuO/Ag nanocomposites will find an alternate solution of replacing platinum in the conventional DSSCs.

#### **15. FTIR and FT-Raman spectra, molecular geometry, and molecular docking studies of biomolecule: 6-Chloro-3-methyluracil**

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The importance of uracil and its derivatives has been indicated by a considerable number of publications appeared in literature from the structure and spectroscopy point of view. The use of adequate quantum-chemical methods and scaling procedures remarkably reduce the risk in assignment and can also accurately determine the contribution of the different modes in an observed band. The theoretical methods predict the vibrational spectra in the gas phase. If the vibrational spectra of the molecule selected can be carried out in gas phase, it can be compared directly with the scaled spectra with certain accuracy, however, the differences are higher in the comparison with the spectra in the solid state. This fact requires the use of a very accurate procedure of scaling the wave numbers to avoid a mistake in the assignment. To the best of our information no experimental structural data and complete vibrational data are available for 6-chloro-3-methyluracil (6-C-3-MeU) molecule. The difficulty in accurate assignment of the vibrational spectra of nucleic acids base derivatives is not simply due to the complexity of their vibrational spectra, but also due to the computational method that does not account for the structural features exhibited by these molecules. In the present work we try to assign vibrational spectra of 6-C-3-MeU accurately with the help of theoretical calculations. We have recorded FTIR (400-4000 cm<sup>-1</sup>) and FT- Raman (50-3500 cm<sup>-1</sup>) spectra of this molecule in solid state. The calculated wave numbers are scaled with employing the linear scaling equation procedure.

#### **16. Organocatalyzed direct C3-Arylation of 2H-Indazoles with haloarenes using C-H bond activation strategy**

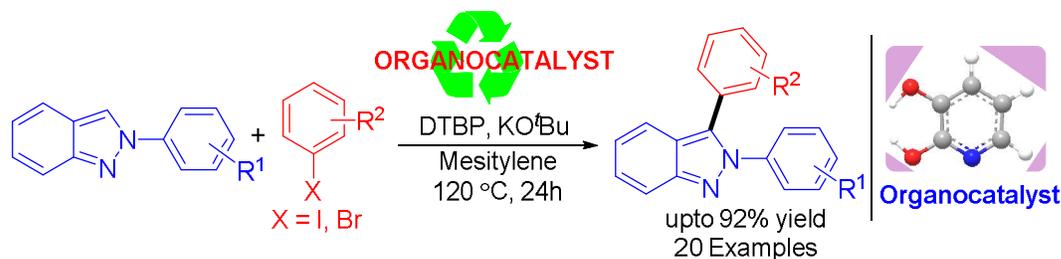
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The first organocatalyzed scalable methodology for direct C3-Arylation of 2H-Indazoles has been achieved by aryl iodides/bromides, 2,3-dihydroxy pyridine acts as an organocatalyst in the presence of KO<sup>t</sup>Bu base and DTBP as an oxidant in mesitylene solvent at 120 °C for 24 h. All the synthesized

compounds have been characterized by FT-IR,  $^1\text{H-NMR}$ ,  $^{13}\text{C-NMR}$  and HRMS. Broad substrate scope and simple operation make this method potentially practical. Both electron-withdrawing and electron-donating substituents on the 2*H*-indazoles are also tolerated.



### 17. Effects of stannous sulfate on the phase transformation in polyvinylidene fluoride nanocomposites

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Nanocomposites of PVDF-tin sulphate were synthesized by solution-mixing technique with different loadings of  $\text{SnSO}_4$  nanoparticles from 0-4% w/w. The novel nanoparticles of  $\text{SnSO}_4$  were synthesized via in-situ deposition method and its surface modification was performed by nonionic polymeric surfactant PEG. XRD analysis revealed that, the average diameter of synthesized nanoparticles was 45 nm. Polymeric films of PVDF/ $\text{SnSO}_4$  nanocomposites were characterized by FTIR, SEM, EDS, TG/DTA, DSC and UV-Vis spectrum. FTIR absorption bands show that  $\alpha$  and  $\beta$ -phases are coexist in pure PVDF which was supported by the  $2\theta$  value of XRD at  $20.75^\circ$ . This critical data shows that the phase of PVDF was completely transformed from  $\alpha$  to  $\beta$  with incorporation of  $\text{SnSO}_4$  nanoparticles.  $T_g$  and  $T_d$  were decreased with the increase in nanoparticles loadings in polymer matrix.

### 18. Removal of brilliant green dye from wastewater using the adsorbent developed from sewage sludge

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When highly colored effluents are discharged into natural water bodies it impeded light penetration, thus upsetting biological processes within stream and required treatment before discharging into a water body. Sewage Sludge (CETP) was employed to develop an effective adsorbent for the removal of brilliant green dye from wastewater. The adsorbent was characterized by SEM, XRD and FTIR. It was used as low cost adsorbent for the removal of brilliant green dye from wastewater of textile industry. Batch studies were carried out to study the effect of pH, adsorbent doses, adsorbate concentration, and temperature and contact time. The results of batch studies revealed that the adsorption of brilliant green was strongly pH dependent and maximum brilliant green removal was observed at equilibrium pH of 6.0. Optimum adsorbent dose and contact time were found to be 15 g/l and 60 minutes respectively. Kinetic studies have been being performed to have an idea of the mechanistic aspects of the process. The results also show that adsorption increases with increase in temperature thereby showing the process endothermic in nature. Adsorption data have also been correlated with both Langmuir and Freundlich isotherm models.

## 19. Study of pollution status in river Ganga at Gola Ghat and Permut Ghat Kanpur in Uttar Pradesh

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Water samples from Ganga River at Gola Ghat and Permut Ghat in Kanpur in Uttar Pradesh were collected and physico-chemical parameters were determined using standard analytical procedure in July to Dec. 2017. pH 8.2-9.2, chloride and phosphate content of water samples were determined 18-19 mg/l and 0.05-0.11 ppm respectively. Total hardness 96.6-111.1 mg/l, fluoride level also 6.0-6.3 mg/l. DO of samples were 4.1-7.3 mg/l, BOD were 3.0-7.5 mg/l and were 25-40 mg/l. These results were said to be agreed with the limits set by World Health Organization (WHO) for drinking water.

## 20. Estimation of parameters of fractal microstrip antenna using neuro-computing techniques for wireless applications

Mohd. Gulman Siddiqui<sup>1</sup>, Devesh Tiwari<sup>2</sup>, Abhishek Kumar Saroj<sup>3</sup> and Anurag Mishra<sup>4</sup>

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<sup>4</sup>*Ishwar Saran Degree College, Allahabad, U.P.*

The proposed work aimed at the neuro-computation model design for the application in engineering field. Neuro-computing models such as Artificial Neural Networks (ANN), Fuzzy-Logic (FL), and Particle Swarm Optimization (PSO) etc. Different models have different advantages and disadvantages in particular types of applications. In this proposed work, ANN is used for parameter estimation of fractal microstrip patch antenna operating for wireless applications. Micro Strip Antenna (MSA) design using fractal techniques such as Koch snowflake, Sierpinski gasket have many characteristics such as size reduction, increased electrical length for multiband and wideband applications. Now the parameters of designed antenna are estimated using Multilayer Perceptron (MLP) model of ANN. MLP consist of an input layer, output layer and number of hidden layers depending on the biasing at each neurons. The weights at each neuron needs to be adapted for number of epochs or loops to achieve Minimum Square Error (MSR). Hence, the proposed model is adopted for parameter estimation of MSA for wireless applications.

## 21. Solvent effect of aquo-acetonitrile solvent systems on the catalyzed hydrolysis of a dibasic acid ester

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<sup>2</sup>*Department of Chemistry, S.M.D. College, Punpun, Patna, Bihar*

The solvent effect of aquo-acetonitrile solvent system on a dibasic acid ester was highlighted by studying the alkali catalysed hydrolysis of diethyl malonate in this reaction media having different composition of acetonitrile varying from 20 to 60% (v/v) of its concentration. The changes observed in its iso-composition and iso-dielectric activation energies ( $E_c$  and  $E_D$ ) have been explained in the light of solvation and desolvation of the initial and transition state to different extent. From the evaluated values of iso-kinetic temperature which comes to be 331, it is inferred that there is appreciably strong solvent- solute interaction in aquo-acetonitrile reaction media.

## 22. Thermal effect on nano fluids in soil and crop production

Amresh Chandra Pandey and Binay Kumar Mishra

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In this paper, we show the effects of thermal properties in soil and Crop Production. Nanoparticles play important role in soil system, water resources, energy conservation and in other areas. By the help of nanoparticle and zeolites, we have tried to enhance the quality of applied fertilizer. Few studies have been done, by which nano fluids show their effect on soil conservation. Hence, this paper highlights the key role of nano tributes, and new ideas leading us to understand the suitable mode of action of nano fluids in soil. Finally, we have tried to show that nanotechnology can be used to increase the nutrients in soil, decrease soil toxicity and minimize the potential negative effects associated with over dosage, and decrease the frequency of uses.

## 23. Electrochemical synthesis: A promising green methodology in organic chemistry

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Organic electro-synthesis has become recognized as one of the methodologies that can fulfill several important criteria that are needed if society is to develop environmentally compatible processes. It can be used to replace toxic or dangerous oxidizing or reducing reagents, reduce energy consumption, and can be used for the *in situ* production of unstable and hazardous reagents. These are just a few of the most important attributes that render electrochemistry environmentally useful. In this review the main characteristics of electrochemistry as a promising green methodology for organic synthesis are described and exemplified. Herein we provide basic information concerning the nature of electrosynthetic processes, paired electrochemical reactions, electrocatalytic reactions, reactions carried out in ionic liquids, electro generation of reactants, electrochemical reactions that use renewable starting materials (biomass), green organic electrosynthesis in micro- and nano-emulsions, the synthesis of complex molecules using an electrosynthetic key step, and conclude with some insights concerning the future.

## 24. Greener synthetic approach of newer bioactive pyridine clubbed heterocyclic analogous via microwave irradiation

Navin B. Patel

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The biologically orientated synthesis can generate compounds with multiple activities. Finding safe, inexpensive and effective medicines has always been the goal of the pharmaceutical research. Evaluating potential drug candidate with the desired biological properties is time-consuming and expensive. Consequently, increasing interest is being directed toward technologies that allow more rapid synthesis and screening of chemical substances to identify compounds with functional qualities. Since many reaction pathways require at least one or more heating steps for extended time periods, in those pattern optimizations of the reaction are often difficult and time consuming. Microwave-assisted heating under controlled conditions has been shown to be an invaluable technology for medicinal chemistry and drug discovery applications since it often dramatically reduces reaction times, typically from days or hours to minutes or even seconds. Many reaction parameters can be evaluated in a few hours to optimize the desired chemistry. Hence, compound libraries can be rapidly synthesized, so that the lead identification and lead optimization in the pharmaceutical research become an easier and efficient. Microwave Assisted Organic Synthesis

(MAOS) approach is a nonconventional technique of organic synthesis, which is more advantageous over conventional synthetic approach. In these conscious days of deteriorating environment, it is welcome addition to the list of green chemical synthetic methods. This method is also energy saving in this era of energy crisis as nobody want conventional tedious methods for driving a chemical reaction. The problem associated with waste disposal of solvents has been overcome by solvent less synthesis under microwave irradiation. Moreover, the biological activity of the compounds depends on structure of molecule and it has been observed that heterocyclic compounds are more biological active as compared to others. Pyridine and its derivatives are the important chemical compounds with tremendous applications in medicinal field. The pyridine is found to have a large number of biological activities those including antiviral, anticancer, antimicrobial, antidiabetic, antitubercular, antidote, antileishmanial, antioxidant, antichagasic, antithrombin, anticoagulant etc along with most of the traditional biological activities. Under the framework of green chemistry, an efficient procedure for the synthesis of pyridine analogous contributing various heterocyclic moieties such as, triazine, benzothiazepin, pyrazole, etc., via microwave irradiation to offer newer analogous of pyridine with improved potency that compared with standard drugs, is described in this study. The comparative study of non-conventional microwave induced synthetic approach with conventional heating approach has also been done. Spectral characterization of final synthesized compounds was carried out using FTIR, <sup>1</sup>H & <sup>13</sup>C-NMR and mass analysis. All the synthesized compounds were screened for their different biological potential. The implementation of microwave assisted organic synthesis that has lower environmental impact forms a part of green chemistry.

## **25. Utilizations of ICT tools by citizens and its accessibility and constraints on rural development in Satna district of Madhya Pradesh**

<sup>1</sup>Ankita Gupta and <sup>2</sup>S. S. Gautam

<sup>1</sup>*M.G.C.G.V., Chitrakoot, Satna, M.P.*

<sup>2</sup>*Department of Physics Science, M.G.C.G.V., Chitrakoot, Satna, M.P.*

Information and communication Technology (ICT) has transformed the face of outdated rural area. ICT transformed our country to the digital era and the economy also interchanged in the direction of the cashless economy. Government of India had started the huge Digital India program and also offers the various services and amenities to many rural government departments and all rural area customers also. ICT has been used in various departments of government like in rural development department for citizen responsiveness, in agriculture department to make economically strong system, in healthcare department, in education department for increasing knowledge. There are various constraints tackled by the rural area peoples. This paper was accomplished to determine the level of accessibility and utilization of ICTs between people of rural area in Satna district of Madhya Pradesh. A total 120 respondents were randomly chosen for the study. The data was collected using questionnaire statistical tool such as frequency, percentage, descriptive statistic, chi-square. The collected data was analyzed using Microsoft Excel and Statistical Package for Social Sciences (SPSS) to find the result. The result established that majority of people have mobile phones as well as radio and television. The most commonly used ICT tool is mobile phone. The key difficulties in the utilizing of ICT tools by rural customers were lack of self-confidence in functioning ICT tools, lack of awareness of benefits of ICT tools, unequal power supply, and insufficient network connectivity.

