

Update

A research communication



**Extended abstracts of
research papers of Thapar
University faculty published
in SCI Journals**

Editorial Note

Dear Reader

We are pleased to inform the publication of 'Update' - a Thapar University research communication from this semester, with an objective, to share, with the outside World, the research conducted by the Thapar University faculty.

The frequency of the newsletter will be twice a year - one in summer and the other in winter, and it will be brought both as a hard as well as a soft copy enabling it to reach a large number of readers.

The 'Update' will include 'extended abstracts' of the research papers published in SCI journals in the last semester. However, this issue, being the first one, contributions from the last two semesters - January to December 2010, are being included.

Each issue of the 'Update' will cover the research facilities and the research conducted in one of the TU research labs as well.

We invite your feedback and suggestions; please send in your comments to update@thapar.edu.

I am thankful to the members of the editorial board for their active and proactive support to bring this issue. I am also thankful to Mrs Parveen for secretarial support; Mr Rakesh for technical support; and Mr Abhishta for design of update.

N.K. Verma

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Sustainable Binder for Building Materials from Biological Sources

Building materials such as concrete and brick are processed at high temperatures and transported through a long distance. High energy requirement for the process contributes to huge emission of CO₂. It is predicted that rapid growth in building industry would increase CO₂ emission by two folds in ten years. Nature, on the other hand, builds and heals structures with locally available material at ambient conditions. Anthills and coral reefs hold significant clues towards a sustainable building technology for human habitat.

Natural construction techniques require dramatically lower energy. They also have the enviable property of self healing. Although adoption of all these attributes into human construction is a distant dream there are some early signs of bio-inspired materials that enhance the human building materials. The authors describe a novel technique using biomineralization of calcite using *Sporosarcina pasteurii*. However, the method can be far too expensive and slow for practical use.

The authors demonstrate the methods of increasing efficiency and cost reduction. Expensive laboratory nutrients have been replaced by industrial effluents that are considered potential pollutants such as lactose mother liquor and corn steep liquor. The efficiency of the process has been improved through mutagenesis. It is observed that microbial action reduces the porosity of concrete, particularly near its surface, and reduces ingress of moisture and chloride ions. Thus reinforced concrete samples exhibited reduction in mass loss of the reinforcing bars and increase in their pull-out strength when exposed to harsh corrosive conditions. The current work demonstrates that biocalcification by *S. pasteurii* can at least partially replace the industrial binders and provide a more sustainable alternative.

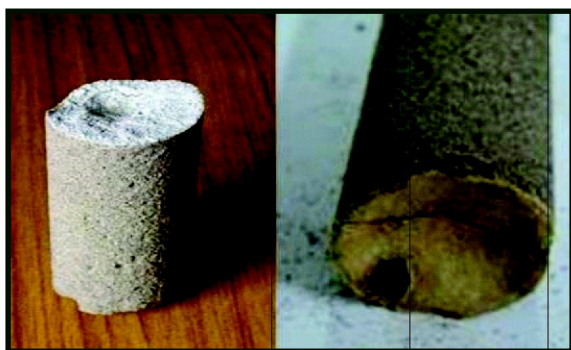


Fig.: Sand columns cemented with microbes

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3. **Achal V., Mukherjee A., Reddy M.S.,** Biocalcification by *Sporosarcina pasteurii* using corn steep liquor as nutrient source. *Industrial Biotechnology*, Vol. 6(3) 170-174, 2010.



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Use of Fly Ash as Soil Amending Agent

Fly ash, a resultant of combustion of coal at high temperature, has been regarded as a problematic solid waste all over the world. Many possible beneficial applications of fly ash are being evaluated to mini-mize waste, decrease cost of disposal and provide value-added products. The conventional disposal methods for fly ash lead to degradation of arable land and contamination of the ground water. However fly ash is a useful ameliorant that improves the physical, chemical and biological properties of problem soils and is a source of readily available plant macro and micronutrients. In conjunction with organic manure and microbial inoculants, fly ash enhances plant biomass production from degraded soils. Electrostatic precipitator (ESP) fly ash obtained from a thermal power plant was mixed with a slightly alkaline soil on w/w basis for use as a potting mixture for poplar nursery and investigated for its influence on microbial activity and soil physical properties. Application of fly ash as an amendment @ 10% was found to be optimum for bacterial population, soil dehydrogenase activity and microbial biomass. Water holding capacity of fly ash amended soil was increased and bulk density was decreased as result of fly ash addition as compared to unamended soil. The suitability of fly ash to be used as a soil ameliorant in nursery plantations attains significance from the point of view of eco-friendly disposal of fly ash.

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1. **Kohli,, Jala S, Goyal D.,** Effect of fly ash application on some physical properties and micro-bial activities. *Acta Agrophysica*. 16(2): 327-335, 2010.
2. **Sudha Jala Kohli and Goyal D.,** Effect of ESP fly ash on physical properties of ultisol of Orissa. *Indian Journal of Environmental Protection* 30 (8): 648-652, 2010.
3. **Sudha Jala Kohli and Goyal D.,** Effect of fly ash on Lac Z +ve bacteria in soil. *Indian Journal of Environmental Protection* 30 (11): 940-942, 2010.

Removal of heavy metals from waste water by microbial systemsa

Discharge of heavy metals from metal processing industries is known to have adverse effects on the environment. Conventional treatment technologies for removal of heavy metals from aqueous solution are not economical and generate huge quantity of toxic chemical sludge. Biosorption of heavy metals by metabolically inactive non-living biomass of microbial or plant origin is an innovative and alternative technology for removal of these pollutants from aqueous solution. Due to unique chemical composition biomass sequesters metal ions by forming metal complexes from solution and obviates the necessity to maintain special growth-supporting conditions. Biomass of *Aspergillus niger*, *Penicillium chrysogenum*, *Rhizopus nigricans*, *Ascophyllum nodosum*, *Sargassum natans*, *Chlorella fusca*, *Oscillatoria angustissima*, *Bacillus firmus* and *Streptomyces* sp. have highest metal adsorption capacities ranging from 5 to 641 mg g⁻¹ mainly for Pb, Zn, Cd, Cr, Cu and Ni. Biomass generated as a by-product of fermentative processes offers great potential for adopting an economical metal-recovery system.

Removal of heavy metals (Pb²⁺, Zn²⁺) from aqueous solution by dried biomass of *Spirulina* sp. was investigated. *Spirulina* rapidly adsorbed appreciable amount of lead and zinc from the aqueous solutions within 15 min of initial contact with the metal solution and exhibited high sequestration of lead and zinc at low equilibrium concentrations. The specific adsorption of both Pb²⁺ and Zn²⁺ increased at low concentration and decreased when biomass concentration exceeded 0.1 g L⁻¹. The binding of lead followed Freundlich model of kinetics where as zinc supported Langmuir isotherm for adsorption with their r² values of 0.9659 and 0.8723 respectively. The adsorption was strongly pH dependent as the maximum lead biosorption occurred at pH 4 and 10 whereas Zn²⁺ adsorption was at pH 8 and 10.

Bioaccumulation of chromium by living biomass of different filamentous fungi isolated from biocontaminated diesel was in the order of *Aspergillus terricola* > *Aspergillus niger* > *Acremonium strictum* > *Aureobasidium pullulans* > *Paecilomyces variotii* > *Aspergillus foetidus* > *Cladosporium resinae* > *Phanerochaete chrysosporium*. Non-living fungal biomass had higher potential for metal removal than living cells. More than 90% removal of chromium(VI) was observed by non-living biomass of *P. chry-sosporium* from multimetallic synthetic solution as well as chrome effluent bringing down the residual concentration to 0.1 mg l⁻¹ in the effluent, which falls within the permissible range. Removal of Cr(VI) by *P. chrysosporium* was rapid from synthetic multi-metallic solution whereas from chrome effluent it took longer duration to achieve same level and was not affected by the presence of other metallic species such as Fe, Zn, Ni in the solution. Fourier transform infrared (FTIR) spectral analysis revealed presence of carboxylate and amine functional groups on the cell surface, which were involved in chromium binding.

Removal efficiency of Cr (III) and Cr(VI) from aqueous solution and tannery effluent by microbial waste biomass was studied in batch mode. Various parameters including biomass dosage (0.25-2%), pH (2-6) of the solution, different concentration of chromium (5-50mg/l) and contact time were standardized. 97.81% of Cr(III) removal was observed by MB1 and 72.38% by MB2 at pH 4.0. Increase in contact time from 0.08 to 4 h led to an increase in Cr(III) removal from 40-70% in both MB1 and MB2. Maximum 65% of Cr(III) removal was observed within first 2 h, which represents the time at which equilibrium of chromium biosorption is presumed to have been attained. MB1 (*Aspergillus* sp.) was most effective for Cr(VI) removal (93%) than MB2 (*Streptomyces* sp.) (84.6%). Adsorption of Cr(VI) was pH-dependent and showed maximum removal at an optimum pH of 4.0 with adsorbate dosage of 1%. Increase in the initial Cr(III) concentration and contact time were found to increase Cr(VI) removal.

