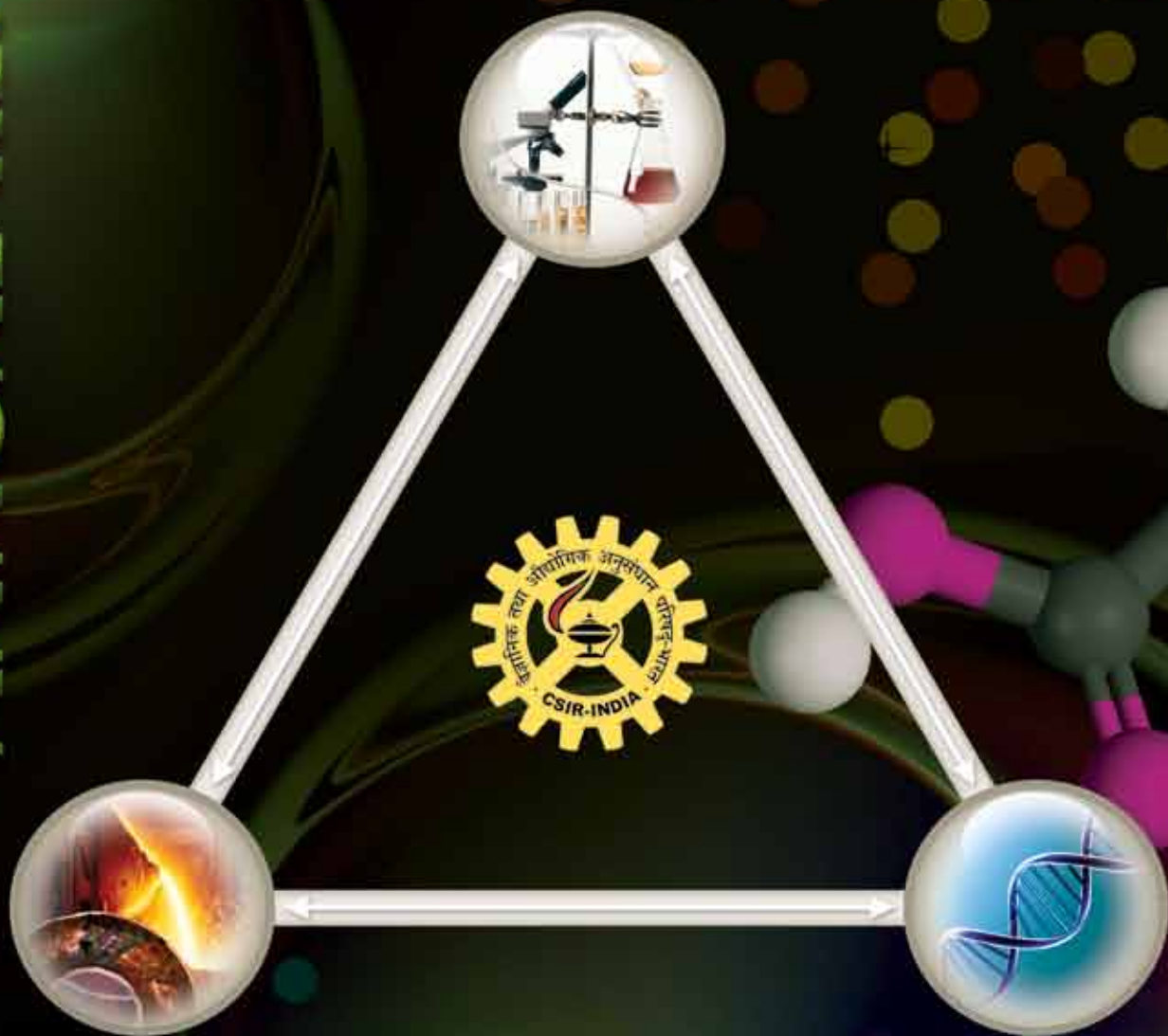


# ANNUAL REPORT

Annual Report 2010-2011

वार्षिक प्रतिवेदन २०१०-२०११



National Institute for Interdisciplinary Science & Technology

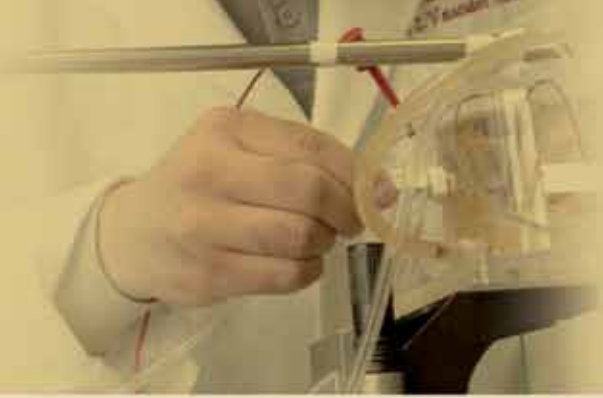
राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान

(Council of Scientific & Industrial Research)

(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)

Thiruvananthapuram

तिरुवनंतपुरम



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**राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान**

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National Institute  
for Interdisciplinary Science & Technology

- Published by** : The Director  
National Institute for Interdisciplinary Science & Technology  
Thiruvananthapuram
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- Design & Printing** : Akshara Offset, Thiruvananthapuram



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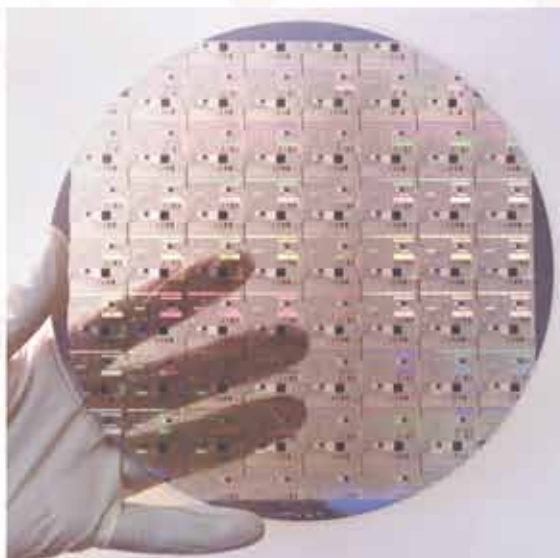
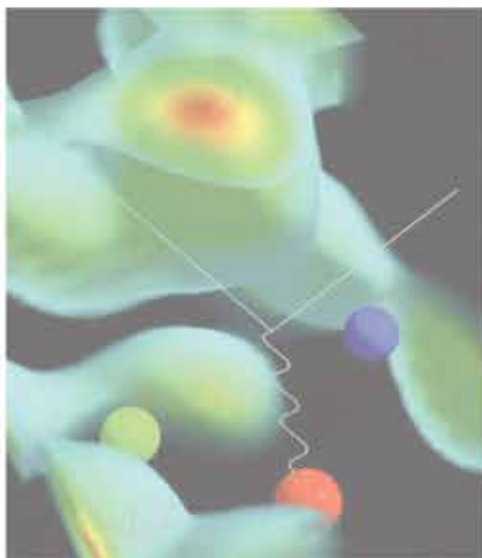
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## FOREWORD

On behalf of my colleagues, it gives me great pleasure to present the Annual Report of the Institute for 2010-2011. It has once again been a productive year for us in all spheres of our activities. During this year we have witnessed a significant improvement in the quality of our research publications and also developed and disseminated several new technologies for processing/value addition of spices and other agri-products, details of which are provided in the Annual Report. I wish to thank all the members of our staff for their concerted efforts which has made this possible.

I also wish to express my sincere thanks to DG CSIR and other colleagues from CSIR Head Quarters for their valuable guidance and support.

**Suresh Das**  
Director

FOREWORD



## प्राक्कथन



मेरे सहयोगियों की ओर से वर्ष 2010-11 के संस्थान की वार्षिक रिपोर्ट प्रस्तुत करते हुए मुझे अत्यंत प्रसन्नता होती है। हमारी गतिविधियों के सभी क्षेत्रों में यह एक बार फिर एक उत्पादक वर्ष रहा है। इस वर्ष के दौरान हम ने अपने अनुसंधान प्रकाशनों की गुणवत्ता में एक महत्वपूर्ण सुधार देखा है और यह भी स्पाइसेस और अन्य कृषि उत्पादों के प्रसंस्करण/मूल्य वर्धन के लिए कई नई प्रौद्योगिकियों के विकास एवं प्रसार किये गये, जिनका विवरण वार्षिक रिपोर्ट में प्रदान किए जाते हैं। मैं संस्थान के सभी स्टाफ सदस्यों का धन्यवाद देना चाहता हूँ, जिनके संगठित प्रयास ने इसे संभव बनाया।

मैं सीएसआईआर मुख्यालय के महानिदेशक तथा अन्य सहयोगियों को उनके बहुमूल्य मार्गदर्शन और समर्थन के लिए ईमानदारी से धन्यवाद देना चाहता हूँ।

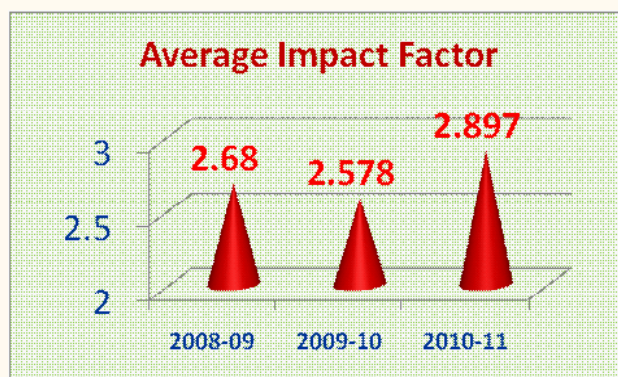
**सुरेशदास**  
निदेशक

संस्थान



## HIGHLIGHTS

The steady growth of the National Institute for Interdisciplinary Science and Technology continued during the year 2010-11 with several accomplishments and participation in major activities of the CSIR. The Institute actively participated in the CSIR Technofest programme organized at New Delhi and took a leading role in showcasing the achievements of CSIR particularly in the field of Chemical Sciences. The Institute also initiated formulation of 12<sup>th</sup> Five Year Plan proposals in close coordination with other Chemical Cluster Institutes of CSIR by consolidating the expertise acquired during the XI Five Year Plan and initiating projects that are strategically important and scientifically challenging. With the Institute R&D being focussed on the interface between Chemistry & Biology and Chemistry & Materials, five new in-house projects were initiated during the year on similar lines viz., (i) Bioactives from plants and microbial sources for the prevention/control of metabolic disorders, (ii) Development of new functional materials for energy efficient and energy generating tools for sustainable energy, (iii) Liquid and gaseous biofuels from biomass, (iv) Design and development of smart and functional materials, and (v) Green enterprises for the micro-sector (GEMS). Besides the Institute identified a few technologies suitable for self-help groups or small entrepreneurs. A programme with emphasis on delivery of these technologies for adaptation by low income and/or less techno-educated sections of society has also been initiated. Twenty five new grant-in-aid, four sponsored and nine consultancy projects were initiated during this financial year. A sum of Rs. 633.166 lakhs were obtained through contract research programmes. The Institute published 197 research papers (182 SCI, average IF = 2.897) and filed 18 patents (13 foreign & 5 Indian). The white pepper technology which received NRDC & WIPO awards was transferred to four more clients.



### R & D Highlights

A modern drying facility to process two tons of nutmeg per day using refrigerated dehumidification with heat recovery was set up for M/s Ann Impex, the House of Spices at Cochin. This drying method prevented the oozing of essential oils and formation of aflatoxin compared to the other artificial drying practices during the monsoon harvest season. The institute extended its process and engineering skills for setting up the facility for processing ginger in the state of Sikkim and this commercial venture has been commissioned. The marketing of ginger, which was hitherto dependant of the climatic conditions, will undergo a sea change and the produce is expected to generate remunerative prices for the farmers.





*In vitro* studies to evaluate the antioxidant potential of the bioactives from pineapple residue, a byproduct of the pineapple processing industry, showed significant therapeutic properties in ameliorating diabetes related complications.

A solid-state fermentation process was developed for the production of L-leucine amino peptidase by cultivating *Streptomyces gedanensis* on an inert support impregnated with a minimal medium. Achievement of the high yield in this process shows promising technical feasibility of LAP production under SSF using inert support for industrial application. An effective pretreatment process was also developed to derive the fermentable sugars for the production of bioethanol from cotton stalk. The high temperature treatment completely removed lignin which helped to increase the total hydrolysis efficiency up to 96%. Considering the carbohydrate presence in the cotton plant waste and utilization of xylose and arabinose to value-added product, the total process economy for the production of ethanol from cotton plant waste can be highly effective.

Novel  $\pi$ -conjugated oligo poly(phenylenevinylene) (OPV) architectures and efficient green and red emitting organic-inorganic hybrid materials were developed. The role of molecular packing on their optical properties have been investigated. Time-resolved emission spectroscopy studies showed that excitation energy migration was more efficient in OPV gelators with small end functional groups than the gelators with bulky end groups. Structure-property studies showed that the solid state emission of  $\pi$ -conjugated materials can be enhanced by prevention of co-facially stacked H-type (sandwich) aggregates and the formation of slipped stack or J-type aggregates led to significant enhancement of solid state luminescence.

Fluorescent dyes for the selective detection of cyanide, DNA, metal ions, nitrite and amino thiols in blood and aqueous medium were developed. A core-modified calixphyrin exhibiting aggregation-induced enhanced-emission characteristics was synthesized which can be used for selective detection of Hg ions. Further, novel functionalised cyclophanes based systems have been synthesized which interacted with important biomolecules.

Synthesis of novel aza-BODIPYs (4,4-difluoro-4-bora-3a,4a-diaza-s-indacenes) substituted with heavy atoms such as bromine and iodine have been achieved. These molecules hold great promise as ideal sensitizers for the generation of singlet oxygen, which has numerous applications in synthetic chemistry, waste water treatment, photodynamic cell death, etc.

Strategies for efficient production of nanowires, gold nanoparticle functionalized carbon nanotubes and palladium nanoparticle-cored dendrimers, which have potential applications in light induced electron transfer processes and catalysis were developed.

New synthetic methodologies were developed for the functionalized mono- and diphenoxycalix[4]arenes as well as transitional metal catalysed facile route towards functionalized indanones and indanols. Potential biological applications of nimbolide, a triterpenoid isolated from *Azadirachta indica* leaves have been investigated using different cell lines.

Nano sized cerium oxide nano rods and nano tubes for chemical mechanical planarisation (CMP), rare earth doped zinc oxide varistors for medium voltage surge protection and magnetic dye adsorbent catalyst for dye removal from effluent were developed at the laboratory level.

A technology for optimisation of fly ash for flux bonded products was demonstrated and this has been transferred to M/s. Navudaya Ceramics, Hyderabad. The process can use up to 80 wt% fly ash in making bricks, blocks and glazed ceramic products.



Sol-gel coating precursors for multi channel ultra filtration ceramic membrane for industrial water recycling were developed in collaboration with BHEL-CTI Bangalore. Low temperature curable self cleaning hybrid coatings for solar cell panel were developed and about 99 per cent transparency was achieved on glass slides. Chemically stable and ecofriendly rare earth-doped  $\text{Bi}_2\text{MoO}_6$  yellow pigments for coloration of plastics were synthesized.

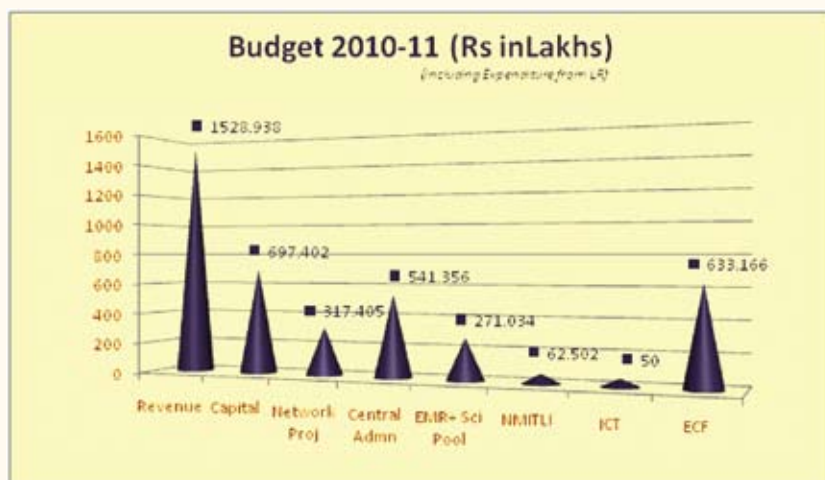
Apatite type rare earth silicates were prepared by the solid state ceramic route. The compounds showed very low dielectric constants and low loss factor in the microwave frequency region. These are suitable materials for microwave substrate applications.  $\text{MgB}_2$  based superconducting current leads with a critical current rating of 1000 A and length in the range of 10 to 20 cm prepared for fusion magnet application.

As a part of developing a viable and scalable process for the generation of bio-fuel from Indian marine microalgae, an experimental raceway pond reactor was installed for carrying out the experiments on algal cultivation and developed autoflocculating algal cultures. An agent-based stimulation model to study the population dynamics of algal raceway pond was also developed.

Violacein, a high value pigment, obtained from chromo bacterium isolate purified and characterized. Fermentation steps including ideal media composition and culture conditions were optimized.

A modified anaerobic process for banana fibre extraction was found suitable for good quality fibre production from banana pseudostem. It is observed that the characteristics of the banana pseudostem fibre vary with the position of leaf sheath and method of extraction.

Field trials of large scale reverse flow convection driers for ball copra and groundnut have been initiated after commissioning of the driers at farmers' fields. The pappad drier was re-designed and tested with agri-fuel as the heat source.



## Honours & Awards

Patented technology of the Institute for the production of white pepper from black pepper, has won the World Intellectual Property Organisations' (WIPO) Gold Medal for the best invention of the year 2009. This international recognition follows the NRDC meritorious award for the Year 2009, which carries a purse of Rs. 5 lakhs. The technology was developed by a team comprising Dr. V.B. Manilal, Shri. Ajit Haridas and Dr. Gopinathan M.



Director, Dr Suresh Das was elected as the Fellow of Indian National Science Academy, Dr. K.R. Gopidas was elected Fellow of the Indian Academy of Sciences, Bangalore and Dr M. Sundararajan was elected Fellow of Geological Society of India during the year.



*NIIST team receiving the WIPO Gold medal.*

## Human Resource Development

Many staff members and students were deputed for various training programmes. Deputations of thirteen scientists were processed for their visit to foreign countries in connection with the R&D activities. Many seminars, workshops and invited lectures were arranged to keep the staff updated with the recent developments in their respective areas. An orientation training programme for the benefit of Assistants and Stenographers of the Institute was held by CSIR- HRDC during 21-25 Feb. 2011. The Orientation training was conducted to inculcate good practices among staff members and to foster healthy interpersonal relationships, so that the process would pave the way for transforming NIIST to a 'Centre of Excellence'. Another orientation programme was also held for research fellows and project assistants making them aware of the CSIR system, good laboratory practices and safety measures.

## Other Activities

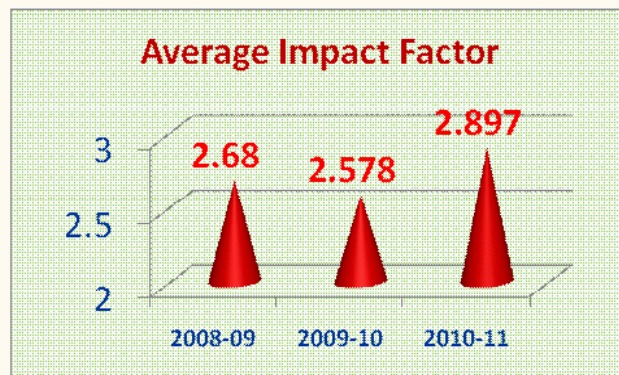
The National days as well as CSIR and Institute foundation days were celebrated and the institute was kept open for students and public to have a glimpse of the achievements. As a part of the CSIR programme, one day training for higher secondary and college level teachers in the area of chemistry was organized on 17<sup>th</sup> & 18<sup>th</sup> of February 2011, respectively. The main objective of this programme was to promote interest, excitement and excellence in science education. 5<sup>th</sup> Mid Year CRSI Symposium in Chemistry (23-24th July, 2010), Hindi Day Celebration (14th September, 2010), Vigilance Awareness Week (last week of October, 2010), One day seminar on Mushroom: Prospects & Problems (8th February, 2011), Celebration of International Year of Chemistry (10th February, 2011), etc. are some of the major functions arranged at the Institute.

The staff club and student association also arranged many functions to celebrate festivals and other social activities.



## विशेषताएं

राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान ने वर्ष 2010-11 के दौरान कई उपलब्धियों और सीएसआईआर की प्रमुख गतिविधियों में भागीदारी के साथ अपना स्थिर विकास जारी रखा। नई दिल्ली में आयोजित सीएसआईआर टेकनोफेस्ट कार्यक्रम में संस्थान ने सक्रिय रूप से भाग लिया और सीएसआईआर की उपलब्धियों के प्रदर्शन में, विशेष रूप से रसायन विज्ञान के क्षेत्र में एक अग्रणी भूमिका निभा ली। ग्यारहवीं पंचवर्षीय योजना के दौरान अर्जित विशेषज्ञता को मजबूत करके तथा सामरिक रूप से महत्वपूर्ण और वैज्ञानिक दृष्टि से चुनतिपूर्ण परियोजनाओं की शुरुआत के द्वारा सीएसआईआर के अन्य रासायनिक क्लस्टर संस्थानों के साथ निकट समन्वय में संस्थान ने 12 वीं पंचवर्षीय योजना प्रस्तावों का संरूपण शुरू किया। संस्थान के अनुसंधान एवं विकास में रसायन विज्ञान एवं जीव विज्ञान तथा रसायन विज्ञान और सामग्री के बीच के इंटरफेस पर ध्यान केंद्रित किया जा रहा है। वर्ष के दौरान समान विषय के पांच नई इन-हाऊस परियोजनाएं शुरू की गयी, (i) चयापचय संबंधी अव्यवस्था के रोकथाम / नियंत्रण के लिए पादप तथा माइक्रोबियल स्रोतों से जैवसक्रियों, (ii) धारणीय ऊर्जा के लिए ऊर्जा दक्ष और ऊर्जा उत्पादन उपकरणों के विकास में नयी कार्यात्मक सामग्री के विकास (iii) बायोमास से तरल और गैसीय जैव ईंधन (iv) स्मार्ट और कार्यात्मक सामग्री के डिजाइन और विकास, और (v) माइक्रो सेक्टर के लिए ग्रीन उद्यमों (जेम्स)। इसके अलावा संस्थान ने कुछ स्वयं सहायता समूहों या छोटे उद्यमियों के लिए उपयुक्त प्रौद्योगिकियों की पहचान की। कम आय और / या समाज के कम तकनीकी शिक्षित वर्गों द्वारा अनुकूलन के लिए इन प्रौद्योगिकियों के वितरण पर जोर देने के साथ एक कार्यक्रम भी शुरू कर दिया गया है। इस वित्तीय वर्ष के दौरान पच्चीस नई सहायता- अनुदान, चार प्रायोजित और नौ परामर्श परियोजनाएं शुरू की गयी। संविदा अनुसंधान कार्यक्रमों के माध्यम से 633.166 लाख रुपये की राशि प्राप्त की गयी। संस्थान ने 197 शोध पत्र (182 एससीआई, औसत आईएफ 2.897) प्रकाशित किए और 18 पेटेंट (13 विदेशी और 5 भारतीय) दायर किए। एनआरडीसी तथा डब्ल्यूआईपीओ पुरस्कार प्राप्त सफेद मिर्च प्रौद्योगिकी और चार ग्राहकों को हस्तांतरित की गयी।



### अनुसंधान एवं विकास की विशेषताएं

कोच्चीन में, मेसेर्स एन इंपेक्स स्पाइसेस हाऊस के लिए गर्मी की वसूली के साथ प्रशीतित निराद्रीकरण का इस्तेमाल करके प्रति दिन दो टन जायफल के प्रसंस्करण के लिए एक आधुनिक सुखाने की सुविधा स्थापित की गई। सुखाने की यह विधि ने मानसून फसल के मौसम के दौरान प्रयुक्त अन्य कृत्रिम सुखाने की प्रथाओं की तुलना में सगंध तेल के रिसाव तथा एफ्लाटैक्सीन निर्माण को रोका दिया। संस्थान ने सिक्किम राज्य में अदरक प्रसंस्करण सुविधा की स्थापना के लिए अपनी प्रक्रिया और इंजीनियरिंग कौशल बढ़ाया और इस वाणिज्यिक उद्यम कमीशन किया गया है। इससे अब तक जलवायु परिस्थितियों पर निर्भर अदरक के विपणन में भारी परिवर्तन आएगा और कृषकों को अपने उत्पादनों के लिए लाभकारी मूल्य मिलने की आशा है।



अनानास प्रसंस्करण उद्योग का एक उपोत्पाद, अनानास अवशेष से उत्पन्न जैवसक्रितों की एंटीऑक्सीडेंट क्षमता का मूल्यांकन करने के लिए किए गए विट्रो अध्ययन ने यह सूचित किया है कि मधुमेह संबंधी जटिलताओं को सुधारने में अनानास अवशेषों में महत्वपूर्ण चिकित्सीय गुणधर्म विद्यमान हैं।