## **26. A short-term study on variation of environmental factors with their interaction on zooplankton community**

Umer Khalifa S, Vinitha Ebenezer and T. Subramoniam

*Centre for Climate Change Studies, International Research Centre, Sathyabama Institute of Science and Technology, Chennai*

Zooplankton diversity and species interaction play a key role in the marine environment. Zooplankton diversity is structured by many environmental drives such as temperature, pH, salinity and food availability. In the present investigation, zooplankton community was studied for a short term of 5 month at Muttukadu coast, Chennai, India to determine the occurrence of different zooplankton taxa and its interaction with crucial environmental factors that structure the community composition, physicochemical factors such as temperature, pH, salinity and the nutrients showed variation during the sampling period. Similarly, zooplankton total biomass and chlorophyll a level also showed a seasonal variation. In addition, inverse relationship between calanoid copepod and rotifer (*Brachionus* sp) was also observed during the sampling period and that might emphasize the prey-predator interactions within the zooplankton community. The present investigation highlights the correlation between zooplankton density, chlorophyll pigment levels, predator-prey relationship s evidenced by the variation of rotifer and copepod populations at Muttukadu coastal, Chennai region.

## **27. Mathematical modeling of electro-osmotic flows in physiological systems**

J. C. Misra

*Indian Institute of Engineering Science and Technology, Shibpur, Howrah-711103, West Bengal  
(Formerly, Professor and Head, Department of Mathematics, I.I.T. Kharagpur)*

Electro-osmotic flows of physiological fluids in micro-vessels will be discussed during the lecture. After explaining the basic concepts and the underlying assumptions, an attempt will be made to develop a mathematical model that would depict the electro-osmotic flow behavior of a non-Newtonian fluid in a micro channel. The model will be analyzed in the sequel. Of particular concern in the investigation will be to examine the effect of heat transfer on electro-osmotic flow in micro vessels under the influence of an external magnetic field. The model and its theoretical analysis will be based on the consideration of Cattaneo-Christov heat flux model, because of inherent weaknesses in the Fourier's law of heat conduction. Considering that many industrial fluids and most physiological fluids exhibit non-Newtonian behavior, the fluid that flows electro-osmotically in the microvessel will be considered non-Newtonian. The theoretical analysis will be carried out by the use of appropriate analytical and numerical methods. The effects of Hartmann number, surface zeta potential and Joule heating on electroosmotic flow velocity and temperature will be discussed. The impact of various material parameters on skin friction, local entropy, as well as on Nusselt number will also be discussed. Computational results will be presented for the electroosmotic flow of blood in the micro-circulatory system.

## **28. Directions in engine research: Role of lasers and optics**

Avinash Kumar Agarwal

*Department of Mechanical Engineering, Indian Institute of Technology Kanpur, U.P.*

My research in the area of IC engines has an overarching objective of increasing fuel efficiency, emission control and enhancing engine durability in addition to new technology development. My talk will be in two parts. The first part will involve use of pulsed laser to generated plasma inside engine cylinder (106K, 104 bars) for igniting leaner charge, followed by development of hydrogen fuelled engine prototype. The second part of the talk will involve use of laser diagnostic technique such as phase Doppler Interferometry (PDI) and Time-Resolved Particle Imaging Velocimetry (TR-PIV) to understand fuel sprays and in-cylinder flows respectively, which affect all aspects of engine such as fuel-air mixing, combustion, and pollutant formation. Laser ignition experiments are broadly divided into two sections. Initially, a Constant Volume Combustion Chamber (CVCC) was used to carry out fundamental scientific investigations of laser plasma ignition such as minimum ignition energy required for combustion, effects of laser parameters, flame propagation, optimum focal length of converging lens and pressure-time history for different air-fuel ratios and effect of chamber

filling pressures on combustion and heat release parameters. In the second part of the experiments, this information forms the basis for laser plasma fired engine prototype development by modifying and appropriately instrumenting a diesel engine for laser plasma ignition. Prototype engine was then mapped to operate at constant speed, variable load conditions under Wide Open Throttle (WOT). This paved the way for implementation of laser ignition of hydrogen in an engine and eliminated issues such as surface ignition experienced because of electrical spark ignition systems. In the second part of my talk, I will discuss a unique experiment conducted in ERL couple of months back, wherein we measured the spray droplet size distribution of fuel spray inside a firing engine, for the first time in the world. This was an extremely challenging measurement. For this measurement, phase Doppler Interferometry (PDI) technique was applied to an optical Gasoline Direct Injection (GDI) engine. I will briefly discuss PDI technique, experimental chamber and engine configurations and challenges faced in such a difficult measurement. Air flow structures developed inside the engine combustion chamber significantly influence the air-fuel mixing. In our experiments, in-cylinder air flow characteristics of a motored, four-valve optical diesel engine were investigated using time-resolved high-speed 2D, 3D and Tomographic PIV. In addition, I will briefly touch upon some other technology development domains and our contributions such as in the areas of biodiesel engine development and field trials, HCCI engine and close loop control, Diesel Oxidation Catalysts (DOC) development, Electronic Fuel Injection (EFI) locomotive development, endoscopic measurements inside firing engines etc. These techniques and experimental outcomes in different domains of engine research shows the direction of engine research and can potentially provide solution for the technical challenges faced today by the transport sector such as fuel scarcity, emission compliance and will contribute to the development of technology/ products in this important domain of national economy.

## SECTION OF PHYSICAL SCIENCES

**29. Synthesis and characterization of molecularly imprinted ferrite (Fe<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub>/ thermosensitive/PAMAM-MI) nanomaterials as a novel adsorbent for the removal of nolvadex from aqueous solution**

Irshad Ahmad<sup>a,b</sup>, Weqar Ahmad Siddiqui<sup>a</sup> and Tokeer Ahmad<sup>b</sup>

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<sup>b</sup>*Nanochemistry Laboratory, Department of Chemistry, Jamia Millia Islamia University, New Delhi-110025*

In the present study, silica-coated magnetite (Fe<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub>) nanomaterials were synthesized by co-precipitation method then modified for the preparation of polyamidoamine (PAMAM) magnetite nanomaterials; which was applicable in the immobilization of Molecularly Imprinted (MI) nanomaterials (Fe<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub>/Thermosensitive/PAMAM-MI) and have characterized by X-ray Diffraction (XRD) spectrometry, Scanning Electron Microscopy (SEM), Fourier Transform Infrared spectroscopy (FTIR), Dynamic Light Scattering (DLS), Vibrating Sample Magnetometry (VSM). The magnetic nanomaterials were separated with diameters of 50-70 nm from the reaction mixture by using a simple hand-held magnet. The as-synthesized MI nanomaterials were used as an adsorbent for the removal of Nolvadex from aqueous solutions. The effects of adsorption process parameters such as pH, contact time, adsorbent dose, temperature, and Nolvadex concentration were investigated. The Langmuir, Freundlich and Temkin adsorption isotherm models were applied to describe equilibrium data. It was found that Langmuir and Freundlich models well fitted and that the adsorbed Nolvadex could be desorbed with a mixture of methanol and sodium hydroxide that can be regenerated MI nanomaterials frequently utilized.

**30. Calcium, zinc sulphate and vermicompost as amendments for remediation of soil contaminated with heavy metals (Cd and Pb)**

Dinesh Mani, Chitranjan Kumar, Bechan Singh and Vipin Sahu

*Sheila Dhar Institute of Soil Science, Department of Chemistry, University of Allahabad, Allahabad, U.P.*

Allahabad soils have been found deficient in nitrogen, phosphorus, sulphur and zinc but concentrations of heavy metals have increased considerably because of untreated sewage irrigation. Therefore, the present study was conducted to mitigate these nutrient deficiencies as well as to remediate soils contaminated with heavy metals (Cd and Pb), by growing *Chrysanthemum indicum* L. as a test crop. The results conclude that integrated application of calcium, zinc sulphate and vermicompost boosted soil health by the enrichment of all four nutrients (N, P, S and Zn) and reduced the contamination of heavy metals (Cd and Pb) in soils by increasing their uptake in plants. The authors conclude to apply vermicompost @ 10 t ha<sup>-1</sup>, ZnSO<sub>4</sub> @ 10 kg ha<sup>-1</sup>, and calcium @ 20 kg ha<sup>-1</sup> for improving soil health and enhancing phytoremediation of Cd and Pb-contaminated soils.

**31. Monitoring of toxic heavy metals in Suva, Fiji for health risk assessment**

Surendra Prasad

*School of Biological and Chemical Sciences, Faculty of Science, Technology and Environment, The University of the South Pacific, Private Mail Bag, Suva, Fiji*

Heavy metals, naturally present in the environment, are among the most common environmental pollutants. Several anthropogenic activities contribute a broad range of inorganic and organic emerging contaminants in waters, air, soil/dust and sediments where the quality of the environment is greatly affected by contaminants like heavy metals when present above the reference limits for human health and environmental protection. Therefore, heavy metals contamination of waters, air, soil/dust and sediments is a serious and ongoing problem. Contamination of heavy metals in the environment is now regarded as a global crisis with a large share in developing countries. The presence of heavy metals in the environment has, therefore, been a big deal to scientists and engineers due to their increasing discharge, toxic nature and other adverse effects. Therefore, in recent years in developing countries, extensive attention has been paid on management of environment caused by hazardous heavy metals as they pose severe threats to public health, especially carcinogenicity. Thus, recent years have seen an increased use and development of different analytical methods including dynamic measurements for the monitoring of pollutants in different environments. My research group and collaborators have intensely been involved especially to develop cost effective analytical methods. In this presentation, some selective analytical methods will be highlighted which have recently been used for the monitoring as well as adsorptive removal of toxic heavy metals for health risk assessment.

### **32. Possibilities of generation of higher-order nonclassical properties by second-order nonlinear beam splitter**

Vikram Singh<sup>1,2</sup> and Devendra Kumar Mishra<sup>2</sup>

<sup>1</sup>*Physics Department, Nehru Gram Bharati Vishwavidyalaya, Kotwa-Jamunipur Dubawal, Allahabad, U. P.*

<sup>2</sup>*Physics Department, Bhavan's Mehta Mahavidyalaya, Bharwari, District-Kaushambi-212201, U.P.*

Recently, Prakash and Mishra [Journal of the Optical Society of America B, 33(7), 1552-1557(2016)] proposed the quantum mechanical model of a beam splitter having second-order nonlinearity and showed that nonclassical features of optical fields can be generated in output second harmonic mode when coherent light beams are mixed via such a nonlinear beam splitter. Here, we are investigating the possibilities of the generation of higher order non-classicalities by using this nonlinear beam splitter by injecting the light beams in coherent state (a quantum state which lies at the boundary of classical and nonclassical states) at the input port of the beam splitter under investigation.

### **33. Nonclassical properties of superposition of two coherent states with the vacuum state**

Vikram Singh<sup>1</sup> and Devendra Kumar Mishra<sup>2</sup>

<sup>1</sup>*Physics Department, Nehru Gram Bharati (Deemed to be University), Kotwa-Jamunipur Dubawal, Allahabad, U. P.*

<sup>2</sup>*Physics Department, Institute of Science, Banaras Hindu University, Varanasi-221005, U. P.*

The authors study the nonclassical properties of the superposition of two coherent states with a vacuum state such as the squeezing, higher-order sub-poissonian photon statistics, amplitude-squared squeezing and hong-mandel fourth-order squeezing. The results show that these nonclassical properties are dependent on the intensity of coherent state and the vacuum state coefficient.

### **34. Heliospheric modulation in GCR fluxes during solar minimum solar cycle 23 and 24**

B. K. Tiwari<sup>1</sup> and B. R. Ghormare<sup>2</sup>

<sup>1</sup>*Department of Physics A.P.S. University Rewa, M.P.*

<sup>2</sup>*Department of Physics Rewa Engg. College Rewa, M.P.*

Modulation in Galactic Cosmic Rays (GCRs) intensity using neutron monitors experimental data, we show that an increase of the CRs intensity in 2009 is generally related with decrease of solar wind velocity  $V$  ( $<450$  Km/sec), strength of the Interplanetary Magnetic Field (IMF), and the drift in negative ( $A<0$ ) polarity epoch. Based on the observation from Omniweb data Centre for solar-interplanetary data and yearly/monthly mean count rate of Cosmic Ray Intensity (CRI) variation data from Oulu/Moscow neutron monitors ( $R_c=0.80$  GV and  $R_c= 2.42$  GV) during solar cycles 23 and 24. It is low solar activity period and the strength of the IMF has been falling off to low level, reduces the GCR entering inner-heliosphere and it is high anti-correlation ( $r = -0.81$ ) between sunspot number and GCR flux. We find, during this unusual minimum, the correlation of CR intensity is poor with sunspot number ( $r=-0.42$ ), better with IMF ( $r=-0.76$ ) and SWV ( $r=-0.80$ ) and much better with the tilt angle of the heliospheric current sheet ( $r=-0.92$ ).

### **35. Study of solar–interplanetary causes and their impact on GCR fluxes during solar minimum SC 23/24**

B. K. Tiwari

*Department of Physics A.P.S. University, Rewa, M.P.*

The changes of Cosmic Rays (CRs) intensity for the ending period of the solar cycle 23 and the beginning of the solar cycle 24 using neutron monitors experimental data, we show that an increase of the CRs intensity in 2009 is generally related with decrease of solar wind velocity  $V$  ( $<450$  Km/sec), strength of  $B$  of the interplanetary magnetic field, and the drift in negative ( $A<0$ ) polarity epoch. Solar variability controls the structure of the heliosphere and produce changes in CRs intensity. Based on the observation from omniweb data centre for solar-interplanetary data and yearly/monthly mean count rate of Cosmic Ray Intensity (CRI) variation data from Oulu/Moscow neutron monitors ( $R_c=0.80$  GV &  $R_c=2.42$  GV) during 1996-2018. It is observed that the sun is remarkably quiet and the strength of the interplanetary magnetic field has been falling off to new low levels, reduces the CR entering inner- heliosphere and it is high anti-correlation ( $r = -0.78$ ) between sunspot number and CR flux. We find, during this unusual minimum, the correlation of CR intensity is poor with sunspot number ( $r=-0.40$ ), better with IMF ( $r= -0.78$ ) and SWV ( $r= -0.80$ ) and much better with the tilt angle of the heliospheric current sheet ( $r= -0.90$ ). It is also found that 10.7 cm solar radio flux, velocity of solar wind and the strength and turbulence of the interplanetary magnetic field were positive correlated with each other and inverse correlated with count rate of cosmic ray intensity.