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1. **Aneja RK., Choudhary, G., Ahluwalia, SS and Goyal, D.,** Biosorption of Pb²⁺ and Zn²⁺ by non-living biomass of *Spirulina* sp. *Indian Journal of Microbiology* 50 (4):438-442, 2010.
2. **Indu Sharma and Dinesh Goyal,** Adsorption Kinetics: Bioremoval of trivalent chromium from tannery effluent by *Aspergillus* sp. *Biomass. Research Journal of Environmental Sciences* 4(1) 1-12, 2010.
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Factors affecting in vitro formation of cormlets in *Gladiolus hybridus* hort. and their field performance

The modern day gladioli are a complex assemblage resulting from the extensive natural and artificial hybridisation and are valued for magnificent spikes in myriad of colours and long vase life. Many new hybrids with novel floral architecture and colour combinations are being developed. These new cultivars are propagated through corms/cormels, and can be produced in only limited numbers causing inevitable delays before these can reach the commercial growers. Further, repeated cycles of vegetative propagation in the field result in decline in the performance of cultivars. Therefore, lifespan of such commercially important cultivars becomes limited, which can be extended by maintaining disease-free propagules in culture. Therefore, the present study was focused on production of cormlets in culture. The effect of number of important factors on in vitro cormlet formation has been investigated in *Gladiolus hybridus* Hort. Sucrose concentration of 232 mM in the medium was found to be best for producing higher number of cormlets per flask, whereas, the average mass of a cormlet increased with increase in sucrose concentration. Amongst three cultivars (cvs), maximum number of cormlets produced per flask was recorded in cv 'Her Majesty', but the average cormlet mass was higher in case of cv 'Bright Eye'. Incubation temperature also influenced cormlet formation. Although the number of cormlets produced was found to be marginally higher at 30 °C when compared with 20 °C, the average cormlet mass was higher at the lower temperature. Both, the number of cormlets formed per culture flask as well as the average fresh mass of a cormlet increased with increase in the size (volume) of the culture flask used.

The known inhibitors of gibberellin biosynthesis used in this study suppressed cormlet formation, and the maximum inhibition was recorded in case of maleic acid hydrazide. Polyamines were found to be beneficial for cormlet formation, and amongst the polyamines used, incorporation of spermidine in the culture medium resulted in maximum number of cormlet formation per culture flask. Field trials indicated that the performance of such in vitro produced cormlets was comparable to that of conventionally produced cormels of the same weight range. The plants raised from in vitro produced cormlets were found to be morphologically similar to the mother plant.

Reference:

Kumar A, Palni LMS, Sood A., Factors affecting in vitro cormlet formation in *Gladiolus hybridus* Hort. and evaluation of field performance of cormlets. *Acta Physiologiae Plantarum* 33:509-515, 2010.

Scientific paper

Without publication, science is dead.

- Genard Piel

Factors affecting in vitro propagation and field establishment of *Chlorophytum borivillianum*

Chlorophytum borivillianum is a traditional medicinal plant belonging to family Liliaceae. Poor regeneration and seed germination in the natural habitat was responsible for being endangered species. Subsequently, attempts were made for the conservation of this species both through conventional methods including domestication, cultivation and in vitro approaches. Attempts have been made to develop protocol for in vitro propagation, however there are clone specific variations and still these protocols are required to be refined for commercial micropropagation. Therefore, the present study was aimed to investigate the role of some of the important factors such as plant growth regulators (PGRs), gelling agents, sucrose concentration, heat shock treatment, etc., which may influence the commercial micro-propagation of *C. borivillianum*. Amongst the various PGRs used, benzyladenine (BA) was found to be better cytokinin over kinetin (KN) for shoot multiplication. Sucrose concentrations from 116 - 290 mM in the basal medium (BM) promoted shoot multiplication. Heat shock (50 °C, 1 h) also promoted shoot multiplication at these sucrose concentrations on both BM medium and BM supplemented with 5.0 µM BA. Beneficial effect of sucrose was also observed on rooting of shoots on BM as well as BM supplemented with 5.0 µM IBA. Phytigel as a gelling agent was found to be more effective for shoot proliferation and growth compared to agar. Amongst various soil mixtures tested, higher survival of plants was observed in soil containing vermicompost. It was interesting to note that a maximum plant survival (> 95 %) was observed when plants were directly transferred to nethouse (irradiance reduced to 50 % with green net, without humidity and temperature control) than polyhouse (with humidity and temperature control). Random amplified polymorphic DNA (RAPD) and inter simple sequence repeat (ISSR) analysis of regenerated plants showed genetic similarity to that of mother plant.

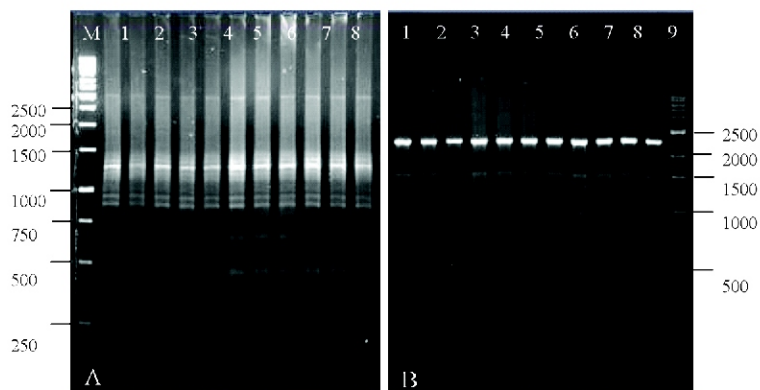


Fig.: RAPD profiles of micropropagated plantlets and mother of *C. borivillianum* plant using two different primers (A & B) Lane 1: Mother plant; Lane 2-11: regenerated plants; Lane M: 1 kb molecular weight markers

Reference:

Kumar A, Aggarwal D, Gupta P and Reddy MS, Factors affecting in vitro propagation and field establishment of *Chlorophytum borivillianum*. *Biologia Plantarum* 54(4): 601-606, 2010.



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Shoot organogenesis in elite clones of *Eucalyptus tereticornis*

Eucalyptus (Family Myrtaceae), due to its growth, broader adaptability and multipurpose wood is most widely planted in the tropical and subtropical part of the world. It comprises of over 700 species and *Eucalyptus tereticornis* is widely grown in India. It is an important source of fuel wood, timber and raw material for pulp and paper industry. Although it is most favoured species, its productivity in India is low, and many elite clones with superior growth and better wood quality with respect to pulp and paper industry has been selected from seed raised population. Further, there is a requirement of need-based improvement of these clones, which can be achieved through trait specific genetic manipulations. In order to undertake an effective genetic improvement programme, an efficient regeneration (through shoot differentiation and/or somatic embryogenesis) protocol is required.

In this study an efficient shoot organogenesis system has been developed from mature plants of selected elite clones of *Eucalyptus tereticornis* Sm. Cultures were established using nodal explants taken from freshly coppice shoots cultured on Murashige and Skoog medium containing 58 mM sucrose, 0.7% (w/v) agar (MS medium) and supplemented with 2.5 μM benzyladenine (BA) and 0.5 μM α -naphthaleneacetic acid (NAA). Shoot organogenesis was achieved from leaf segments taken from elongated microshoots on MS medium supplemented with 5.0 μM BA and 1.0 μM 2,4-dichlorophenoxyacetic acid (2,4-D). The addition of cefotaxime to the medium promoted shoot differentiation, whereas carbenicillin and cephalixin inhibited shoot differentiation. Maximum shoot bud organogenesis (44.6%) occurred in explants cultured on MS medium supplemented with 5.0 IM BA, 1.0 IM 2,4-D and 500 mg/l cefotaxime. Leaf maturity influenced shoot regeneration, with maximum shoot organogenesis (40.5%) occurring when the source of explants was the fifth leaf (14-16 days old) from the top of microshoot. Shoot organogenic potential also varied amongst the different clones of *E. tereticornis*. Random amplified polymorphic DNA (RAPD) and inter-simple sequence repeat (ISSR) analyses indicated clonal uniformity of the newly formed shoots/ plants, and these were also found to be true-to-type.



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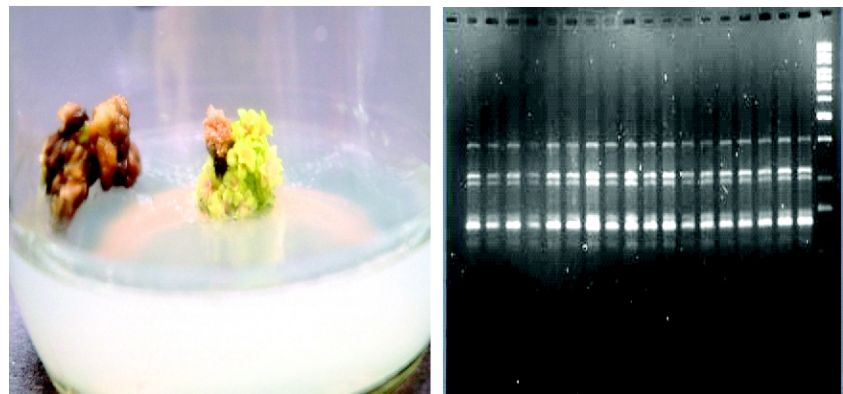


Fig.: Shoot organogenesis from leaf explant of *E. tereticornis* on MS medium supplemented with 5.0 M BA and 1.0 M 2,4-D. RAPD profile of regenerated plantlets and mother plant of *E. tereticornis*

Reference:

Aggarwal D, Kumar A and Reddy M.S., Shoot Organogenesis from elite plants of *Eucalyptus tereticornis*. *Plant Cell Tissue and Organ Culture* 102:45-52, 2010.