न्यूनतम माध्यम के साथ अनुप्राणित एक अक्रिय समर्थन पर स्ट्रेप्टोमाइसीज़ गिडेन्सीज़ की खेती के द्वारा एल-ल्यूलीन ऐमीनो पेप्टीडेस के उत्पादन के लिए एक ठोस अवस्था किण्वन प्रक्रिया विकसित की गई। इस प्रक्रिया से उपलब्ध उच्च स्तर उपज, औद्योगिक अनुप्रयोग के लिए अक्रिय समर्थन का उपयोग कर ठोस अवस्था किण्वन के अधीन एल-ल्यूलीन ऐमीनो पेप्टीडेस (एलएपी) के उत्पादन पर उदीयमान तकनीकी व्यवहार्यता दर्शाती है।

बायोएथेनॉल के उत्पादन के लिए कपास डंठल से किण्वन योग्य शर्करा की वसूली के लिए एक प्रभावी पूर्वोपचार प्रक्रिया विकसित की गयी। उच्च तापमान उपचार लिग्निन को पूरी तरह से हटा, जिससे कुल जल अपघटन दक्षता को 96% तक बढ़ाने में मदद मिली। कपास संयंत्र अपशिष्ट में वर्तमान कार्बोहाइड्रेट और मूल्य वर्धित उत्पाद के रूप में सिलोज़ और अरैबिनोस के इस्तेमाल को ध्यान में रखते हुए, कपास संयंत्र कचरे से एथेनॉल के उत्पादन के लिए कुल प्रक्रिया अर्थव्यवस्था अत्यधिक प्रभावी हो सकती है।

नूतन  $\pi$  संयुग्मित ऑलिगो पॉली (फेनिलीनवाइनीलीन) (ओपीवी) आर्किटेक्चर और कुशल हरे और लाल उत्सर्जन कार्बनिक-अकार्बनिक संकर सामग्री विकसित की गई और उनके ऑप्टिकल गुणधर्मों पर आणविक पैकिंग की भूमिका पर जांच की। समय विभेदित उत्सर्जन स्पेक्ट्रोस्कोपी अध्ययन से पता चला कि भारी अंत समूहों युक्त जेलीकरों की तुलना में छोटे अंत कार्य समूहों युक्त ओपीवी जेलीकरों में उत्तेजना ऊर्जा प्रवास दक्षता अधिक थी। संरचना- गुणधर्म अध्ययनों से पता चला कि सह-आननीय सवृत एच टाइप समुच्चय (सेंडविच) के रोकथाम के द्वारा सह  $\pi$  संयुग्मित सामग्री के ठोस अवस्था उत्सर्जन में वृद्धि की जा सकती है और फिसल सवृत या जे- टाइप समुच्चय के निर्माण के द्वारा ठोस अवस्था संदीप्ति में महत्वपूर्ण वृद्धि उत्पन्न करती है।

रक्त तथा जलीय माध्यम में साइनाइड, डीएनए, धातु आयनों, नाइट्राइट और ऐमिनोथिऑल्स की चुनिंदा संसूचन के लिए संदीप्तिशील रंजकों का विकास किया।

समुच्चयन प्रेरित संवृद्धित उत्सर्जन विशेषताओं को प्रदर्शन करने वाला एक कोर संशोधित कैल्क्सप्रिन संश्लेषित किया गया जिसका पारा आयनों के चुनिंदा संसूचन के लिए इस्तेमाल किया जा सकता है। इसके अलावा, नूतन प्रकार्यात्मक साइक्लोफेन आधारित सिस्टम संश्लेषित किया गया है, जिसने महत्वपूर्ण जैवअणुओं के साथ अतःक्रिया किया।

ब्रोमिन तथा आयोडीन जैसे भारी परमाणुओं के साथ प्रतिस्थापित नूतन aza-BODIPY (4,4-difluoro-4-bora-3a,4a-diazas-indacenes) का संश्लेषण किया गया। ये अणुओं को एकक ऑक्सीजन के उत्पादन में आदर्श सुग्राहीकर के रूप में इस्तेमाल किया जा सकता है, जिन्हें सिंथेटिक रसायन विज्ञान, अपशिष्ट जल उपचार, प्रकाशगतिक कोशिका मृत्यु, जैसे असंख्य क्षेत्रों में अनुप्रयोग होता है।

प्रेरित इलेक्ट्रॉन अंतरण प्रक्रिया तथा कटैलिसीस में शक्य अनुप्रयोग होनेवाले नैनोतंतुओं, गोल्ड नैनोकण प्रकार्यात्मक कार्बन नैनोट्यूब, पैलेडियम नैनोकण क्रोडित डेन्ड्रिमरों के कुशल उत्पादन के लिए योजना विकसित की गई।

प्रकार्यात्मक मोनो और डाइफिनोक्सीकैल्क्स [4] ऐरीन के लिए नई सिंथेटिक पद्धतियां विकसित की तथा प्रकार्यात्मक इन्डेनोन्स तथा इन्डेनॉल्ल के लिए संक्रमण धातु उत्प्रेरित सरल मार्ग विकसित किया गया है। विभिन्न सेल लाइनों का उपयोग करके निंबोलाइड, जो अजडिराटा की पत्तियों से अलग किए गए ट्राइटेरपिनाइड है, के संभावित जैविक अनुप्रयोगों की जांच की है।

प्रयोगशाला स्तर पर रासायनिक यांत्रिक (सीएमपी) प्लैनेराइसेशन के लिए नैनो आकार सैरियम ऑक्साइड नैनो छड़ और नैनो ट्यूब, मध्यम वोल्टेज प्रोत्कर्ष संरक्षण के लिए दुर्लभ पृथ्वी डोपड जिंक आक्साइड वारिस्टेर्स और बहिःस्त्रावों से रंजकों के दूरीकरण के लिए चुंबकीय रंजक अवशोषण उत्प्रेरक विकसित किए गए।



फ्लक्स बंधित उत्पादों के लिए फ्लाइ ऐश के अनुकूलन के लिए एक प्रौद्योगिकी का निदर्शन किया गया और इसे मेसेर्स नवोदया सिरेमिक्स हैदराबाद को हस्तांतरित किया गया है। इस प्रक्रिया में ईंटों, ब्लॉकों, और काचित सिरेमिक उत्पादों को बनाने में 80% तक फ्लाइ ऐश का उपयोग कर सकता है।

बीएचईएल - सीटीआई, बंगलौर के साथ सहयोग से औद्योगिक पानी के रीसाइक्लिंग के लिए मल्टी चैनल अल्ट्रा निस्पंदन सिरेमिक झिल्ली के लिए सॉल- जेल कोटिंग पूर्वगामियों विकसित की। सौर सेल पैनल के लिए कम तापमान उपचार योग्य स्वयं सफाई संकर कोटिंग्स विकसित किए गए और गिलास स्लाइड पर 99 प्रतिशत पारदर्शिता हासिल की गई। प्लास्टिक की रंगाई के लिए रासायनिक रूप से स्थिर और पर्यावरण-हितैषी दुर्लभ पृथ्वी डोप्पड  $Bi_2MoO_6$  पीले रंजक संश्लेषित किए गए।

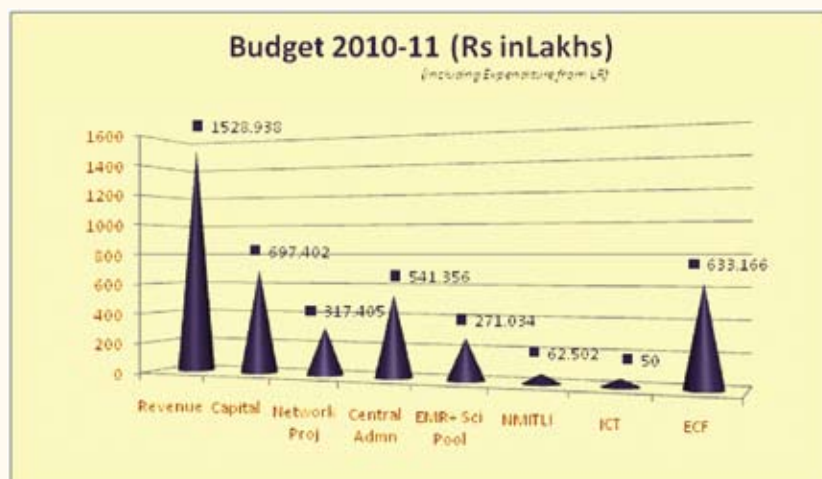
ठोस अवस्था सिरेमिक मार्ग द्वारा एपेटाइट टाइप दुर्लभ पृथ्वी सिलिकेट तैयार किया गया। यौगिकों ने माइक्रोवेव आवृत्ति क्षेत्र में बहुत कम डाइइलेक्ट्रिक स्थिरांक और कम नुकसान कारक दिखाया। ये माइक्रोवेव सबस्ट्रेट अनुप्रयोगों के लिए उपयुक्त सामग्री हैं। संलयन चुंबक अनुप्रयोग के लिए 1000 एमपेअर के क्रिटिकल करंट रेटिंग के साथ और 10 से 20 से.मी रेंज की लंबाई की  $MgB_2$  आधारित अतिचालक करंट लीड्स तैयार किया गया।

भारतीय समुद्री सूक्ष्मशैवाल से जैव ईंधन के उत्पादन के लिए एक व्यवहार्य और स्केलेबल प्रक्रिया के विकास के एक भाग के रूप में शैवाल की खेती पर परीक्षणों को जारी करने के लिए प्रयोगात्मक नाला तालाब रिएक्टर स्थापित किया गया और स्वतःऊर्णन शैवाल संवर्धन विकसित किया। शैवाल नाला तालाब की जनसंख्या गतिकी के अध्ययन के लिए एक एजेंट आधारित उत्तेजना मॉडल भी विकसित किया।

क्रामो बैक्टीरियम अलगाव से प्राप्त एक उच्च मूल्य वर्णक, वायोलासीन का शुद्धीकरण और अभिलक्षण किया गया। आदर्श माध्यम संरचना और संवर्धन की स्थिति सहित किण्वन के कदमों को अनुकूलित किया गया।

केले के छद्मतना (स्यूडोस्टेम) से अच्छे गुणवत्ता वाले फाइबर के उत्पादन के लिए केले फाइबर निकासी के लिए एक संशोधित अवायवीय प्रक्रिया उपयुक्त पायी गयी। यह देखा गया है कि केले छद्मतना फाइबर की विशेषताएं पत्ती के म्यान और निकासी की विधि की स्थिति के साथ बदलती हैं।

किसानों के खेतों में शुष्ककों के कमीशनिंग के बाद बड़े पैमाने पर बॉल खोपरा और मूंगफली के लिए रिवर्स प्रवाह संवहन शुष्ककों के फील्ड परीक्षण शुरू किया गया। पाप्पड सुखाने की मशीन फिर से डिजाइन किया गया और कृषि ईंधन का गर्मी के स्रोत के रूप में परीक्षण किया।





### सम्मान एवं पुरस्कार

काली मिर्च से सफेद मिर्च के उत्पादन के लिए संस्थान द्वारा पेटेंट की गई प्रौद्योगिकी को , विश्व बौद्धिक संपदा संगठन के वर्ष 2009 के सबसे अच्छा आविष्कार के लिए (डब्ल्यूआईपीओ) स्वर्ण पदक जीता है । अंतरराष्ट्रीय स्तर पर के यह पहचान के अलावा इस प्रौद्योगिकी को वर्ष 2009 के एनआरडीसी विशिष्ट पुरस्कार भी प्राप्त है, जिसमें 5 लाख रुपए का नकद पुरस्कार भी शामिल है । डॉ. वी.बी.मणिलाल, श्री. अजित हरिदास और डॉ. गोपीनाथन एम. की एक टीम द्वारा यह प्रौद्योगिकी विकसित की गयी थी ।

निदेशक, डॉ. सुरेश दास भारतीय राष्ट्रीय विज्ञान अकादमी के फेलो चुने गये, डॉ. के.आर. गोपिदास भारतीय विज्ञान अकादमी, बंगलौर के फेलो चुने गए और डॉ. एम. सुन्दरराजन भारतीय जियोलाजिकल सोसाइटी के फेलो निर्वाचित किया गया ।



एनआईआईएसटी टीम डब्ल्यूआईपीओ स्वर्ण पदक प्राप्त करते हुए ।

### मानव संसाधन विकास

कई स्टाफ सदस्यों और छात्रों को विभिन्न प्रशिक्षण कार्यक्रमों के लिए प्रतिनियुक्त किया गया । अपने विभिन्न अनुसंधान एवं विकास गतिविधियों के संदर्भ में 13 वैज्ञानिकों के विदेश की प्रतिनियुक्तियों पर विचार किया गया । स्टाफ सदस्यों को अपने संबंधित क्षेत्रों में हाल के विकास से अद्यतन करने के लिए अनेक सेमिनारों, कार्यशालाओं तथा आमंत्रित व्याख्यानों का आयोजन किया गया । फरवरी 21-25 2011 के दौरान सीएसआईआर- एचआरडीसी द्वारा संस्थान के सहायकों तथा आशुलिपिकों के लाभार्थ अभिमुखीकरण प्रशिक्षण कार्यक्रम आयोजित किया गया । स्टाफ सदस्यों के बीच अच्छी प्रथाएं विकसित करने और उनके बीच अच्छे पारस्परिक संबंधों को बढ़ावा देने के लिए अभिमुखीकरण कार्यक्रम का आयोजन किया गया, ताकि यह प्रक्रिया एनआईआईएसटी को "उत्कृष्टता के केंद्र" के रूप में बदलने के लिए मार्ग तैयार करेगी । अनुसंधान फेलो, तथा परियोजना सहायकों को सीएसआईआर प्रणाली के बारे में तथा अच्छे प्रयोगशाला प्रथाओं तथा सुरक्षा उपायों के बारे में अवगत कराने के लिए एक और अभिमुखीकरण कार्यक्रम का आयोजन किया गया ।



### अन्य गतिविधियां

राष्ट्रीय दिनों तथा सीएसआईआर और संस्थान के स्थापना दिवस समारोह का आयोजन किया गया और संस्थान की उपलब्धियों की झलक छात्रों तथा आम जनता को उपलब्ध कराने के लिए उन दिनों को आम दिवस के रूप में मनाया गया ।

सीएसआईआर कार्यक्रम के भाग के रूप में 17 एवं 18 फरवरी 2011 को क्रमशः उच्चतर माध्यमिक और कॉलेज स्तर के शिक्षकों के लिए रसायन शास्त्र के क्षेत्र में एक दिवसीय प्रशिक्षण का आयोजन किया गया । इस कार्यक्रम के आयोजन का मुख्य उद्देश्य विज्ञान शिक्षा के क्षेत्र में अभिरुचि, उत्तेजना, और उत्कृष्टता को बढ़ावा देना था ।

रसायन विज्ञान में 5 वीं मध्य वर्ष सीआरएसआई संगोष्ठी (23-24 जुलाई, 2010), हिंदी दिवस समारोह (14 सितंबर, 2010), सतर्कता जागरूकता सप्ताह (अक्टूबर 2010 के अंतिम सप्ताह,), मशरूम पर एक दिवसीय संगोष्ठी: संभावनाएं एवं समस्याएं (8 फरवरी, 2011), अंतरराष्ट्रीय रसायन विज्ञान वर्ष समारोह (10 फरवरी, 2011), आदि संस्थान में आयोजित कुछ प्रमुख समारोह हैं ।

त्योहारों और अन्य सामाजिक गतिविधियों को मनाने के लिए स्टाफ क्लब और छात्र संघ भी कई समारोह का आयोजन किया ।



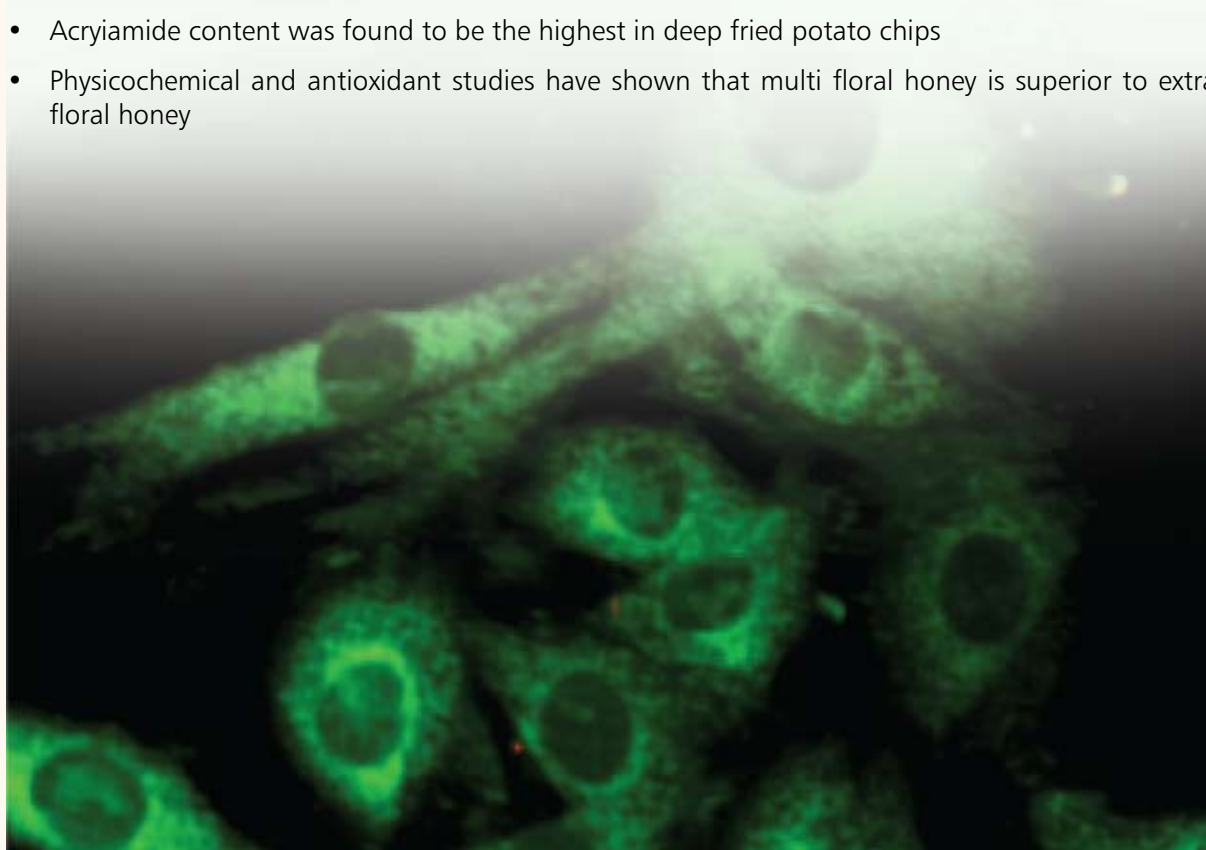


## AGROPROCESSING AND NATURAL PRODUCTS

The major research activities were in the areas of lipid science and technology, spices and flavor technology and natural products. Division acquired modern facilities for chemo profiling and bio evaluation of herbal, medicinal and natural products. Test methods had been standardized for *in vitro* and cell line studies to explore the potential of phyto constituents of selected plant materials in inhibiting metabolic disorders. Many plant extracts and their fractions were tested for biological activities. A commercial plant to process fresh ginger was commissioned in Sikkim and refrigerated dehumidified dryers for nutmeg as well as mace were developed and put into commercial operation. Quality evaluation of selected processed foods and mitigation strategies to maintain quality were also undertaken.

### Highlights

- Commercial plant for processing fresh ginger commissioned in Sikkim
- Refrigerated dehumidified dryer for Nutmeg/Mace was developed and commercial unit is in operation
- Pineapple residue showed significant therapeutic property in ameliorating diabetes related complications
- Ethyl acetate fraction of *Piper longum* extract observed to reduce lipid droplet formation in pre-adipocytes and down regulate PPAR- $\gamma$  expression
- Acrylamide content was found to be the highest in deep fried potato chips
- Physicochemical and antioxidant studies have shown that multi floral honey is superior to extra floral honey



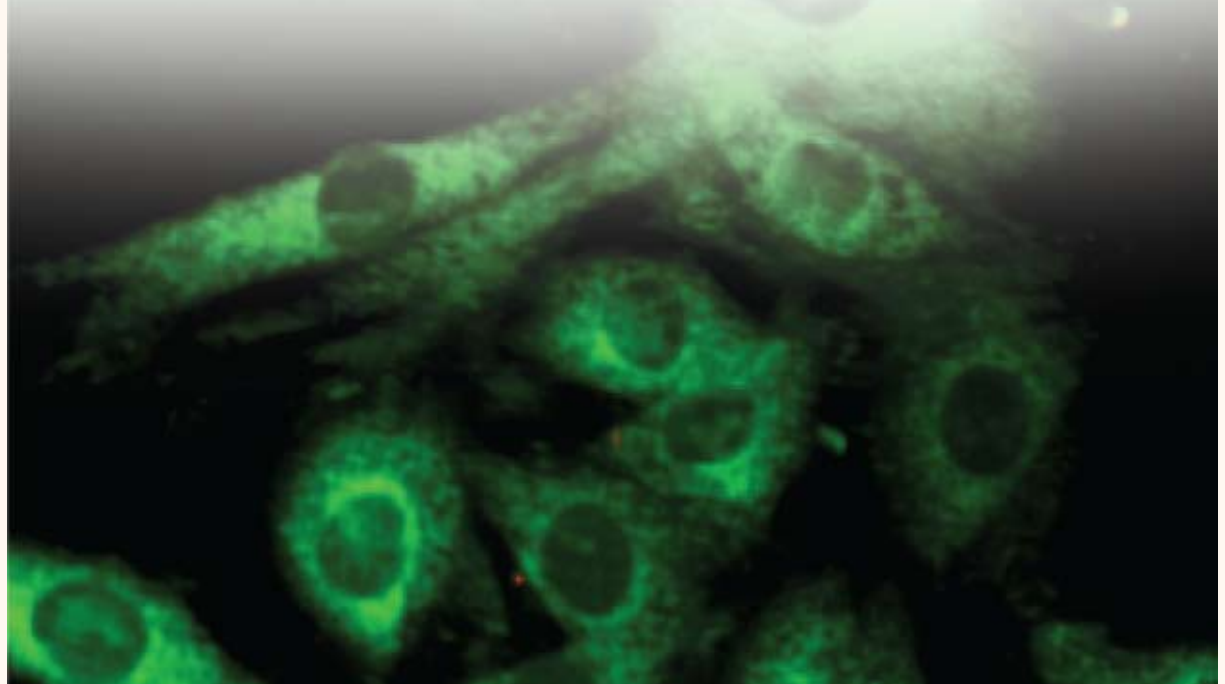


## कृषि प्रसंस्करण तथा प्राकृतिक उत्पादों

प्रभाग की प्रमुख अनुसंधान गतिविधियाँ लिपिड विज्ञान तथा प्रौद्योगिकी, मसाले और स्वाद प्रौद्योगिकी और प्राकृतिक उत्पादों के क्षेत्रों में थीं। प्रभाग ने रासायनिक रूपरेखा और जड़ी बूटी, औषधीय और प्राकृतिक उत्पादों के जैव मूल्यांकन के लिए आधुनिक सुविधाओं का अधिग्रहण किया था। चयापचय अव्यवस्थाओं को रोकने में चयनित पादप सामग्री के फाइटो घटकों की क्षमता का पता लगाने के लिए इन विट्रो और सेल लाइन अध्ययन परीक्षण तरीकों को मानकीकृत किया गया था। कई पादप निष्कर्षों और उनके अंशों को जैविक गतिविधियों के लिए परीक्षण किया गया। ताजा अदरक के प्रसंस्करण के लिए वाणिज्यिक संयंत्र सिक्किम में कमीशन किया गया और जायफल तथा मेस के लिए एक प्रशीतन निरार्द्रकृत ड्रायर विकसित किया गया और वाणिज्यिक संचालन में डाला गया। चयनित प्रसंस्कृत खाद्य पदार्थों के गुणवत्ता मूल्यांकन और गुणवत्ता बनाए रखने की मिटिगेशन योजनाओं के लिए भी कार्य किए गए।