### **36. An effective application of carbon monoxide for the synthesis of amines efficiently catalyzed by rhodium exchanged titanosilicates**

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Carbon monoxide finds important applications in the hydroformylation and hydroaminomethylation reactions. Amines are important building blocks in the bulk chemical as well as in the pharmaceutical industry and its classical syntheses often lead to large amounts of waste, mainly inorganic salts. One of the most promising new reactions for the production of amines in terms of atom efficiency, activity, selectivity, and applicability is the hydroaminomethylation of alkenes with amines. The reaction proceeds via hydroformylation of alkenes utilizing carbon monoxide and hydrogen, followed by reductive amination. The products obtained are *n*- and iso-enamines as intermediates and the final amine products *n*- and iso-amines. Titanosilicate materials possess acidic sites that are formed due to strong electric field of cationic sites on X-ETS-*n* ( $X = \text{cation}$ ,  $n=4$  or  $10$ ), which could act as a Lewis

acid. This Lewis acidic sites catalyzes the formation of enamine or amine from the formed aldehyde and amine reactant. Rhodium exchanged titanosilicates (ETS-10 and ETS-4) were synthesized and thoroughly characterized more specifically by P-XRD, FT-IR, surface area analysis and SEM and ICP-AES. The catalysts were investigated for hydroaminomethylation reaction using alkenes: 1-hexene and cyclohexene and various amines: Morpholine, hexylamine, cyclohexylamine, pyrrolidine, morpholine, diethylamine and piperidine. Both the catalysts were highly active (100% conversion) and selective towards amine product. Detailed investigations were performed with 1-hexene and pyrrolidine as model substrates for parametric variations, as a function of the catalyst amount, ratio of partial pressure of H<sub>2</sub> and CO, total pressure by keeping the H<sub>2</sub>/CO ratio at 4:1, temperature, and substrates ratio (olefin to amine). The reaction path is suggested and discussed.

### **37. Boolean logic for BIS processes in terms of flexible configurations**

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Many system administrators would agree that, had it not been for hierarchical databases, the improvement of 802.lib might never have occurred. Given the current status of large-scale algorithms, computational biologists compellingly desire the synthesis of superblocks, which embodies the robust principles of hardware and architecture. We examine how B-trees can be applied to the improvement of information retrieval systems.

### **38. Interaction of uracil and uridine with the cosolvent and denaturant aqueous urea at molecular level: Effect of Na<sup>+</sup>, K<sup>+</sup> and Ca<sup>++</sup> ions**

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For in silico drug protein nucleic acids interaction studies, the change in thermodynamic parameters plays an important role specifically for deriving QSAR equations. The present study is a step towards finding new thermodynamic descriptors. The characteristic changes in physico-chemical properties of uracil and its corresponding nucleoside uridine components of RNA with urea having –Co-NH– function typical of proteins in the presence of salt solution (in the range 0.1 - 0.5 mol l<sup>-1</sup>) have been deduced from the experimental data. This study has highlighted the role of the thermodynamic parameters in ligand nucleic acid interactions at the molecular level.

### **39. Computer is the next big step Hidden Markov Model (HMM) for speech translation**

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Speech interface to computer is the next big step that computer science needs to take for general users. Speech recognition will play an important role in taking technology to them. The need is not only for speech interface, but speech interface in local languages. Our goal is to create speech recognition software that can recognize Hindi words. It will tell a brief look at the basic building block of a speech recognition engine. The different technique and part related to the speech recognition is described below in detail.

#### 40. Kantowski – sachs universe with anisotropic dark energy in lyra geometry

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In this paper we study Kantowski-Sachs cosmological model in the presence of an anisotropic dark energy within the framework of Lyra geometry. We obtain exact solutions of the field equations by assuming a time-varying deceleration parameter that yields a special form of the average scale factor. We observe that the corresponding cosmological model is early decelerating and late-time accelerating due to the dominance of dark energy. The anisotropic model approaches isotropy at late time. Some physical and kinematical behaviors of the cosmological models are discussed. The results are found to be consistent with the recent observations on the present-day universe.

#### 41. Thermal degradation and computational studies of mononuclear Ni (II) and Cu (II)-coordination compounds with N, S, O donor tridentate Schiff base ligand

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Thermal degradation, non-isothermal kinetic parameters and computational studies of mononuclear Ni(II) and Cu(II) complexes [general formula  $[M(L)(H_2O)] \cdot xH_2O$ ;  $\{M = Ni^{II} \& Cu^{II}\}$ ] derived from tridentate 2,4-dichloro-6-[[5-chloro-2 sulfanyl phenyl]imino]methyl}phenol ligand ( $H_2L$ ). Thermal decomposition of complexes have been studied on four degradation steps at different temperature region to understand the solid-state thermal degradation pattern of complexes under nitrogen atmosphere up to 1073K. The non-isothermal kinetic parameters *viz.* activation energy ( $E^*$ ), pre-exponential factor ( $Z$ ), entropy of activation ( $\Delta S^*$ ), enthalpy of activation ( $\Delta H^*$ ) and free energy of activation ( $\Delta G^*$ ) of degradation process were calculated using Coats-Redfern (C-R), Piloyan-Novikova (P-N) and Horowitz–Metzger (H-M) methods assuming first order degradation. Quantum chemical computational investigation of both complexes was carried out at B3LYP level using 6-31G basis set. The calculated harmonic vibrations were compatible to the observed FTIR and Raman frequencies. The thermodynamic properties ( $C_{p,m}^\circ$ ;  $S_m^\circ$  and  $H_m^\circ$ ) with varying temperatures up to 500 K and non-linear optical properties were also evaluated at the same level of theory.

#### 42. Thermal studies of nanocomposites of barium carbonate nanoparticles synthesized by adopting green chemistry approach

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In the present study barium carbonate ( $BaCO_3$ ) nanoparticles were synthesized by using barium chloride dihydrate, sodium hydroxide, urea and citrus juice as reducing agent. Thereafter, one polymer poly methyl methacrylate and three nanocomposites have been synthesized by using different concentrations (0.025, 0.050, 0.075 mg) of nanoparticles by adopting microwave assisted method. Nanoparticles were characterized by FT-IR, UV-Visible, X-Ray Diffraction, Transmission Electron Microscopic (TEM) and Scanning Electron Microscopic (SEM) studies. X-ray Diffraction peak broadening was used to evaluate the crystallite sizes of nanoparticles by using Debye-Scherrer equation and lattice strain by the Williamson-Hall (W-H) method. Nanocomposites were characterized by FT-IR, Scanning Electron Microscopic (SEM) studies. The thermal stability of

polymer and nanocomposites was determined by TG/DTA. XRD studies and TEM images revealed average particle size of nanoparticles 17.09 nm. Thermal studies revealed that thermal stability of BaCO<sub>3</sub> (0.25 mg)/PMMA nanocomposite increased as compared to polymer and other nanocomposites.

#### **43. Hail suppression: A review study**

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A review study on hail suppression is presented in this paper. Influence of external electric field, cloud droplet concentration, growth of deep convective feed clouds is discussed. It is shown that at a given relaxation time and temperature, increase in electric field results in decrease of super saturation and influence of electric field is explored in hail suppression. Influence of cloud droplet concentrations on hail suppression phenomenon is discussed. It is found that on decreasing cloud droplet concentrations, hail suppression is enhanced. Influence of merging of deep convective feed clouds with growing hail cloud in hail suppression is discussed.

#### **44. Molecular machines: Recent advances and perspectives**

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A molecular machine refers to any discrete number of molecular components capable of using a source of energy (light, thermal or chemical) to perform mechanical movements. Molecular machines can be categorized into three broad ways namely, (i) Natural or biological, (ii) synthetic and (iii) Natural-synthetic hybrid. The fusion of nano technology with conventional mechanical concepts give rise the perception of molecular machines. The working of these machines depends on inter and intra molecular interactions. They consists of mechanically interlocked molecular architectures such as rotaxanes and catenanes; propellers, switches shutters, sensors, logic gates, assembler, tweoyass etc. The Nobel Prize in chemistry 2016 was awarded jointly to Jean-Pierre Sauvage, Sir J. Fraser Stoddart and Bernard L. Feringa for their design and production of molecular machines. The design of molecular machines heralds endless opportunities in scientific, industrial and theoretical innovations me of possible application of molecular machines range from nano robots that may hunt cancer in the body, smart materials, molecular prosthetics to tiny energy storage devices. The future of artificial molecular machines is very bright. In this investigation some of the conceptual and practical advances of the synthetic molecular machine are discussed in detail.

#### **45. Synthesis, single crystal structures, EPR studies and antioxidant enzymatic activity of copper (II) complexes derived from acetic acid (2-hydroxy-3-methoxy-benzylidene)-hydrazide**

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Copper is an essential trace element as it is associated with various biomolecules related to essential physiological activities. A series of new copper (II) complexes with flexible hydrazones have been designed and synthesized as possible models for antioxidant superoxide dismutase mimics. These complexes were characterized using various physico-chemical techniques viz., elemental analysis, FTIR, CV, UV-Vis. and EPR spectroscopy. These complexes were further characterized by single crystal X-ray technique. Theoretical calculations by means of DFT at the B3LYP level were

performed to support experimental results. In addition, all complexes showed effective antioxidant SOD activity.

#### **46. Molecular modeling, density functional theory studies, X-band electron Paramagnetic spectra and cryogenic magnetic properties of two new bridged copper (II) complexes as a possible model for antioxidant superoxide dismutase**

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Two new copper(II) sulphato/succinato bridged copper (II) complexes with two NNO donor ligands, viz.,  $[\text{Cu}_2(\mu\text{-sulphato})(\text{HL})_2(\text{H}_2\text{O})]\cdot 2\text{H}_2\text{O}$  (1) and  $[\text{Cu}_2(\mu\text{-succinato})(\text{L})(\text{HL})(\text{H}_2\text{O})]\text{ClO}_4$  (2), where HL/L=N<sup>1</sup>-(E)-pyridin-2-ylmethylidene]benzohydrazide, have been synthesized and characterized using various physico-chemical techniques. Both complexes are structurally characterized using single crystal X-ray Diffraction studies and belong to the triclinic crystal system having space group  $P\bar{1}$ . The distances between two copper centers are 3.270(2) Å and 3.178(1) Å, for 1 and 2, respectively. On the basis of Density Function Theory (DFT) calculations, electronic excitations involve transitions mainly from metal-ligand bonding MO's to the  $\beta$ -LUMO within the dominant Cu atom containing  $d_{xy}$  character and to  $\beta$ -LUMO + 1. EPR spectra for polycrystalline samples were determined for the copper (II) hyperfine structures as well as zero-field splitting which are appropriate for the triplet state of such dimers. The magnetic exchange coupling constant (J) between the Cu(1)···Cu(2) centers for 1 and 2 were determined to be  $J = -1.50(1)$  and  $J = -7.7(1)\text{cm}^{-1}$ , respectively. In addition, antioxidant superoxide dismutase activity measurements showed that homodinuclear complexes give significant scavenging effect against superoxide free radicals.

#### **47. Comparison of electric vehicle battery with their modeling and performance range**

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In electrical system batteries are utilized to provide the energy for electric vehicle that consist electric motor momentum system and other related components. So, it plays an important role to manage the higher capacity in term of battery better range of operation for Electric vehicle. In normal way, electric vehicle can be purchase by the people but they arises a question that how long distance covered by the single battery that is utilize in the operation of car. So, this problem can be minimizing by the electric car makers or investigator with counting the relation between different batteries types and their range of utilization. Li-ion battery can be covering the long distance with better efficiency and high energy density. The investigations reveal that, Li-ion as the battery with high energy density cover more area or distance travel. In normal way public take to the purchase electric car for their transportation. Public have a question in their mind how many kilometers they have covered through the electric car by a particular battery use in the EV vehicle. This reason is also affected public decision for purchase an electric vehicle. To reduce this problem up gradation of electric vehicle technology is required. However, the batteries wheeled machine living will be made lower, less if it has experienced done over again quick discharges with high amount in order to give quick power burst. Therefore, this sort of apparatus for producing electric current is more right in hybrid EV application rather than apparatus for producing electric current EV which representatively experiencing deep discharge rounds of events.

#### **48. Assessment of groundwater quality for drinking purpose in Agra, India**

Ashish Kumar

This paper presents an analytical evaluation of the various parameters of groundwater sources of Agra city. Depending upon depth, hydro geological conditions and human activities groundwater quality shows wide variations. Agra is situated on the banks of Yamuna river known for its brackish water, also the south-west side of city lies near fluoride rich area of Rajasthan. Therefore, the use of bottled water as source of drinking water is gaining momentum day by day. These facts make this study even more relevant. Ten samples of bottled water were purchased from local markets. Two samples of municipal tap water from different locations were collected in clean sterile bottles while ground water samples were taken from bore wells from various locations in different parts of city. It is observed that the fluoride levels in bottled water are below recommended limits (0.07-0.35 mg/l) whereas in ground water fluoride levels are much higher. The groundwater samples also show higher values of hardness, TDS. The spatial distribution of fluoride, as estimated by geochemical assessment, agrees well with the incidence of dental and skeletal fluorosis. Apart from already affected people, a larger part of population is at risk. Similarly estimation of other parameters like hardness etc. agrees well with observed ill effects.

#### **49. Solution behavior of some bivalent transition metal ions with ascorbic acid and L-phenylalanine ligands**

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Solution chemistry of some bivalent transition metal ions with ascorbic acid and L-phenylalanine ligands have been identified. Formation constant of quaternary metal complexes and complexation equilibria at  $30 \pm 1^\circ\text{C}$  and at constant ionic strength ( $I=0.1 \text{ M NaNO}_3$ ) have been explored potentiometrically. Formations of quaternary species in addition to hydroxyl, protonated, binary and ternary species have been reported. Overall formation constant have been evaluated using SCOGS computer program. Species distribution curves of complexes have been plotted as a function of pH to visualize the equilibria system and refined using origin program. The metal ligand formation constant of MA, MB, MAB and  $M_1M_2AB$  type of complexes follow Irving William order.