Agrobacterium tumefaciens mediated genetic transformation of selected elite clone(s) of Eucalyptus tereticornis

Plantation forestry, with optimized and increased productivity is the major source of wood products for many purposes. The increase in forest productivity and refinement of wood quality through genetic manipulations is becoming increasingly important. Plant genetic transformation offers an attractive alternative to conventional breeding, because it provides the potential of incorporating novel trait specific gene(s) into selected genotypes without affecting their desirable genetic combination. Therefore, the present study was aimed at to develop an efficient protocol for Agrobacterium tumefaciens mediated T-DNA delivery into the tissues taken from selected E. tereticornis elite clones and subsequent regeneration of transformed shoots. Amongst two strains of A. tumefaciens namely, EHA105 and LBA4404 (harboring pBI121 plasmid), strain EHA105 was found to be more efficient. Pre-culturing of tissue (2 days) on medium supplemented with 100 µM acetosyringone, before bacterial infection significantly increased transient expression of reporter gene (GUS). Co-cultivation period of 2 days and a bacterial density of 0.8 OD600 resulted in higher transient GUS expression. Method of injury to tissue, presence of acetosyringone in co-cultivation medium and photoperiod during co-cultivation also influenced the expression of transient GUS activity. Among the three clones tested, maximum transient GUS activity was recorded in clone 'CE2' followed by clone 'T1'. Regeneration of transformed shoot was achieved on modified Murashige and Skoog medium (potassium nitrate was replaced with 990 mg/l potassium sulphate and ammonium nitrate with 392 mg/l ammonium sulphate, and mesoinositol concentration was increased to 200 mg/l). Stable transformation was confirmed on the basis of GUS activity and PCR amplification of DNA fragments specific to uidA and nptII genes. The absence of bacteria in the stable transformed tissues was confirmed by PCR amplification of fragment specific to 16S rRNA of bacteria.

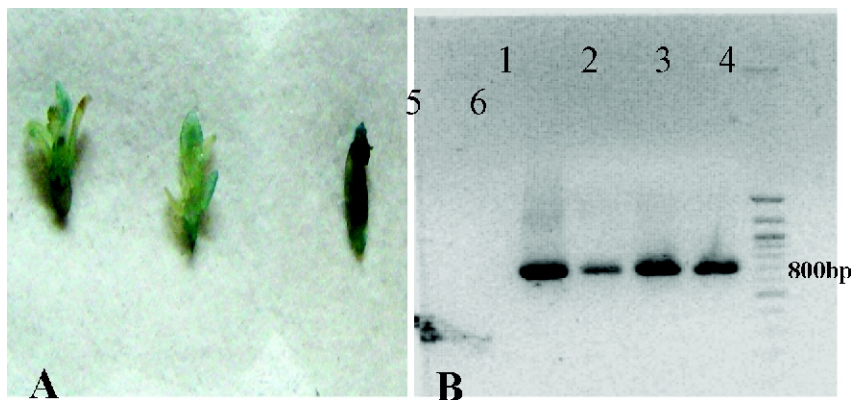


Fig.: A Transformed E. tereticornis shoots showing Stable GUS activity after 8 cycles of subculture
B. Amplification of nptII gene (~760bp) from genomic DNA of transformed tissue Lane-1: Negative control (Non-transformed tissue) Lane-2: Positive control (amplification from pBI121) Lane- 3: Amplification from DNA of transformed Callus Lane 4/5: Amplification from DNA of transformed Shoot
Lane-6: 100bp DNA ladder

Reference:

Aggarwal D, Kumar A, Reddy MS, Agrobacterium tumefaciens mediated genetic transformation of selected elite clones of Eucalyptus tereticornis. Acta Physiologiae Plantarum: DOI 10.1007/s11738-010-0695-3, 2010.



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Pentachlorophenol Degradation By Bacteria In The Secondary Sludge Of Pulp And Paper Mill

Chlorinated phenols are major environmental pollutants discharged from pulp and paper mill. Among the chlorophenols, pentachlorophenol (PCP) is expected to be recalcitrant to aerobic biodegradation due to its high chlorinated ring structure. PCP is in the list of priority of pollutants of EPA and the safe permissible limits of PCP in water are 0.30 mg/L. However pulp and paper mill effluent contains far above the permissible limit of PCP even after the treatment at industrial scale. Chemical and physical-based clean-up methods have some disadvantages, including their high costs and the possibility of causing secondary pollution. A large variety of bacteria are known which can utilize chlorophenols as a carbon and energy sources under aerobic conditions. In this investigation, we have isolated and characterized different bacteria which are capable of degrading high concentrations of PCP.

Pentachlorophenol (PCP) degrading strains such as *Bacillus* (CL3, CL5, and CL11), *Pseudomonas stutzeri* (CL7) and *Kocuria* sp. were isolated from the secondary sludge of a pulp paper mill and characterized. These isolates were identified based on their 16S rRNA sequence analysis. These isolates were able to grow and utilize PCP as a carbon and energy source. HPLC analysis and stoichiometric release of chloride in the medium confirmed the degradation ability of these isolates. The removal efficiency of PCP by these bacterial isolates was highly significant and they were able to degrade more than 90% of PCP when grown at high concentration of PCP (600 mg L⁻¹). The removal efficiency of PCP by the bacterial isolate used in this study was found to be more efficient than what has been reported with other species. These results suggest that the bacterial isolates are very effective PCP degraders and can be used in remediation of PCP-contaminated sites.

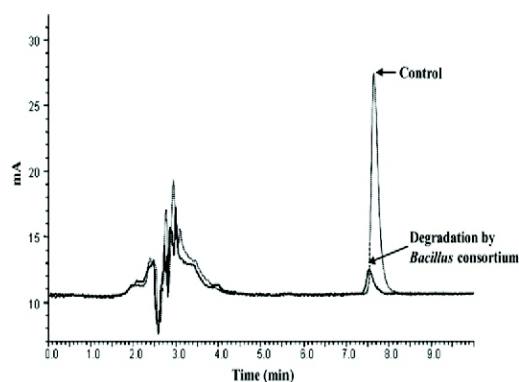


Fig.: HPLC chromatogram showing PCP degradation in sludge by the consortium of *Bacillus* species.

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1. **Santosh K. Karn, S.K., Chakrabarty and M. S. Reddy**, Characterization of pentachlorophenol degrading *Bacillus* spp. from secondary sludge of pulp and paper Industry. *Int. J. Bio-deterioration and Biodegradation* 64: 609-613, 2010.
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Biotransformation and biofortification of selenium in seleniferous environments

Our research group at Department of Biotechnology and Environmental Sciences has been associated with studies on selenium bioremoval, transformation and natural fortification by Se tolerant biota, since year 2004. The major focus of the research work was to examine the concentration, accumulation and speciation profile of selenium in biological systems such as bacteria and crop plants present in seleniferous region of Punjab. The initial focus of the group was to exploit the potential of selenium tolerant bacterial isolates to mobilize selenium from soils and to understand the mechanisms of biological transformations.^{1,2} Further studies were carried to characterize the biotransformed forms of selenium, leading to demonstration of biogenesis of selenium nanoparticles. This work also led to evidences on mobilization of selenium by the Se tolerant bacteria from the Se-enriched soils and its accumulation in plants.³ The on-going work at the lab is aimed at understanding the environmental and biological speciation of selenium from seleniferous region of Punjab. As a part of the study, the selenium levels have been quantified in crop produce such as rice, wheat, maize and mustard; and their post harvest residues.⁴ In addition, detailed speciation studies have been carried out in few grain varieties and their processed food materials. In addition, our recent research interests also include mobilization and fortification of selenium of Se rich agri-residues to edible mushrooms with ultimate aim to exploit pharmaceutical/neutraceutical properties of selenium rich crop and mushrooms.

Reference:

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4. **Cubadda F, Aureli A, Ciardullo S, D'Amato M, Raggi A, Acharya R, Reddy AVR, Tejo Prakash N,** Changes in selenium speciation associated with increasing tissue concentration of selenium in wheat grain. *Journal of Agriculture and Food Chemistry*, 58: 2295-2301, 2010.

Title

First impressions are strong impressions; a title ought therefore to be well studied, and to give, so far as its limits permit, a definite and concise indication of what is to come.

- T. Clifford Allbutt



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Solving the Problems of Recycled Fiber Processing with Enzymes

The pulp and paper industry has started applying new, ecologically sound technology (biotechnology) in its manufacturing processes. Many interesting enzymatic applications have been proposed. Implemented technologies tend to change the existing industrial process as little as possible. Enzymes have great potentials in solving many problems associated with the use of recycled fiber, especially related to deinking, drainability, hornification, refining, and stickies. Based on the promising results of mill-scale trials, several mills in the world have started using enzymes for deinking. The potentials of cellulase enzymes have also been demonstrated for reducing the energy requirement in pulp refining, improving the machine runnability and stickies control when using recycled fiber. They have the important benefits in that they can be considered a "green" product. They are natural occurring compounds with little adverse impact on the environment. This paper deals with the importance of recycling of paper, problems associated with the recycling, and potentials of enzymes in solving these problems. A few case studies have also been included.



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Bajpai, P.K., Solving the problems of recycled fiber processing with enzymes, BioResources 5(2), 1311-1325, 2010.



Degradable Polymeric Material For Packaging

Polymers are widely used because of their easy processability, low density and desirable physical, chemical, mechanical, thermal, and electrical properties. Traditional applications of synthetic polymers are mostly based on their inertness to environmental degradations (hydrolysis, oxidation, biodegradation, etc.). Biodegradable polymers are necessary in the design, synthesis and applications of biomedical implants, drug release systems and packaging applications. Mixing of two or more polymers to produce blends by common processing steps is today a well-established approach for obtaining suitable materials for specific end-uses. Specific applications of biodegradable blends have drawn marked attention in offering an attractive route to further improve environmental waste management.

The polythene bags were playing havoc with the environment. These were also a heavy burden on the systems of agriculture, sewerage and disposal of waste water. Authors demonstrate development of biodegradable polymer and its biodegradability studies. Besides biodegradability, the technical developments made in the research process, could have significant advantages for the final consumers and contribute to the solution of technical, economical and environmental issues in specific market areas.