मुख्य विशेषताएं

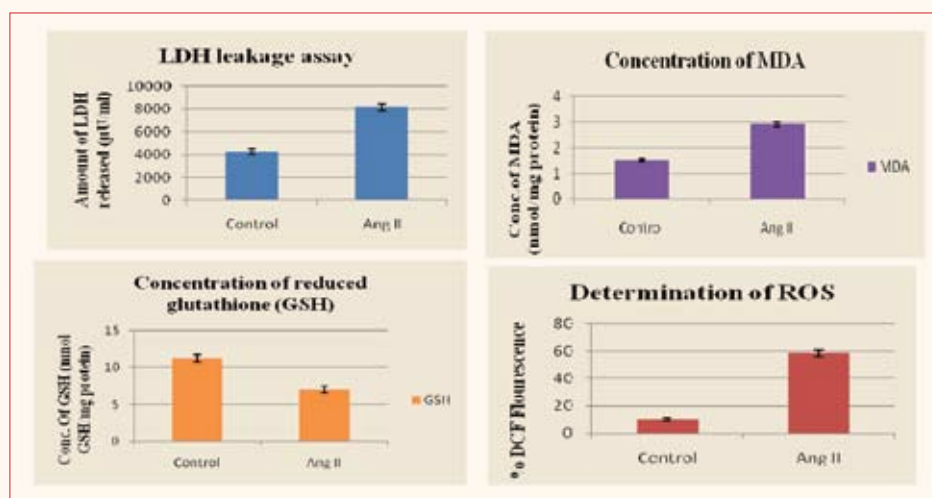
- ताजा अदरक प्रसंस्करण के लिए सिक्किम में वाणिज्यिक संयंत्र कमीशन किया।
- जायफल / मेस लिए प्रशीतन निरार्द्रकृत ड्रायर विकसित किया गया था और वाणिज्यिक इकाई प्रचालन में है
- मधुमेह संबंधी जटिलताओं को सुधारने में अनानस अवशेषों में महत्वपूर्ण चिकित्सीय गुणघर्म है
- पाइपर लॉगम निकाल के एथिल एसीटेट अंश प्री-एंडिपोसाइटों में लिपिड बूंदों के रूपांतरण को कम करता है और पीपीएआर
- अभिव्यक्त की कमी को नियंत्रित करता है
- गहरी तली हुई आलू के चिप्स में ऐक्रिलअमाइड अंश उच्चतम पाया गया।
- भौतिकरासायनिक और एंटीऑक्सीडेंट अध्ययन से पता चला है कि बहु पुष्प मधु अतिरिक्त पुष्प मधु से बेहतर है



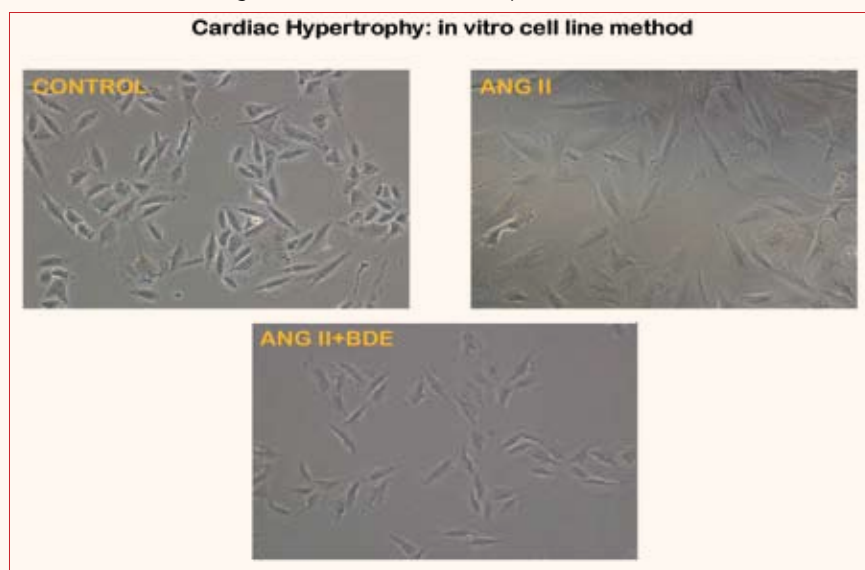


## Protective effects of *Desmodium gangeticum* and *Boerhaavia diffusa*

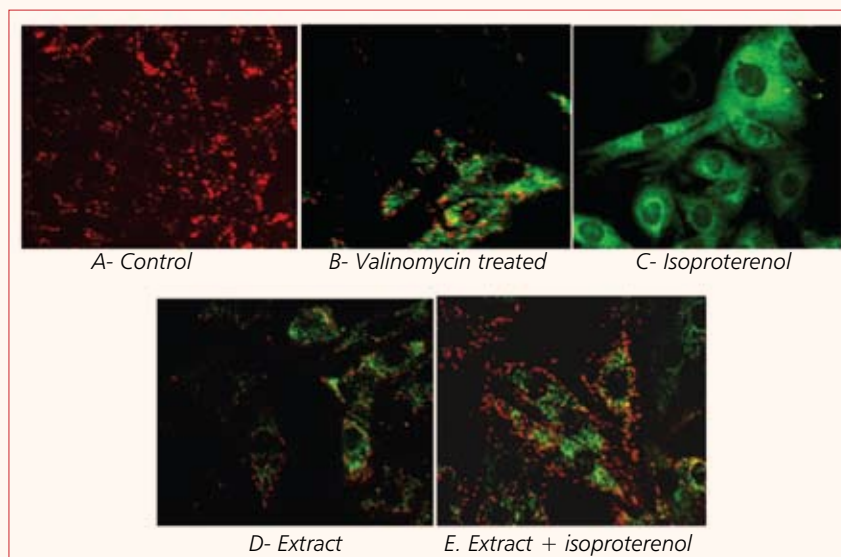
A cell line based method was established to study the various molecular mechanisms underlying the pathophysiology of the cardiac hypertrophy disorder. In order to induce hypertrophy that mimic *in vivo* hypertrophy in animals, cardiac myoblast cell line (H9c2) was treated with Isoproterenol/angiotensin II (100 nM). Development of hypertrophy was confirmed by measuring size of the cell, LDH release into the medium, reactive oxygen species (ROS) generation, lipid peroxidation (malonaldehyde), glutathione. Since oxidative stress is one of the factor responsible for hypertrophy and the mitochondria is the major site of ROS production in the cell, changes in mitochondrial transmembrane potential were studied using fluorescent imaging techniques. Two well known medicinal plants *Desmodium gangeticum* and *Boerhaavia diffusa* were used. Methanolic extracts of *Boerhaavia diffusa* and *Desmodium gangeticum* were evaluated for their protective property. The extract (100 µg/ml) reduced the cell size, oxidative stress and LDH leakage, brought back mitochondrial transmembrane potential to normal induced by angiotensin II and protected antioxidant status of the cells (reduced glutathione and MDA). The detailed study on various signaling pathway involved in the etiology of hypertrophy and the phytochemicals responsible for its protective effects are in progress.



Details on LDH leakage, concentration of Malonaldehyde and Glutathione and generation of ROS with Angiotension treatment in comparison with control



Size of the cell with Angiotension (control, angiotension, angiotension with BDE (Boerhaavia diffusa extract) treated



Confocal imaging of mitochondria in different groups

## Bioactives from Pineapple residue

Pineapple (*Ananas comosus*) is a tropical fruit with potential health benefits. The present study evaluated the therapeutic properties of the pineapple residue, a byproduct of the pineapple processing industry. The antioxidant potential of the fractions obtained by extraction was evaluated. The *in vitro* antioxidant activity was assessed by ABTS radical scavenging assay and total antioxidant activity. The control of postprandial blood glucose concentration is one of the therapeutic interventions for the treatment of diabetes.  $\alpha$ -Glucosidase plays a very important role in the digestion of carbohydrates to produce glucose. So the inhibitory potential of the fraction against this enzyme was assessed and found significant inhibition against the same. The antiglycation effect of the two fractions (methanolic and ethyl acetate) was also investigated. A progressive decrease in fluorescence was obtained at the most effective concentration. There are reports that oxidative stress induces DNA breakage, accordingly the study was extended to evaluate the protective effect against Fenton reaction induced DNA damage. Overall, the *in vitro* studies showed that the bioactives from pineapple residue have significant therapeutic property to ameliorate diabetes related complications.

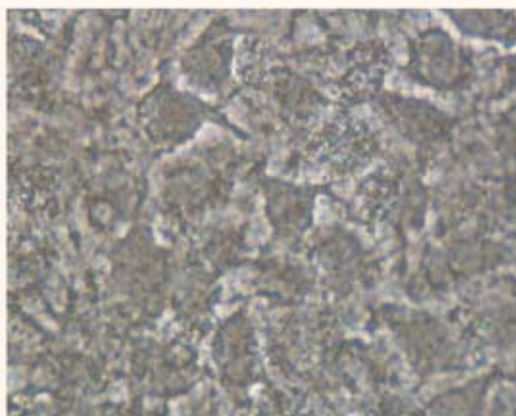


DNA damage protection assay- Effect of ME on Fenton's reagent induced DNA damage.  
Lane 1: pUC18 plasmid only, Lane 2: negative control (plasmid DNA + Fenton's reagent),  
Lane 3&4: positive control (plasmid DNA + Fenton's reagent + ellagic acid-conc. 50ng and 5ng respectively),  
Lane 5&6: ME (plasmid DNA + Fenton's reagent + ME-conc. 200µg and 500µg respectively)

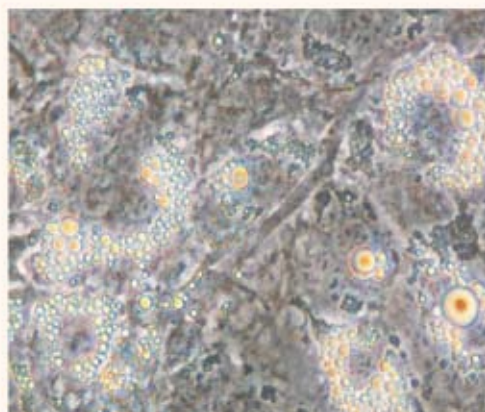


### Standardization of PPAR $\gamma$ modulatory activity using 3T3-L1

Peroxisome Proliferator Activated Receptors (PPARs) are ligand-activated transcription factors belonging to the nuclear hormone receptor superfamily. Three different PPAR isoforms have been identified in humans. PPAR  $\gamma$  is largely expressed in adipose tissue as well as skeletal muscle, sites where this PPAR isoform exerts much of its metabolic actions. PPAR  $\gamma$  is reported to have pleiotropic effect in lipid and carbohydrate metabolism such as increasing the insulin sensitivity and its rejuvenation, in differentiation of adipocyte to increase the expression and activity of glucose transporter 4, etc. Under this program a cell line based method to evaluate PPAR  $\gamma$  activity was standardized. 3T3-L1 cells were cultured to confluence in DMEM (Dulbecco's modified Eagle's medium) supplemented with 10% (v/v) FBS (Fetal bovine serum). At 2 days post-confluence (designated day 0), cells were induced to differentiate with DMEM supplemented with 10% (v/v) FBS (fetal bovine serum), 1  $\mu$ M dexamethasone, 0.5 mM isobutylmethylxanthine, 1  $\mu$ g/ml insulin and after 48 h, the media were replaced with DMEM supplemented with 10% FBS and 1  $\mu$ g /ml insulin. The cells were subsequently re-fed every 48 h with DMEM supplemented with 10%FBS. Eighth day onward there was formation of lipid droplet in the media indicating final stage of differentiation through activation of peroxisome proliferator activated receptor  $\gamma$ .



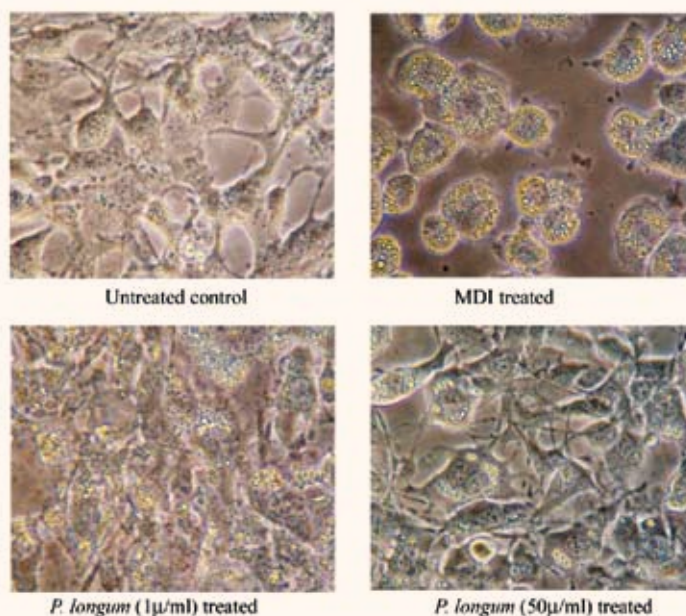
*Free adipocytes*



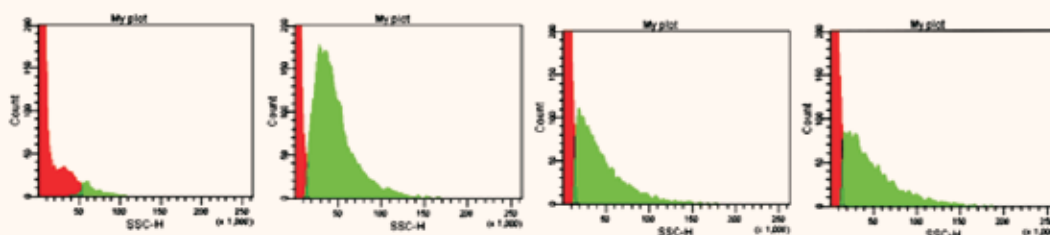
*Matured adipocyte with lipid droplets*

### Inhibitory effect of ethyl acetate fraction of *Piper longum* extract on lipid droplets in pre-adipocytes

Ethyl acetate extract of *Piper longum* extract showed concentration dependent activity on reducing lipid droplet content in 3T3L1 pre-adipocytes. Cells were grown in differentiation media (MDI media) containing insulin (167  $\mu$ M), dexamethasone (10 nM) and IBMX (11.5  $\mu$ g) per ml. Results showed significant reduction in lipid droplet content after an incubation of 14 days in presence of extract at 1-100  $\mu$ g/ml concentration. Change in size and number of lipid droplets were visualized clearly through bright field microscopic images. Based on cell size and granularity, these cells were separated by flow cytometric analysis. Cells with more lipid droplets acquired a position with high forward and side scatter values. The population statistics showed that extract treatment reduced cell number with high granularity (lipid droplets).



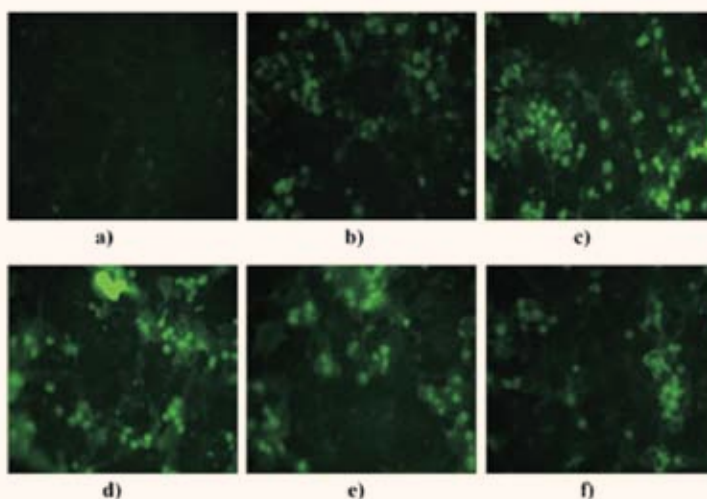
Bright field microscopic images of lipid droplets in 3T3L1 cells upon MDI treatment and in presence of ethyl acetate fraction.



Flow cytometric analysis of differentiated 3T3L1 cells for change in cell size and granularity. Percentage of population is indicated as peaks in the histogram. Population with high size and granularity is indicated in green coloured peak.

### Regulation of the expression of PPAR- $\gamma$ using ethyl acetate fraction of *Piper longum* extract

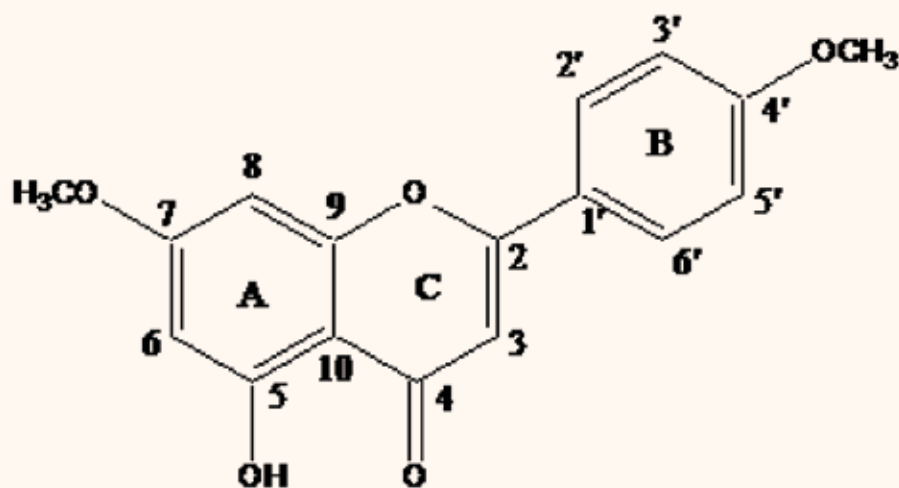
PPAR-  $\gamma$  is a nuclear receptor protein that plays major role in enhancing genes leading to differentiation of pre-adipocytes to adipocytes. This was analyzed using fluorescent tagged antibodies against PPAR- $\gamma$ . Pre-adipocytes were grown to differentiation in presence and absence of ethyl acetate fraction of *P. longum* at 5, 10 and 50  $\mu\text{g}/\text{ml}$  concentration. On image analysis, the effect of ethyl acetate fraction on expression of PPAR- $\gamma$  was clearly evident. At a concentration of 10  $\mu\text{g}/\text{ml}$ , the extract was able to maintain cell morphology in a pre adipocyte state compared to rosiglitazone (100 nM) treated cells. Reduction in lipid droplet level up on extract treatment showed a good correlation with down regulation of PPAR- $\gamma$  expression.



Antibody based detection of PPAR- $\gamma$  with response to ethyl acetate fraction treatment.  
a) Unstained cells b) MDI control c) cultured in presence of Rosiglitazone (100 nM).  
From d-f, cells were grown in presence of 5, 10 and 50  $\mu\text{g/ml}$  ethyl acetate fraction.

### Isolation of compounds from the active fraction of *Piper longum* extract

The ethyl acetate fraction of the *Piper longum* extract was the most active fraction, which was subjected to column chromatographic separation using the solvents hexane, ethyl acetate and methanol in different ratios on silica gel. By adjusting the solvent systems on the fractions obtained after the column separation, several compounds were isolated. Out of which one compound responded positively towards the test for flavanoids. The melting point of this compound was found to be in the range of 166-168°C and was yellow needle shaped crystals. The HR-FAB-MS results showed a molecular weight of 298. By analyzing all the spectral data of this compound such as <sup>1</sup>H-NMR, <sup>13</sup>C-NMR, <sup>1</sup>H-COSY, HMQC and HMBC it was found that the flavanoid obtained was dimethyl ether of apigenin. From literature survey it was clear that the flavanoid was not reported from the *Piperaceae* family of plants. Another compound also responded positively towards the test for saponins (Shinoda's test). The identification of this compound is under progress.



Structure of dimethyl ether of apigenin isolated from *Piper longum* extract



## Studies on antidiabetic activity of fenugreek leaves as a means of affordable diabetic health care management

Fenugreek (*Trigonella foenum-graecum*) is one among the well acclaimed antidiabetic plants. Among different parts of the plants, the seed has been reported to possess antidiabetic activity. However, the leaves of the plant have also been used traditionally for treating diabetes. But, the literature survey does not highlight the antidiabetic potential of the leaves of fenugreek. The present study investigated the antidiabetic and antioxidant potential of fenugreek leaves. Sequential extracts of fenugreek leaves were prepared and were analysed for their antioxidant and antidiabetic potential. Among the extracts, 70% methanol and ethyl acetate extracts showed potent antioxidant activity, when compared with other extracts such as methanol, hexane, and water. 70% Methanol and ethyl acetate extracts were found to be effective in DPPH and ABTS radical scavenging assay. In  $\alpha$ -glucosidase inhibition assay, ethyl acetate extract showed potent antidiabetic activity. These findings indicated that the magnitude of the antihyperglycemic power of ethyl acetate extract (IC<sub>50</sub>-1.83 $\mu$ g/ml) was potentially 18-fold stronger than that of acarbose (IC<sub>50</sub>-Acarbose 33.10 $\mu$ g/ml). Results on glucose uptake using confocal microscopy concluded that the ethyl acetate and hexane extracts of fenugreek leaves possessed significant antidiabetic activity. These results were also confirmed using flowcytometric analysis. The efficacy of ethyl acetate in *in vitro* cell line study on 2-NBDG uptake also resulted in a good correlation with  $\alpha$ -glucosidase inhibition assay. Further characterization studies and isolation of the bioactive compounds present in these extracts responsible for these properties are in progress.

## Studies on antioxidant potential and antifungal properties of *Calotropis gigantea*

The present study investigated the antioxidant potential and antifungal properties of the sequential extracts from leaves, flowers, stem and latex of *Calotropis gigantea*. The total phenolic content (TPC) and total reducing power (TRP) of the extracts were evaluated. DPPH radical scavenging assay, ABTS radical cation scavenging assay, hydroxyl radical scavenging assay were carried out for the assessment of *in vitro* antioxidant activities. Ethyl acetate and water extract of leaf showed good antioxidant activity, when compared to other extracts. From these results it was evident that these extracts possessed significant antioxidant activity and there was a good correlation between the phenolic content and their antioxidant activity. In addition to *in vitro* antioxidant activity, all the ethyl acetate extracts, namely from leaf, flower and stem, possessed a remarkable antifungal activity against agricultural pathogens. Among the extracts, ethyl acetate extract of stem was found to be highly effective. Based on the results there is a scope for developing this plant as a good source of antifungal agent and the work is in progress.

## Development of refrigerated dehumidified dryer for Nutmeg/ Mace

Nutmeg and mace exported from the country often faced severe quality constraints in the European markets due to the presence of aflatoxin. As the crop is harvested in monsoon, sun drying was not possible. Further, artificial drying, in addition to higher input costs, resulted in a product with the essential/ fixed oil oozing out of the spice. A modern drying facility was set up for M/s Ann Impex, the House of Spices at Cochin under consultancy agreement with a capacity to process 2 tons of Nutmeg per day. Refrigeration induced dehumidification with heat recovery was employed for the generation of heat as well as for the removal of the moisture. The unit is undergoing commercial trials.

## Determination of essential oil composition of two ginger cultivars from Sikkim

Volatile oils from two most popular cultivars from Sikkim namely, Bhaisa and Majulay were isolated, characterized by analytical gas chromatography and gas chromatography-mass spectroscopy. Sixty constituents accounting for 94.5% and 92.6% of the Bhaisa and Majulay oils were identified. The major compounds of Bhaisa oil were Geranyl acetate (18.8%), Zingiberene (16.3%), Geranial (8.2%) and of Majulay oil were Zingiberene (19.8%), and Geranial (16.5%). Compared to other ginger cultivar oils the Bhaisa oil had higher content of oxygenated compounds (43.1%). This is the first report on the constituents of essential oils of Sikkim ginger





### Bio actives from spent turmeric oleoresin

The spent Oleoresin of turmeric received from M/s Synthite Industrial Chemicals, Cochin was used for the studies which was found to have low curcumin content of 8%, compared to the commercial samples. The sample was fractionated to enrich the curcumin content as per the following procedure. The sample was mixed with cellulose on treatment with a polar solvent hexane and in the process the turmeric oil got dissolved along with other low polar compound which was separated by filtration. The residue, then contain cellulose, curcumin and other non dissolvable substances. From this residue, curcumin enriched fraction was separated using a mixture of ethyl acetate and hexane in different ratios as 30:70, 40:60, 50:50, 60:40, and 70:30. The curcuminoid content of the each fraction was determined and it was found that in the fraction obtained through extraction with 60:40 mixture of ethyl acetate and hexane, the curcuminoid content has almost become double.

### Evaluation and control of acrylamide formation in traditional deep fried snack products

Acrylamide is known to be a neurotoxic, genotoxic and potentially carcinogenic compound. Presence of acrylamide has been reported in foods subjected to very high temperature processing such as frying and baking. The present study was undertaken to evaluate the level of acrylamide in some of the deep fried snacks viz., potato, banana, jack and colocasia chips. The study also looks into different mitigation strategies to control the formation of acrylamide in banana chips. The compositional analysis of chips collected from various outlets of two cities in Kerala, Trivandrum and Cochin, was completed and reported earlier. In continuation to that, analytical method for detection and quantification of acrylamide was optimized. The quantification of acrylamide in different deep fried chips as mentioned above, collected from four different outlets was performed by HPLC system consisting of a binary pump with a temperature controlled oven and a DAD. The chromatographic separations were performed on a C18 column using standard acrylamide. Acrylamide was detected at 206 nm with continuous monitoring of the peak spectra within the range of 190-350 nm for spectral confirmation. The acrylamide content was found to be the highest in Potato chips ( $14.104 \pm 0.312$ ) followed by Jack chips ( $13.824 \pm 0.485$ ), colocasia chips ( $13.415 \pm 0.346$ ) and Banana chips ( $12.983 \pm 0.247$ ). The acrylamide content in potato chips were in agreement with the published reports as it contains high amount of asparagine amino acid, which is a precursor for the formation of acrylamide. Further studies are underway to find out the mitigation strategies using various pre-treatments of the raw materials and also to evaluate the relation between the composition of raw materials and acrylamide formation.