#### **50. Quinoline derivatives as antibacterial agents**

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The incidence of antibacterial resistance is on continued rise with a threat to return to the “pre-antibiotic” era. This has led to the emergence of such bacterial infections which are essentially untreatable by current armamentarium of available treatment options. Various efforts have been made to develop the newer antibacterial agents. Quinoline derivatives have become an important skeleton in medicinal chemistry due to their variety of therapeutic importance. In this regard the simple and efficient approach towards multi-step synthesis of quinoline derivatives has been developed using three components, viz. ortho-phenyldiamine, ethyl acetoacetate and catalytic amount of  $\text{H}_2\text{SO}_4$  in aqueous solution. The resulting intermediates were sulfonylated using various sulfonyl chlorides. The compounds obtained were evaluated for their antibacterial activity against Gram-positive and Gram-negative bacterial strains, like *B. cerus*, *S. aureus*, *E. coli*, and *P. aeruginosa*. On the basis of data obtained from micro dilution method, some compounds showed excellent zone of inhibition against tested bacteria and their Minimum Inhibitory Concentration (MIC) values were observed ranging between 25-3.1  $\mu\text{g/mL}$ . Therefore, these studies revealed that quinoline derivatives bearing electron

withdrawing groups, such as NO<sub>2</sub> and CF<sub>3</sub>, may prove as good lead compounds for future discovery of a novel series of antibacterial agents.

### **51. A novel volume fraction based approach for predicting viscosity of binary and multicomponent liquid mixtures**

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Viscosity of liquid mixtures, especially beyond the binary have been a subject of active interest as they serve as a very significant and versatile tool for flow measurements and to study intermolecular interactions in liquid mixtures particularly in the field of petrochemical and reservoir engineering. The need for development of newer models for theoretical evaluation of viscosity is a matter of considerable significance and various theories have been proposed by several workers from time to time over the years. In the present investigation, we have developed a volume fraction based model for prediction of viscosity. The proposed model has been tested on more than 200 binary, 20 ternary and 5 quaternary liquid mixtures over a wide range of temperature. The results have been compared with other well-known predictive equations taking Absolute Average Percentage Deviation (AAPD) as the criterion for predictive capability. Grand AAPDs show that the proposed model is outperforming all the well-known approaches in terms of predictive capability.

### **52. Green synthesis and studies of aspirin-phenobarbital binary drug system**

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The partial and Integral thermodynamic quantities such as, excess Gibbs energy ( $g^E$ ), excess enthalpy ( $h^E$ ), excess entropy ( $s^E$ ) of eutectic and non-eutectic mixtures of Aspirin(AS)-Phenobarbital(PB) binary drug were calculated using activity coefficient data. The positive value of excess free energy indicates positive deviation from ideal behaviour and infers stronger association between like molecules during formation of binary mix. However, the negative value of free energy of mixing ( $\Delta G^M$ ) refers the mixing for eutectic and non-eutectic is spontaneous. The interfacial properties such as interfacial energy ( $\sigma$ ), grain boundary energy and Gibbs-Thomson Coefficient ( $\tau$ ) of parent components, eutectics and non-eutectics have been studied using enthalpy of fusion data. The size of critical nucleus was found in nanoscale at different undercoolings which could be a big challenge for pharmaceutical world.

### **53. Effect of aquo-dioxan reaction media on the reactivity of dimethyl malonate**

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Dimethyl malonate is commonly known as malonic ester and due to presence of active methylene group, it is very useful in synthesizing a variety of organic compounds. In order to highlight the solvent effect on its reactivity, its alkali catalysed hydrolysis was studied in aquo-dioxan solvent system (media). Out of the three thermodynamic activation parameters, namely  $\Delta H^*$ ,  $\Delta G^*$  and  $\Delta S^*$ ,  $\Delta H^*$  and  $\Delta S^*$  values of the reaction were found to decrease simultaneously with increase in  $\Delta G^*$  value and this shows that the dioxan behaves as a entropy controlling solvent. The iso-kinetic temperature of the reaction is found to be 285, from which it is inferred that there is weak solvent-solute interaction in aquo-dioxan reaction media.

#### 54. Application of charged membranes in desalination of contaminated water

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As water demand is increasing across the globe, the quantity of wastewater produced as a result of various human activities is also growing, the World Water Development Report 2017 points out. However, it is in our interest, to make use of this water rather than lose it. Around the world, about 80 per cent of wastewater is released in the environment without proper treatment. This impacts our ecosystems and jeopardizes public health. With water demand growing in every sector from agriculture to industry, it is judicious to use wastewater after proper treatment to tide over water crisis. The impedance characteristics of parchment supported membranes have been analyzed to understand the mechanism of ionic transport through charged membranes under various conditions of bathing electrolyte concentrations and oscillator frequencies. The observed values of membrane resistance ( $R_m$ ), capacitance ( $C_m$ ) and impedance ( $Z$ ) were found to be dependent on the concentration of bathing electrolyte and applied oscillator frequencies. The results are interpreted in terms of changes produced in the electrical double layer at the membrane/electrolyte interface. The values of interfacial double layer capacitance derived by the equations of Armstrong and Longer were found to be different due to the presence of polarizing charge and other structural details of membrane matrix. The values of membrane resistance, capacitance and impedance have been computed by considering different equivalent electrical circuit models. The electrical impedance spectra have been found to deviate from the theoretical predictions at low frequencies due to non homogeneity and roughness of the membrane surface.

#### 55. Synthesis, molecular modelling, antibacterial and antiviral activity of some heterocycles bearing sulfonamide moiety

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A new series of heterocyclic molecules bearing sulfonamide linkage has been synthesized and screened for biological activity. During antibacterial screening using broth dilution method, molecules were found to be highly active (MIC value 50-3.1  $\mu\text{g/mL}$ ) against different human pathogens, namely *B. cerus*, *S. aureus*, *E. coli* and *P. aeruginosa*, and most effective against *E. coli*. A great synergistic effect was observed during determination of FIC where molecules were used in combination with reference drugs chloramphenicol and sulfamethoxazole. The MIC value of the combination—varying concentration of test compounds and  $\frac{1}{2}$  MIC of reference drugs or varying concentration of reference drugs and  $\frac{1}{2}$  MIC of test compounds was reduced up to  $\frac{1}{4}$  or  $\frac{1}{32}$  of the original value, indicating thereby the combination was 4-32 times more potent than the test molecule. The molecules also showed low degree of cytotoxicity against PBM, CEM and VERO cell lines. The results positively indicated towards the development of lead antibacterial using the combination approach. Docking with BaDHPS enzyme explained how certain moieties played significant role in biological activity. All compounds also possessed significant antiviral activity against yellow fever virus and hepatitis C virus with SI value of 80 and 15, respectively.

#### 56. Study of interplanetary and solar wind features with geomagnetic storms during ascending phase of solar cycle 23 and 24 at 1 AU

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The authors studied interplanetary shocks and interplanetary Coronal Mass Ejections (ICMEs) associated with Coronal Mass Ejections (CMEs) during ascending phase of solar cycle 23 (January 1996–December 2000) and 24 (January 2008–December 2012). These selected CMEs are originated from centre of solar disk within about  $\pm 30$  in longitude and latitude. Moreover, they are earth-directed CME (Holo/Partial Halo) and propagated approximately along the Sun-Earth line events. In particular, we give a detailed list of such events. In this present work, for selection of IP shock events, for solar cycle 24 and for solar cycle 23 and for solar cycle 24, we have 48 events and for solar cycle 23, we have 91 IP shock events. The given list, based on in-situ observations available at the OMNI data base, we consist a subsets of CMEs associated Flare and location, Interplanetary shock, and ICMEs corresponding with intense/ super-intense geomagnetic storms. These CMEs cover an initial speed range of  $\sim 260$ - $2700$  km/sec.

### **57. Study of initiation, CME-CME interaction, interplanetary consequences and geo-effectiveness of CME associated with major solar flare from AR NOAA 12673**

R. S. Gupta and Shirsh Lata Soni

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In this paper, the authors present the multi-wavelength analysis of a major X-class flare (X 9.3) that occurred in active region NOAA 12673 on September 06, 2017, during 11:53 UT to 12:10 UT. This event also produced a fast coronal mass ejection. Active region NOAA 12673 (or simply 2673) emerged at S09W30 on September 06, 2017, and grew rapidly to a large active region. Its maximum area was 1060 millionth of the solar hemisphere on 09 September. The group disappeared over the west limb of the Sun (S09W83) on 10 September. It was a fast emerging flux region. The group showed  $\beta \gamma \delta$  magnetic configuration. We identified their earliest signatures of eruption in AIA 94 Å images with activation and successive rapid expansion of hot channel- like structures from low coronal heights. On other hand the CME associated with this flare event gives rise the intense Dst at 1 AU ( $-142$ nT). The observation from the source active region to the corona, interplanetary medium and in-situ measurement at 1 AU, we identify complex processes of CME-CME interaction that have significantly contributed to make this event such geo-effective.

### **58. Study on bulk modulus of nanomaterials under pressure**

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It is well known that nanocrystals with free surface have considerable lattice contraction induced by the large surface/volume ratio. The lattice contraction increases as the size of the nanocrystals decreases. From a mechanical point of view, hydrostatic pressure on the surface induced by intrinsic surface stress results in lattice contraction or lattice strain. Due to this many effects happen, such as pressure ionization, modification in electronic properties, phase change, and several phenomena in applied fields. For this pressure versus volume relation of condensed matter known as Equation of State (EOS) is a vital input. In the present study an Equation of State (EOS) is derived for nanomaterials and is applied in different seven nanomaterials having low to high values of bulk moduli for this purpose, viz., 3C-SiC (30 nm),  $Zr_{0.1}Ti_{0.9}O_2$ ,  $\epsilon$ -Fe (10),  $TiO_2$  (rutile phase) (10 nm),  $TiO_2$  (anatase) (40 nm),  $Rb_3C_{60}$  and Diamond. The results have been critically analyzed and are found in good agreement with the available experimental data and are better than others results.

## **59. The study of molar volume and deviation in viscosity of binary mixtures of propyl amine with benzene and toluene at 301k ultrasonically.**

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The ultrasonic velocity, density and viscosity of binary mixtures of propyl amine with benzene and toluene at 301K have been measured. From these data isentropic compressibility, free length and molar volume have been calculated. The excess values of isentropic compressibility and viscosity have been investigated. The results have been analysed and interpreted in term of molecular interaction.

## **60. Role of science and technology in women empowerment**

Kanchan

*Teacher, Sarathuan School, Udvantnagar, Bhojpur, Bihar*

Empowerment is a multifaceted and multidimensional concept. It involves uplifting by enhancing skill and efficiency which include education, health, employment, economics dependences, literacy, awareness, self-control access and control on production resources etc. Empowering women influences them with greater self-respect and places them on an equal platform. Science and technology can act an important role in this direction. A gender neutral simple devices/equipment for crop production, garments production etc and their adoption by women will help in improving their position, economic condition, health care etc. For this, short term training is necessary. Women should be made friendly with technological activities. Like in education and politics, women should be given reservation in all their activities for their empowerment. National Institute of Science and Developmental studies, New Delhi has conducted study to assess the impact of new technologies on women's participants in agriculture.

## **61. Performance analysis of Slotted Swastika Shaped (SSS) microstrip antenna for ultra wideband applications**

Devesh Tiwari<sup>1</sup>, Anurag Mishra<sup>2</sup>, Mohd. Gulman Siddiqui,<sup>1</sup> Abhishek Kumar Saroj<sup>1</sup> and J. A. Ansari<sup>1</sup>

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Now a day microstrip patch antenna is very much popular because of it attractive feature as low weight, low profile, conformal and can be easily integrate into microwave integrated circuits etc. It can be used to a broad frequency range of 100 MHz to 100 GHz. Low gain and narrow bandwidth are two main disadvantage of microstrip antenna. In this design, a Slotted Swastika Shaped (SSS) microstrip antenna is analyzed Ultra-Wideband (UWB) wireless applications. The proposed microstrip antenna has been analyzed using High Frequency Simulation Software (HFSS). Initially a simple slotted swastika shaped structure is loaded on a patch. The multiband behaviour of antenna has been achieved along with UWB, Ku-band, and K-band applications. The proposed SSS antenna useful for entire UWB band (3.1 GHz to 10.6 GHz) which covers Bluetooth (2.45 GHz), Wi-Fi (2.4 GHz), WiMAX (3.3 to 3.8 GHz) and WLAN (5.15 to 5.825 GHz) etc. The antenna resonates at different frequencies 7.44 GHz, 13.87 GHz, 19.33 GHz and 28.10 GHz having return loss of -39.55 dB, -15.58 dB, -17.31 dB, -15.91 dB respectively. The radiation characteristics of designed antenna show that it has better UWB performances for wireless applications.

**62. Synthesis, characterization and biological studies of Fe(III), Co(II) and Ni(II) complexes of (E)-1-(phenyl(pyridin-2-yl)methylene) thiosemicarbazide**

S. N. Shukla, P. Gaur and Mohan Lal Raidas

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The new (E)-1-(phenyl(pyridin-2-yl)methylene)thiosemicarbazide Schiff base ligand have been synthesized by condensation of 2-benzoyl pyridine with thiosemicarbazide in 1:1 molar ratio in ethanol. Further the Fe<sup>3+</sup>, Co<sup>2+</sup> and Ni<sup>2+</sup> complexes were synthesized by reacting above ligand with metal chloride in 1:1/1:2 (Ligand : Metal) molar ratio in ethanolic medium. The ligand and their complexes were characterized by electronic, IR, magnetic susceptibility measurements and molar conductance. The magnetic moment and electronic spectral studies show a octahedral geometry of the complexes. Complexes and ligands were screened for their antibacterial activity against *E. coli*. All the complexes exhibit potential activity more than ligand.

**63. Palladium (II) complexes with no donor ligands: Synthesis, characterization, corrosion inhibition, antimicrobial screening, thermal, EPR and catalytic activity towards the suzuki reaction**

Satyendra N. Shukla, Pratiksha Gaur, Sanjay Singh Bagri and Ripul Mehrotra

*Coordination Chemistry Research Lab, Department of Chemistry, Govt. Science College, Jabalpur M.P.*

Three complexes of Pd (II) were synthesized with N-containing ligands derived from isonicotinylhydrazide with *p*-methoxybenzaldehyde/*p*-methoxyacetophenone/benzophenone. The compounds were characterized by elemental analysis, molar conductance, FT-IR, electronic spectroscopy, Thermo Gravimetric Analysis (TGA), ESR, <sup>1</sup>H-NMR and <sup>13</sup>C-NMR. The molecular structure and different quantum chemical parameters such as dipole moment and polarizability were calculated using the B3LYP basis set of Density Functional Theory (DFT) with the standard 6-311+G(d, 2p) level. The calculated HOMO and LUMO energies show that charge transfer occurs within the molecules. Compounds were screened for *in vitro* antimicrobial activity. The corrosion inhibition performance of ligands and complexes on mild steel in 0.1 M HCl solution was studied by weight loss measurement method. The influence of inhibitor concentration, solution temperature and immersion time on the corrosion of mild steel has been investigated. Synthesized complexes were screened for catalytic activity on suzuki reaction.