Melt blending of linear low density polyethylene (LLDPE) and polylactide (PLLA) was performed in an extrusion mixer with post extrusion blown film attachment with and without compatibilizer - grafted low density polyethylene maleic anhydride. Varying degrees of property modifications were achieved by blending these polymers. Many of these blends are immiscible or only partially miscible and need compatibilizers to increase their compatibility. The authors developed polymeric blends having optimum performance properties based on poly (L-lactic acid) using linear low density polyethylene (LLDPE) that are partially degradable under some specific environmental conditions and investigated the effect of PLLA composition & compatibilizer content on the thermal and degradation properties of blends.

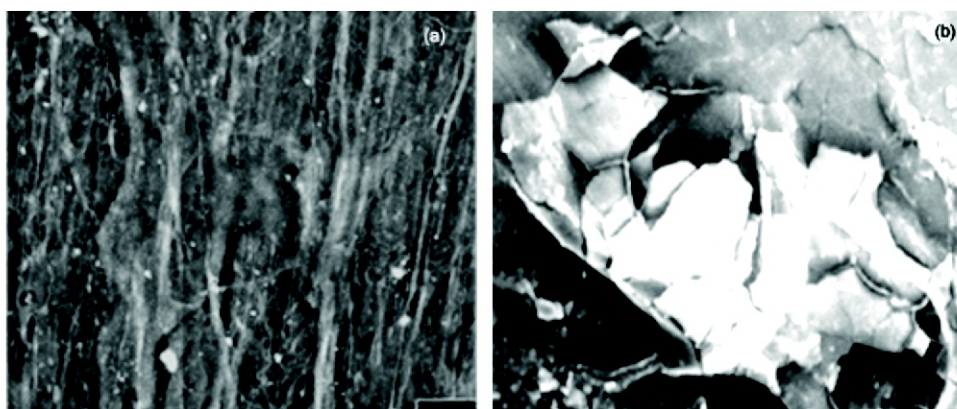


Fig.: SEM of the LLDPE and PLLA blend: (a) before and (b) after degradation

Reference:

Gursewak Singh, Anita Rajor, R. N. Jana, V. Choudhary and H. Bhunia, "Mechanical properties and morphology of polylactide, linear low density polyethylene and their blends", J. Appl. Polym. Sci., 118, 496-502, 2010.



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Waste foundry sand and its leachate characteristics

Solid waste management has become one of the global environmental issues, as there is continuous increase in industrial by-products and waste materials. Due to lack of land filling space and its ever increasing cost, utilization of waste material and by-products has become an attractive alternative to disposal. Waste foundry sand (WFS) is one of such industrial by-product which could be used in various applications including construction materials such as Controlled Low-Strength Material (CLSM) and concrete. The beneficial use of such by-products in construction materials results in reducing the cost of construction materials' ingredients and also helps in reducing disposal problem. The leachate obtained from such materials may contain hazardous compounds, which may possibly effect the environment. So, it is important to know the characteristics of leachate obtained from waste foundry sand.

Understanding the leachate characteristics of WFS is essential in its disposal, environmental impact, and potential development for beneficial utilization towards solid waste management. This paper describes the physical, chemical properties of WFS, various leachate test methods, and research published on leachate characteristics of waste foundry sand

Reference

Rafat Siddique, Gurdeep Kaur and Anita Rajor "Waste foundry sand and its leachate characteristics, "Resources, Conservation and Recycling", Volume 54, Issue 12, 1027-1036, 2010.

Use of municipal solid waste ash in concrete

Because of exponential growing in urbanization and industrialization, the amount of municipal solid wastes (MSWs) has increased very rapidly. The disposal of municipal solid waste (MSW) is becoming an increasing concern for many urban municipalities because of the increasing volume of solid waste generated, the spiraling costs of operating landfills, and the scarcity of landfill sites. With increased en-vironmental awareness and its potential hazardous effects, utilization of these materials has become an attractive alternative to disposal. Ash form MSW could possibly be used in concrete manufacturing.

This paper details about the physical, chemical, and mineralogical composition, and elemental analysis of MSW ash. It also covers the effect of MSW ash on the compressive strength, chloride resistance, and shrinkage of concrete. It also deals with the leachate analysis of MSW ash.

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Rafat Siddique, "Use of municipal solid waste ash in concrete" "Resources, Conservation and Recycling", Vol.- 55, Issue 2, 83-91, 2010.

Blocking Performance in All Optical WDM Network

The blocking probability of a lightpath request is an important performance measure of a wavelength-routed network. This blocking probability can be affected by many factors such as network topology, traffic load, number of links, algorithms employed and whether wavelength conversion is available or not.

Firstly, the models proposed in the literature are mostly very complex in nature and the mathematical computation used is very complicated. So, a low complexity mathematical model is developed which is used for the calculation of blocking probability of network and this model does not require any simulation statistics. The implementation of the model proposed has less complexity and the computation used in this model is quite efficient. An optimum path is suggested as a solution to routing problem and the appropriate number of wavelengths have also been suggested which should be free in a network to have the least blocking probability. This model can be implemented on different network topologies. Further, the model is also used to evaluate the blocking performance of NSFNet topology and hence used to improve its performance on the basis of blocking probability.

Further, an efficient wavelength rerouting algorithm for dynamic provisioning of lightpath is proposed. In wavelength-division multiplexed (WDM) networks rerouting of lightpath can be used to improve throughput and to reduce blocking probability. A Lightpath Rerouting Algorithm (LRRR) for dynamic traffic in WDM optical networks is proposed. The results have shown that LRRR can improve blocking performance of the network. Further, low complexity algorithm has been developed which is used for the calculation of blocking probability of network. The proposed algorithm has also been applied on the realistic network such as NSFnet for calculation and optimization of blocking probability of the network. It is shown that the proposed algorithm can be implemented to huge networks for good blocking performance of the network.

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Abstract

I know the strong impression that scientific communication is being seriously hindered by poor quality abstract written in jargon-ridden mumbo-jumbo.

- Sheila M. McNab



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Effect of Crop Residue Burning on Ambient Air Quality and Respiratory Parameters of Human Subjects of Patiala

Ground-based ambient air monitoring was conducted by gravimetric analysis at five different locations covering sensitive, residential, agricultural, commercial and urban areas in and around Patiala city in Northern India in order to determine the impact of open burning of rice (*Oriza sativa*) crop residues (October-November) on concentration levels of suspended particulate matter (SPM), sulphur dioxide (SO₂) and nitrogen dioxide (NO₂). Monthly average concentrations (24 hour) of SPM, SO₂ and NO₂ have shown significant up and down features at all the selected sampling sites during the study period and varied from 100±11 mgm⁻³ to 547±152 mgm⁻³, 5±4 mgm⁻³ to 55±34 mgm⁻³ and 9±5 mgm⁻³ to 91±39 mgm⁻³. Substantially higher concentrations were recorded at the commercial area site as compared to the other sampling sites for all the targeted air pollutants. Levels of SPM, SO₂ and NO₂ showed clear increase during the burning months (April - May and October-November) incorporated with the effect of meteorological parameters especially wind direction, precipitation and atmospheric temperature.

Aerosol (total suspended particulate) samples were analyzed for loss on ignition (LOI) and organic tarry matter (OTM) content in ambient air during crop residue burning (CRB) episodes and non-crop residue burning (NCRB) months. Results showed high levels of LOI and OTM during wheat and rice crop residue-burning periods at all the sites. Higher levels were obtained during rice crop residue-burning period as compared to the wheat residue-burning period. Results also indicated that OTM and LOI were integral parts of aerosols and their concentrations were influenced. A total of 51 selected subjects of the age group 13-53 were selected from five sites of Patiala for pulmonary function tests (PFTs) using a spirometer. High volume samplers (HVS) and an Andersen cascade impactor were also used to measure the concentration of suspended particulate matter (SPM) and particulate matter (PM) of size less than 10 μm. PFTs show significant decrease and particulate matter shows a significant increase during the burning period of wheat residue. Decrease in FVC and FEV₁ did not recover even after completion of the exhaustive burning period this is a more serious concern than PEF and FEV₂₅₋₇₅%. The results showed that the public exposure to relatively high levels of pollutants during the exhaustive burning period of wheat residue influences the PFTs of even healthy inhabitants. PFTs of young subjects recovered up to some extent after the completion of burning period but the PFT values of children remained significantly lower (p<0.001) even after the completion of burning episodes. Small size particulate matter (PM_{2.5} and PM₁₀) affected the PFTs to a large extent in comparison to the large size particulate matter (SPM). The study indicates that ACRB is a serious environmental health hazard and children are more sensitive to air pollution, as ACRB poses some unrecoverable influence on their PFTs.

Characterization Of Atmospheric Aerosols For Organic Tarry Matter And Combustible Matter During Crop Residue Burning And Non-Crop Residue Burning Months In Northwestern Region Of India, Nirankar Singh, Ravinder Agarwal, Amit Awasthi, Prabhat K. Gupta, Susheel K. Mittal, Atmospheric Environment, 44(2010)1292-1300.



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Impact of rice crop residue burning on levels of SPM, SO₂ and NO₂ in the ambient air of Patiala (India)
 Nirankar Singh, Susheel K Mittal, Ravinder Agarwal, Amit Awasthi and Prabhat Kumar Gupta, International
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Effects of agriculture crop residue burning on children and young on PFTs in North West India Amit Awasthi,
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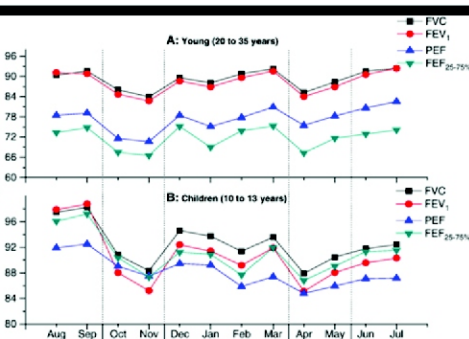
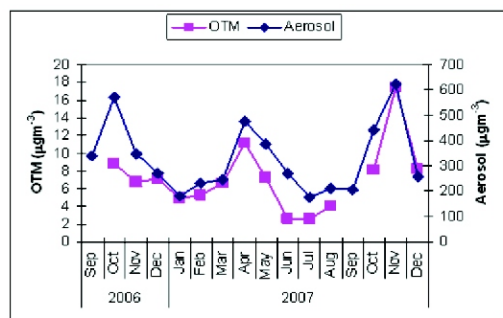


Fig. Variation in Organic Tarry Matter (OTM) levels with respect to SPM levels at Sanauri Adda Site [commercial area site].