### Evaluation of the presence of trans fatty acid in selected labeled and unlabelled Indian bakery products

The present study aimed in determining the fat content, nature of fat and the trans fat levels in selected labeled and unlabelled bakery products. Five bakery food items which are popularly consumed were selected through market survey and was analyzed for their total fat, fatty acid composition and trans fat content. The selected food items include: biscuits, pastries, cakes, bread and bun. Fat content in samples were extracted by using Folch extraction method and fatty acid methyl esters were analyzed by GC-FID using Supelco SP-2560 column (75m, 0.18mm id and 0.14 $\mu$ m film thickness). Among the five products analyzed, cakes samples had higher fat content ( $20.1 \pm 3.54 - 29.4 \pm 5.8\%$ ) and TFA content ( $1.53 \pm 0.2 - 3.20 \pm 1.0\%$ ). Biscuits had  $12.00 \pm 1.7 - 21.60 \pm 1.86\%$  of total fat, but had negligible TFA content ( $< 0.08 \pm 0.0\%$ ), pastries had  $10 \pm 1.3 - 21.0 \pm 2.45\%$  of total fat and  $0.12 \pm 0.0 - 1.37 \pm 0.1\%$  TFA, bun had  $5.60 \pm 0.89 - 15.70 \pm 3.22\%$  of total fat,  $0.58 \pm 0.1 - 2.22 \pm 0.4\%$  TFA and bread samples showed  $2.00 \pm 0.6 - 5.00 \pm 1.97\%$  of total fat,  $0.03 \pm 0.0 - 0.9 \pm 0.22\%$  TFA. The main trans form in all samples was elaidic acid- C18:1  $\Delta 9t$  (a major TFA in the partially hydrogenated vegetable oil), except butter bun where vaccenic acid (C18:1  $\Delta 11t$ ) along with linolelaidic acid (C18:2  $\Delta 9c\Delta 12t$  &  $9t 12c$ ) was present. The predominant saturated fatty acid in all products was palmitic acid (C16:0) which was a major form found in palm oil. Though TFA was less in other products, they were rich in



SFA which is also a health risk. Quality studies included evaluation of free fatty acid value, peroxide value; p-Anisidine and totox values which were done on the extracted fat from all samples. Higher FFA, PV, p-Anisidine & totox values were observed which indicated the poor quality either contributed by the processing (baking) or storage deterioration.

### Physicochemical parameters, phenolic profile and antioxidant properties of Indian honey samples from extra floral sources and multi floral sources

The honey samples vary widely in their physico-chemical as well as antioxidant properties. All extrafloral honey (EFH) samples were lighter than mixed floral honey samples and these samples had high Y value when measured using lovibond colorimeter. The free acidity values of the honey samples ranged from 16.25 to 49.25 meq/kg and EFH samples had higher acidity ranging from  $37.25 \pm 8.5$  to  $46.25 \pm 5.2$ . All honey samples studied were acidic in nature and the pH values varied from 3.29 to 4.56. The TPC of samples ranged between 202 to 307.8 mg gallic acid/kg of honey. IC<sub>50</sub> values of the honey samples for DPPH scavenging activity ranged between  $4.5 \pm$  to  $66.05 \pm$ . Eventhough the EFH samples had TPC ranging from  $207.4 \pm 12.6$  to  $230.3 \pm 22$ , they were not potential DPPH radical scavengers as shown by their IC<sub>50</sub> values. The IC<sub>50</sub> values of these samples ranged from  $36.37 \pm 2.1$  mg/ml to  $46.53 \pm 0.9$  mg/ml. The correlation matrix showed a positive correlation (0.605) between TPC and colour. Only 1 sample with high colour value showed a low TPC (214.6). Correlation matrix showed a negative relation (-0.55) between DPPH radical scavenging activity and TPC, which showed that higher the TPC value lower the IC<sub>50</sub> value. Also a negative correlation was seen between colour and DPPH (IC<sub>50</sub>) indicating that darker the sample lower the IC<sub>50</sub> value. Each honey sample showed varied hydroxyl radical scavenging activity (20.23% to 80.19%) at the tested concentration (100mg/100μl).

Only 1 EFH sample showed 50% inhibition at the tested concentration. DPPH and hydroxyl radical scavenging activity showed a positive correlation (0.309) where as a negative relation was seen between hydroxyl and TPC and hydroxyl and colour: (-0.46) and (-0.33) respectively. The phenolic characterization of mixed floral and EFH showed the presence of gallic acid (RT: 3.85 min) and chlorogenic acid (RT: 4.40 min). Mixed floral honey also had an additional prominent unidentified peak at RT 19.65. This study thus shows that EFH is not as superior as mixed floral honey as identified through their TPC, antioxidant activity studies and phenolic profile adding support to the influence of foraging sources of bee.

### Optimisation studies on the preparation of palm syrup from palm (*Borassus flabellifer* L.) sap and evaluation of their physicochemical properties

The chief product of the Palmyra is the sweet sap (toddy) obtained by tapping the tip of the inflorescence. Palmyra sap oozing out from the inflorescence was analyzed before natural fermentation. The physicochemical properties evaluated were °brix(14.2), refractive index (1.355), specific gravity(1.05508), ash (0.4%), moisture(83.66%), pH(10.2), lipid content(0.19%), reducing sugar(0.2%), non reducing sugar(13.17%) content and protein content(0.30%). Palm syrup was then prepared under various process conditions and it was observed that thermal processing of the palm sap (14.2°brix) in an open pan to a temperature of 110°C to achieve a final brix of 67 was an optimal condition to obtain a product of desirable physico chemical properties. Minerals content in palm syrup was analyzed by volumetric (Ca), and AAS methods (Fe, Mg, Co) showed a high value of Ca (673mg/100g) followed by Fe (18.18 μg/100g) Mg (17.03 μg/100g) and Co (1.86 μg/100g).

### Biodiesel from used frying oils

In the present study experimental tests were conducted to produce biodiesel by transesterification of waste frying oils collected from various restaurants of Tirunelveli and to test its fuel properties in comparison to standard diesel fuel. Biodiesel was produced using the pilot plant facility and the yield was around 87%. The biodiesel produced were characterized and its fuel properties were adhering



to ASTM standards. The performance, emission and combustion properties were evaluated using a DI diesel engine. The combination of unblended biodiesel, 100% fossil diesel and blends of 25, 50 & 75% biodiesel with standard diesel fuel were used for evaluation. It was observed that the specific fuel consumption was higher for biodiesel and its blends compared to diesel fuel. Brake thermal efficiency was lower for biodiesel and its blends compared to diesel fuel. Smoke density of B100 and B75 were 19 and 10% lower than diesel. The measured CO emission of B100 and B75 are 52 and 35% lower than diesel. The measured HC emission of B100 and B75 are 38 and 19 lower than diesel. Diesel fuel and B25 have similar performance and much closer emission profile. B75 and B100 resulted in the lower amounts of emissions over the entire test. Over all the brake thermal efficiency was less for biodiesel and its blends but all the emission levels are lower for B75 and B100.



## BIOTECHNOLOGY DIVISION

The Biotechnology Division's R&D activities focus on bio-based processes and product development, with main emphasis on industrial enzymes and biodegradable polymers. The bioethanol programme of the Centre for Biofuels at NIIST is continuing its activities with the involvement of other agencies such as Ministry of New and Renewable Energy (Govt. of India). The newly created microbial culture collection, NII Culture collection is continuously growing with the inclusion of new and novel isolates from areas such as the Western ghats of Kerala. The research program of the division can be classified into three major areas, viz. (1) Bio-based processes and products, (2) Bioenergy, and (3) Health and genomics. Following are the key features/highlights on the activities of the division:

### Highlights

- A bioprocess developed for the production of biodegradable biopolymer (PHB) using raw glycerol generated from biodiesel industry using a bacterial culture of *Bacillus firmus* NII 0830, which was able to utilize the un-treated glycerol as carbon source without any pretreatment. The culture accumulated 60% (of cell dry weight) PHB when grown in a mineral salt medium.
- A solid-state fermentation based laboratory process developed for the production of leucine amino peptidase enzyme, in which very high level of enzyme titres has been produced by *Streptomyces gedenensis*.
- An effective pretreatment process was developed to derive the fermentable sugars for the production of bioethanol from cotton stalk (plant waste). The high temperature treatment completely removed lignin which helped to increase the total hydrolysis efficiency up to 96%. Considering the whole carbohydrate present in the cotton plant waste and utilization of xylose and arabinose to value-added product, the total process economy for the production of ethanol from cotton plant waste can be highly effective.



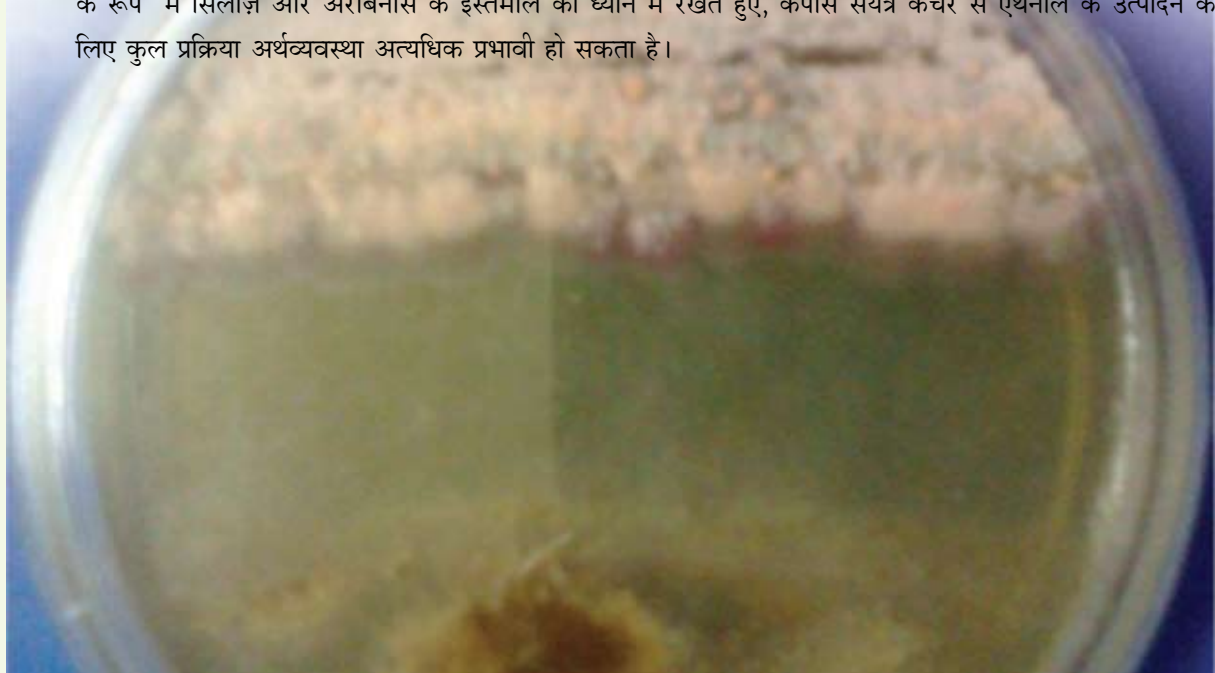


## जैवप्रौद्योगिकी प्रभाग

जैव प्रौद्योगिकी प्रभाग के अनुसंधान एवं विकास गतिविधियों के ध्यान औद्योगिक एंजाइमों तथा जैवनिम्नीकरणीय पॉलिमरों पर मुख्य जोर के साथ, जैव आधारित प्रक्रियाओं और उत्पादों के विकास पर केंद्रित है। एनआईआईएसीटी में जैव ईंधन केंद्र के बायोएथनॉल कार्यक्रम देश में एक केंद्रीय और अग्रणी स्थिति पाने के लिए अन्य एजेंसियों की भागीदारी के साथ अपनी गतिविधियों को जारी कर रहा है जैसे नवीन और नवीकरणीय ऊर्जा (भारत सरकार) आदि। नव निर्मित माइक्रोबियल संवर्धन संग्रह, एनआईआई संवर्धन संग्रह, केरल के पश्चिमी घाट जैसे आला क्षेत्रों से नए और नूतन आइसोलेट्स के शामिल किए जाने के साथ लगातार बढ़ रहा है। प्रभाग के अनुसंधान कार्यक्रम के तीन प्रमुख क्षेत्र हैं - 1. जैव आधारित प्रक्रियाओं और उत्पादों के विकास, 2. जैव ऊर्जा, और 3. स्वास्थ्य और जीनोमिक्स प्रभाग की गतिविधियों की मुख्य विशेषताएं निम्न हैं:

### मुख्य विशेषताएं

- बेसिलस फर्मस एनआईआई 0830 के जीवाणु संवर्धन का उपयोग करके तथा बायोडीजल उद्योग से उत्पन्न कच्चे ग्लिसरॉल के इस्तेमाल से एक जैवनिम्नीकरणीय बायो पॉलिमर (पीएचबी) के उत्पादन के लिए एक जैवप्रक्रिया विकसित की, जो कच्चे ग्लिसरॉल को, बिना किसी भी पूर्व उपचार के, कार्बन स्रोत के रूप में उपयोग करने में सक्षम थी। खनिज नमक माध्यम में विकसित करने पर संवर्धन 60% पीएचबी (सेल सूखी वजन के) की जमा दर्शाया।
- ल्यूलीन ऐमीनो पेप्टिडेस एंजाइम के उत्पादन के लिए एक ठोस अवस्था किण्वन आधारित प्रयोगशाला प्रक्रिया विकसित की, जिसमें स्ट्रेप्टोमाइसीज़ गिडेनइन्सीज़ द्वारा एंजाइम का उच्च स्तर अनुमाप उत्पन्न किया गया।
- बायोएथेनॉल के उत्पादन के लिए कपास डंठल (संयंत्र अपशिष्ट) से किण्वन योग्य शर्करा निकालने के लिए एक प्रभावी पूर्वोपचार प्रक्रिया विकसित की गयी। उच्च तापमान उपचार लिग्निन को पूरी तरह से हटा, जिससे कुल जल-अपघटन दक्षता 96% तक बढ़ाने में मदद मिली। कपास संयंत्र अपशिष्ट में वर्तमान पूरी कार्बोहाइड्रेट और मूल्य वर्धित उत्पाद के रूप में सिलोज़ और अरैबिनोस के इस्तेमाल को ध्यान में रखते हुए, कपास संयंत्र कचरे से एथेनॉल के उत्पादन के लिए कुल प्रक्रिया अर्थव्यवस्था अत्यधिक प्रभावी हो सकता है।



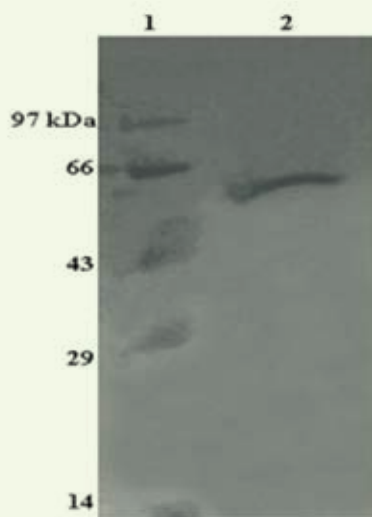


## BIOPROCESS AND PRODUCT DEVELOPMENT

### Industrial enzymes

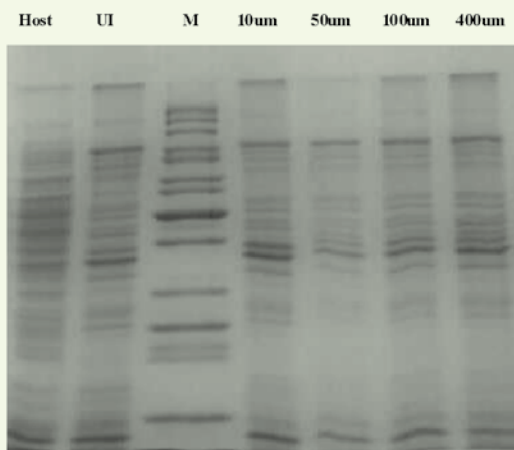
**Leucine and methionine aminopeptidase:** Solid-state fermentation was carried out for the production of L-leucine amino peptidase by cultivating *Streptomyces gedanensis* on an inert support (PUF) impregnated with a minimal medium. The optimized process with media engineering and response surface methodology of Box Behnken design yielded 489 IU enzyme per gram PUF. The high level of yield achieved shows promising technical feasibility of LAP production under SSF using inert support for industrial application.

**Proline aminopeptidases:** A proline specific aminopeptidase (PAP) (3.4.11.5) was produced and purified to homogeneity from the culture free extract of *Streptomyces lavendulae* ATCC. The purified protein showed a molecular weight of 60 kDa. Kinetic studies showed a  $K_m$ ,  $V_{max}$  of 0.23 mM and 0.087  $\mu\text{mol}/\text{min}$ , respectively using Pro-p-NA, the substrate with maximum specificity.



SDS-PAGE of the purified extracellular proline aminopeptidase from *Streptomyces lavendulae*. Lanes: 1, protein marker; 2, extracellular PAP

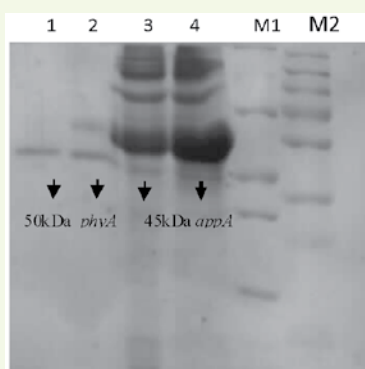
**L-asparaginase:** L-asparaginase is an antineoplastic agent that selectively decreases the level of L-asparagine in blood and diminishes the proliferation of the cancerous cells. L-asparaginases from *E. coli* are widely used for clinical application because of their high substrate specificity and limited glutaminase activity. An enzyme with increased half life will be stable in blood than the normal enzyme, thus the frequent administration of the drug can be avoided. Hence, an ideal asparaginase for therapeutic use should possess characteristics such as high activity, a low  $K_m$ , and a strong preference for asparagine over glutamine. During the present study, the L-asparaginase II gene of a lab isolate (isolated from the cow dung) was cloned in pET20b vector and over-expressed in *E. coli* BL21DE3. The cloned gene showed 98% sequence similarity towards the L-asparaginase II of *E. coli*. The protein was over-expressed with inducer concentration of 10  $\mu\text{M}$  IPTG and the over-expressed protein was purified through affinity chromatography using the Ni-NTA spin column. With the sequencing data, the L-asparaginase was modeled with the project mode of Swiss PDB using the *E. coli* L-asparaginase II (3ECA) crystal structure as template. Studies were initiated to introduce mutation into the cloned gene in order to improve the stability of L-asparaginase.



SDS PAGE analysis of soluble fraction after expression

**Advancement and comparative profiles in the production technologies using solid-state and submerged fermentation for microbial cellulases:** Development of improved cellulases for bioconversion seems to help materialize the dream of developing eco-friendly lignocellulosic ethanol to a reality. Improvement in cellulases has been achieved partly by developments in production technology such as, adopting cheaper bioprocess technology, employing cheaper substrate, employing engineered organisms etc., and partly by developments of artificial/engineered cellulases and cocktails of enzyme. Artificial/engineered cellulases and enzyme cocktails rich in glucose tolerant  $\beta$ -glucosidase has been proved successful for increasing the rate or efficiency of hydrolysis of biomass so as to prove the technology economically feasible.

**Thermostable and low pH tolerant phytase:** Phytase gene from *A. niger* NII 08121, cloned in expression vector pET 20b was co-expressed with chaperone pGro7 from *E. coli* BL21DE3. Arabinose and IPTG concentration was optimized for effective soluble heterologous expression. Recloning of the same insert with a C-terminal 6X histidine tag to permit single step purification did not work as tag interfered with the activity of the expressed protein. Hence, in order to distinguish between the endogenous *E. coli* phytase and deglycosylated *phyA* expressed in *E. coli*, *appA* deletion mutant was constructed using P1 transduction. Since constructed knock-outs gave undesirable enhanced activity in cytosol which interfered with expression studies, salting out fractionation of cytosol using ammonium sulphate was carried out to separate the *appA* and *phyA* having molecular weight 45 and 50 kDa, respectively. Fractionated *phyA* was analyzed by activity staining and optimum pH. Phytase gene isolated from *E. coli* XL-1 blue was expressed with its native signal sequence in periplasm of BL21DE3 *plysS* cell was carried out under optimized inducer conditions. In an effort to express the fungal phytase from yeast system, *phyA* gene cloned in pKLAC1 was linearized and transformed in to *Kluyveromyces lactis* GG799. Transformants were screened for determining chromosomal integration of expression cassette. Purification and characterization of glycosylated *phyA* is currently under progress.



Coomassie staining of ammonium sulphate fractions; 1-4: Coomassie stained fractions after an activity staining; M1- Unstained SDS PAGE ladder (Fermentas SM 0431); M2- Prestained ladder (Fermentas SM 1811)



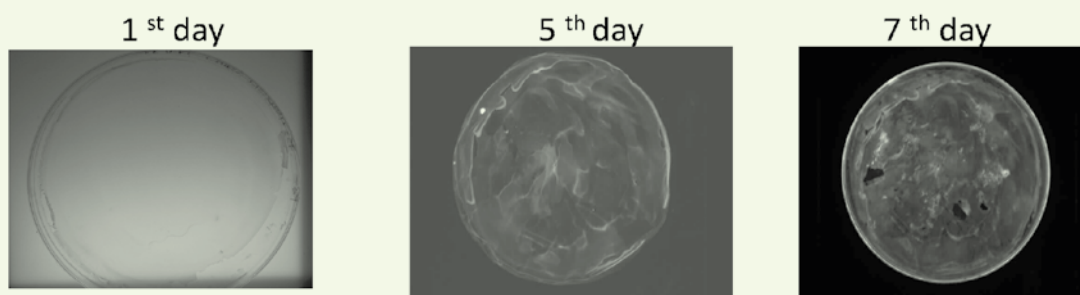
*Properties of a major beta glucosidase-BGL1 from Aspergillus niger NII-08121 expressed differentially in response to carbon sources:* *A. niger* NII 08121 produced different BGL isoforms when grown on different carbon sources indicating a difference in the induction of these isoforms. Maximal production of moderately glucose tolerant isoforms was observed with lactose induction while a major BGL was produced in all carbon sources. The major beta glucosidase (BGL1) upon purification and characterization showed interesting properties, including an optimum temperature of 70°C, optimum pH of 4.8 and extended stability at 50°C for more than 48 h. Normal enzymatic hydrolysis of biomass is performed at 50°C over 24–72 h and loss of enzyme activity is a major limitation in such processes. BGL1 with its extended stability is a very potent candidate for biomass hydrolysis.

## Biopolymers and biosurfactants

*Production of polyhydroxybutyrate (PHB):* The production of PHB using bio-diesel industry generated glycerol as sole carbon source was evaluated in batch process in parallel fermenters. The maximum PHB production was at 30<sup>th</sup> hour of fermentation with a yield of 1.03g/l. As the ammonium (limiting substrate) concentration depleted, the PHB accumulation increased. When the DO concentration was reduced to 30%, PHB production increased up to 3.85g/l. A kinetic model that described the bacterial growth, PHB production and glycerol consumption was used to predict the performance of batch fermentation. The maximum specific growth rate ( $\mu_{max}$ ) and the kinetic constant (Ks) for crude glycerol were 2.4 h<sup>-1</sup> and 10g/l, respectively.

*In vitro anti-microbial analysis of drug incorporated PHB-nanoparticles:* The PHB biopolymer was purified from *Bacillus sphaericus* NII 0838 and chloramphenicol incorporated PHB nanoparticles were prepared. The *in vitro* antibacterial activity of PHB-drug nanoparticle was assessed in the presence of microorganisms such as *E coli*, *Raoultella planticola*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Micrococcus luteus*. A good zone of inhibition was seen around *E coli* and *R. planticola*.

*Biodegradation of polylactides (PLA):* The aim of this study was screening and isolation of microorganisms capable of degrading PLA, to do enzymatic degradation studies and to investigate the biodegradability of PLA after discarding in natural conditions, such as waste water treatment, landfill, and condition both in real and control in laboratory. PLA degrading enzyme induced and secreted might be involved in the degradation process, therefore research on the induction of the PLA degrading enzyme is of interest. The results can be used for the determination of appropriate disposal environments for PLA packaging waste. Two different approaches such as PLA emulsified plates and PLA films were used for screening and isolation of microorganisms capable of degrading PLA. Soil and sludge samples collected from different places were used for screening and the newly isolated cultures were evaluated for degradation capabilities. The enzymatic studies of the isolated cultures were conducted. The parameters used for the monitoring of degradation include variation in lactic acid concentration, pH, dry cell weight, residual film weight. The figure shows the morphological changes of PLA film when inoculated with a microbial consortium containing the newly isolated cultures capable of PLA degradation. Over a period of week, The PLA sheet was deformed, changed from clear to white opaque and become brittle and started breaking apart.