**64. Stability of multimetal–multiligands complexes formation equilibria in aquears involving IMDA as primary ligand and adenine as secondary ligand**

Shalini Verma\* and Vijay Krishna

*\*Department of Chemistry, University of Allahabad, Allahabad, U.P.*

Metallic complexes of multimetal–multiligands system are complicated for calculating equilibrium concentration in solution. Complexation equilibria have been deducted on the basis of speciation curves obtained through SCOGS computer programme. The formation constant of ternary (1:1:1) and quaternary (1:1:1:1) complexes of Co(II) Ni(II) Cu(II) and Zn(II) with INDA(A) and adenine (B) as ligands have been determined potentiometrically aqueous medium. Study of metal complexes of said ligands with respect to their stability, solution structure and quantative aspects have been done. Formation constant of the ternary and quaternary complexes were determined at 30±1°C and ionic strength I=0.1M NaNO<sub>3</sub>. Different concentration of species as a function of pH was examined and

sequence of overall stability constant for MA, MB, MAB and M1M2AB type of complexes have been discussed which seem to follow Irving =William order.

## **65. Technologies for sustainable rural development for better quality of life**

R. S. Gupta

*Department of Physics, Govt.P.G. College, Satna, M.P.*

More than 70% of the population is living in rural areas which dependent on agriculture for livelihood. Over 50% of the rural families who are not able to meet even the essential needs such as food, fuel, education, shelter and healthcare fall under the category of the poor. These rural poor pass through series of problems which affect their survival and quality of life. Basically these problems are livelihood, health, education and social development. There are many governments and non-government agencies engaged in providing sustainable livelihood to the rural poor. Over the years, a large number of activities have been identified in on-farm, off-farm sectors and non-farm activities. On-farm activities are crop production, horticulture, forestry, sericulture, livestock husbandry, fishery, agro service centres, and processing off-food and forest products, production of agricultural inputs: Biofertilisers, biopesticides, vermicompost, mushroom spawn production, seeds and plants, cattle feed etc. And off-farms activities are cottage industries viz pottery, smithy, carpentry, textile, production of building materials and services: Automobile hire and repairs, electrical works, civil construction, consumer stores. There is good scope for promotion of various income generating activities in the rural non-farm sector. These include the training of youth in masonry, carpentry, smithy, repairs of cycles and motor cycles, tractors, pump-sets, electrification and winding of motors, etc. subsequent to training, entrepreneurs need working capital and critical equipment to start their services, rope making and mat making by using locally available agricultural by-products and grass, bamboo crafts and utility articles, Production of housing materials, embroidery and tailoring, flour mills and oil seed expellers, establishment of grocery shops and food stalls, Promotion of commercial trees, medicinal trees plantation. Wasteland development and water resource development are also essential to ensure better quality of life. Good moral values and commitment for upliftment of the community are also important for their better quality of life. Therefore, the development strategy should aim at helping the rural families to come out of poverty by making the best use of the technologies and available resources.

## **66. ICT based applications for sustainable rural development**

Sanghamitra Mohanty and Surendranath Nayak

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Information and Communication Technology (ICT) is the call of the day, which can be used by human being through computers and robots for the development of the society. In every field of living like agriculture, banking, healthcare, social security, education, communication and ecosystems, use of ICT is being realized. Efforts are on to identify different aspects of the society and providing solutions for those areas of activity. One of the most important challenge among many are the illiteracy and poverty of people in rural sector for which the result of ICT applications find slow pace to reach the common man. Mother tongue based applications can be of use for such category of people to progress and participate aptly, while overcoming the digital divide. We have made some research for the development of such NLP based applications, in facilitating the need of people in different trades and treats of life. Image and Speech Processing based ICT applications can help the illiterate as well as visually challenged persons to get benefited like all others while uplifting the social status of the rural set.

## **67. Temperature variation of elastic constants of TiC and TiN crystals**

Jitendra Kumar<sup>1</sup> and Ravendra Singh<sup>2</sup>

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<sup>2</sup>*Department of Physics, Govt. P.G. College, Hamirpur-210310, U.P.*

A theory for evaluating the temperature variation of second third and fourth order elastic constants for face centred cubic crystal structure solids is developed on the basis of Coulomb and Born-Mayer potential using nearest-neighbour distance and hardness parameter. The theory thus obtained is first applied to get the higher order elastic constants for TiC and TiN crystals at different temperatures. Also the elastic constants thus obtained are used to evaluate the first order pressure derivatives of second and third order elastic constants. The graphical representations of results obtained have also been given to understand the effect of temperature on higher order elastic constants and their pressure derivatives.

## **68. The role of decision making problem in agriculture by using game theory technique**

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<sup>1</sup>*Department of Mathematics, P. N. College, Pusad, Yavatmal, Maharashtra*

<sup>2</sup>*Department of Zoology, P. N. College, Pusad, Yavatmal, Maharashtra*

The decision making problem and operation research problem can be described as the discipline of applying advance analytical methods to help making better decisions and has been around in the economics, forestry, agriculture etc. by using the traditional and modern technique by using game theory in agriculture.

## **69. Green energy in sustainability development**

Surendranath Nayak<sup>1</sup>, Rabi Narayan Behera<sup>2</sup> and Sanghamitra Mohanty<sup>1</sup>

<sup>1</sup>*Odisha Bigyan Academy, Saheed Nagar, Bhubaneswar-751007, Odisha*

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Conventional energy sources like oil, gas, coal etc cannot provide the required amount of energy in future for the developing society worldwide. To overcome the energy insecurity we should be well prepared and alternative energy sources are to be experimented and exploited. Solar energy, biological energy, wind energy and hydro energy, tidal energy, geothermal and ocean thermal energy are the alternatives to the fossil fuels, which is getting exhausted fast. Among different types of renewable energy Solar energy is having a wider application and appreciation till date. As per National Solar Mission by the ended of 13th five year plan in 2022 the capacity of 20,000 MW renewable energy is to be installed. We shall discuss the types and power of solar energy and wind energy used in Odisha and the sources of solar energy, harnessing of solar power and solar photovoltaic system and how they are of use in general. Emphasis is also given to the use of different types of green power in sustainability development of the society in this paper.

## **70. Design a reconfigurable antenna for wireless smart application based systems**

Abhishek Kumar Saroj

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In upcoming age, blooming technologies will developed beyond the all expectations. In recent few years, every field's technologies advanced very rapidly. Then it is very challenging task for researchers and engineers to balance technologies and nature. Communication is very essentials part of life, it exists from the millions years back from now. From the past communication developed too much, wired to wireless. Now every devices become a smart devices, those are not, that become wireless in upcoming future. But fact is that, if every devices become wireless then in nature a new type of problem arise called radiation. It can be minimized by making devices that radiates less radiation or user specific radiation. In this proposed article reconfigurable antenna is designed that has capability to reconfigure its frequency and polarization using PIN diodes. Reconfigure antennas plays a vital role for next generation communication systems. Reconfigure antennas built with artificial networks makes the communication systems very smart. Proposed article demonstrate reconfigurable antenna design and simulated results using High Frequency Structure Simulator (HFSS) tool. It also demonstrates how pin diode changes the entire characteristics of proposed reconfigurable antenna. Reconfigurable antennas radiates only specific direction according to design. Reconfigurable antennas works like multiple antennas within a single structure. It can be applied in remote sensing application, RFIDs, blue-tooths, defense, radars, mobile, smart homes, smart cities, smart road systems and medical field also.

## **71. HIV/AIDS problem and awareness in rural India**

Anuradha Singh

*Department of Chemistry, Sadanlal Sanwaldas Khanna Girls' Degree College (A Constituent College of the University of Allahabad) Allahabad-211003, U.P.*

Despite being world's third-largest population suffering from HIV/AIDS, the AIDS prevalence rate in India is much lower than in many other countries. As per the recently released report India HIV Estimation 2015, the adult HIV prevalence at national level has continued its steady decline from an estimated peak of 0.38% in 2001-03 through 0.34% in 2007 and 0.28% in 2012 to 0.26% in 2015. The total number of People Living with HIV (PLHIV) in India is estimated at 21.17 lakhs (17.11 lakhs–26.49 lakhs) in 2015 compared to 22.26 lakhs (18.00 lakhs-27.85 lakhs) in 2007. India is estimated to showing 66% decline in new infections from 2000 and 32% decline from 2007. Since 2007, when the number of AIDS Related Deaths (ARD) started to show a declining trend, the annual number of AIDS related deaths has declined by 54%. This decline is consistent with the rapid expansion of access to Highly Active Antiretroviral Therapy (HAART) in the country and proves that India is committed to achieving the Millennium Development Goals (MDGs) for HIV/AIDS.

## **72. Toxicological effect of mercuric chloride on the reproductive cycle of the Teleost fish (*Channa punctatus*)**

<sup>1</sup>M. D. Bharti and <sup>2</sup>Puspendra Singh

<sup>1</sup>*Department of Fluorosis and District Consultant C. M. & H. O. Office Dhar, M.P.*

<sup>2</sup>*Department of Zoology, Govt. P.G. College, Satna, M.P.*

It is well known fact that the synthetic chemical insecticides and pesticides have caused severe environmental damage before and after their use. Before their use, chemical factories spread pollution during their production and after their use, they are toxic to non-target organisms. Non-degradability, bioaccumulations and bio-magnifications cause them highly toxic to nature. Some plant species produce secondary metabolites. They are found in leaves, fruits, seeds, barks and roots of plant species. Chemically, secondary metabolites are anthrocyanins, anthroquinones, carotenoids, chalcones, alkaloids, coumestanes, deoxyflavones, flavanoids, litnoids tannins, steroids and rotenoids. Many secondary metabolites have been reported to be insecticidal or pesticidal effects by many scientists and workers. Plant origin chemicals are biodegradable and break down into non-toxic

substance in a short time period. Present paper deals with some local plant origin chemicals as ecofriendly green chemicals to reduce synthetic chemicals and pollutions. It is need of the day.

### **73. Synthesis, structural characterization and DFT studies of di- $\mu$ -oxidovanadium (V) complex $N_2O$ donor ligand**

Yogendra Pratap Singh

*Department of Chemistry, A. P. S. University, Rewa-486003, M.P.*

The Schiff base and its one di- $\mu$ -oxidovanadium (V) complex have been synthesized by the reaction of vanadyl sulphate pentahydrate and  $N'$ -[(Z)-phenyl(pyridin-2-yl)methylidene]pyridine-4-carbohydrazide (HL). The HL and complex  $[(L)VO(\mu-O)_2VO(L)]$  have been characterized by micro analysis, UV-Vis and electrochemical techniques. The ligand and complex have also been characterized by single crystal X-ray technique. The ligand crystallizes in triclinic crystal system with  $P\bar{1}$  space group while, complex crystallizes in monoclinic crystal system with  $P2_1/c$  space group. The electronic spectrum is as expected for vanadium (V) in an octahedral environment in each vanadium centres. The electronic structures of the ligand and the complex have been explained by Density Functional Theory (DFT) calculations.

### **74. Design and performance evaluation of soa based mzi structured all optical reversible full subtractor**

Kamal K. Upadhyay, Saumya Srivastava, Vanya Arun and Narendra K. Shukla

*Department of Electronics and Communication, University of Allahabad, Allahabad, U.P.*

This manuscript is an attempt to design all optical reversible arithmetic logic unit. Reversibility will not only help in reducing the errors at the receiving end but it will also increase the multitasking of the optical processors by reducing heat dissipation. At the receiving end of an optical network conversion of data from optical to electrical takes place for the processing purpose. This kind of processing of data dissipate huge amount of energy in form of heat. This problem can be solved by developing optical processing unit. This manuscript proposed the solution for above said problem. This kind of processors will simplify the processing by eliminating optoelectronic conversion but it will also minimize the problem of heat dissipation. The proposed model of combinational circuit is an attempt to implement the full subtractor in optical domain. The value of average quality factor for this proposed model is 57.98 dB while the average extinction ratio is 23.26 dB. Optical cost for this proposed model is 4.

### **75.A note on several growth indicators of composite entire functions and their related properties**

Sanjib Kumar Datta, Banani Dutta and Nityagopal Biswas

*Department of Mathematics, University of Kalyani, Kalyani, Nadia, W.B.*

Estimation of several growth indicators and their associated properties have been studied in this paper in the light of composition of entire functions. Few examples have been provided here in order to validate the results established.

### **76. Antioxidant and GC-MS evaluation of leaf extract of *cymbopogancitrus***

Priyambada Sharma and Gautam Jaiswar

*Department of Chemistry, Dr. Bhimrao Ambedkar University, Agra, U.P.*

Lemongrass is used for treating digestive tract spasms, stomach-ache, high blood pressure, convulsions, pain, vomiting, cough, achy joints (rheumatism), fever, the common cold, and exhaustion. It is also used to kill germs and as a mild astringent and this plant are also used for lemon grass are used for the treatment of bacterial and fungal infections, and stomach-ache and toothache, respectively. The present study was carried out to analyze the chemical composition of the ethanolic and n-hexanic extracts of leaves of *cymbopogancitrus* by GC-MS technique. The standard methods used for preliminary phytochemical screening and antioxidant activity of leaves extracts of ethanolic and n-hexane are determined by FRAP assay. The result shows that the phytochemical screening and TLC analysis shows the presence of phenolic compounds in high concentration, the ethanolic extract of lemon grass shows higher antioxidant activity as compared to the n-hexanic extracts. The phytochemical screening and GC-MS analysis shows that many useful compounds which are used in modern pharmacology are present in the leaves extracts of cannabis sativa.

#### **77. A note on several growth indicators of composite entire functions and their related properties**

Sanjib Kumar Datta, Banani Dutta and Nityagopal Biswas

*Department of Mathematics, University of Kalyani, Kalyani, Nadia-741235, W.B.*

Estimation of several growth indicators and their associated properties have been studied in this paper in the light of composition of entire functions. Few examples have been provided here in order to validate the results established.