Fig. Monthly variation of PFTs %pred of children and young subjects from August 2008 to July 2009.

Reference

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Monitoring and analysis of SPM of an industrial town of Punjab (India)

Suspended particulate matter (SPM) levels in ambient air were monitored at Mandi Gobindgarh, an industrial town of Punjab, India located on the National Highway-1 during November 2001 to March 2002 covering spring and winter seasons to check the variation of SPM and its constituents in the town. The maximum levels of SPM varied between 594 g/m³ to 620 g/m³ at selected monitoring sites while the minimum levels varied between 209 g/m³ to 220 g/m³. These values were observed always above the National Ambient Air Quality Standards (NAAQS) set by the State regulatory body. Major sources of SPM were identified as the industrial activity and traffic plying on the national highway. Collected SPM samples were further analyzed for the ignitable matter as loss on ignition (LOI) and organic tarry matter (OTM) content. Ignitable component of the SPM constituted about 45% and tarry matter in the ambient air was about 12%. Effects of meteorological parameters like temperature, wind direction and wind speed on SPM levels are discussed.

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BOD exertion and OD600 measurements in presence of heavy metal ions using microbes from dairy wastewater as a seed

BOD measurements in presence of cobalt, nickel, copper, zinc, silver and cadmium are reported using wastewater from dairy industry as a seed. Extent of inhibition in BOD is studied for variables like, concentration of metal ions (0.2 mL⁻¹ to 1.4 mL⁻¹), pH (3 to 8) and temperature of incubation (15, 20, 25, 30 and 35). Results of BOD inhibition are supported by absorbance measurement (OD600) studies of microbial matter preserved in Luriya broth medium. OD measurement results are used to derive minimum inhibitory concentration, i.e., threshold concentration of each metal showing toxicity towards microbes. Silver is found to be the most toxic element.

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Susheel K Mittal and Siloni Goel, Journal of Water Resources and Protection, 2, 478-488, 2010.



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Potentiometric Chemical Sensors

Cerium(III)-selective membrane electrodes have been prepared using dibenzo-24-crown-8 (DB24C8) as an electroactive material which works very well over a wide Ce(III) ion-concentration range of 1×10^{-5} M to 1×10^{-1} M with a Nernstian and a detection limit of 3×10^{-5} M. It has a fast response time of 20 seconds and has an average lifetime of four months. The working pH range is 3.5-8.0. The proposed sensor shows a good selectivity for cerium(III) with respect to alkali, alkaline earth, some transition and rare earth metal ions that are normally present along with cerium in its ores. The proposed sensor was investigated in partially non-aqueous media using acetone, methanol and DMSO mixtures with water. The electrode was further used as an indicator electrode for the potentiometric titration of Ce(III) solution against oxalic acid solution. Membranes containing varying compositions of electroactive material and epoxy resin as binder have been prepared and it has been shown that the one having composition 60% ZrSbMo and 40% epoxy resin exhibits best performance. The membrane demonstrates excellent response in the concentration range of 10^{-4} to 10^{-1} M Dy(III) ion with super-Nernstian slope of 44.0 mV/decade and fast response time of less than 10 s. Effect of internal solution was studied and the electrode was successfully used in partially non-aqueous medium. The proposed sensor revealed good selectivity with respect to alkali, alkaline earth, some transition and rare earth metal ions. It can be used in the pH range of 2.1 - 9.8. The sensor was used as an indicator electrode in the potentiometric titration of Dy(III) ion against EDTA.



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The linked 2, 2'-dipyridylamine derivatives have been explored as neutral carrier ionophores for preparing poly (vinyl chloride) based electrodes selective to Ag(I) ions. Based on the stability constants determined by sandwich membrane method and the energy minimization studies using CAChe software, the ionophore was found selective for Ag (I) ions. Different compositions of the membrane were studied. The best performance was found with the electrode composition (w/w) ionophore (3%): PVC (33%): o-NPOE (64%).

This electrode exhibits Nernstian response with a slope of 59mV/decade of activity in the concentration range 5.5×10^{-6} - 1.0×10^{-1} M of Ag (I). The electrode shows satisfactory performance over a pH range of 2.0 - 9.5, with a fast response time of 14s. Response of the electrode was highly selective to Ag(I) ions over a number of uni-, di- and trivalent metal cations. Also, the electrode has been used successfully as an indicator electrode in potentiometric titrations of Ag (I) ions.

A new aluminum-selective liquid membrane electrode based on a neutral carrier 2-(4,5-dihydro-1,3-imidazol-2-yl)phenol(L) in a poly(vinyl chloride) (PVC) matrix is described. The sensor exhibits a Nernstian response for Al(III) over a wide concentration range (1×10^{-6} M - 1×10^{-1} M) and detection limit of (7×10^{-7} M). The sensor exhibits the advantages of fast response time (10 seconds), operational lifetime (120 days), mixed solvent media tolerance upto (20%) and good selectivity co-efficient for Al(III) over an alkali, alkaline earth and transition metal ions. The electrode was used as indicator electrode in potentiometric titration of Al(III) with ethylenediaminetetraacetic acid (EDTA).

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Biocatalyzed transesterification of waste-edible and non-edible oils

Vegetable oils and their derivatives (especially methyl esters), commonly referred to as "biodiesel," are prominent candidates as alternative diesel fuels. They have advanced from being purely experimental fuels to initial stages of commercialization. Amongst the various catalysts that are in use at experimental and industrial levels, whole cell biocatalysis has been an approach of promise with certain obvious advantages over other routes. The studies, till-date, primarily involved isolation and characterization of fungal strains from bio-contaminated clarified cooking butter. An isolate, *Aspergillus* sp. having potential to use oil as carbon source and exhibiting significant lipolytic activity was further exploited for the studies on transesterification. Over a series of experiments, this isolate was induced to be tolerant to the growth medium optimized at 90% oil (edible and non-edible) as sole carbon source and 10% modified minimal media. The lipolytic activity of this strain was examined in detail under various culture conditions such as modulations in pH, temperature and nitrogen source (Aulakh and Prakash, 2010). A comparison was also drawn with commercial pure lipase sourced from *Candida rugosa* for transesterification (Aulakh et al., 2010).

The studies on fungal induced transesterification using the above isolate resulted in complete transesterification (>98%) with 70% of used edible (cottonseed oil) or non-edible (karanja) oil as a carbon source. In case of *Jatropha* oil the complete transesterification was achieved with 60% supplementation of oil as carbon source. The transesterification of oil to biodiesel was confirmed by thin layer chromatography and ¹H-NMR (400 Mhz) observations. Further to these observations, pure glycerol was obtained as an important by-product, the purity of which was also confirmed by H-NMR analysis. The research group has also attempted to examine the effect of frying on the transesterification process of cooking oil using whole cell biocatalysis (Prakash et al., 2010).

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Introduction

A bad beginning makes a bad ending.

- Euripides

Results

The great tragedy of Science -the slaying of a beautiful hypothesis by an ugly fact.

- T. H. Huxley



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Recent Developments in Liquid Crystals

Liquid crystals (LC) are highly anisotropic fluids, thermodynamically positioned between an isotropic liquid and three-dimensional ordered solid materials. The effective interactions between dispersed materials and the polar LC molecules result in the design of new soft composite materials. The thermotropic and lyotropic liquid crystalline materials can be used as good organic solvents that can disperse dyes, polymers as well as nano materials.

The authors demonstrate the various undispersed and dispersed systems to enhance the physical parameters of liquid crystals. Silica (SiO_2) nanoparticles in different wt/wt% ratios were dispersed in a novel room temperature ferroelectric liquid crystal mixture. We noticed an increase in optical transmission with increasing SiO_2 concentration from 0.01 to 0.1 wt/wt% [1]. Polymer dispersed ferroelectric liquid crystal composites of low polymer viscosity shows faster switching whereas higher optical transmission was observed in a higher polymer viscosity film [2].

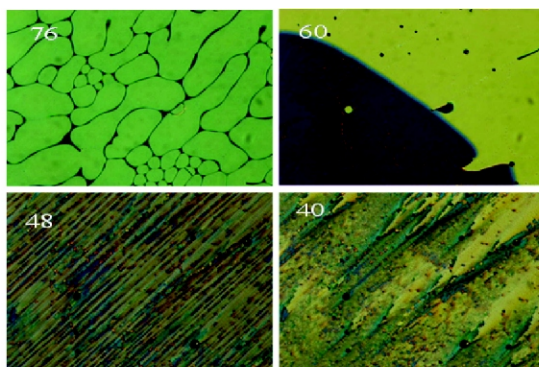


Figure: Micro-textures of 0.1% silica doped FLC mixture under crossed polarizers at 10X.

Electro-optic and dielectric studies were carried out in two different ferroelectric systems and the obtained results were compared [3]. A better transmission and faster response time was observed in dye doped polymer dispersed liquid crystal film over the pure polymer dispersed nematic liquid crystal [5]. The dielectric and electrical properties of a short pitch high polarization and its guest host derivatives with anthraquinone dichroic dye were demonstrated [6].