Changes in surface morphology of PLA sheets when inoculated with a microbial consortium of PLA degrading microbes





*Production of biosurfactant from Pseudozyma sp:* A NIIST culture, *Pseudozyma* sp NII 08165 produced glycolipid biosurfactants when grown in a liquid medium under controlled condition. The purified glycolipid was identified as mannosylerythritol lipids (MEL), one of the versatile biosurfactants. The molecular weight of MEL was between 700- 800 Dalton. The fatty acid profiling of purified MEL revealed that MEL was more abundant in C16 fatty acid. Quantification by HPLC showed the production as 12 g/l. The culture showed the ability to grow in diesel and kerosene supplemented media.

## BIOENERGY

*Conversion of cellulose and hemi-cellulose into sugars and ethanol:* A fungal strain, *Penicillium janthinellum* was used for cellulase production under solid-state fermentation using wheat bran as substrate. The culture produced 60FPU/gds in flasks. Tray fermentation with improved media engineering and factorial design studies resulted 62FPU/gds enzyme. Hydrolysis of steam exploded sugarcane bagasse with 10% biomass loading with different enzyme loadings resulted 94% as maximum efficiency with enzyme loading of 50FPU/g. Supplementation of cellulase with beta glucosidase (BGL) produced from a NIIST isolate, *A. niger* showed good hydrolysis efficiency at reduced cellulose dose. Efficiency can be further improved by increasing BGL supplementation.

### Pretreatment of biomass

*Cotton stalk:* With an aim to use the cotton stalk as feedstock for bioethanol production, different pretreatment strategies were tried using sodium hydroxide in a high pressure reactor equipped with a pitch blade turbine stirrer, followed by enzymatic hydrolysis using cellulases. Best results were achieved when the pretreatment was carried out at 180 °C for 45 minutes with mixing of substrate at 100 rpm. The sugar yield was evaluated based on pretreatment severity. The hydrolysis efficiency of pretreated cotton plant waste was very good (96%), showing the excellent efficiency of the method in removing the lignin. The material balance in each stage of the process showed that the process efficiency was 53% based on glucose conversion.

*Microwave pretreatment:* Sugarcane bagasse was used for bioethanol production in which combined pretreatment strategy was adopted. With microwave-alkali pretreatment an overall yield of 0.665 g/g dry biomass fermentable sugars were obtained which was 0.249g/g dry biomass with at microwave-acid pretreatment. Microwave-alkali followed by acid pretreatment gave an overall reducing sugar yield of 0.83 g/g dry biomass. The X- ray diffraction profile of native and microwave pretreated sugarcane bagasse showed that the crystallinity index of native sugarcane bagasse was less compared to other pretreated samples. The crystalline size was higher in native sugarcane bagasse than the pretreated ones. The FTIR spectra showed the stretching of hydrogen bonds of pretreated sugarcane bagasse.

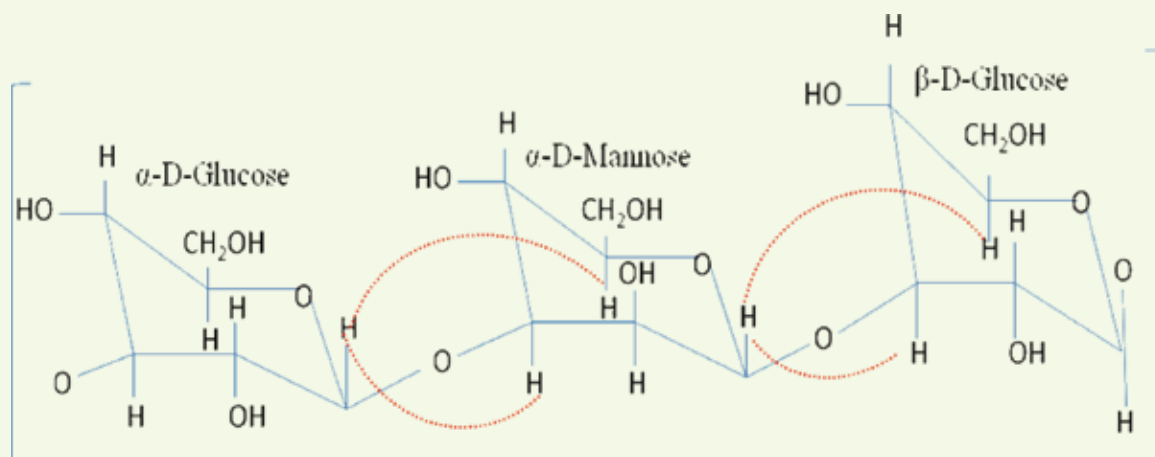
*Studies on enzymes for biomass hydrolysis:* The kinetics of enzymatic hydrolysis of sodium hydroxide pretreated rice straw and cotton stalk was evaluated for sugar yield and models were developed for cellulose degradation, cellobiose and glucose formation, xylan degradation and xylose formation. For rice straw, biomass loading of 12.5% with enzyme loading of 50 FPU at 50 °C was optimum for sugar release. Initial two hours of hydrolysis was very crucial and during this period almost 60% of sugar yield was achieved. The maximum sugar yield from NaOH pretreated rice straw was 0.48 g/g dry biomass. The cellobiose, one of the degradation products of cellulose, formation from rice straw was maximum (0.2 g/g dry biomass) during the initial 10 h of hydrolysis.

The estimation of various carbohydrates generated at different time points during enzymatic hydrolysis of NaOH pretreated cotton stalk showed that the hydrolysis rate was maximum during the first three hours. During this period 63% glucose yield was recorded. The maximum sugar yield (0.752 g/g pretreated biomass) was recorded at 60 hours on incubation at 50 °C with biomass loading of 15% and cellulose loading of 60 FPU. The rate of glucose yield followed a logarithmic increase till 12 h, and then it decreased and almost became constant by 60 h of hydrolysis. The xylose yield was increased up to 32 h of hydrolysis and then it became constant.



## HEALTH AND GENOMICS

**Nutraceuticals from lactic acid bacteria:** Exopolysaccharides (EPS) from lactic acid bacteria contribute to specific rheology and texture of fermented milk products and finds applications even in non-dairy foods and in therapeutics. Box-Behnken model of response surface methodology (RSM) was employed to formulate the production medium for EPS production. FT-IR spectral analysis of the purified EPS from *Lactobacillus plantarum* MTCC 9510 revealed prominent characteristic groups corresponding to polyhydric alcohols. The degradation temperature ( $T_d$ ) of the polysaccharide was 260 °C as revealed by thermo gravimetric analysis (TGA). Structure elucidation of the EPS showed that it consisted of a trisaccharide repeating unit of  $\alpha$ -D-glucose,  $\beta$ -D-glucose and  $\alpha$ -D-mannose.

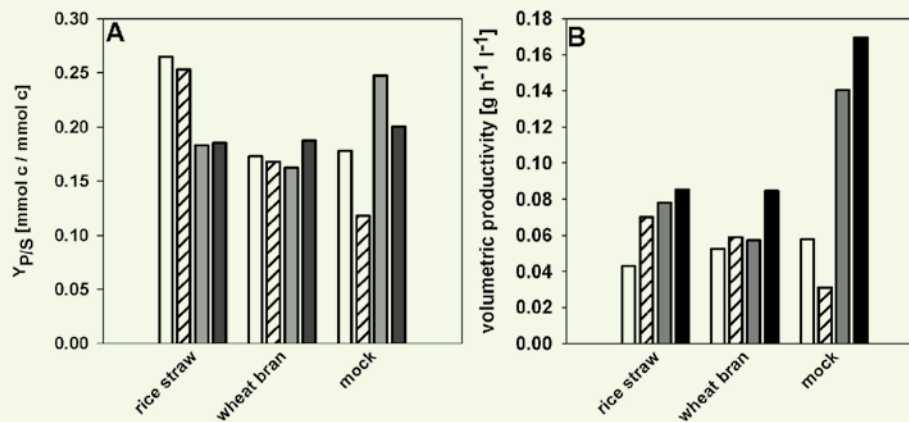


Postulated hypothetical structure of exopolysaccharide purified from *Lactobacillus plantarum*

The cultures showed potent antifungal activity and were identified to be closely related to *L. plantarum* and *L. pentosus* by 16SrRNA sequencing.

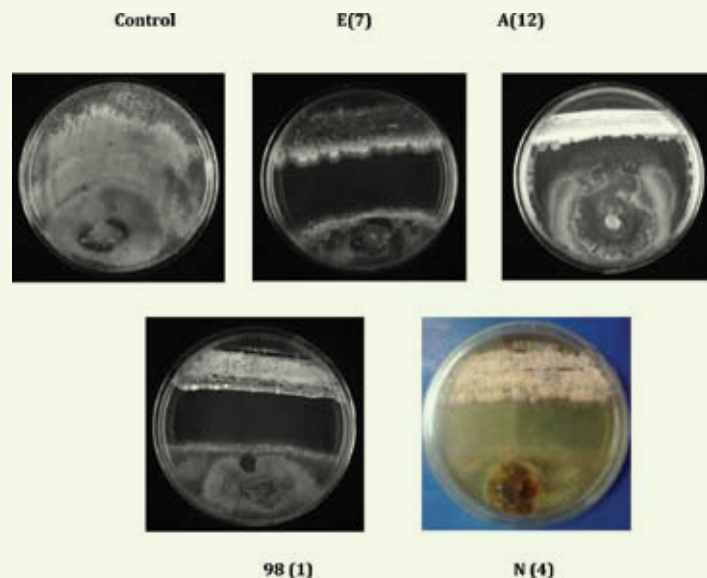
### Microbial production of amino acids

**Utilization of agro residual hydrolyzates for the production of L-glutamate and L-lysine by recombinant pentose utilizing *Corynebacterium glutamicum*:** *Corynebacterium glutamicum* wild-type (ATCC 13032) strain lacks the ability to utilize the pentose fractions of lignocellulosic hydrolyzates. To overcome this, heterologous expression of the *araBAD* operon and *xylA* gene (either singly or together) of *Escherichia coli* in the wild-type *C. glutamicum* and in a L-lysine producing strain of *C. glutamicum* DM1729 were carried out, which enabled the production of L-glutamate and L-lysine respectively from acid hydrolyzates of rice straw and wheat bran by co-utilizing the C5 sugars (arabinose and xylose) along with the glucose. Maximum L-lysine yield of 42 mM was produced by the genetically engineered DM1729 strain capable of pentose sugar utilization. Similarly, the engineered ATCC 13032 strain produced a maximum of 93 mM glutamate from the above hydrolyzates. Figure below shows the yields and volumetric productivity for L-lysine in different hydrolyzate media and with different *C. glutamicum* strains.



Yields and volumetric productivity for L-lysine production experiments in different hydrolysate media and with different *C. glutamicum* strains. A Yields product per substrate in mmol-c/ mmol-c separated for the different media. B Volumetric productivity in  $g\ h^{-1}\ l^{-1}$  separated for the different hydrolysates. White: DM1729 (pEKEx3)(pVWEx1); hatched: DM1729(pEKEx3)(pVWEx1-araBAD); Grey: DM1729(pEKEx3-xylA)(pVWEx1); black: DM1729(pEKEx3-xylA)(pVWEx1-araBAD); (b) Production of L- Arginine from the hydrolysate of Cassava bagasse and Jack fruit seed

**Exploitation of microbial biodiversity for enzyme inhibitors and plant growth promoters:** Soil samples collected from Western ghats in Kerala region were used for microbial screening and the newly isolated pure cultures were evaluated for antagonistic properties against *Phytophthora capsici* and *Rhizoctonia solani*. Of the 112 cultures tested so far, two cultures 98(1) and E7 showed antagonism against *Phytophthora capsici* on dual culture assay. Similarly, of the 80 cultures tested so far, 4 cultures 98(1), E (7), A (12), N (4) showed antagonism against *Rhizoctonia solani* on dual culture assay.



Antagonism shown by isolates against *Rhizoctonia solani* on dual culture assay

**Bioactives from the microbes isolated from the soil samples of Western ghats in Kerala:** A total of 8377 bioactive samples obtained from IHBT, Palampur; IICT, Hyderabad, IMT, Chandigarh, IIMT, Bhubaneswar and NEIST, Jorhat were screened in NIIST for of beta lactamase and peptide deformylase inhibitors. Two hundred samples showed betalactamase inhibition. Two samples from NIIST were active against a clinical strain of *Klebsilla pneumonia* which produced extended spectrum of beta lactamase activity (ESBL). Three other samples showed very strong antimicrobial activity (wide spectrum). The bioactive producing cultures were identified as *Bacillis methylophilicus* (Gene bank submission NII716 JF732920), *Bacillus amyoliquefaciens* and *Sreptomycetes launalinharesii*.

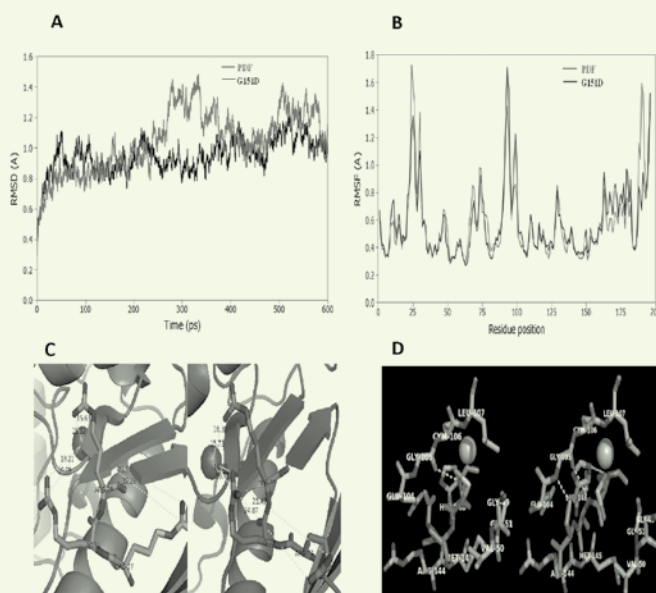


*Isolation, screening & characterization and structural elucidation of bioactive compounds derived from secondary metabolites of actinomycetes:* Soil samples collected from Silent valley were used for isolation and screening of potent actinomycetes against various fungal phytopathogens. Four strains which showed maximum antifungal activity were selected for the extraction and purification of antifungal compound(s). One of these (NII 1006) belonged to Streptomyces genus, which produced extra-cellular anti-fungal activity. This activity was stable at 121°C and pH range 5.0 to 9.0. Ethyl acetate extract of the culture supernatant showed the presence of more than one antifungal compound, of which one potent compound had molecular weight around 315 Dalton. The culture also showed chitinase enzyme production which also contributed to its antifungal activity.

*Construction and screening of environmental DNA libraries for novel lipases:* A BAC library was constructed using soil DNA isolated from silent valley as well as effluent soil samples and 1,356 BAC clones were obtained. BAC clones were confirmed by plasmid isolation. Insert size was found to be ~25kb. Eighteen clones gave clear zones in tributyrin plates conferring lipolytic activity. Five clones cleaved phenyl fatty acid esters above 10 carbons, showing that they were lipase; rest all was esterases. Esterase from clones 1(41) and 9(62) were temperature stable (80°C), solvent tolerant (up to 25 % methanol) and halo tolerant (up to 2M NaCl). These properties make them very unique and highly desirable for industrial applications, including transesterification reactions for biodiesel production and in organic synthesis. Sub-cloning, purification and characterisation of selected clones are in progress.

## Mycobacterium research

*Glycine in the conserved motif III modulates the thermo-stability and oxidative stress resistance of peptide deformylase in Mycobacterium tuberculosis:* The peptide deformylase of *Mycobacterium tuberculosis* H37Rv (MtbPDF), over-expressed and purified from *E. coli*, was characterized to be an iron



Molecular dynamic simulations and docking studies on MtbPDF and G151D structures. (A) RMSD from energy-minimized starting structure of MtbPDF (magenta) and G151D (blue) during dynamics for 600ps. (B) C $\alpha$ -RMSF plot of MtbPDF (magenta) and G151D (blue) structures during dynamics for 600ps. (C) Movements of side chain atoms of R77-R79 residues in the insertion loop with reference to metal cofactor Fe<sup>2+</sup> in MtbPDF (green sticks) and G151D (pink sticks) structures during dynamics. (D) Binding sites of MtbPDF (Cyan) and G151D (Green) with substrate N-for-Met-Ala-Ser docked in (Pink sticks). The hydrogen bonds stabilizing the substrates in the cavity are shown as yellow dotted line.



containing enzyme having stability towards  $H_2O_2$  with moderate thermo-stability. Substitution of two conserved residues (G49 and L107) from MtbPDF with the corresponding residues found in human PDF affected its deformylase activity. Among all the characterized PDFs, glycine (G151) in the motif III instead of conserved aspartate is characteristic to *Mycobacterium tuberculosis*. Even though G151D mutation in MtbPDF increased its deformylase activity and thermo-stability; it affected the enzyme stability towards  $H_2O_2$ . Molecular dynamics and docking results confirmed an improved substrate binding and catalysis in case of G151D mutant and the study provides yet another possible molecular basis for the stability of MtbPDF against oxidizing agents. The molecular dynamic simulations and docking studies on MtbPDF and G151D structures are shown below.



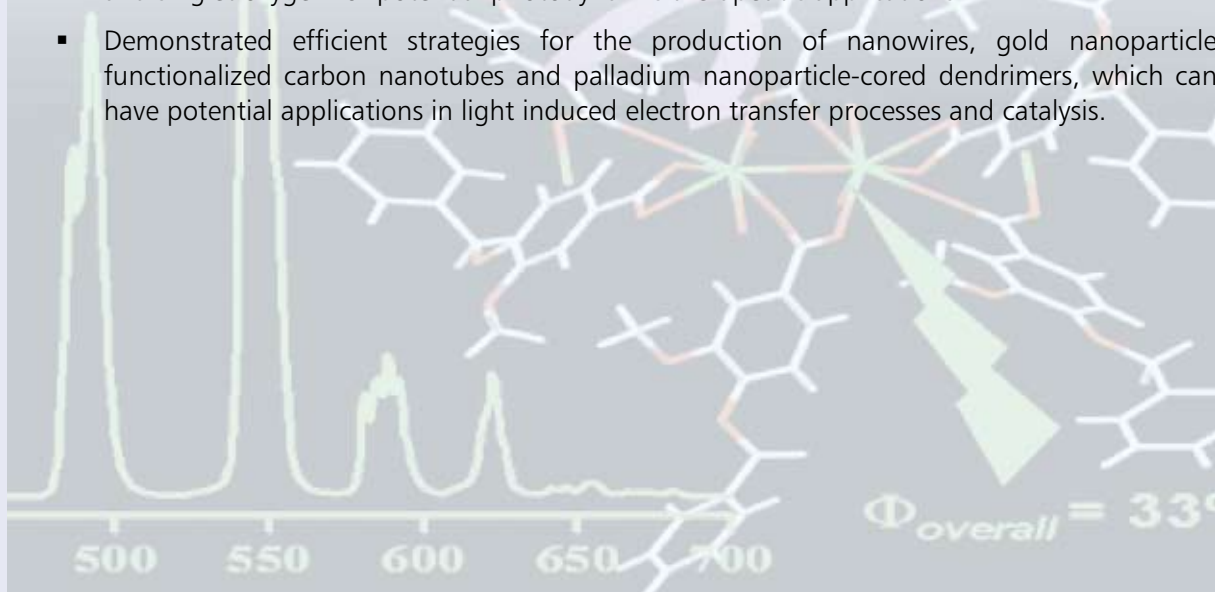
## CHEMICAL SCIENCES & TECHNOLOGY

The main research activities of the Chemical Sciences and Technology Division during the year 2010-2011 can be broadly classified under (i) fundamental and applied aspects of photochemistry with the purpose of developing photonic materials for applications in solar energy harvesting, electro optical devices and photo medicine, (ii) design and development of inorganic materials and polymers for applications in areas related to energy storage, lighting and molecular sensing for imaging and diagnostics and (iii) to isolate and synthesize new bioactive molecules and to develop the state-of-the-art synthetic organic methodologies for the fine chemical industry.

Apart from the R&D activities in these areas, the Division has also organized several conferences and seminars, which include i) the Indo-French workshop on 'Self-assembled hybrid systems: Advanced materials for the future', ii) the Indo-US workshop on 'Self-assembled fibrillar gels', iii) the DST Group Monitoring Workshop for Fast-Track projects, iv) the Chemistry International Year Celebrations under the auspices of CRSI, Trivandrum Chapter, and v) the 5th Mid-Year CRSI National Symposium in Chemistry. Several members of the Division have also received important recognitions during this period such as fellowships of the Indian National Science Academy, New Delhi and the Indian Academy of Sciences, Bangalore and the Materials Research Society of India medals. Given below are the some of the research highlights of the Division achieved during 2010-2011 along with brief abstracts of the work published in peer reviewed international journals.

### Highlights

- Novel  $\pi$ -conjugated poly(phenylenevinylene) architectures and efficient green and red emitting organic-inorganic hybrid materials were developed and their optical properties investigated.
- Fluorescent dyes for the selective detection of cyanide, DNA, metal ions, nitrite and amino thiols in blood and aqueous medium developed.
- New synthetic methodologies developed for the functionalized mono- and diphenoxycalix[4]arenes, indanones and indanols and the biological applications of nimbolide isolated from *Azadirachta indica* investigated.
- Synthesized novel aza-BODIPY derivatives and successfully tuned their quantum yields of triplet and singlet oxygen for potential photodynamic therapeutic applications.
- Demonstrated efficient strategies for the production of nanowires, gold nanoparticle functionalized carbon nanotubes and palladium nanoparticle-cored dendrimers, which can have potential applications in light induced electron transfer processes and catalysis.





## रसायन विज्ञान तथा प्रौद्योगिकी

वर्ष 2010-2011 के दौरान रसायन विज्ञान और प्रौद्योगिकी प्रभाग ( सीसटीडी) की मुख्य अनुसंधान गतिविधियों को मोटे तौर पर (i) सौर ऊर्जा संचयन, इलेक्ट्रो ऑप्टिकल उपकरणों और प्रकाश चिकित्सा में अनुप्रयोगों के लिए फोटोनी सामग्री को विकसित करने के उद्देश्य के साथ प्रकाश रसायनविज्ञान के मौलिक और अनुप्रयुक्त पहलुओं, (ii) ऊर्जा भंडारण, इमेजिंग और निदान के लिए प्रकाश व्यवस्था और आणविक संवेदन से संबंधित क्षेत्रों में अनुप्रयोगों के लिए अकार्बनिक पदार्थों और पॉलिमर के डिजाइन और विकास और (iii) नए जैवसक्रिय अणुओं का अलगाव और संश्लेषण करना तथा उत्कृष्ट रसायन उद्योगों के लिए अत्याधुनिक सिंथेटिक कार्बनिक तरीके विकसित करना ।

इन क्षेत्रों में अनुसंधान एवं विकास गतिविधियों के अलावा, प्रभाग ने कई सम्मेलनों और सेमिनारों का आयोजन किया है, जिसमें शामिल है i) 'स्वतः समुच्च संकर प्रणालियों: भविष्य के लिए उन्नत सामग्रियों' पर इंडो - फ्रांस कार्यशाला ii) 'स्वतः समुच्च तंतुमय जैल' पर इंडो - यूएस कार्यशाला iii) फास्ट ट्रेक परियोजनाओं के लिए डीएसटी ग्रुप मॉनीटरिंग कार्यशाला iv) सीआरएसआई, त्रिवेंद्रम चैप्टर के तत्वावधान में रसायन विज्ञान के अंतरराष्ट्रीय वर्ष समारोह v) रसायन विज्ञान में पांचवें मध्य- वर्ष सीआरएसआई राष्ट्रीय संगोष्ठी । प्रभाग के कई सदस्यों को इस अवधि के दौरान भारतीय राष्ट्रीय विज्ञान अकादमी, नई दिल्ली और भारतीय विज्ञान अकादमी, बंगलौर और भारतीय पदक पदार्थ रिसर्च सोसायटी की फेलोशिप जैसे महत्वपूर्ण सम्मान प्राप्त हुए । वर्ष 2010-2011 के दौरान प्रभाग की उपलब्धियों की मुख्य विशेषताएं तथा सहकर्मियों द्वारा समीक्षा की गई अंतरराष्ट्रीय पत्रिकाओं में प्रकाशित काम का संक्षिप्त सार नीचे प्रस्तुत है

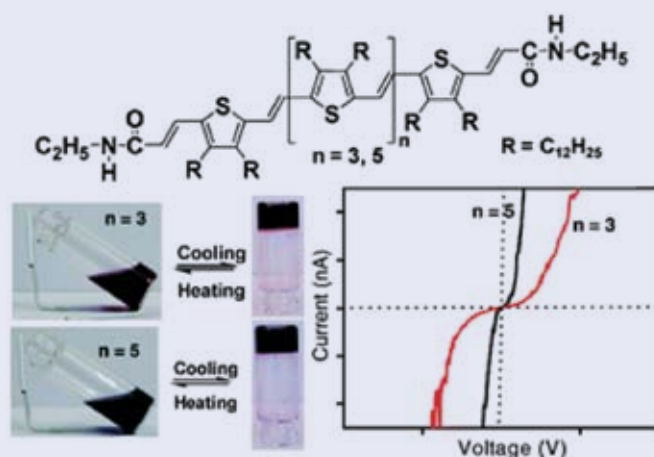
### मुख्य विशेषताएं

- नूतन  $\pi$  संयुग्मित पॉली (फेनिलीनवाइनीलीन) आर्किटेक्चर और कुशल हरे और लाल उत्सर्जन कार्बनिक अकार्बनिक संकर सामग्री विकसित किए गए और उनके ऑप्टिकल गुणधर्मों पर की जांच की रक्त तथा जलीय मध्यम में साइनाइड, डीएनए, धातु आयनों, नाइट्राइट और ऐमिनोथिऑल्स, की चुनिंदा संसूचन के लिए संदीप्तिशील रंजकों का विकास किया ।
- प्रकार्यात्मक मोनो और डाइफोनॉक्सीकैलिक्स (4) ऐरीनों, इन्डेनोन्स और इन्डेनॉल्स के लिए नए सिंथेटिक तरीके विकसित किए और अजडिराटा इंडिका से अलग किए निंबोलाइड के जैविक अनुप्रयोगों की जांच की ।
- नूतन aza- BODIPY व्युत्पन्नों का संश्लेषण किया संभाव्य प्रकाशगतिक चिकित्सीय अनुप्रयोगों के लिए उनके ट्रिपलिट और एकक ऑक्सीजन के क्वान्टम उत्पाद को सफलतापूर्वक समस्वरित किया ।
- नैनोतंतुओं, गोल्ड नैनोकण प्रकाशित कार्बन नैनोट्यूब, पैलेडियम नैनोकण क्रोडित डेन्ड्रिमरों के उत्पादन के लिए कुशल योजना का निदर्शन किया, जिन्हें प्रकाश प्रेरित इलेक्ट्रॉन अंतरण प्रक्रिया तथा कटैलिसिस में शक्य अनुप्रयोग हो सकता है ।

## PHOTOSCIENCES AND PHOTONICS

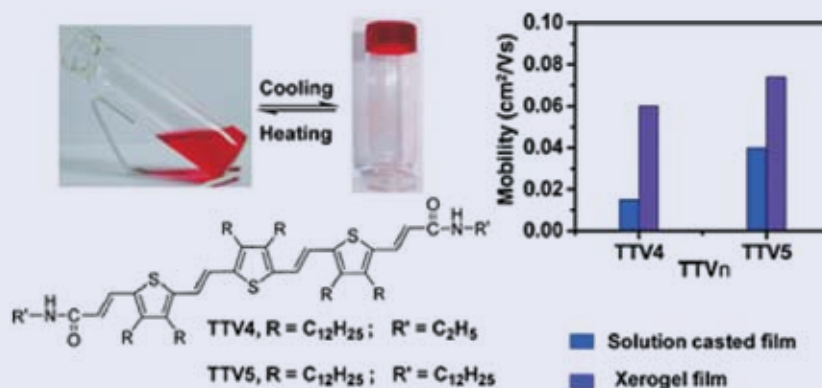
### Self-Assembly of thienylenevinylene molecular wires to semiconducting gels with doped metallic conductivity

Oligo(thienylenevinylene) (OTV) based gelators with high conductivity are reported. When compared to OTV1, OTV2 having an increased conjugation length forms relatively strong gels with a metallic conductivity of 4.8 S/cm upon doping, which is the highest value reported for an organogelator. This new class of conducting gels is expected to be useful in organic electronics and photonics applications, particularly in bulk heterojunction devices (*J. Am. Chem. Soc.* 2010, 132, 13206–07).