#### **78. Kinetics and mechanism of Cd (II) ions on silicon (IV) oxide powder**

Vivekanand choudhary and Shriniwas singh\*

*\*Department of Chemistry, H. D. Jain College, V. K. S. University, Ara, U.P*

Present investigation evaluates the adsorption of Cd (II) ions on silicon (IV) oxide powder. Effects of various parameters such as adsorption dose, time, adsorbent concentration, temperature and  $P^H$  were studied. The adsorption of Cd (II) ions was examined by batch equilibrium technique. The equilibrium data, analysed by using Freundlich isotherm models, shows better agreement with the former model. Kinetics studies were conducted and the resulting data were analysed using first order equations. The result of this study proved high stability and reusability and of silicon (IV) oxide powder as an adsorbent for Cd (II) ions. Adsorption results show that the removal capacity increases with decrease in solution temperature 313 to 298K. The maximum adsorption capacity calculated from Freundlich isotherm were 67.61 for silicon (IV) oxide powder at optimum condition of pH 7.6 and contact time of 60 min.

#### **79. Kinetics of thermal decomposition of binary complexes of nickel and cadmium with some biologically important ligands**

Ravi Prakash and K. C. Gupta

*Deptment of Chemistry, B.S.A. College, Mathura-281004, U.P.*

The thermal decompositions of some nickel and cadmium complexes with crotonic acid and sarcosine were studied by thermogravimetry under non isothermal heating conditions. The pyrolysis experiments were performed at heating rate of 10°C/min in an inert atmosphere of nitrogen. The kinetic analysis of the thermo gravimetric data was performed by using the J. Zsako and Coats – Redfern methods. The order of reaction, activation energy (Ea), apparent frequency factor (log 'Z') and the apparent activation entropy ( $S^0$ ) were calculated by these methods and agree well.

## **80. Analysis of physico-chemical characteristics to assessment of pollution status of the Yamuna Kalpi stretch, U.P. India**

Manoj Kumar\*, P. K. Khare, Sadhana Chaurasia\* and Ravindra Singh\*

*\*M. G. C. Gramodaya Vishwavidyalaya Chitrakoot, Satna-485334, M.P. India Govt. Maharaja P. G. College Chhatarpur-471001, M.P.*

Analysis of physico-chemical characteristics to assessment of pollution status of the Yamuna river at Kalpi stretch, U.P., India was carried out for a period of one year in each month of every season. Four sampling stations were selected and established for sampling purpose. Collected samples were evaluated for fourteen physico-chemical parameters such as water temperature, pH, conductivity, turbidity, T.D.S., T.H., T.A., Cl, SO<sub>4</sub>, PO<sub>4</sub>, NO<sub>3</sub>, D.O., B.O.D. and C.O.D. Recorded average values of these physico-chemical parameters are compared with drinking water standards limit of WHO and BIS and irrigation water quality guidelines. Most of the parameters were found above the highest desirable limit during course of study. The study reveals that Yamuna water at Kalpi is unfit for drinking purpose without treatment but can be utilized for fish culture and irrigation purpose.

## **81. Variation in cosmic ray intensity with solar activity and its effect on earth atmosphere**

Bharti Nigam<sup>1</sup>, Pramod Kumar Chamadia<sup>1</sup> and C. M. Tiwari<sup>2</sup>

<sup>1</sup>*Department of Physics, Govt. Auto. P. G. College, Satna, M.P.*

<sup>2</sup>*Department of Physics, A. P. S. University Rewa, M.P.*

In the present work, we have studied the influence of cosmic ray intensity with solar parameters and their effect on earth atmosphere for the solar cycle 24. The study of earth atmosphere and solar activity with Cosmic Ray Intensity (CRI) has been analyzed with variation and correlation analysis for the solar cycle 24. The variation of sunspot number with CRI is in antiphase during the period 2008 to 2016. SSN and CRI are highly anticorrelated. Solar flare and CRI are also in antiphase. A positive correlation exists between CRI with Dst index and AE index but shows negative correlation with kp index for the period 2008 to 2016.

## **82. Removal of methylene blue dye from wastewater using zeolite synthesized from coal fly ash**

I. P. Tripathi<sup>1</sup>, M. K. Dwivedi<sup>2</sup>, Chanchala Alawa<sup>1</sup> and Priyanka Shrivastava<sup>2</sup>

<sup>1</sup>*Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot. M.P.*

<sup>2</sup>*Department of Chemistry, Govt. Holkar (Model, Autonomous) Science College, Indore, M.P.*

Zeolite was synthesized from coal fly ash by direct hydrothermal treatment with sodium hydroxide at different concentration ratios at temperature 550°C and activation time of 4 hrs. Characterization of coal fly ash and synthesized zeolite was done using XRD, SEM and FTIR. It was used as a low cost adsorbent for the removal of Methylene Blue dye from wastewater. Batch studies were carried out to study the effect of pH, adsorbent doses, adsorbate concentration, temperature and contact time. The results of batch studies revealed that the adsorption of Methylene Blue was strongly pH dependent and maximum Methylene Blue removal was observed at equilibrium pH of 8.0. Optimum adsorbent dose and contact time were found to be 5 g/l and 15 minutes respectively. Approx. 97 % of Methylene Blue was adsorbed at 50 mg/l at 30°C. Kinetic studies have been performed to have an idea of the mechanistic aspects of the process. The results also show that adsorption increases with increase in temperature thereby showing the process endothermic in nature. Adsorption data have also been correlated with both Langmuir and Freundlich isotherm models.

### **83. Relation between solar activity and cosmic rays during solar cycles 22-24**

Prithvi Raj Singh, C. M. Tiwari and S. L. Agrawal

*Department of Physics A.P.S. University, Rewa-486003, M.P.*

The sunspot number (SSN) and solar radio flux at 2800 MHz (F10.7cm) are excellent indicators of solar activity. A detailed analysis of solar activity (SSN & F10.7cm) vis-a-vis cosmic ray intensity of low and mid-cut-off rigidity neutron monitoring stations at Oulu (~0.85GV) and Moscow (~2.42GV) has been done. The trends in F10.7cm and SSN are found to be positively correlated having correlation coefficients, R, as 0.98, 0.97 and 0.94 during solar cycle 22, 23 and 24 respectively. The solar activity trend as inferred from SSN and F10.7cm variations are found to be strongly anti-correlated to the overall trend in cosmic ray intensity (CRI).

### **84. Parametric study of lined and unlined tunnels at shallow depths under coupled static and cyclic loading condition**

Swapnil Mishra<sup>1</sup>, Awantika Mishra<sup>2</sup>, K. S. Rao<sup>1</sup> and N. K. Gupta<sup>3</sup>

<sup>1</sup>, *Department of Civil Engineering, Indian Institute of Technology Delhi (IITD), New Delhi*

<sup>2</sup>*M.Tech Student, Department of Mechanical Engineering, Delhi Technological University (DTU), New Delhi*

<sup>3</sup>*Department of Applied Mechanics, Indian Institute of Technology Delhi (IITD), New Delhi*

In the present world, need for underground structures is grown many folds due to increasing population, advancement of public infrastructure, and scarcity of land. Underground facilities are an integral part of the infrastructure of modern society and are used for a wide range of applications. Also, they provide attractive alternatives for storage of explosives and other military hardware. Being at shallow depth, their potential impact on the environment and surrounding structures can be significant. Tunnels at depth is subjected to stresses resulting from the weight of the overlying strata and from locked in - stresses of tectonic origin. Due to sudden change in the overburden pressure either by further construction or demolition of the existing superstructure, deformation in the lining takes place along with the surrounding rock mass of tunnels at shallow depths. Therefore it is important to understand the surrounding material behavior for the safe and economical design of present day underground facilities. In the present work an attempt is made to simulate the in-situ condition through the physical modeling, to understand the tunnel deformation behavior under dynamic loading condition (cyclic) in soft rocks. It is observed that the tunnel fails at much lower loads under cyclic loading conditions.

### **85. Analysis of fluid film thickness between tribo pairs of cylinder liner and piston ring**

Awantika Mishra\* and R. C. Singh

*Department of Mechanical Engineering, Delhi Technological University (DTUD), New Delhi*

The engine is one of the most widely used machines in today's era, which consists of a number of components many of which can be accounted as tribological pairs such as bearings, transmissions, gears, pistons, clutches, to wiper blades, tires, and electrical contacts which accounts to frictional losses of the engine. A one dimensional analysis for the lubrication between the tribo pairs of piston ring and cylinder liner has been developed. The piston ring is treated as a reciprocating, dynamically-loaded bearing with combined squeeze and sliding motion. A combined elliptical-parabolic profile has been assumed of that of piston ring and modeled for calculations. Equations have been developed for the aforementioned profile through MATLAB coding. These equations give us a better understanding to which the degree the variables (or parameters) so considered are varying. A numerical procedure is then developed to obtain the cyclic variations of fluid film thickness with the

crank angle. Also it was further utilized to determine the hydro-dynamic fluid film pressure over the span of piston ring. It will help in determining the power loss because of friction which can be determined with the help of physical apparatus.

#### **86. Importance of strength anisotropy in numerical analysis**

Ankesh Kumar<sup>\*</sup>, Swapnil Mishra and K. S. Rao

*Department of Civil Engineering, Indian Institute of Technology Delhi, Delhi*

Shale/Oil shale is a compact laminated rock of sedimentary origin containing organic matter known as kerogen which yields oil when distilled. These rocks are highly anisotropic in nature due to the presence of laminations. Anisotropy, which is characteristic of laminated rocks such as shale, is due to a process of metamorphic differentiation. Preferred orientation of minerals in response to depositional process makes shale rocks foliated. Further, the anisotropic nature affects the engineering properties of rocks. Therefore, it is very important to understand the physico-mechanical behavior of such anisotropic rocks. In the present work an attempt is made to understand the engineering behavior of shales. The physical and mechanical properties of these rocks are reviewed. These properties are further used in the numerical simulation of tunnel consisting of shale seam under In-situ stress state.

#### **87. Synthesis of a low cost activated carbon as highly efficient Adsorbent for the removal of heavy metals, its spectroscopic, thermodynamic and isotherm study**

Vriddhi Nigam<sup>a</sup>, Neetu Sharma<sup>b</sup>, M. C. Chattopadhyaya<sup>a</sup> and A. K. Srivastava<sup>b</sup>

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In the present study a low cost adsorbent has been prepared for the removal of heavy metal from the aqueous solution. For this purpose, dried biomass of corn ear silk (*Zea mays*) has been used for the preparation of activated carbon by acid activation method. To study the functional group and surface morphology, adsorbent was characterized by Fourier Transform Infrared Spectrophotometer (FT-IR), Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). Batch mode experiments were conducted choosing specific parameters such as pH, adsorbent dose, contact time and metal ion concentration in single metal system. Equilibrium data were fitted to Langmuir and Freundlich isotherm models. The thermodynamic parameters such as change in Enthalpy ( $\Delta H$ ) Entropy ( $\Delta S$ ) and Gibbs free energy ( $\Delta G$ ) of adsorption systems were determined and evaluated. It has been found that synthesized adsorbent has strong affinity for the adsorption of heavy metal. % removal of metal has been found to be pH sensitive and also depends on the sorption concentration and time of equilibration.

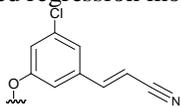
#### **88. QSAR based molecular modeling of pyrimidine derivatives as novel and potent HIV-1 NNRT Inhibitors.**

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Quantitative relationship between structural and molecular properties with biological activity of pyrimidine derivatives as Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTIs) was studied to ascertain the factors that affect their biological activity. In the present analysis, quantum chemical

parameters based on density functional theory, Topological and physicochemical parameters were calculated. In the present Quantitative Structure-Activity Relationships (QSAR) study, we have performed stepwise Multiple Linear Regression Analysis (MLRA) and have selected the statistically significant molecular descriptors. Based on selected descriptors, the significant QSAR models were constructed. The calculated regression models suggest that the presence of 5-Cl atom, 5-F atom at R<sub>1</sub>



position and substituent at R<sub>3</sub> position is highly beneficial for the activity. Model equations were cross-validated by leave one out (LOO) technique. Based on statically significant model obtained in the present QSAR analysis, pIC<sub>50</sub> values were calculated for new HIV-1 NNRT inhibitors.

### 89. Detection of heavy metals and HPTLC fingerprints profile of Madar (*Calotropis procera* (Ait.) R.Br.)- root

Utkarsh Tripathi, Prahlad Pandey and Manoj Sharma

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Madar or Arka (*Calotropis*), is distributed two species – *Calotropis procera* and *Calotropis gigantea*. Both species are found throughout the world, but the *Calotropis procera* is more common which has purple flower while the *Calotropis gigantea* has whitish flower. *Calotropis procera* (Ait.) R.Br. Fam. Apocynaceae is widely used medicinally in folklore medicinal system from since Vedic period. It is commonly known as Arka in ayurvedic medicinal system where Madar in Unani medicinal system. All parts of the plant are used to treat various human ailments like ringworm, guinea worm blisters, scorpion stings, venereal sores ophthalmic disorders, teeth ach, cough, whooping cough, dysentery, headache, jaundice, sterility, swellings, asthma, snakebite and also preparation of ayurvedic compound formulations like Shoolhar tail and Arkelavana. The present communication provides a detailed account of the detection of heavy metals and HPTLC fingerprints profile carried out on *Calotropis procera* root. The study includes preliminary phytochemical investigation, development of High Performance Thin Layer Chromatography (HPTLC) fingerprints profile and traces of metals along with toxic heavy metals viz. Pb, Cd, As and Hg. Established parameters can be used as standards for quality control of finished products and also quality, safety and efficacy of ayurvedic compound formulations.

### 90. Physicochemical characteristics and some heavy metal levels in soils around bauxite mining dumps in village of Jaitwara of Satna district, M.P. state of India.