The various studies promise liquid crystals and dispersed liquid crystal composite systems as promising materials for developing display technologies

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Ferroelectric Electroceramics: Preparation And Charaterization

BZT and PZT based ferroelectric electroceramics are potential candidates for a large number of applications. Among the two, BZT is mainly used for capacitor applications due to its high dielectric constant and low dielectric loss. PZT (near morphotropic phase boundary) exhibits remarkable ferroelectric and piezoelectric properties which render it applicable in FRAM, DRAM, sensors and actuators etc. The properties of these electroceramics can further be modified by altering the compositional and processing parameters. Substitution of suitable ions in place of host ions is included in compositional modifications while alteration in processing parameters involve the change in sintering temperature and time, use of novel techniques like microwave sintering, mechanochemical alloying etc.

The authors demonstrate the effect of substitution of different ions like La^{3+} , Sm^{3+} and Zr^{4+} on the structural, dielectric, ferroelectric and piezoelectric properties of modified BZT and PZT ceramics. The ceramics were prepared by solid state reaction method. Substitution of Zr^{4+} for Ti^{4+} ions in BPT ce-ramics results in the decline in dielectric losses and curie temperature (Figure 1), which is desired for capacitor applications [1, 2]. As far as ferroelectric properties of these ceramics are concerned, they are found to be more dependent on the microstructure. The modified composition (BPZT) was then substituted by some rare earth ions (La^{3+} and Sm^{3+}) and the further improvement in the dielectric and ferroelectric properties was noticed by authors [3]. Effect of Mn^{4+} on the dielectric and ferroelectric properties of BPZT ceramics was also demonstrated [4]. For PZT, the effect of substitution of La^{3+} and Sm^{3+} on the ferroelectric properties was investigated (Figure 1), which is desired for capacitor applications [1, 2]. As far as ferroelectric properties of these ceramics are concerned, they are found to be more dependent on the microstructure. The modified composition (BPZT) was then substituted by some rare earth ions (La^{3+} and Sm^{3+}) and the further improvement in the dielectric and ferroelectric properties was noticed by authors [3]. Effect of Mn^{4+} on the dielectric and ferroelectric properties of BPZT ceramics was also demonstrated [4]. For PZT, the effect of substitution of La^{3+} and Sm^{3+} on the ferroelectric properties was investigated (Figure 1). Improvement in remnant polarization and squareness of the PE loops was observed which is useful for FRAM and other such applications [5, 6].



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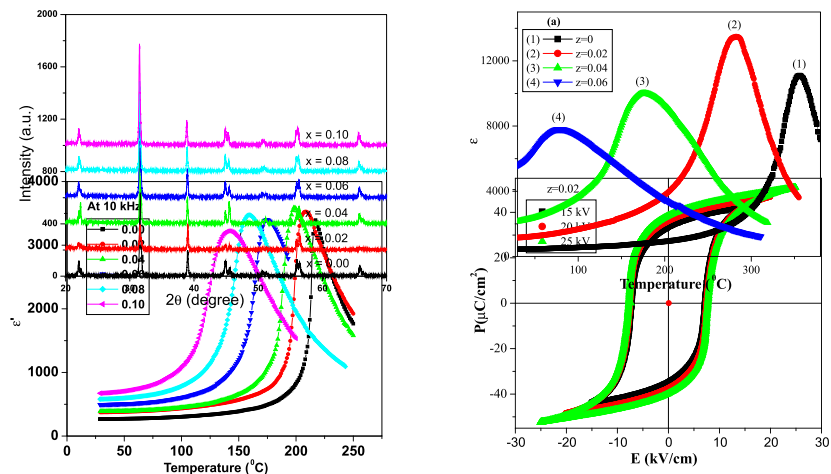


Fig.: XRD patterns and Dielectric constant versus Temperature curves for $\text{Ba}_{0.80}\text{Pb}_{0.20}\text{Ti}_{1-x}\text{Zr}_x\text{O}_3$ (BPZT) ceramics (in left), Dielectric constant versus Temperature curves for $\text{Pb}_{1-z}\text{La}_z\text{Zr}_{0.588}\text{Ti}_{0.392}\text{Fe}_{0.01}\text{Nb}_{0.01}\text{O}_3$ and PE loop for $z = 0.02$ (in right).

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Enhanced luminescence of UV irradiated Zn(1-x)Ni(x)S nanoparticles

PVP-capped Zn(1-x)Ni(x)S ($x = 0.001, 0.005, 0.01, 0.03, 0.05$ and 0.1) nanoparticles have been synthesized using chemical precipitation route, in aqueous media, at room temperature. The synthesized nanoparticles have been irradiated by UV light for 24 h so as to study the effect on their structural and optical properties. The nanoparticles have been characterized through XRD and HRTEM to study the crystal structure and size. Characterization was also carried out through FTIR spectroscopy to reveal the presence of PVP and the effect of UV irradiation on the surface chemistry of the synthesized nanoparticles. The optical properties have been studied through UV-vis absorption spectroscopy and room temperature photoluminescence. There has been an enhancement in the intensity of the green emission centered at 547 nm,

with increase in Ni concentration up to 0.5 at.% and a decrease in the intensity, observed for higher concentrations of Ni. However, the $I(\text{green})/I(\text{blue})$ intensity ratio increases continuously with the increase in Ni concentration and also on prolonged UV irradiation of the samples.



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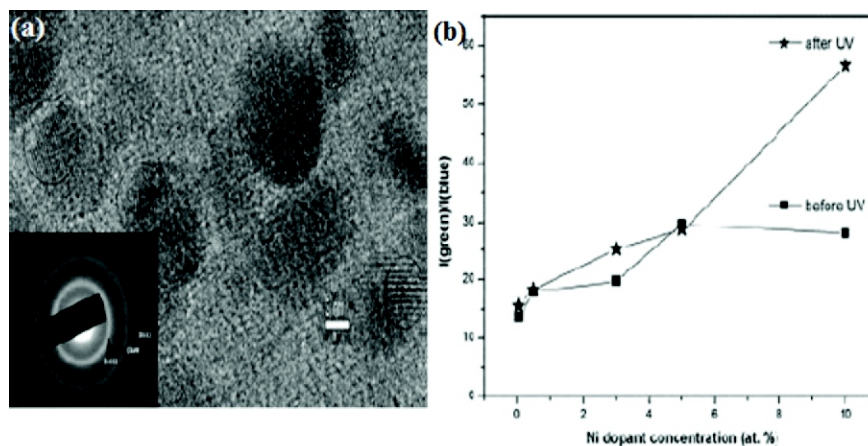


Fig.(a) HRTEM image of Zn_{0.995}Ni_{0.005}S nanoparticles and the SAED pattern (inset) showing the polycrystalline nature of the nanoparticles and (b) Plot of intensity ratio of green to blue emission with change in concentration of Ni.

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Discussion

It is the fault of our rhetoric that we cannot strongly state one fact without seeming to belie some other.

- Ralph Waldo Emerson

Synthesis and characterization of Bi-doped zirconia for solid electrolyte

(100-x)ZrO₂(x)Bi₂O₃ (x=5, 10, 15) system has been synthesized by solid-state reaction technique. Tetragonal Bi_{7.38}Zr_{0.62}O_{12.31} phase has formed in all the samples after sintering at 850 °C for 24 h. Apart from this, ZrO₂ and Bi₂O₃ are also identified as minority phases. The volume fraction of Bi_{7.38}Zr_{0.62}O_{12.31} phase increases with increasing concentration of Bi₂O₃. The AC conductivity plots exhibit phase transition at 570 °C and 460 °C for x=10 and x=15 samples, respectively. The maximum conductivity is observed (1.60 mS/cm) in x=15 sample. These results are correlated and supported with microstructural and thermal analysis.

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Kapil Sood, Kulvir Singh, O.P.Pandey, Synthesis and characterization of Bi-doped zirconia for solid electrolyte. *Ionics*, 16:549-554, 2010.

Study of Energy Transfer from Capping Agents to Intrinsic Vacancies/Defects in passivated ZnS nanoparticles

The study of energy transfer mechanism from different capping agents to intrinsic luminescent vacancy centers of zinc sulfide (ZnS) has been reported in the present work. Nanoparticles of capped and uncapped ZnS are prepared by co-precipitation reaction. These nanoparticles are sterically stabilized using organic polymers- Poly Vinyl Pyrrolidone (PVP), 2-mercaptoethanol (ME) and Thioglycerol (TG). Monodispersed nanoparticles were observed under TEM for both capped and uncapped ZnS nanoparticles. However, for uncapped ZnS nanoparticles tendency for formation of nanorod like structure exists. Size of ZnS crystallites was calculated from X-ray diffraction pattern. The primary crystallite size of capped nanostructures is 1.95-2.20 nm and 2.2nm for uncapped nanostructures for 111 plane that was estimated from the X-ray diffraction patterns. FTIR spectra were conducted to confirm capping. Zeta potential measurements have been done to check the stability of dispersed nanoparticles. Band gap measurement was done by UV Visible spectrophotometer. Excitation and emission spectra are also performed in order to compare optical properties in various samples. Increase in emission intensity and band gap has been observed by adding different capping agents in comparison to uncapped ZnS nanoparticles. The results show that in capped ZnS nanoparticles the mechanism of energy transfer from capping layer to photoluminescent vacancy centers is more pronounced. Further studies in this will lead to the development of highly efficient devices.