### Solution phase epitaxial self-assembly and high charge-carrier mobility nanofibers of semiconducting molecular gelators

Trithienylenevinylenes having amide end functional groups form supramolecular gels in nonpolar solvents, comprised of self-assembled nanowires. These gels exhibit the unique property of solution phase epitaxy leading to the alignment of fibers on mica surface. FP-TRMC studies revealed high charge carrier mobility for xerogels from decane–chloroform whereas films obtained from chloroform solutions showed less mobility, highlighting the role of self-assembly and gelation on the electronic properties of semiconducting molecular gelators. This study opens the window for a new class of conducting gelators, which may find wide application in organic electronic devices (*J. Am. Chem. Soc.* 2010, 132, 8866–67).

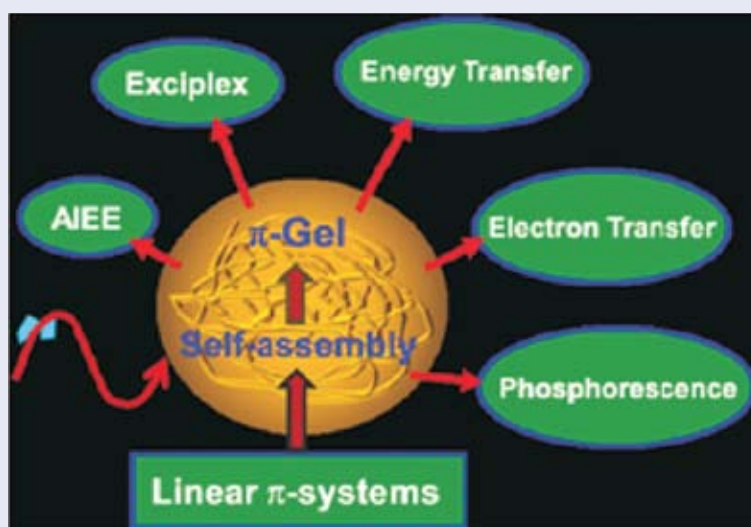






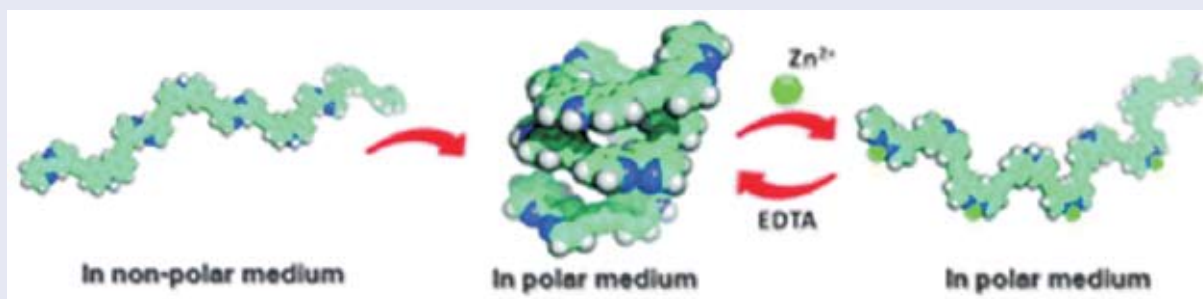
## Excited state processes in linear $\pi$ -system-based organogels

This article describes the recent progress made to the understanding of the excited state interactions in organogels derived from linear  $\pi$ -conjugated molecules. The soft organogel scaffolds of such systems create an excellent ambience for the self-organization of the molecules allowing the modulation of their excited state properties and thereby opening a new world of fascinating materials with interesting physical properties at nano- and macroscopic levels. Noncovalent interactions provide opportunity for the molecules to interact electronically within a space of defined size and shape. As a result, the photophysical properties of the molecules in solution and gel states are different from each other. Analyzed the role of the self-assembled organogel scaffolds of  $\pi$ -gels derived from linear  $\pi$ -systems in modulating the excited state properties such as excited state energy transfer, exciplex emission, phosphorescence, and aggregation-induced enhanced emission (AIEE), when compared to the corresponding individual molecules. (Perspective, *J. Phys. Chem. Lett.* 2010, 1, 3413-24).



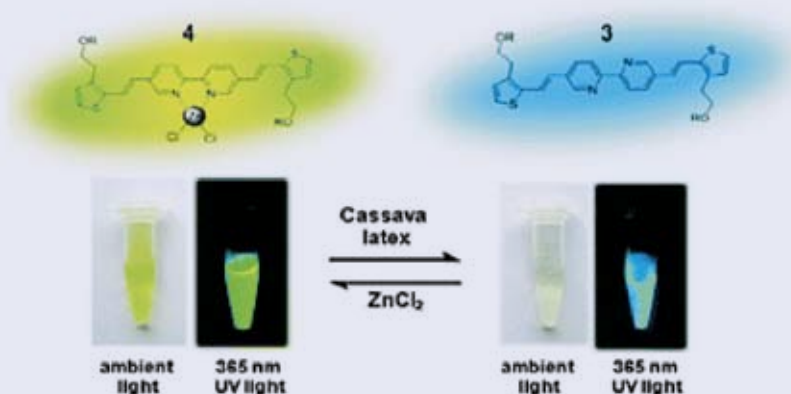
## Conformational control in a bipyridine linked $\pi$ -conjugated oligomer: Cation mediated helix unfolding and refolding

A chiral  $\pi$ -conjugated oligomer having alternate bipyridine and carbazole moieties connected through acetylinic bonds undergoes helical folding in chloroform–acetonitrile (40/60, v/v) as evident by fluorescence and circular dichroism changes. In the presence of transition metal cations such as  $Zn^{2+}$  defolding of the helical conformation occurs. Upon decomplexation of the cation with EDTA, the helical conformation is regained (*Chem. Commun.* 2010, 46, 8392-94).



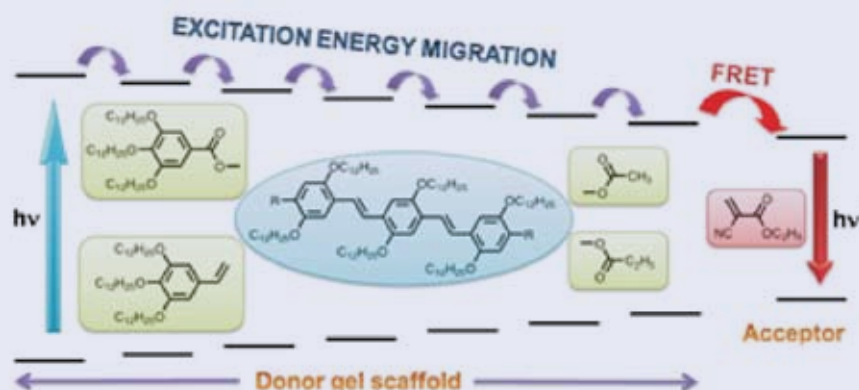
## A Zn<sup>2+</sup>-specific fluorescent molecular probe for the selective detection of endogenous cyanide in biorelevant samples

A Zn<sup>2+</sup> specific molecular probe **3** was developed for the selective detection of CN<sup>-</sup> ions under aqueous conditions. The fluorescent Zn<sup>2+</sup> complex of **3** upon addition of CN<sup>-</sup> ions generates a bright blue fluorescence that allows the detection of the latter and is useful for the screening of natural products with and without endogenous cyanide content (*Chem. Commun.* 2010, 46, 6069–71).



## Excitation energy migration in oligo(p-phenylenevinylene) based organogels: Structure-property relationship and FRET efficiency

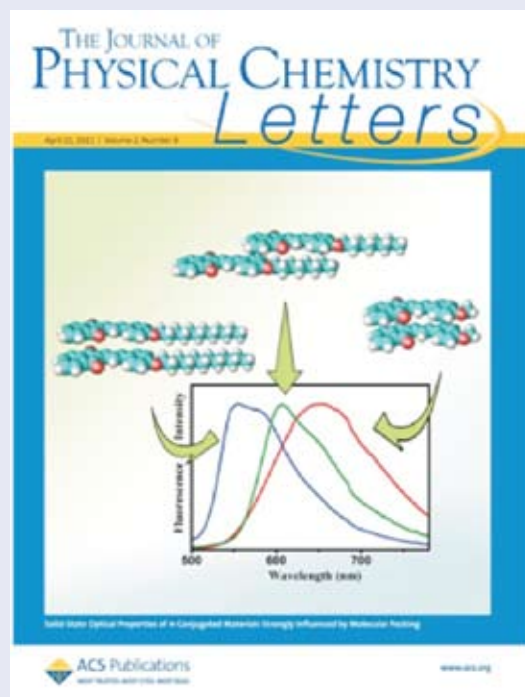
Excitation energy migration (EM) and assisted energy transfer (ET) properties of a few oligo(p-phenylenevinylene) (OPV) based organogelators with different end functional groups have been studied using picosecond time-resolved emission spectroscopy (TRES). EM was found to be more efficient in OPV gelators with small end functional groups (OPV3–4) when compared to that of the gelators with bulky end groups (OPV1–2) in the gel state. TRES studies at elevated temperature and in chloroform solution highlight the role of the self-assembled scaffolds in assisting the EM and ET processes. Increase in temperature and solvent polarity leads to the aggregate breaking and hence adversely affects the EM and ET efficiencies. The effect of EM efficiency on the fluorescence resonance energy transfer (FRET) properties of the OPV gels was studied by using OPV1 and OPV3 as the donors and OPV5 as the acceptor. Better transfer of excitation energy was observed in the donor system (OPV3) having higher EM efficiency even at very low concentration (3.1 mol%) of the acceptor molecules, whereas ET efficiency was lower in the donor system (OPV1) with low EM efficiency (*Phys. Chem. Chem. Phys.* 2011, 13, 4942–49).





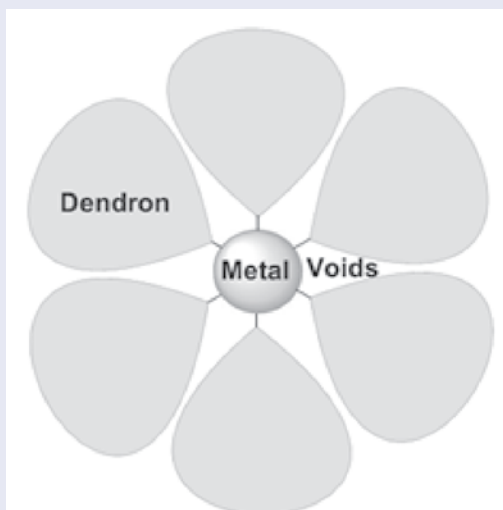
## Role of molecular packing in determining solid-state optical properties of $\pi$ -conjugated materials

The current interest in the study of optical and electronic properties of  $\pi$ -conjugated materials has been stimulated mainly by their potential for application in devices such as light-emitting diodes, photovoltaic devices and field effect transistors. Although structure-property relationships of organic electronic materials are fairly well established at the molecular level, factors that control their bulk properties are still not fully understood. Optical properties of materials depend strongly upon the intermolecular dipole coupling, which in turn is determined by the relative positions of adjacent molecules and directions of their dipole moments. Understanding the nature of the interactions that determine the packing of molecules in the solid state and how they affect the optical and electronic properties of the materials is therefore essential for tuning their properties. Studies related to the understanding of the role of molecular packing in controlling the functional properties, in particular, the optical properties of different classes of  $\pi$ -conjugated organic have been conducted. These studies have shown that the solid state emission of  $\pi$ -conjugated materials can be enhanced by prevention of co-facially stacked H-type (sandwich) aggregates. On the contrary, formation of slipped stack or J-type aggregates led to significant enhancement of solid state luminescence (*J. Phys. Chem. Lett.* 2011, 2, 863–73).



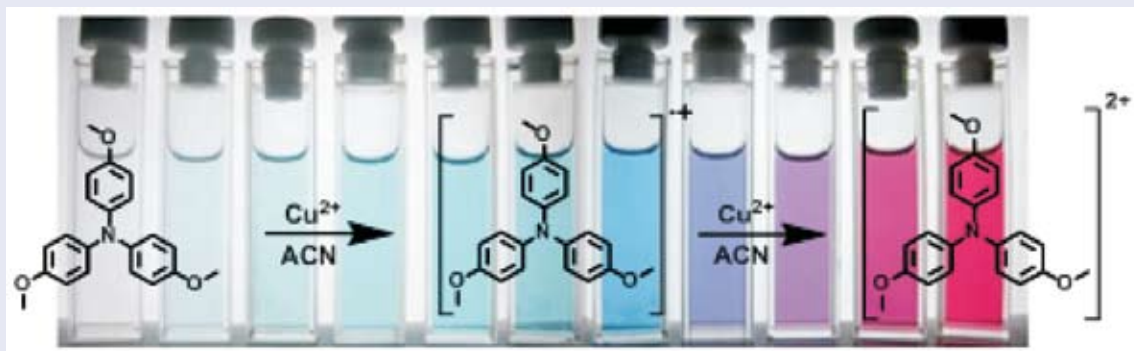
## Palladium nanoparticle-cored $G_1$ -dendrimer as chemoselective, room temperature hydrogenation catalysts

Transition metals, especially palladium, find great importance in the field of catalysis. Palladium nanoparticle-cored Fréchet type  $G_1$ -dendrimer (Pd- $G_1$ ) stabilized by Pd-carbon bonds were synthesized and characterized by IR, NMR, UV-Vis spectroscopic methods. TEM analysis indicated the presence of nearly spherical, polydisperse particles with average diameter of 2.7 nm. Pd- $G_1$  was found to be a highly efficient, chemoselective and reusable catalyst for the room temperature hydrogenation of carbon-carbon multiple bonds. Reducible functionalities like CHO, CO, COOR, CN, NO<sub>2</sub> and halogens were unaffected. Pd- $G_1$  is an efficient catalyst for the selective hydrogenation of carbon-carbon multiple bonds in multifunctional organic molecules. (*Tetrahedron Lett.* 2011, 52, 3102-05).



### Cu (II) mediated generation and spectroscopic study of tris (4-anisyl) amine radical cation and dication

Tris(4-anisyl)amine(TAA) can react with one equiv of  $\text{Cu}^{2+}$  to generate  $\text{TAA}^{+\cdot}$ , whereas reaction with two equiv  $\text{Cu}^{2+}$  gave  $\text{TAA}^{2+}$ , both in relatively stable conditions.  $\text{TAA}^{+\cdot}$  was characterized by absorption and EPR spectra. The dicationic species was identified by its absorption spectrum and detailed characterization of its structure was attempted based on its  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectra. In order to explain the shielding observed in the  $^1\text{H}$  and  $^{13}\text{C}$  signals of one of the three methoxy groups a reversal in the sign of the diamagnetic anisotropy cone of the  $\text{C}=\text{O}$  group is proposed. (*Organic Letters* 2011, 13, 1134-37).

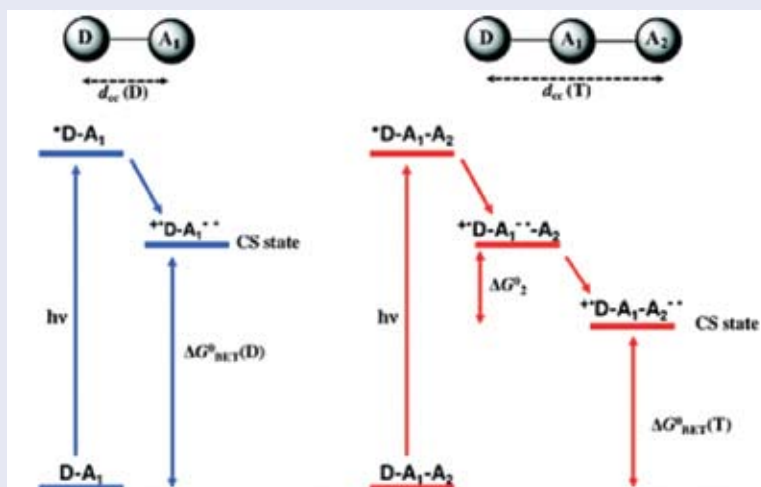


### Photoinduced charge separation in two bis(phenylethynyl)-anthracene based triads: Inverted region effect vs distance effect on back electron transfer

Photoinduced electron transfer processes in two bis(phenylethynyl)anthracene (BPEA)-based triads were investigated to identify the dominating factors that lead to long-lived charge-separated (CS) states in BPEA-based donor-acceptor systems. In both systems studied, phenothiazine moieties acted as final donors. Nitrotoluene or pyromellitic diimide units acted as final acceptors. Two possible electron transfer pathways could be identified in these systems. Fluorescence of the BPEA chromophore was highly quenched in both systems due to the photoinduced electron transfer process. Picosecond transient absorption studies suggested that excitation of BPEA leads to electron transfer from  $1\text{BPEA}^*$  to the acceptor followed by a second electron transfer from phenothiazine to the BPEA radical cation. In both systems formation of long-lived CS states was confirmed by nanosecond flash photolysis. A comparison showed that the BPEA-based triads exhibited lower CS state lifetimes compared to the BPEA-phenothiazine dyad. Analysis of the  $\Delta G^\circ$  and  $\lambda$  values showed that for both triads -  $\Delta G^\circ \leq \lambda$ ,

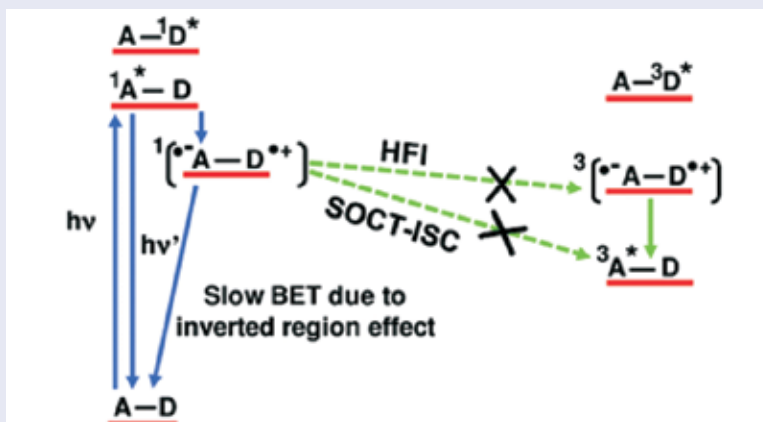


and hence, the inverted region effect cannot operate. Hence, the long lifetime of the final CS state is attributed to the long distance separating the donor and acceptor components in the CS state. This study supports the contention that if the CS state in a dyad is long-lived due to the inverted region effects, the CS state lifetime will decrease if the dyad is converted to a triad (*J. Phys. Chem. C* 2010, 114, 18735-44).



### Long-lived photoinduced charge separation due to the inverted region effect in 1,6-bis(phenylethynyl)pyrene–phenothiazine dyad

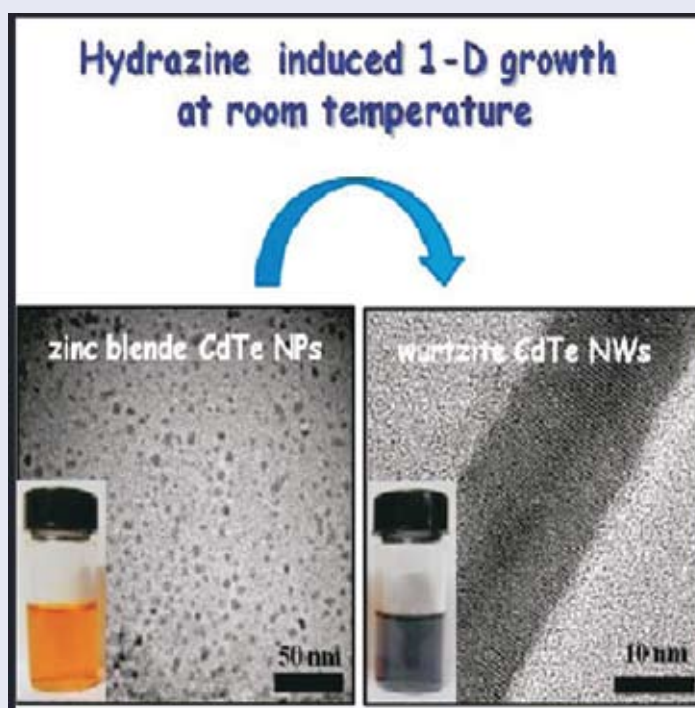
Photoinduced electron-transfer processes in a 1,6-bis(phenylethynyl)pyrene-phenothiazine dyad, BPEP–PT, were examined using various techniques. The BPEP singlet excited state was quenched by electron transfer from PT leading to formation of BPEP radical anion and PT radical cation. Rate constants and quantum yields of the PET processes were determined from steady-state and time-resolved fluorescence experiments, and spectroscopic identification of the radical ion products was achieved using picosecond and nanosecond flash photolysis experiments. The charge-separated (CS) state was found to be long-lived but decayed to the BPEP triplet state under the influence of external heavy atom effect. The energy level diagram constructed on the basis of experimental data revealed the existence of the local triplet state below the CS state, yet the CS state did not exhibit any tendency to decay to this level. This showed that hyperfine interaction (HFI) or spin–orbit charge-transfer intersystem crossing (SOCT-ISC) mechanisms were not effective in inducing intersystem crossing in the CS state. It is suggested that absence of SOCT-ISC in the CS state may be a consequence of the total absence of ISC in the parent BPEP chromophore. The only option available to the CS state is a spin-allowed transition to the ground state, and this process is slow because of inverted region effects (*J. Phys. Chem. C* 2010, 114, 18725–34).