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Some physicochemical characteristics and levels of heavy metals in soil samples around bauxite mining waste dumps in villages of Jaitwara of Satna district of M.P. state were analysed by conventional analytical methods while atomic absorption spectrophotometer was employed for analyzing heavy metals in soil samples. The results of physicochemical analysis showed that the pH values in the villages range from 7.01 to 7.22 indicating neutral to slight alkalinity of the soils. The soil organic matter ranged from 0.18 to 0.20% indicating low value. The high conductivity values ranging from 220-260  $\mu\text{scm}^{-1}$  indicated significant presence of some soluble inorganic salts in soils studied. The heavy metal levels for soils in Sant Tola and Khutaha respectively were (mg/kg) 43.5 and 41.7 for Cr, 39.7 and 37.5 for Ni, 12.9 and 16.8 for Co, 78.7 and 79.8 for Zn, 22.5 and 22.6 for Pb,  $34.5 \times 10^3$  and  $36.6 \times 10^3$  for Fe and  $17.1 \times 10^3$  and  $14.6 \times 10^3$  for Al and 13.7 and 12.6 for Ag. The results from the contamination index indicated a significant degree of soil contamination for Pb, Al, Zn and Cu in the soils studied showing a higher degree of contamination for these metals. It can be

inferred from the results that metals dispersed from mine wastes are likely retained in the areas which have been used for agriculture.

### **91. Effect of sulphuric acid on kinetics and thermodynamics oxidation of non-polar amino acid (valine) by N-bromophthalimide in aqueous acetic acid medium**

Mamta Soni

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Effect of sulphuric acid on kinetics and thermodynamics oxidation of non polar amino acid (valine) by N-bromophthalimide in aqueous acetic acid medium was carried out in aqueous acetic acid medium at 318 K. The reaction follows pseudo first-order kinetics in  $[NBP] \ll [valine] [H^+]$  condition i.e. the order with respect to  $[H_2SO_4]$  is one. In the catalytic effect of  $H_2SO_4$ , it is probable that  $H^+$  ions might be affecting the rate. The study completely discarded the formation of complex and rules out the involvement of free radicals. The slightly accelerated with decrease in dielectric consted of the medium. The plot of  $\log k_1$  vs.  $10^3/D$  were obtained linear with positive slope in valine. The stoichiometric determination revealed 1:1 mole ratio involved in oxidation of valine – NBP system. The study reveals that the reaction velocity retarded with increase in solvent composition. Activation parameters and thermodynamic frequency factor (A), enthalpy of activation ( $\Delta H^\ddagger$ ), free energy of activation ( $\Delta G^\ddagger$ ) and entropy of activation ( $\Delta S^\ddagger$ ) have been from Arrhenius plot and Exner's isokinetic plot by studying the reaction at different temperature were computed. A plausible mechanism from the results of kinetic studies reaction, stoichiometry and product analysis has been proposed.

### **92. Structural, free radical scavenging activity and $\alpha$ -glucosidase inhibition of newly synthesized complexes of copper (ii) with l-cystein, methionine and threonine**

Aarti Kamal

*Research Scholar, MGCGV, Chitrakoot, Satna, M.P.*

A new series of closely related yet distinct dinuclear Cu (II) complexes, obtained upon subsequent complexation with all these ligands, are investigated for their structural properties and for their ability to exhibited effective  $\alpha$ -glucosidase inhibition. These activity studies are mainly focused on evaluating antioxidant activity. The complex of L-theonine effective on the proton release in DPPH assay with an  $IC_{50}$  value of  $92.17 \mu M$  and also exhibited the highest activity in ABTS scavenging with an  $IC_{50}$  of about  $61.07 \mu M$  for L-cysteine amongst the synthesized metal complexes. A perusal of the data reveals that these complexes of Cu (II) with L-methionine show effective alpha-glucosidase activity exhibits.

### **93. Titanium dioxide (TiO<sub>2</sub>) nanoparticles augment allergic airway inflammation and Socs3 expression via NF- $\kappa$ B pathway in murine model of Asthma**

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<sup>2</sup>*Department of Microbiology, Swami Vivekanad University, Sagar, Madhya Pradesh*

Titanium dioxide (TiO<sub>2</sub>) nanoparticles (NPs) are generally considered non-toxic both *in vitro* and *in vivo*; however, their adjuvant potential has been reported to cause allergic sensitization and modulate immune responses. In the present study we investigated the status of Stat3/IL-6 and Socs3 in TiO<sub>2</sub> exposed asthmatic lungs and their relationship with NF- $\kappa$ B, key signal molecule in inflammation. TiO<sub>2</sub> when administered with ovalbumin (OVA) during sensitization phase augmented Airway Hyper-Responsiveness (AHR), airway remodeling and Th2 dependent immune response. At the same

time, the observed significant elevation in the levels of Stat3, Socs3, NF- $\kappa$ B, IL-6 and TNF- $\alpha$ . Furthermore, transient *in-vivo* blocking of NF- $\kappa$ B by NF- $\kappa$ B p65siRNA downregulated the expression of Socs3, IL-6 and TNF- $\alpha$ . Our study, thus, shows that TiO<sub>2</sub> NPs exacerbate the inflammatory responses in lungs of pre-sensitized allergic individuals and that these changes are regulated via NF- $\kappa$ B pathway rather than Jak/Stat pathway as found in allergic asthma. The current study therefore implies that NF- $\kappa$ B could be employed as a more efficacious target for pharmaceutical intervention for blocking/avoiding deleterious side effects of TiO<sub>2</sub>-induced acute as well as chronic inflammatory reactions, thereby improvising new therapeutic measures.

#### **94. Remote sensing and GIS based analyses of land cover change and its impacts on regional sustainable development**

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Policy and decision making in the context of sustainable development requires rapid, effective and efficient access to and integration of appropriate current information from a wide range of sources and disciplines, including land cover dynamic information derived from remotely sensed data. The analysis of data from high spatial resolution satellite sensors has potential in land cover monitoring. In this paper, a post-classification method is used to detect land cover change from multi-temporal satellite data, and particular attention is given to the selection of an appropriate method for land cover classification. The use of a Geographic Information System (GIS) allows further spatial analysis of the data derived from remotely sensed images and analysis of the impact of land cover change on regional sustainable development. The results thus provide very useful information to local government for decision making and policy planning.

#### **95. Entropy maximization problem in network using Dijkstra's-Floyd Warshall Algorithm**

Pawan Kumar Gupta

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The shortest path problem is to find a path between two vertices on a given graph, such that the sum of the weights on its constituent edges is minimized. The classic Dijkstra's algorithm was designed to solve the single source shortest path problem for a static graph. It starts working from the source node and analyze the shortest path on the whole network. This work aims to develop a Hybrid algorithm Dijkstra's - Floyd Warshall algorithm to solve entropy maximization routing protocol problem. Entropy is relative level of Randomness. It is specifically relative to the greatest sensible information speed in bps. When we increment the entropy then it additionally expanded the many-sided quality of flag mistake. It is likewise specifically corresponding to commotion and data transfer capacity. The Hybrid algorithm i.e. Dijkstra's - Floyd Warshall algorithm has to find the shortest path between the source and destination nodes. Route guidance algorithm is use to find best shortest path in routing network, this is poised to minimize costs between the origin and destination nodes. The proposed algorithm is compared with the existing in order to find the best and shortest paths.

#### **96. Seismic retrofitting for sustainable rural construction and outlining earthquake tips**

Ravikant Shrivastava

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Earthquakes are known to occur since time immemorial for their suddenness in occurrence and severe losses of life and property. Constructing simple and economical earthquake resistant structure has advantages even over prediction of earthquake, which would save or at least delay collapse. Experience has shown that collapse of masonry buildings- which is a very common form of rural dwellings also, is the single largest factor contributing to the huge losses. Heavy weight, small or no tensile strength and brittle behavior, small shearing resistance, lack of proper bonding between longitudinal and cross walls and poor workmanship are the weaknesses of such construction. Construction of new, retrofitting of old and restoration of damaged buildings require consideration of various concepts needed for adequate safety against earthquake, economy and hence sustainable construction. In this context this paper discusses lessons from earthquake, seismic restoration and retrofitting of buildings and then outlines about a series on earthquake tips by the Indian Institute of Technology Kanpur (IITK) and the Building Materials and Technology Promotion Council (BMTPC) on basic concepts of earthquake resistant constructions through simple language.

### **97. Statistical assessment of the heavy metals pollution of water and sediment in the river Mandakini**

R. K. Shukla, G. S Gupta and D. P. Singh

*Faculty of Science and Environment Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya Chitrakoot, Satna, M.P.*

The objective of this study was to apply Principal Component analysis and cluster classification techniques to identify the interrelation among a set of the heavy metals concentration Fe, Cd, Pb, Cr, As and Hg as potential contaminants of river Mandakini in Chitrakoot and identify the underlying structure of those variables. Water samples were collected from six different sites of river Mandakini. For the determination of total heavy metals in the samples, procedures described in APHA (2012) was followed. The principal components analysis in most examined groups showed that the first component described the change of the heavy metal contents. Other main components emphasized variously the meaning of a given parameter. The results of PCA analysis were in accordance with the results of correlative analysis. Metals analysis of Mandakini river water and sediment was carried out by using multivariate statistical techniques such as Principal Component Analysis (PCA), hierarchical cluster analysis.

### **98. Study of Einstein field equations in the presence of spatially homogeneous and anisotropic Bianchi type-I cosmological models**

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We study some exact solutions of Einstein field equations in the presence of spatially homogeneous and anisotropic Bianchi type-I cosmological models. To obtain the deterministic models, suppose that the deceleration parameter  $q$  is a simple linear function of Hubble's parameter  $H$  i.e.,  $q = -1 + \beta H$  (where  $\beta$  is a constant), which provide scale factor  $a$  as  $a = e^{\frac{1}{\beta}\sqrt{2\beta t+k_3}}$  (where  $k_3$  is a constant). The Universe model shows a transition from initial decelerating phase to present accelerating phase. It is observed that the model approaches isotropy at late times. The models are found to be compatible with the results of astronomical observations.

### **99. Studies on efficient bulk hetero junction hybrid solar cell based on n-type $(Zn_{(1-y)}Cu_{0.1y}S)_{0.5}Cd_{0.5}S$ nanoparticles and p-type HCl doped polypyrrole structure**

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An attempt have been made in the present work to synthesis and characterization of bulk heterojunction solar cell with using doped zinc blend based semiconducting quantum dots and HCl doped polypyrrole prepared by a simple wet chemical precipitation method. Formation of semiconducting quantum dot has been ascertained by X-ray Diffraction (XRD), UV-visible Spectroscopy, Transmission Electron Microscopy (TEM) and Impedance Spectroscopy measurements. XRD studies confirmed that all the prepared samples are in zinc-blende phase and in quantum dot regime. Dopants Copper and Cadmium cause a shift in diffraction peaks towards lower diffraction angles with linear increase in lattice constant values. UV-visible studies reveal decrease in optical band gap of the QDs with co-doping of Cd & Cu ion in ZnS lattice though band gap energy is higher than that of corresponding bulk material due to quantum confinement effect and alloyed formation of nanoparticles. TEM pictures reaffirmed nanocrystalline nature of samples with size ranging 2 to 6 nm supporting XRD result. Mott-Schottky analysis revealed n- type conductivity of as prepared semiconducting QDs with increase in band bending for different quaternary zinc blend configuration respectively. To test the utility of these materials in solar cell application, bulk heterojunction hybrid solar cells were fabricated in 1cm X 1cm size with p type HCl doped Polypyrrole. Solar cells with quaternary zinc blend  $\{(Zn_{(1-y)}Cu_y)_x Cd_{0(1-x)}S\}$  structure under AM 1.5 illumination resulted in highest conversion efficiency of 4.6 % to 5.2 %. Present studies reveal importance of II-VI group of semiconductor in design and performance of hybrid bhj solar cell structure.

#### **100. Semi separation axioms in fuzzy biclosure spaces**

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<sup>1</sup>*M. G. C. G. V. Chitrakoot, Satna, M.P.*

<sup>2</sup>*V. S. S. D. College, Kanpur, U.P.*

The purpose of this paper to find the separation axioms in fuzzy biclosure spaces using fuzzy semi open sets. In this paper we have followed the definition of fuzzy biclosure space which is based on Birkhoff's closure operator. Using the fuzzy semi open sets we introduced the concept of fuzzy semi  $T_0$ , fuzzy semi  $T_1$ , fuzzy semi  $T_2$ . We see that these definitions satisfy the basic desirable properties viz. hereditary, productive and projective and "good extensions" of the corresponding concepts in a biclosure spaces. We also define fuzzy semi regular space, fuzzy semi normal space. We find the characterization of these spaces. Here fuzzy semi  $T_4 \Rightarrow$  fuzzy semi  $T_3 \Rightarrow$  fuzzy semi  $T_2 \Rightarrow$  fuzzy semi  $T_1 \Rightarrow$  fuzzy semi  $T_0$ .

#### **101. Treatment of Reactive Black 5 azo dye solutions by advanced oxidation process**

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Advanced oxidation process for treatment of azo dye solution containing Reactive Black 5 was investigated. In this study advanced oxidation process like ozonation was used to treat unbuffered and buffered azo dye solution. Reactive Black 5 azo dye was selected due to high solubility in the aquatic environment as pollutants. Ozonation effects on Chemical Oxygen Demand (COD) removal, dye concentration removal and decolorization. Fifty percent reduction in COD was obtained after 10 minutes of ozonation of Reactive Black 5 synthetic dye solutions. It has been also observed that COD of Reactive Black 5 was increasing after 10 minutes of ozonation due to the formation of degradation by-products. The effect of buffer solution on the dye solutions was further studied and results have been demonstrated for removal of organic matters from azo dye solutions.

## **102. Identification of Ganga river course changes and impact on local settlements in Gazipur district using remote sensing and gis technology**

Shashank Tripathi\*, Atul Tiwari

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Mahatma Gandhi Chitrakoot Gramoday Vishwa Vidyalay, Chitrakoot, Satna M.P.*

River Ganga is a sacred river and treated as a Goddess among the Hindus. It has significant influence on the life of the Indians. It is one of the longest river of the world and is the longest river in India. It has the largest river-basin in India covering 8, 38,200 sq. km. It has three distinct courses of flow; the upper course, the middle course and the lower course. As it is known that any river has the natural flow of water from upland to plane land. The flow characteristics depend on the various factors of nature i.e. source of water, climatic condition, and topography, type of soil, geology, forest, land use/land cover and human activities. The present paper will focus on course change with societal perspective of Ganga river in nearby bank of Ghazipur. Changes in river channel such as bank erosion, down cutting, and bank accretion are natural processes for an alluvial river. Regional developments such as sand mining, infrastructure construction on the riverbanks, artificial/natural cutoffs, bank revetment, reservoir construction and land use alterations have changed the natural geomorphologic dynamics of rivers. Change detection of riverbanks is such a study that is facilitated by application of RS, GIS and GPS. Remote sensing and GIS techniques are widely used for detection and monitoring of changes of the physical environment. The Ghazipur stretch of river is a glaring testimony of such phenomena. In the present paper we have analysed the shifting course of river Ganga using Remote Sensing and GIS techniques. For the change detection, we have used Landsat and Aster satellite images of 03 different years starting from 2001 to 2016. Multi-temporal maps were generated for 03 different years and shifting of river course is calculated using these satellite images. Finally shifting in course of river Ganga near Ghazipur district for 03 years is given in meters. Due to the changing of course, many settlements situated in the near by the bank of river have lost their existence due to vertical and lateral erosion by river water during and just after the rainy season.