PACS CODE: 78.55m; 78.67.bf

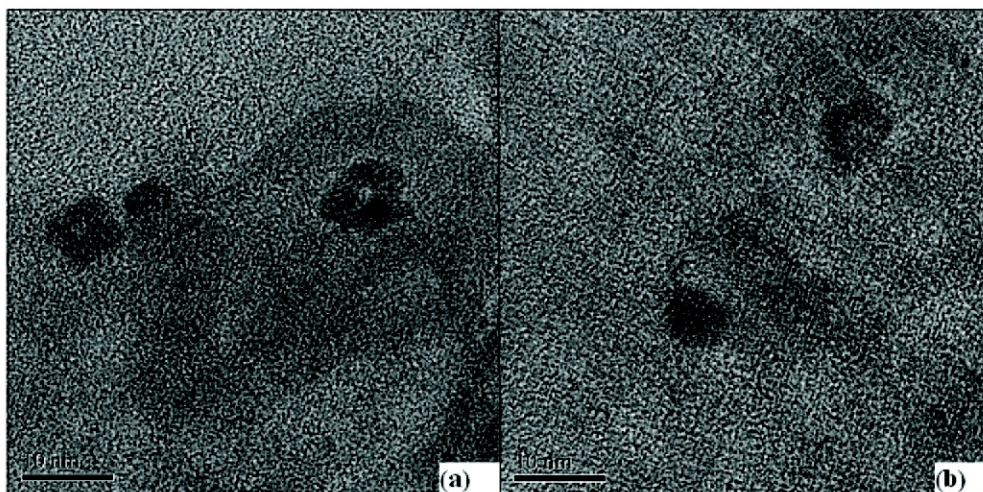


Fig.: TEM images of (a) PVP capped (b) TG capped (c) ME capped and (d) uncapped ZnS nanoparticles.

Reference:

M. Sharma, S. Kumar, O P Pandey, Study of energy transfer from capping agents to intrinsic vacancies/defects in passivated ZnS nanoparticles *J Nanopart. Res.*, 12 (7): 2655-2666, 2010.



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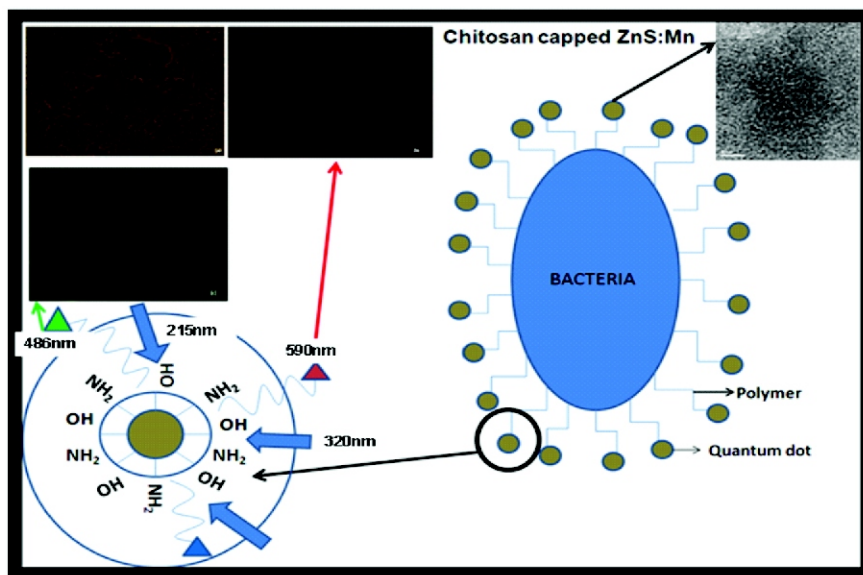
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Excitation induced tunable emission in biocompatible chitosan capped ZnS nanophosphors

Colloidal semiconductor nanomaterials exhibit color modulation which can be useful for various optoelectronic and biolabelling applications. Previous studies on CdSe and CdTe have shown tunable color modulation by varying the size of nanomaterials but toxicity of cadmium has created doubt for its end applications as biosensor. The recent work on ZnS:Mn²⁺ doped semiconductor has shown some viability for biolabelling but for tunable behavior particles of different doping concentration needs to be synthesized. In the present work all the above problems were considered and viable solution has been given to use ZnS:Mn²⁺ doped semiconductor using chitosan as capping agent. Here we report deliberate color modulation for chitosan capped ZnS: Mn²⁺ nanoparticles (NPs) synthesized in single step instead of many samples of different size. The tunable behavior is achieved by varying the excitation wavelength in same sample. Shifting of emission peak from dopant related emission at 590nm (d states of Mn²⁺) to 481nm defect related emission (Sulphur vacancy to Zn²⁺) and 421nm (sulphur vacancy to valence band) has been observed. The work illustrate coupling between Frenkel exciton in organic polymers with Wannier exciton in inorganic semiconductors which has been observed for the present nanophosphors. Synthesized chitosan capped ZnS: Mn²⁺ NPs have been characterized by XRD, HRTEM, EDX and FTIR for structural studies. UV Visible absorption spectroscopy and Photoluminescence studies were done to observe optical behaviour. Due to non-toxic nature of chitosan capped ZnS: Mn²⁺ with tunable color properties in single sample, these materials can be used as biolabels. Biocompatibility of chitosan functionalized ZnS:Mn quantum dots has been also verified with bacteria (staphylococcus aureus).



Reference:

M. Sharma, S. Singh, O P Pandey, Excitation induced tunable emission in biocompatible chitosan capped ZnS nanophosphors. J. Appl. Phys., 107: 104319, 2010.

Entrance Channel Independence In The Decay Of $^{215}\text{Fr}^*$ nucleus

The fusion-fission excitation functions for the decay of compound nucleus $^{215}\text{Fr}^*$, formed in $^{11}\text{B}+^{204}\text{Pb}$ and $^{180}+^{197}\text{Au}$ reaction channels, are studied on the Dynamical Cluster-decay Model (DCM), showing entrance channel independence, in agreement with experiments, not invoking any quasi-fission (qf) process in either of the two channels.

Reference:

Manoj K Sharma, Gudveen Sawhney, Shefali Kanwar and Raj K. Gupta, Entrance Channel Independence in the Decay of $^{215}\text{Fr}^*$ Nucleus, Modern Physics Letters A, Vol. 25, Nos. 21-23, 2022, 2010.

Decay of $^{176,182,188,196}\text{Pt}^*$ nuclei using the Dynamical Cluster-Decay Model

The decay of $^{176,182,188,196}\text{Pt}^*$ compound systems formed in $^{64}\text{Ni}+^{112,118,124}\text{Sn}$ and $^{132}\text{Sn}+^{64}\text{Ni}$ reactions is studied by using the well established dynamical cluster-decay model (DCM), with effects of quadruple deformations(?) and "optimum" orientations for hot(compact) configurations included. Our calculations indicate that the mass fragmentation yields change from predominantly symmetric to predominantly asymmetric with the increase in number of neutrons in Pt^* nuclei. The comparison between the experiments and DCM calculations are excellent for evaporation residue cross-sections at both the below and above barrier energies, but the fission data show a significant quasi-fission component at the highest one or two energies.

Reference:

Manoj K. Sharma, Shefali Kanwar and Raj K Gupta, Decay of $^{176,182,188,196}\text{Pt}^*$ Nuclei using the Dynamical Cluster-Decay Model, AIP, CP1265, 37, 2010.

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Manuscripts containing innumerable references are more likely a sign of insecurity than a mark of scholarship.

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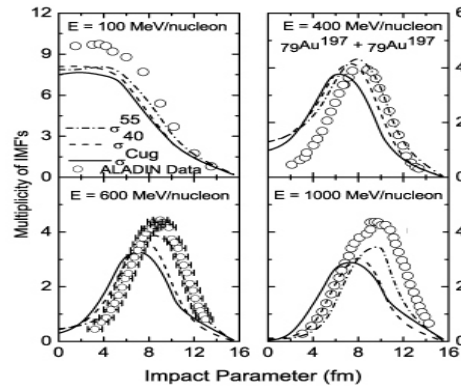
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A comparative study of model ingredients: Fragmentation in heavy ion collisions using quantum molecular dynamics model

We aim to understand the role of NN cross-sections, equation of state as well as different model ingredients such as width of Gaussian, clusterization range and different clusterization algorithms in Multifragmentation using quantum molecular dynamics model. We notice that all model ingredients have sizable effect on the fragment pattern. Comparison of average multiplicity of intermediate mass fragments(IMF's) with ALADIN data at incident energies of 100, 400 MeV/nucleon(top panel) and 600, 1000 MeV/nucleon (bottom panel) as a function of impact parameter. The results are displayed using soft momentum dependent (SMD) interactions.



Reference:

Sanjeev Kumar and Suneel Kumar, A comparative study of model ingredients: Fragmentation in heavy ion collisions using quantum molecular dynamics model *Parmana J. of Physics*, 74, 731, 2010.

Systematic study of the system size dependence of global stopping: Role of momentum dependent interactions and symmetry

Using the isospin-dependent quantum molecular dynamical (IQMD) model, we systematically study the role of momentum dependent interactions in global stopping and analyze the effect of symmetry energy in the presence of momentum dependent interactions. For this, we simulate the reactions by varying the total mass of the system from 80 to 394 at different beam energies from 30 to 1000 MeV/nucleon over central and semi-central geometries. The study is carried in the presence of momentum dependent interactions and symmetry energy by taking into account hard equation of state. The nuclear stopping is found to be sensitive towards the momentum dependent interactions and symmetry energy at low incident energies. The momentum dependent interactions are found to weaken the finite size effects in nuclear stopping.

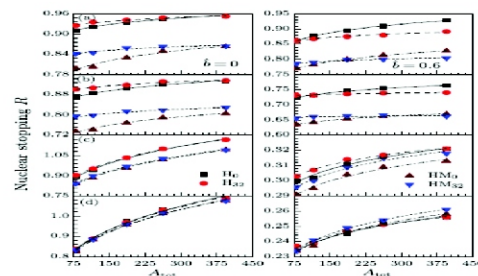


Fig.: The final state anisotropy ratio as a function of composite mass of the system.