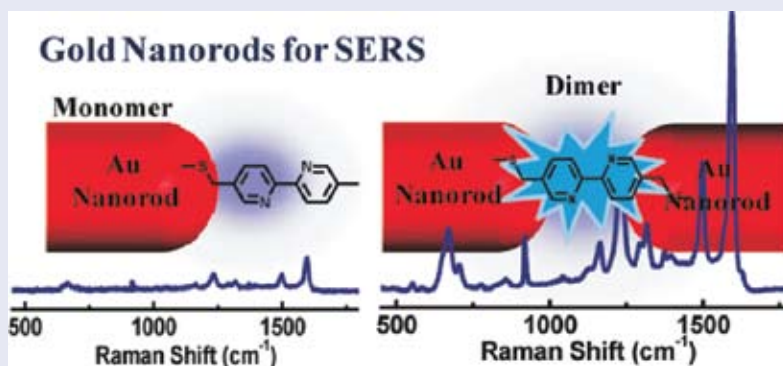
## Hydrazine-induced room-temperature transformation of CdTe nanoparticles to nanowires

The effect of hydrazine on the photophysical and morphological properties of water-soluble thioglycolic acid-capped cadmium telluride (CdTe) nanoparticles at room temperature has been investigated. At lower concentrations of hydrazine (0.5 M), a large enhancement in the luminescence of CdTe nanoparticles was observed without any shape change; hydrazine saturates the Cd dangling bonds on the nanoparticles' surface through coordination. Interestingly, highly crystalline CdTe nanowires with hexagonal wurtzite structure were obtained at higher concentrations of hydrazine (2.0 M) through the recrystallization of linearly assembled aggregated CdTe nanoparticles with a zinc blend structure. Strong dipole-dipole interaction between the nanoparticles in the presence of hydrazine assists their linear aggregation, and low activation energy for phase transition drives their recrystallization to nanowires. Extremely simple methodology presented opens up novel pathways for the synthesis of one-dimensional semiconductor nanostructures at room temperature and provides valuable information about the growth mechanism of nanowires (*J. Phys. Chem. Lett.* 2010, 1, 2094–98).



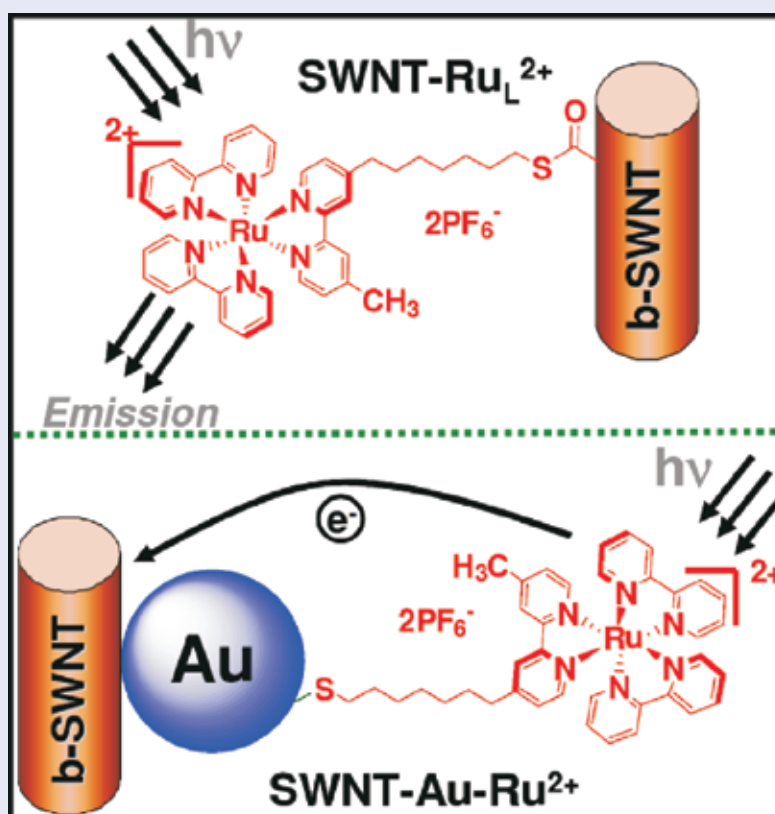
## Surface-enhanced Raman spectroscopy: Investigations at the nanorod edges and dimer junctions

Raman signal enhancement of two analyte molecules, containing bipyridine and phenyl moieties, were investigated by linking them (i) onto the edges of Au nanorods using monothiol derivatives and (ii) at the junctions of two Au nanorods using dithiol derivatives. Edges of Au nanorods are regions of high electric field, and specific interaction of the thiol molecules on the {111} planes at the edges resulted in an enhanced Raman signal. When two Au nanorods are brought together in a linear fashion through dithiol linkages, their longitudinal plasmon oscillations couple each other, creating regions of enhanced electric field (hot spots) at the junctions. Interestingly, dimerization leads to a spontaneous enhancement in the intensity of Raman signals (enhancement factor of  $\sim 1.4 \times 10^5$ ) due to the localization of molecules at the junctions of Au nanorod dimers (*J. Phys. Chem. Lett.* 2011, 2, 610–15).



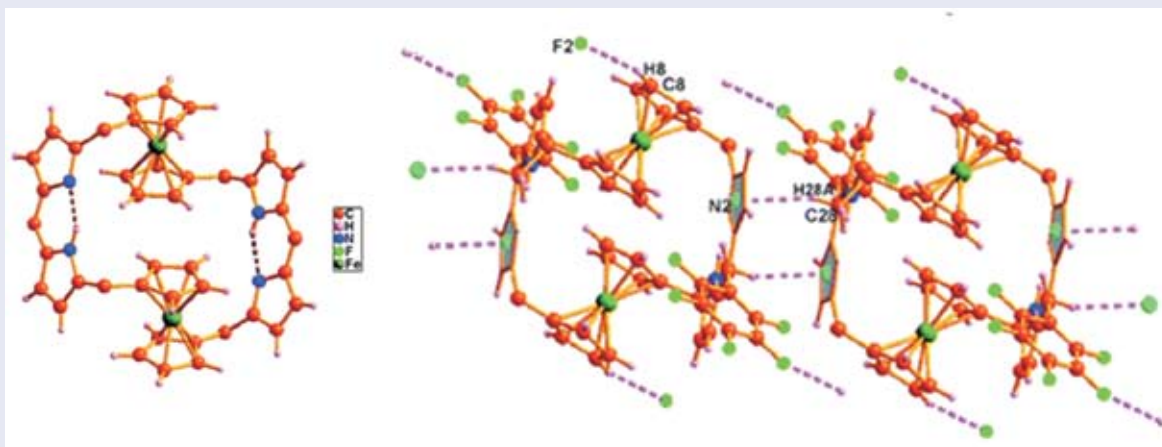
### Gold nanoparticle-functionalized carbon nanotubes for light-induced electron transfer process

The modified electronic properties at the heterojunctions of Au nanoparticle decorated single-walled carbon nanotubes (SWNTs) have been utilized for photoinduced electron transfer by anchoring a photoactive molecule, namely ruthenium trisbipyridine ( $\text{Ru}(\text{bpy})_3^{2+}$ ). A unidirectional electron flow was observed from the excited state of  $\text{Ru}(\text{bpy})_3^{2+}$  to carbon nanotubes when the chromophores were linked through Au nanoparticles ( $\text{SWNT-Au-Ru}^{2+}$ ). In contrast, photoinduced electron transfer was not observed from the excited state of  $\text{Ru}(\text{bpy})_3^{2+}$  neither to SWNT nor Au nanoparticles when these components were linked directly. The charge equilibration occurring at the SWNT-Au heterojunctions, due to the differences in electrochemical potentials, result in the formation of a localized depletion layer at the bundled carbon nanotube walls, which may act as acceptor sites of electrons from  $^*\text{Ru}(\text{bpy})_3^{2+}$ . The charge separation in  $\text{SWNT-Au-Ru}^{2+}$  nanohybrids was sustained for several nanoseconds before undergoing recombination, making these systems promising for optoelectronic and artificial photosynthetic device applications (*J. Phys. Chem. Lett.* 2011, 2, 775–81).



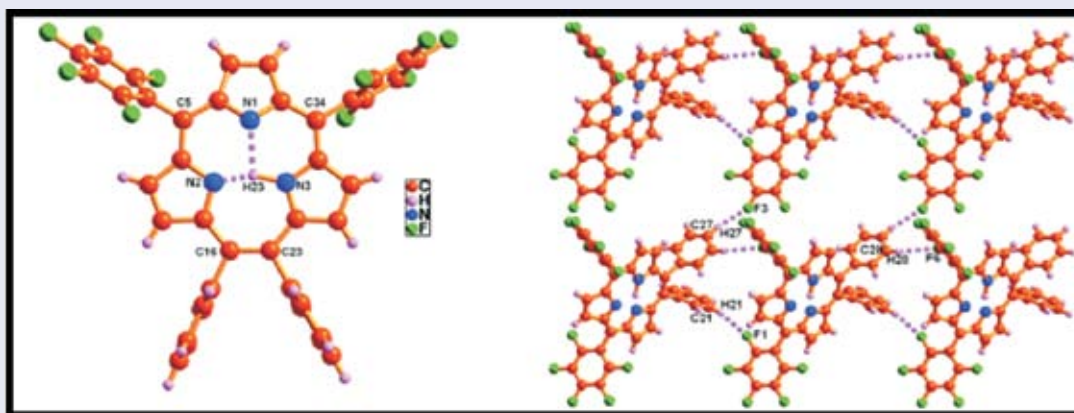
## Synthesis of calix[n]metallocenyl[m]phyrins (n = 1, 2 and m = 2, 4): aryl vs. alkyl substitution

The synthesis, structural and spectral characterization of metallocenes incorporated normal and expanded calixphyrins are investigated. The synthetic methodology adopted here is simple and straightforward. Introduction of the alkyl group at the meso-position assists the expanded macrocycle formation and are considered as potential candidates for the synthesis of higher homologues. These macrocycles are the largest metallocene incorporated porphyrinoids reported to date (*Chem. Commun.*, 2010, 46, 4746-48).



### Synthesis and characterization of meso-aryl triphyrin(2.1.1)

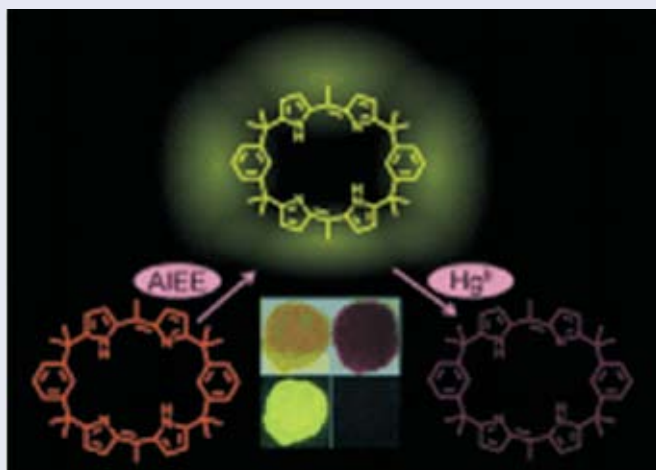
Synthesis, spectral, and single-crystal X-ray structural analysis of meso-aryl triphyrin (2.1.1) featuring three pyrrole rings and four meso-aryl rings is described. The title compound represents the first example of a ring-contracted meso-aryl  $\beta$ -unsubstituted free-base triphyrin containing only pyrrole rings reported to date and generates 2-D supramolecular assembly in the solid state (*Org. Lett.* 2011, 13, 2498-501).



### Calix[2]-m-benzo[4]phyrin with aggregation-induced enhanced-emission characteristics: Application as a Hg<sup>II</sup> chemosensor

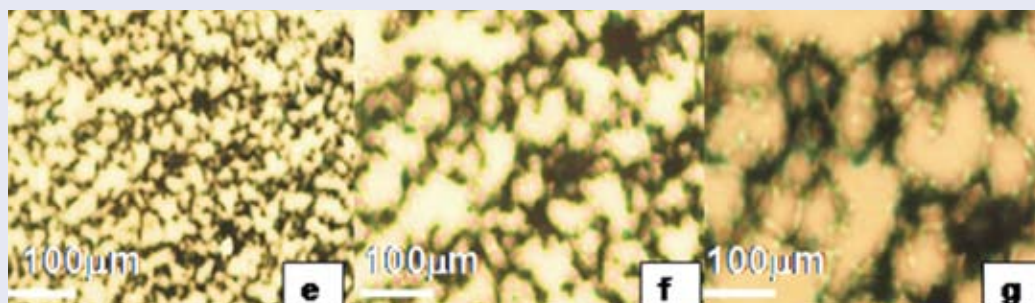
A hybrid, core-modified, expanded calixphyrin was synthesized and confirmed by single-crystal X-ray analysis, and found to exhibit aggregation-induced enhanced-emission (AIEE) characteristics. The aggregate formation was confirmed by HR-TEM analysis. The efficient emission in aqueous solution and in the solid state was utilized for metal-ion-sensing studies, which concluded a potential application for selective detection of Hg<sup>II</sup> ions (*Chem. Eur. J.* 2011, 17, 6598-601).





### Development of electromagnetic shielding materials from the conductive blends of polystyrene polyaniline-clay nanocomposite

EMI shielding materials are receiving much importance in recent years due to the rapid proliferation of miniaturized and portable electronic and telecommunication systems. In this context, electromagnetic interference shielding composite materials were developed from the conductive blends of nanostructured polyaniline-clay nanocomposite (PANICN) and Polystyrene (PS) by an one step host matrix assisted emulsion polymerization of anilinium salt of 3-pentadecyl phenol-4-sulphonic acid in clay. 3-PDPSA was derived from cashew nut shell liquid. These blends were characterized for electrical conductivity, thermal property, dielectric property and electromagnetic shielding efficiency. Percolation threshold concentration was studied by observation under PLM. The interactions between the primary particles and host matrix were manifested from the studies made through spectroscopy and rheology. The key finding of the research is that this low cost PANICN-PS blend with superior electrical conductivity ( $7.6 \times 10^{-1} \text{ S/m}$ ), excellent thermal stability and EMI SE of 10- 20 dB at 8 GHz makes them as a promising candidate for application in EMI shielding and antistatic discharge matrix for the encapsulation of micro electronic devices (*Composites: Part A 41, 2010, 1647–52*).



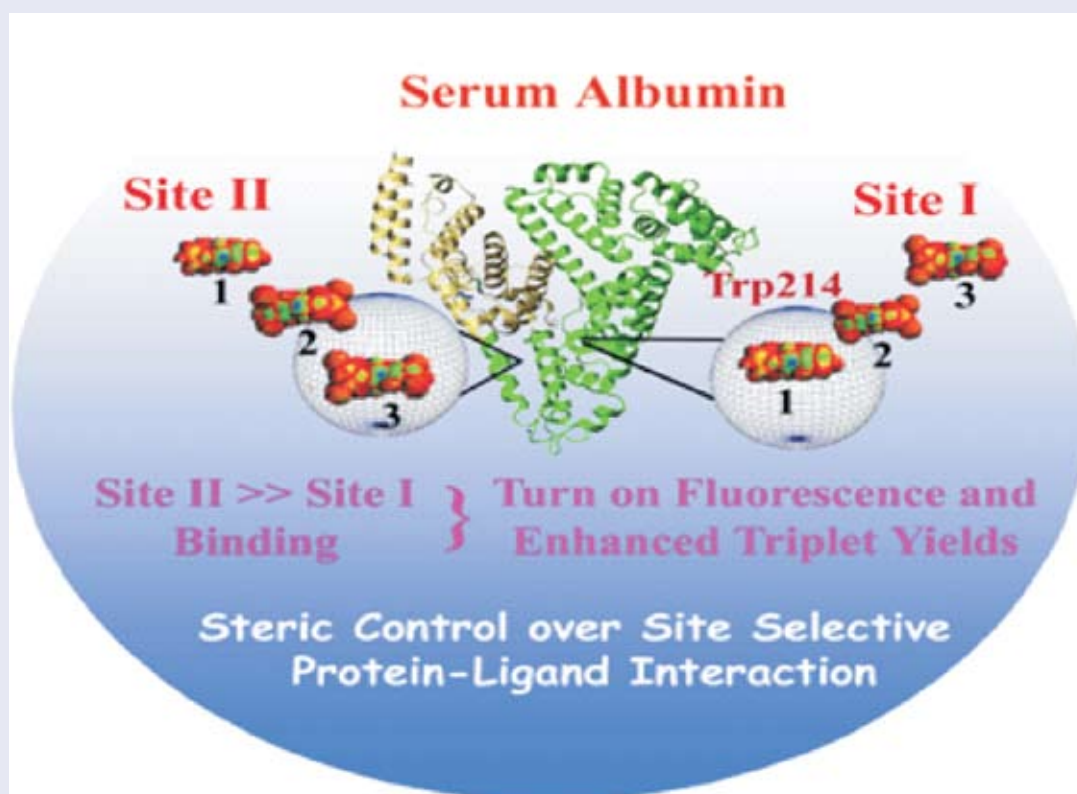
PLM pictures: e) PANI-PDPSA(15%), f) PANICN -PDPSA (15%), g) PANICN- DBSA (15%).

### Squaraine dye-serum albumin complexes with enhanced fluorescence and triplet yields

Protein-ligand interactions are important in biological processes such as enzyme-substrate recognition, signal transduction, and cell communication. Of all the proteins, serum albumin is found abundantly in the bloodstream and because of the ability of the serum albumins to interact with a wide variety of molecules, it is of current interest to exploit its various favourable properties for the development of novel therapeutic agents and drug delivery pharmacokinetics. In the present study the objective was to evaluate the probable *in vivo* transportation pathways of the squaraine dyes and investigate

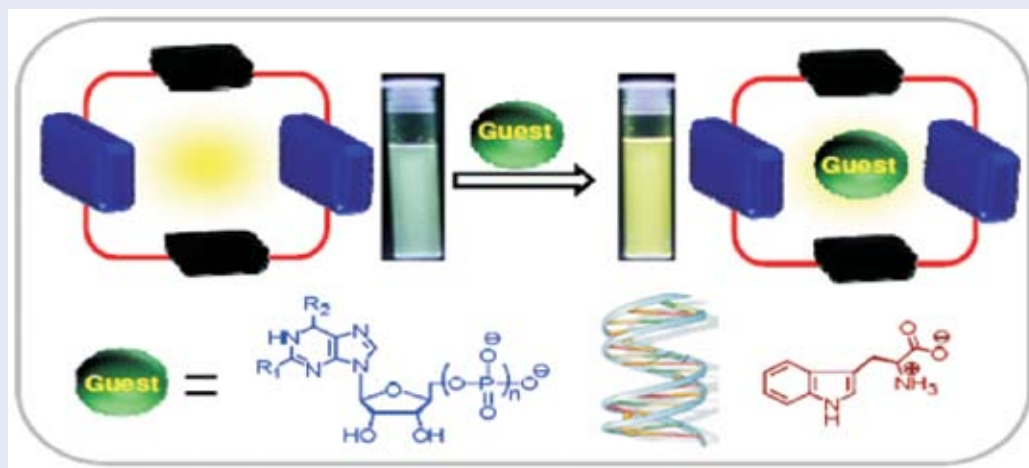


their interactions with human (HSA) and bovine serum albumins (BSA) when compared to the unhalogenated squaraine dye. The results demonstrated that steric factors of the substituents play a predominant role in binding of the squaraine dyes with serum albumins. Interestingly, these dyes with an increase in molecular size exhibited selectivity in binding at site II of the transport proteins HSA and BSA involving synergistic effects of hydrophobic, hydrogen bonding, and electrostatic interactions. As a consequence, these dyes exhibited “turn on” emission intensity and significantly increased triplet excited state lifetimes and quantum yields due to the microencapsulation. Uniquely, these dyes are quite soluble in buffer medium and exhibit site II selectivity and increased emission and triplet yields in the presence of transport proteins, thereby indicating their use as potential non-covalent protein labelling and PDT agents (*J. Phys. Chem. B.* 2010, 114, 5914-19).



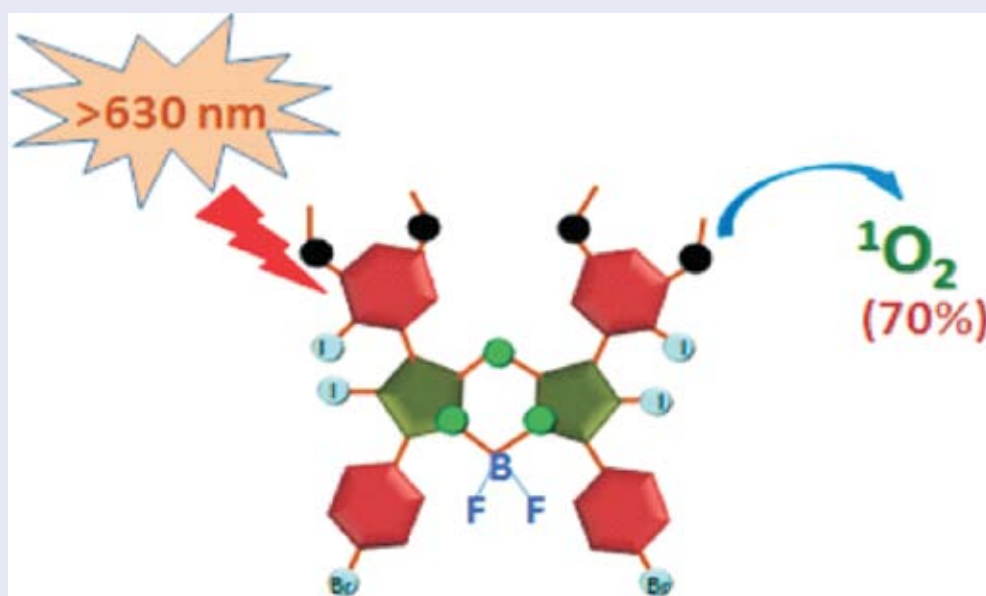
### Functional cyclophanes: Promising hosts for optical biomolecular recognition

Cyclophanes possess defined cavity size and are efficient in encapsulating and stabilizing guest molecules inside the cavity through various non-covalent interactions. This unique property of the cyclophanes has been widely exploited for the development of selective probes for a variety of guest molecules. The present tutorial review highlights the use of various interesting functionalised cyclophanes like phenyl based, naphthalene based, anthracene, pyrene, acridine, phenanthridine, and metallocyclophanes based systems for the sensitive and selective optical recognition of important biomolecules. Designing of selective receptors for a biomolecule of interest is based on the complementarily, preorganisation as well as the different non-covalent interactions possible between these receptors and the guest biomolecules. Since the selectivity of the recognition is decided by the subtle balance between various primary binding forces, the secondary binding interactions between the receptor and the guest molecules would swing the balance in favour of a particular analyte (*Chem. Soc. Rev.*, 2010, 39, 4158–68).



### Tuning photosensitized singlet oxygen generation efficiency of novel Aza-BODIPY dyes

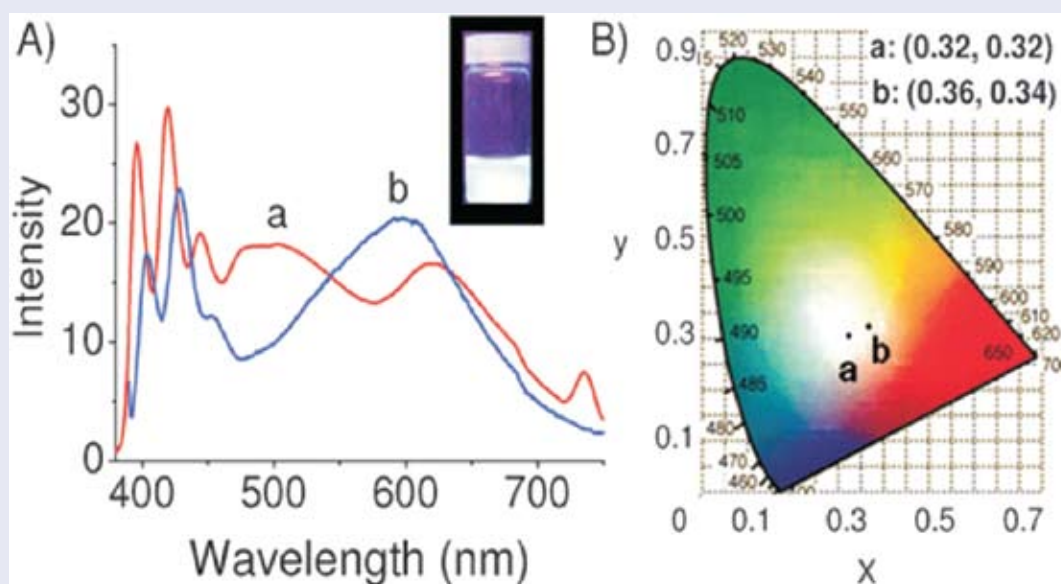
Photosensitized generation of singlet oxygen  $O_2(a^1\Delta_g)$  is a well studied phenomenon, which has found numerous applications from synthetic organic chemistry to wastewater treatment to photodynamic cell death. Triplet sensitization of molecular oxygen  $O_2(X^3\Sigma_g^-)$  is the most commonly employed method for generating singlet oxygen. The 4,4-difluoro-4-bora-3a,4a-diaza-s-indacenes, abbreviated as BODIPYs, hold great promise as ideal sensitizer showing to their favourable properties such as high stability, absorption, and emission in the NIR region; high extinction coefficients and negligible photobleaching. Synthesized novel aza-BODIPY derivatives substituted with heavy atoms such as bromine and iodine, and their triplet and singlet oxygen generation efficiencies have been investigated. These derivatives showed absorption in the NIR region with high molar extinction coefficients. The substitution of heavy atoms at the core as well as the peripheral positions resulted in a significant enhancement in the excited state properties of these derivatives. The dye substituted with four iodine atoms showed yields of  $\Phi_T = 0.78$  and  $\Phi(^1O_2) = 0.70$ , which are the highest values so far obtained for the aza-BODIPY derivatives (*Org. Lett.* 2010, 12, 5720-23).