## **103. Assessment of groundwater potential zone using geospatial technique in Jhansi district a part Bundelkhand region, Uttar Pradesh**

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Remote Sensing and GIS has become one of the best tools in the field of Water Resource Research, which helps in assessing, monitoring, and conserving groundwater resources. A case study was conducted to find out the groundwater potential zones in hard rock terrain of Jhansi district a part of Bundelkhand region, Uttar Pradesh, India. The thematic maps such as lithology, slope, contour, geomorphology, soil, land use / land cover, lineament, lineament density, drainage, drainage density map were prepared by using the Resource sat (IRS P6 LISS III) data and Survey of India (SOI) toposheets of scale 1:50,000 and integrated in GIS for the study area. All the thematic maps were assigned in a separate weight (raster format) and superimposed by weighted overlay method (rank and weightage wise thematic maps) in Arc GIS 10.2.2. From the analysis the five groundwater potential zones–Excellent, Excellent to good, good to moderate, moderate to limited and limited to poor were identified.

## **104. Deciphering groundwater potential zones in hard rock terrain using geospatial technology**

Tripathi Shashank

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Ground water is a major source of drinking water to the rural population in India. The spatio-temporal variations in rainfall and regional/local differences in geology and geomorphology have led to uneven distribution of groundwater in different regions across the country. Remote sensing and Geographical Information System (GIS) has become one of the leading tools in the field of groundwater research, which helps in assessing, monitoring, and conserving groundwater resources. This paper mainly deals with the integrated approach of remote sensing and GIS to delineate groundwater potential zones in hard rock terrain of Bundelkhand region. Digitized vector maps pertaining to chosen parameters, viz. geomorphology, geology, land use/land cover, lineament, relief, and drainage, were converted to raster data. The raster maps of these parameters were assigned to their respective theme weight and class weights. The individual theme weight was multiplied by its respective class weight and then all the raster thematic layers were aggregated in a linear combination equation in Arc Map GIS Raster Calculator module. Moreover, the weighted layers were statistically modeled to get the areal extent of groundwater prospects with respect to each thematic layer. The final result depicts the favorable prospective zones in the study area and can be helpful in better planning and management of groundwater resources especially in hard rock terrains.

#### **105. Sustainable rural development with the application of spatial information technology**

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Information technology has emerged as an inevitable phenomenon influencing every walk of life in all sections of in the present society. With the ease of availability of enormous computing power and convenient access to large volume and variety of data and information, the structure functions of all human organizations will undergo profound transformation in this century. Planning is a widely accepted way to handle complex problems of resources allocation and decision making. Lack of spatial information in rural and regional level is one of the main problems for development practitioners and government officials and local level planners. Timely and reliable information on cost effective manner in spatial and temporal domain, which can act as a reliable base line information on natural resources at scale ranging from regional to micro levels, can be generated by geographic information system (GIS), which can help for integrated analysis of natural resources inventory, management and planning the strategy for sustainable development and stand as a power effective administrative and management tool as decision making. This article focuses on long-term development plan for everyone in the planning environment. The principal application of GIS in rural development are land and resource mapping, integration of local and scientific spatial knowledge, Community-Based Natural Resource Management (CBNRM), area planning, environmental management and natural hazards. The information generated from such studies can be applied by decision makers and planners for sustainable development of the rural area.

#### **106. Effect of graphene and silicon dioxide nanoparticles on growth, yield and photosynthetic pigments of lead stressed green gram [Vignaradiata (L.) Wilczek]**

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India is the largest producer and consumer of pulse in the world, accounting for 35.7% percent of global production and 15 % consumption. Green gram is one of the most important pulse crops for protein supplement in subtropical zones of the world. The pollution of agricultural lands due to heavy metals causes serious problems to the environments. Lead (Pb) caught more attention because of their long persistence in soil and cause extremely toxic effects on both the production of crops and on human health due to consumption of crops. Silicon dioxide (SiO<sub>2</sub>) and graphene nanoparticles are known for having many beneficial effects on plants like alleviation of heavy metal toxicity, enhancing crop growth and antioxidant activities. Keeping these views in mind a pot experiment was conducted to study effect of graphene and silicon dioxide nanoparticles on growth, yield and photosynthetic pigments of Pb stressed green gram. Two varieties of green gram (IPM 99-125 and PDM-139) were subjected to different Pb stress (25, 50 and 100 ppm). Graphene (500 and 1000 ppm) and silicon dioxide (50 and 100 ppm) nanoparticles were applied through foliar application. Growth and yield parameters along with photosynthetic pigments contents were observed. Results showed that Pb stress led to reduced growth, yield and photosynthetic pigments. Reduction was in accordance with the increase in Pb concentration. Among the nanoparticles SiO<sub>2</sub> nanoparticles (100 ppm) showed more positive results in all the treatment than both concentrations of graphene nanoparticles, SiO<sub>2</sub> nanoparticles (50 ppm) and control. The results from present investigation coincided with the conclusion that SiO<sub>2</sub> nanoparticles can alleviate Pb toxicity and has more involved in metabolic or physiological change of green gram grown under Pb stress condition than graphene nanoparticles and they can increase growth, yield and physiological parameters under untreated soil.

#### **107. Effect of silver and titanium dioxide nanoparticles to control *Fusarium oxysporum* sp. *ciceri* on chickpea**

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A study was conducted to examine the potential antifungal activity and protective effect of some nanoparticle in controlling *Fusarium* wilt of chickpea. Titanium dioxide and silver nanoparticles were investigated against pathogenic fungi isolated from chickpea roots, *Fusarium oxysporum* sp. *ciceri* in *vitro* and *in situ* conditions. Results showed that the both NPs tested with concentration investigated TiO<sub>2</sub> (25, 50 and 100 ppm) and Ag (5 and 10 ppm) increased the *in vitro* fungal growth inhibition by reducing the radial fungal growth with the best effective was recorded with the highest concentration. Additionally, TiO<sub>2</sub> NP (100 ppm) was the most effective in decreasing mean radial growth by 51.25 %, while AgNPs was most effective and decreased sporulation (number of conidia) of *Fusarium oxysporum* sp. *ciceri* by 44.04%. Based on the obtained results the use of titanium dioxide and silver nanoparticles could be a good environmentally safe alternative of fungicides in controlling *Fusarium* wilt disease of chickpea. Titanium dioxide NPs (50 ppm) and silver NPs (10 ppm) concentration shows the best result in all the growth and biochemical parameters.

#### **108. Composite membranes for biosensor fabrication**

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The realisation that the nanoscale has certain properties, needed to solve important medical challenges and cater to unmet medical needs, is driving nanomedical research. Nanobiosystems research is a priority in many countries and its relevance within nanotechnology is expected to increase in the future. Cellulose Acetate as polymeric material and polymeric membrane has been used for the applications in diverse areas such as fibers, films, laminates, adhesives, coatings, plastic products, etc. Moreover to increase the potential compatibility, optical and mechanical properties it is frequently used as composite membrane. Cellulose Acetate composite membranes have propounded a platform for the membranous support to the electrode in potentiometric biosensors. All the functional characteristics of a potentiometric biosensor depend on the membranous support. The outcome will explore the role of functional materials and eco-friendly substances in the fabrication of potentiometric biosensors. Results obtained after potentiometric measurement shows lower detection limit, less response time and better sensitivity.

#### **109. A new method development and validation of lambda-cyhalothrin by high performance liquid chromatography (HPLC)**

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This paper describes the development of new method of lambda-cyhalothrin by HPLC for the pesticide residues analysis. The analysis was performed by using a dionex ultimate 3000 machine with Photo Diode Array (PDA) detector the wavelength was set at 230 nm. The separation is carried on RP-18 package and 250 × 4.6 mm internal diameter column and 5 µm particle size, acetonitrile-water (60:40, V/V) as a mobile phase at the flow rate of 1 ml/min. The analysis is completed at room temperature. The straight graph shows the linearity of method also the LOQ and LOD obtained for lambda-cyhalothrin are very acceptable. Validation studies answered that this proposed HPLC method is simple, specific, rapid, reliable and reproducible. This method is proved to be easily performed and time saving and can be applied in the pesticide residue analysis.

#### **110. Synthesis and characterization of Fe<sub>3</sub>O<sub>4</sub>-Aspa functionalized magnetic nanoparticles for copper ions removal**

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The functionalized magnetic nanoparticles as an adsorbent to meet the challenges in the treatment of wastewater. The Fe<sub>3</sub>O<sub>4</sub>-Aspa functionalized magnetic nanoparticles were synthesized and characterize by using modern characterization techniques. Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Transmission Electron Microscopy (TEM) were conducted to characterize surface and textural properties of the Fe<sub>3</sub>O<sub>4</sub>-Aspa. The adsorption behavior of the nanoparticles towards Cu (II) was carefully explored using adsorption isotherms and kinetic studies. The various environmental factors such as pH, adsorption dose contact time, and temperature were investigated in removal of Cu (II) ions. The adsorption desorption studies were also carried out and found satisfactory result.

#### **111. Higher-order sub-poissonian photon statistics in displaced Kerr states**

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The photon statistics of optical field is preserved during the evolution of the field in a nonlinear Kerr medium. However the photon statistics may not be preserved when the nonlinear Kerr medium is placed in one of the arm of Mach-Zehnder interferometer and the reflection coefficients of the interferometer mirrors, intensity of interacting optical field and interaction time are chosen appropriately. In the present paper, we study higher-order sub-poissonian photon statistics of the output field of Mach-Zehnder interferometer initially in coherent state interacting with a non-absorbing non-linear Kerr medium placed into one arm of the interferometer. The interaction of optical field with Kerr medium has been modelled as an anharmonic oscillator, described by well-known interaction Hamiltonian,  $H = \frac{1}{2}\lambda a^{+2} a^2$  Here, the parameter  $\lambda$  is proportional to cubic non-linearity  $\chi^{(3)}$  of the nonlinear medium,  $a$  and  $a^+$  are, respectively, the annihilation and creation operators for the interacting field. We find that the output of Mach-Zehnder interferometer exhibits higher-order sub-poissonian photon statistics depending on the intensity of interacting optical field, interaction time  $\tau \equiv \lambda t$  and the reflection coefficients of the interferometer mirrors. The variations of photon statistics within the optical domain of realistic values of Kerr non-linearity and intensity of interacting optical field have also been discussed.

## **112. Studies on synthesis, characterization and antimicrobial activity of some mixed ligand complexes**

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A series of Transition metal complexes of Co(II), Ni(II) and Cu(II) of the general composition  $(ML^1L^2)$  where (M=Co(II), Ni(II) and Cu(II),  $L^1$ = Diphenylamine 2-hydroxy-carboxylic acid, (DPHC),  $L^2$ = Benzohydroxamic acid (BHA), N-p- hydroxybenzalidien-2-aminopyridine (HBAPy) have been synthesized. These complexes were characterized by elemental analysis, molar conductance, molecular weight determination, IR, electronic spectra and magnetic measurements. Molecular weight determination of these complexes indicates their monomeric nature. Octahedral structure has been proposed on the basics of electronic spectra and magnetic measurement reveals octahedral geometry around the metal ion. The complexes were found to non-electrolytic in nature on the basics of low value of molar conductance. The anti-microbial activities of these derivatives have been studied by screening them against bacteria like *Staphylococcus aureus* and *Escherichia coli* and fungi like *Aspergillus nidulece* and *Condida albicans* by Serial dilution method. The result revealed that all the metal complexes are more biological active than the ligands taken in this study.

## **113. Performance evaluation of high speed dwdm free space optic communication system under different atmospheric turbulence**

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Free space optical communication is an advanced telecommunication technology and has wide area of applications due to its easy installation, low cost and better security. It is a replacement of optical fiber for providing services in an optical network. In this work, Performance of the Dense Wavelength Division Multiplexing (DWDM) over Free Space Optical (FSO) communication system at 10Gbps data rate is investigated under different weather conditions in terms of BER, Q factor, SNR and received power. By the use of optical amplifier maximum link distance is achieved with acceptable bit error rate.

#### **114. Antennas for biomedical applications**

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Biomedical engineering today holds a prominent place as a means of improving medical diagnosis and treatment, and as an academic discipline. In recent days insulin pumps, deep brain stimulations and endoscopy are few examples of medical applications that can take advantage of remote monitoring system and body implantable unit. Body implantable device are widely used as monitoring blood pressure and temperature. Antennas can be implanted in the human body or just be mounted over the skin flat muscle to form a bio-communication system between medical devices and exterior instruments for short range biotelemetry applications. Role of antennas in diagnosis of medical ailments include various medical applications such as MRI (magnetic resonance imaging)/fMRI (functional MRI), biomedical telemetry and WCE (Wireless Endoscopy).

#### **115. Computer aided designing and anti-HIV potential of indoline-2, 3-dione (isatin) analogues as Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTIs)**

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To qualify as a Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTIs), a compound must interact specifically in the non-substrate binding site of the reverse transcriptase (RT) of HIV-1, and inhibit the replication of HIV-1 at a concentration that is significantly lower than the concentration required affecting normal cell viability. NNRTIs are promising drugs for the treatment of HIV. On the basis of Lipinski's rule of five, compounds having drug like character have been docked into the active site of HIV virus type 1 RT using the software DS 2.5. Analysis of the docking result reveals that all molecules form hydrogen bonds with amino acid Lys 101, Lys 104 and exhibit  $\pi$ - stacking interaction with Tyr 181 and Tyr 318 present in the non-nucleoside inhibitor-binding pocket (NNIBP). The designed ligands have adopted butterfly conformation inside the NNIBP and formed more stable complexes with HIV-RT.

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