Reference:

Sanjeev Kumar and Suneel Kumar, Systematic study of the system size dependence of global stopping: Role of momentum dependent interactions and symmetry, *Chinese Physics Letters* 27, 062504, 2010.



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Elliptical flow and isopin effects in heavy-ion collisions at intermediate energies

The elliptical flow of fragments is studied for different systems at incident energies between 50 and 1000 MeV/nucleon using Isospin-dependent Quantum Molecular Dynamics (IQMD) Model. Our findings reveal that elliptical flow shows a transition from positive (in-plane) to negative (out-of-plane) value in the mid-rapidity region at certain incident energy, known as transition energy. This transition energy is found to depend on the model ingredients, size of the fragments, Composite mass of the reacting system as well as on the impact parameter of the reaction. A reasonable agreement is observed for the excitation function of elliptical flow between the data and our calculations. Interestingly, the transition energy is found to exhibit a power law mass dependence.

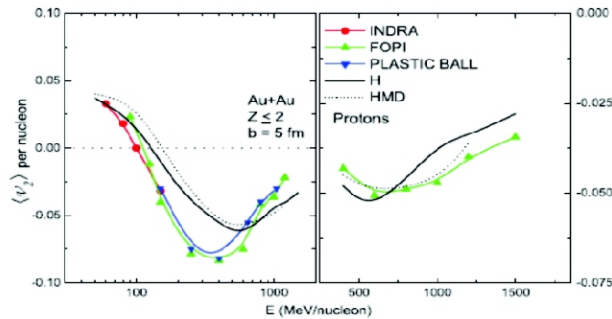


Fig.: Variation of elliptical flow summed over the entire transverse momentum with beam energy. Here a comparison is shown with different experimental groups.

Reference:

Sanjeev Kumar, Suneel Kumar and Rajeev K. Puri, Elliptical flow and isopin effects in heavy-ion collisions at intermediate energies, *Physical Review C*81, 014611, 2010.

Effect of symmetry energy on nuclear stopping and its relation to the production of light charged fragments

We present a complete systematics (excitation function, impact parameter, system size, isospin asymmetry and equations of state dependences) of global stopping and fragments production for heavy-ion reactions in the energy range between 50 and 1000 MeV/nucleon in the presence of symmetry energy and isospin-dependent cross-section. It is observed that the degree of stopping depends weakly on the symmetry energy and strongly on the isospin-dependent cross-section. On the other hand, the symmetry energy and isospin-dependent cross-section has an effect of the order of more than 10% on the emission of light charged particles (LCP's). It means that nuclear stopping and LCP's can be used as a tool to get the information of isospin-dependent cross-section. Interestingly, the LCP's emission in the presence of symmetry energy is found to be highly correlated with the global stopping.

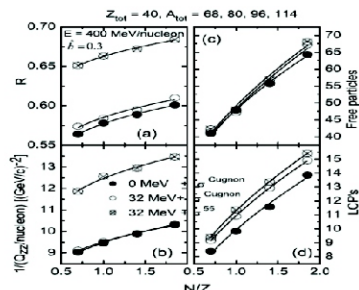


Fig.: Isospin asymmetry of stopping parameters and LCP's in the presence of symmetry energy and the isospin-dependent cross-section

Reference:

Sanjeev Kumar, Suneel Kumar and Rajeev K. Puri, Effect of symmetry energy on nuclear stopping and its relation to the production of light charged fragments, *Physical Review C*81, 014601, 2010.



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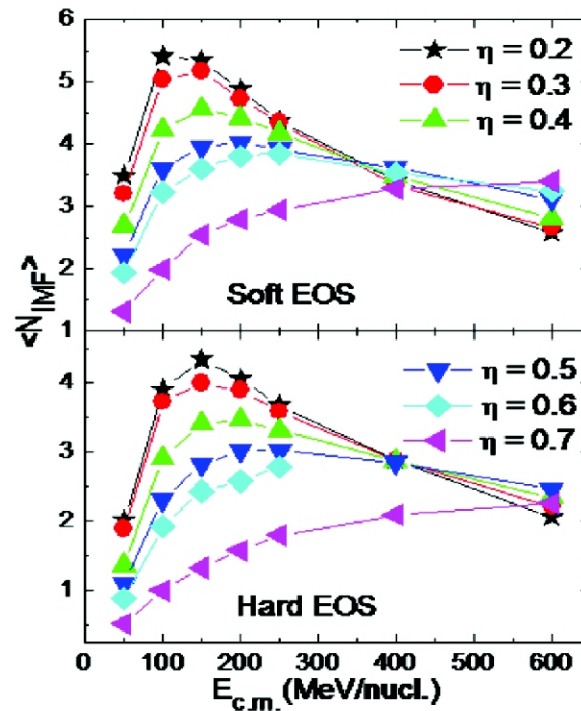


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Systematic study of multi-fragmentation in asymmetric colliding nuclei

We present a complete systematically theoretical study of multi-fragmentation of free nucleons and various fragments by simulating different asymmetric reactions of $^{26}\text{Fe}56 + ^{44}\text{Ru}96$ ($\eta = 0.2$), $^{24}\text{Cr}50 + ^{44}\text{Ru}102$ ($\eta = 0.3$), $^{20}\text{Ca}40 + ^{50}\text{Sn}112$ ($\eta = 0.4$), $^{16}\text{S}32 + ^{50}\text{Sn}120$ ($\eta = 0.5$), $^{14}\text{Si}28 + ^{54}\text{Xe}124$ ($\eta = 0.6$), $^{8}\text{O}16 + ^{54}\text{Xe}136$ ($\eta = 0.7$) in the energy range between 50 MeV/nucleon and 600 MeV/nucleon by using soft and hard equations of state at semi-central impact parameter. Here, the projectile mass is varied between 16 and 56, while, the targets are chosen as different isotopes of Xe, Sn and Ru. While the total mass of the system remains constant, mass asymmetry is varied between 0.2 and 0.7. The asymmetry of a reaction can be defined by the asymmetry parameter $\eta =$

$(A_T - A_P) / (A_T + A_P)$. This study is performed within an isospin-dependent quantum-molecular dynamics model. A simple spatial clusterization algorithm dubbed as minimum-spanning-tree method is used to clusterize the phase space.



The relative multiplicity of free nucleons, light-mass fragments (LMFs) ($2 \leq A \leq 4$), Medium-mass fragments (MMFs) ($5 \leq A \leq 8$), and IMFs ($9 \leq A \leq 6$) follows the hyperbolic behavior which shows the projectile-fragmentation and target-fragmentation respectively for negative and positive mass asymmetry values. We envision an interesting outcome for large asymmetric colliding nuclei. Although nearly symmetric nuclei depict a well-known trend for rising and falling with a peak around $E = 100$ MeV/nucleon, this trend, however, is completely missing for large asymmetric nuclei. Therefore, experiments are needed to verify this prediction.

Reference:

Varinderjit Kaur and Suneel Kumar, Systematic study of multi-fragmentation in asymmetric colliding nuclei, Physical Review, C81, 064610, 2010.



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MATTER LAB - *a central characterization facility*

In addition to having a strong academic program, TU lays equally strong emphasis on research. The number of sponsored research projects TU faculty is working on is an index of magnitude of on-going research at TU. Over the years there has been an impressive increase in the research activities, wherein more funds are being received for sponsored projects.

About 600 graduate students including non-PhD faculty members from nearby institutes and organizations are currently working towards their PhD degrees.

Prominent research areas at TU: Condensed matter physics, Nanoscience, Ceramic materials, Theoretical nuclear physics, Environmental sciences, Microbiology, Health monitoring of structures, Chemical and biosensors, Digital signal processing, Fiber optic communications, Grid computing and security, Data mining, etc.

To give an impetus to research on campus, a need to establish in-house characterization facility has been strongly felt for long. And, therefore, TU management made available a sum of three crore rupees as seed money to create a state-of-the-art characterization facility. Subsequently, 'Materials Testing Engineering and Research Laboratory' (MATTER Lab) came up on campus.

This Lab has the following equipment:

Scanning Electron Microscopy(SEM) - Jeol 8200 JSM

Energy Dispersive X-Ray Analysis(EDAX)- Oxford

X-Ray Diffraction (XRD),with Small Angle X-Ray Scattering(SAXS)-PANalyticalsX'Pert Pro

Scanning Probe Microscopy - NT-MDT

Particle Size Analyzer- Brook Haven

Next phase of development of the lab, aims at procuring the following equipment:

Transmission Electron Microscopy(TEM)

Nuclear Magnetic Resonance (NMR) Spectroscopy

X-Ray Photoelectron Spectroscopy(XPS)

The lab is being operated under the supervision of a committee headed by Dr. K.K. Raina, Deputy Director.



Thapar University *-proud past promising future*

Thapar University (formerly known as Thapar Institute of Engineering and Technology) founded by Late Lala Karam Chand Thapar in 1956 is a premier educational and research institute located in the 250-acre campus, in the historic city of Patiala. TU became 'Deemed University' in December 1985, and, is, today recognized among the leading privately managed grant-in-aid engineering institutions of the country and the best of its kind in the north-western region of India; it runs undergraduate, postgraduate, and PhD programs in all the disciplines.

At TU, an aptitude for learning and growth is well reflected through a vibrant student life. TU provides modern, spacious, and architecturally striking hostels as well as excellent sports facilities. The students are encouraged to participate in multifarious extra-curricular and co-curricular activities, such as movie making, fine arts, photography, dance, music, literary, drama on one side and helping the needy including the children of the unprivileged and underprivileged class on the other. The students are also provided opportunities to express their views on a plethora of academic and non-academic issues through University magazines and TnI – a student newspaper. In fact, TU understands that the educational innovations certainly do not come about automatically. It is the environment which influences and changes the standards of learning.