## DNA-assisted white light emission through FRET

Fluorescence resonance energy transfer (FRET) between an excited fluorescence donor and ground state fluorescence acceptor has been widely used to study the structure and dynamics of molecules. Investigated the excitation energy transfer from the excimer of a DNA-bound symmetric cyclophane, CP-1 to a classical DNA intercalator, ethidium bromide (EB), utilizing various photophysical and biophysical techniques. These studies indicated that CP-1 undergoes effective interactions with DNA as compared to the model cyclophane, CP-2 and shows a high association constant of  $K_{\text{DNA}} = 7.6 \pm 1 \times 10^4 \text{ M}^{-1}$  resulting in the exclusive formation of a sandwich-type excimer having significantly enhanced fluorescence intensity and lifetimes. In the presence of DNA, as compared to the buffer medium, CP-1 exhibited efficient fluorescence resonance energy transfer (FRET) to EB. The steady-state and time-resolved fluorescence and viscometric measurements indicate that the presence of the sandwich-type excimer is a prerequisite for the observation of FRET, wherein EB acts as an acceptor. Extended the energy transfer studies to the organic medium using a DNA-surfactant complex and obtained a pure white light emission with CIE co-ordinates of 0.32, 0.32 (*Chem. Commun.* 2011, 47, 1288-90).



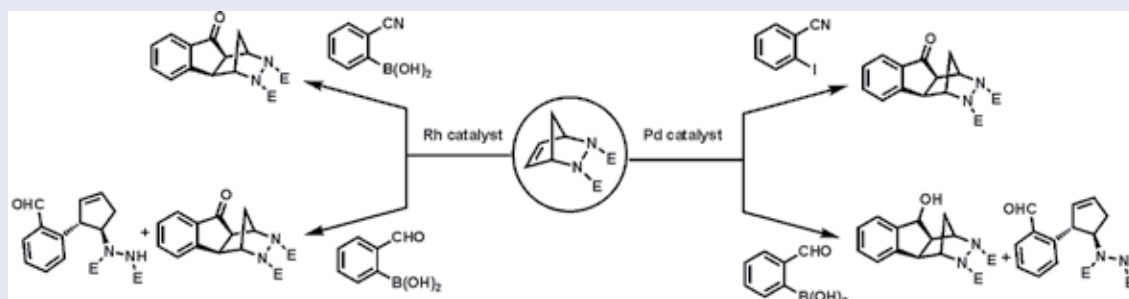
## ORGANIC CHEMISTRY

### Transition metal catalyzed carboannulation of diazabicyclic alkenes with ambiphilic bifunctional reagents: A facile route towards functionalized indanones and indanols

Functionalized indanones are readily prepared in good to excellent yields by the Pd/Rh catalyzed carboannulation of bicyclic and tricyclic hydrazines with 2-iodobenzonitrile, 2-cyanophenylboronic acid and 2-formylphenylboronic acid. The reaction with 2-formylphenylboronic acid afforded 3,4-disubstituted cyclopentenes as minor product along with indanones under Rh catalyzed conditions, whereas indanols were obtained as the major product under Pd catalyzed conditions. The products obtained can be synthetically manipulated easily to pharmaceutically important molecules. The methodology assumes significance as indanones constitute the core structures of many biologically active compounds, synthetic intermediates for pharmaceuticals, ligands for olefin polymerization

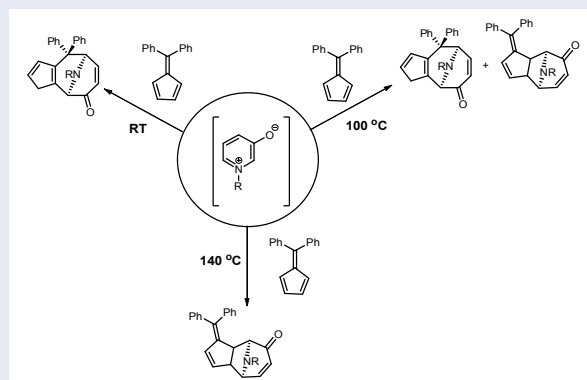


catalysts and discotic liquid crystals. Further work to utilize the fused indanones towards functionalized diaminoindanone derivatives are in progress and will be reported in due course (*Tetrahedron*, 2011, 67, 4905-13).



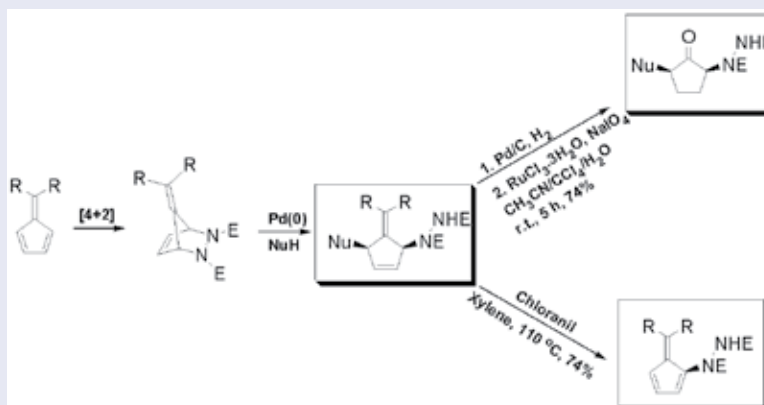
### Expeditious synthesis of N-bridged heterocycles via dipolar cycloaddition of pentafulvenes with 3-oxidopyridinium betaines

A new and highly versatile approach towards the synthesis of bicyclo[6.3.0]undecanes and bicyclo[5.3.0]decanes was accomplished. The methodology adopted involves [6+3] and [3+2] cycloaddition reactions of pentafulvenes with 3-oxidopyridinium betaines generated either by the action of a base on the pyridinium salt or thermally from pyridinium betaine dimer. These well-functionalized bicyclo[6.3.0]undecanes and bicyclo[5.3.0]decanes offer a wide range of synthetic options, which can be expected to translate into a variety of rapid and efficient synthesis of natural products. The methodology assumes significance as bicyclo[6.3.0]undecane and bicyclo[5.3.0]decane frameworks are important synthetic intermediates for a variety of natural products. Application of these compounds in the synthesis of natural products is in progress (*Tetrahedron*, 2011, 67, 1272-80).



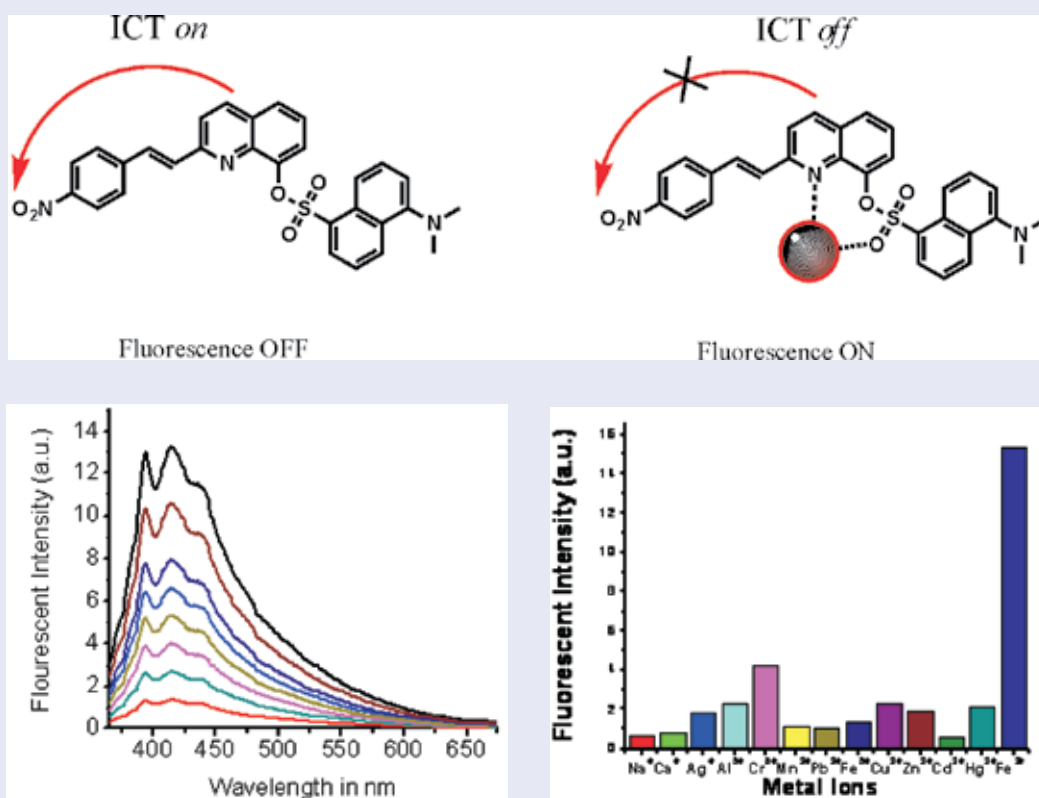
### Trapping the $\pi$ -allyl palladium intermediate from fulvene derived azabicyclic olefin with soft nucleophiles: Facile access towards alkylidene cyclopentene, $\alpha, \alpha'$ -disubstituted cyclopentanone and 1-hydrazino fulvene

A facile method for the synthesis of a new class of disubstituted alkylidene cyclopentenes has been introduced. The methodology involves a palladium catalyzed ring-opening of pentafulvene derived bicyclic hydrazines with phenols and active methylene compounds, furnishing the 1,4-disubstituted alkylidene cyclopentenes in good yield. The utility of multiple points of functionalization was effectively demonstrated by the synthesis of substituted cyclopentanones and 2-hydrazino fulvenes. Efforts for utilizing the developed methodology towards the synthesis of bioactive molecules are in progress (*Synthesis*, 2010, 3649-56).



### Dansyl-styrylquinoline conjugate as divalent iron sensor

Design and development of fluoroionophores involving small molecules with inherent properties of selective binding and sensing of physiologically and environmentally relevant cations is of utmost importance in the broad areas of chemistry and biology due to several advantages of fluorescence spectroscopy like easy detection, high sensitivity and tunability. A 8-methoxyquinoline-dansyl conjugate (DansSQ) has been synthesised, which showed excellent selectivity towards  $\text{Fe}^{2+}$  over other transition metal ions including  $\text{Fe}^{3+}$ . The fluorescent emission of this ligand at 450 nm was enhanced 15-fold upon addition of  $\text{Fe}^{2+}$  in the presence of common interfering metal ions in the background. These studies suggest that DansSQ can be used as a fluorescent sensor for  $\text{Fe}^{2+}$  with a detection limit sufficiently low to allow fluorogenic detection of submillimolar concentrations of  $\text{Fe}^{2+}$  ions (*Tetrahedron Lett.* 51, 2010, 6626-29).



Fluorescence titration profile of DansSQ ( $6 \times 10^{-6} \text{M}$ ) with increasing amount of  $\text{Fe}^{2+}$  ions ( $3.8 \times 10^{-4} \text{M}$ ) and on addition of 5 equivalents of other metal ions.

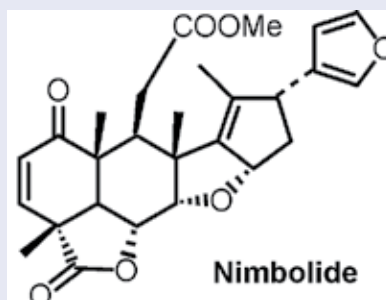


## Natural products

Natural products derived from fruits, vegetables, spices, legumes, cereals, and traditional medicines are currently getting much attention as preferred potential therapeutics for cancer and other chronic diseases because of their safety, affordability and ability to target multiple cell signalling pathways. *Azadirachta indica*, commonly known as 'Neem' is extensively used in traditional medicines of India like Ayurveda and Sidha. It was shown that nimbolide, a triterpenoid isolated from *Azadirachta indica* leaves, has very good potential in cancer chemotherapy. It enhanced the apoptosis induced by inflammatory cytokines and chemotherapeutic agents in tumor cells. This limonoid abrogated the expression of proteins associated with cell survival (Bcl-2, Bcl-xL, IAP-1, and IAP-2), proliferation (cyclin D1), invasion (MMP-9), and angiogenesis (VEGF), all regulated by nuclear factor (NF)- $\kappa$ B. (*J. Biol. Chem.*, 2010, 285, 35406-17).

Cancer cells are much more susceptible than normal cells to the cell-death-inducing effects of a protein known as TNF-related apoptosis-inducing ligand (TRAIL), a difference that may aid in the develop new cancer therapies. However, the acquired tumour resistance to TRAIL is a roadblock. The studies also indicate that nimbolide can modulate the sensitivity of colon cancer cells to TRAIL induced apoptosis (*J. Biol. Chem.*, 2011, 286, 1134-46). Nimbolide also retards tumour cell migration and angiogenesis by down regulating matrix metalloproteinase 2/9 expression *via* inhibiting ERK1/2 and reducing binding activity of NF- $\kappa$ B in colon cancer cells.

In another study, it has also been shown that the natural product Crotepoxide isolated from the plant *Kaempferia pulchra* chemosensitizes tumor cells through inhibition of expression of proliferation, invasion, and angiogenic proteins linked to proinflammatory pathway (*J. Biol. Chem.*, 2010, 285, 26987-97). These studies were carried out in collaboration with the University of Texas M.D Anderson Cancer Centre, USA and SCTIMST, Thiruvananthapuram.



*Azadirachta indica* leaves

The investigations on bioactive compounds of the medicinal rice 'Njavara' led to the isolation of three biologically active compounds *viz.*, Tricin and the two rare flavonolignans – Tricin 4'-O-(erythro-



$\beta$ -guaiacylglycerol ether and Tricin 4'-O-(threo- $\beta$ -guaiacylglycerol)ether which, were studied for their anti-inflammatory effect by *in vivo* (rat-paw oedema method) in collaboration with Dept. of Biochemistry, University of Kerala, Thiruvananthapuram. Results indicate that these compounds show anti-inflammatory effect (>65% inhibition) at a lower concentration of 2.0 mg/kg compared to the standard drug diclofenac at 20 mg/kg (80% inhibition). Other experiments with human, peripheral blood monocytes are being carried out for following the effect on COX, LOX and NO pathways (*Plant Foods Hum. Nutr.*, 2011, 66, 91–96).

## INORGANIC AND POLYMER MATERIALS

### Gold atomic clusters(Auac), cobalt oxide (Coo) and Auac-Coo composite films based aqueous cysteine sensor

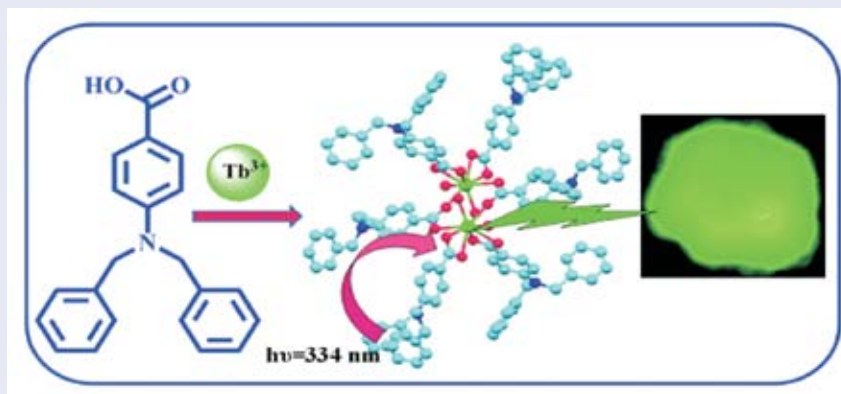
The electrochemical synthesis and the synergistic electro catalytic effect of metal oxide supported gold atomic clusters for sub-nanomolar level sensing of cysteine has been carried out. The developed gold atomic clusters and the hybrid materials were characterized by spectral, morphological and electrochemical methods. Comparative evaluation of the critical role of surfactants in stabilizing the hybrid material and the mechanistic aspects of support scaffolds has been discussed. The modified electrode exhibits highly reproducible wider calibration range of  $10^{-10}$  to  $10^{-6}$  M with lower detection limits of  $1.6 \times 10^{-11}$  M for cysteine (*Biosens. Bioel.* 26, 2011, 3920-26).

### Sequential or simultaneous metal ion mediated and metal/metal oxide modified molecularly imprinted polypyrrole based aqueous amino acid sensors

Polypyrrole(PPy) and molecularly imprinted polypyrrole (MIPPy) film coating on to glassy carbon was achieved by electropolymerization. Metal ion (Co(II), Ni(II), Zn(II) and Cd(II)) mediated, metal (Pt, Pd and Au) and metal and/or metal oxide modified MIPPy electrodes were constructed by sequential method. However, simultaneous deposition of copper metal/copper oxide modified MIPPy film electrode resulted in higher sensitivity (Limit of detection =  $4.0 \times 10^{-9}$  M). The above electrode resulted in better selectivity compared to non-imprinted and PPy film based sensors. Applicability of newly developed sensor for analysis of human urine samples was successfully demonstrated (IPA0264DEL2011: *Talanta*, DOI: 10.1016/j.talanta. 2011.05.025).

### Novel green emitting material based on Tb<sup>3+</sup> dibenzylaminobenzoate

A novel efficient antenna complex of Tb<sup>3+</sup> supported by 4-(dibenzylamino)-benzoic acid ligand has been designed, synthesized, and characterized and its photophysical properties were evaluated. The new aromatic carboxylate complex of Tb<sup>3+</sup> exhibits bright green luminescence efficiency in the solid state with a quantum yield of 82%, thus rendering it an excellent candidate for use in various photonic applications (*Inorg. Chem.*, 2010, 49, 2407-15).

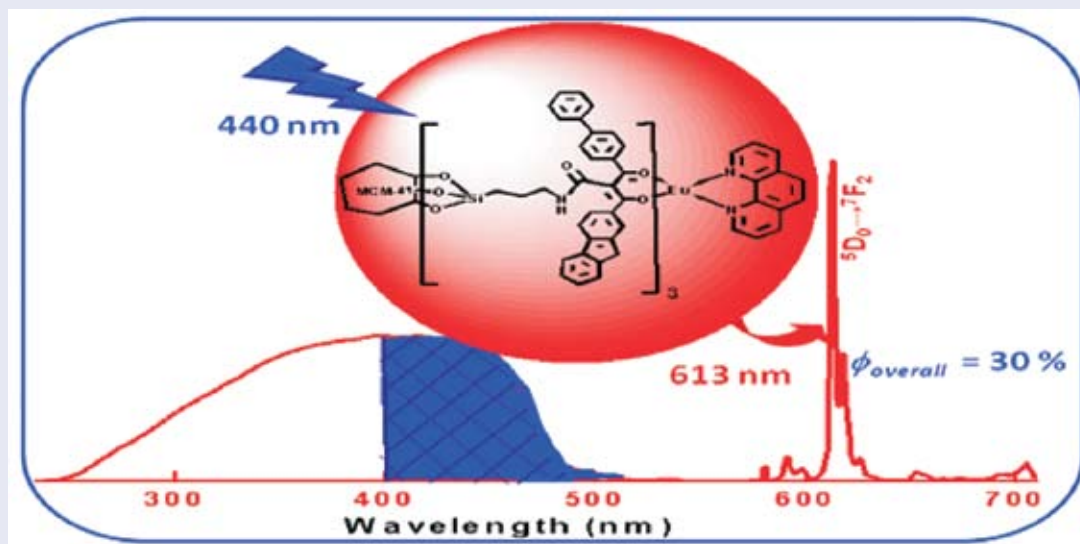






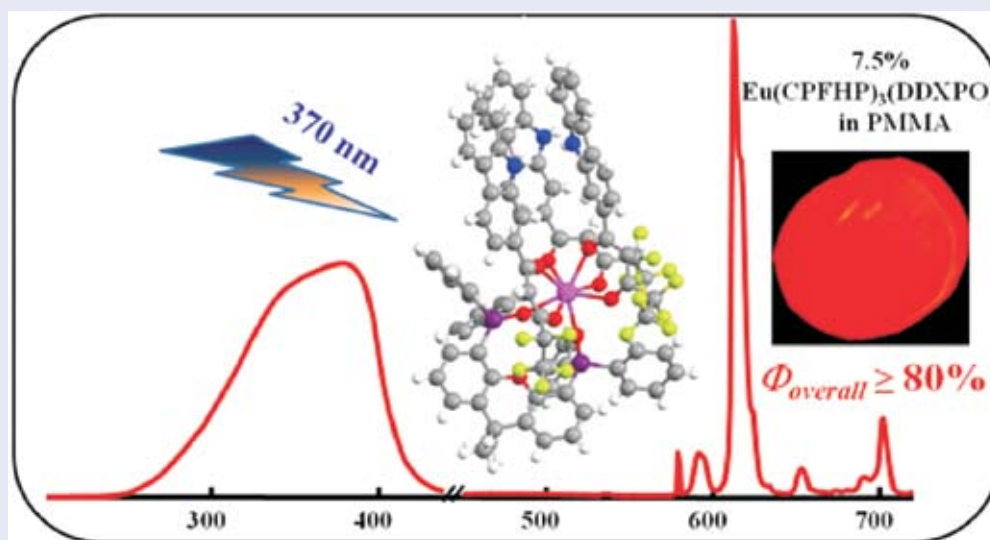
## Visible-light excited red emitting organic-inorganic hybrid mesoporous nanomaterials

This work focuses on the development and characterization of novel visible-light excited red light emitting organic-inorganic hybrid mesoporous nanomaterials based on antenna complexes of  $\text{Eu}^{3+}$  containing highly conjugated  $\beta$ -diketonate. The designed hybrid material shows a stronger red/orange intensity ratio, higher  $^5\text{D}_0$  quantum efficiency, and longer lifetimes, which is a promising candidate as visible-light excitable red phosphor for various photonic applications (*J. Mater. Chem.*, 2010, 20, 5220–27).



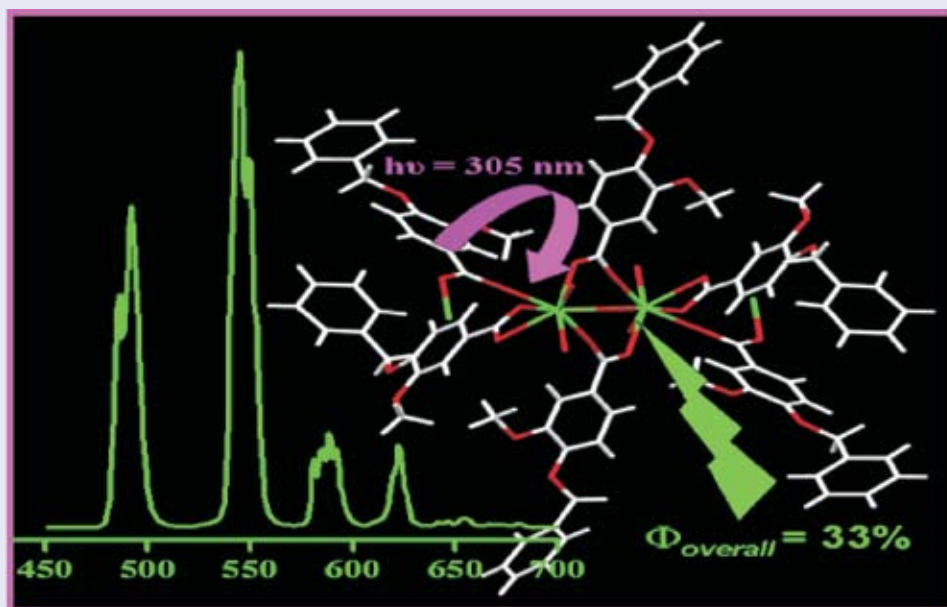
## Luminescent polymeric films doped with $\text{Eu}^{3+}$ complexes

A novel efficient antenna complex of  $\text{Eu}^{3+}$  has been synthesized, structurally characterized, and its photoluminescent behaviour examined. Photoluminescent efficiencies of the doped films (quantum yields 79–84%) are dramatically enhanced in comparison with that of the precursor complex. The new luminescent PMMA-doped  $\text{Eu}(\text{CPFHP})_3(\text{DDXPO})$  complex therefore shows considerable promise for polymer light-emitting diode and active polymer optical fibre applications (*Inorg. Chem.*, 2010, 49, 9055-63).



## Effect of electron-withdrawing and electron-donating groups on luminescent properties of terbium-benzoates

The incorporation of an electron-releasing substituent on 3<sup>rd</sup> position of 4-benzyloxy benzoic acid increases the electron density of the ligand and consequently improves the photoluminescence of the Tb<sup>3+</sup> complexes. On the other hand, the presence of an electron-withdrawing group at this position dramatically decreases the overall sensitization efficiency of the Tb<sup>3+</sup>-centred luminescence (*Dalton Trans.*, 2010, 39, 776–86).



## High NIR reflecting inorganic pigments

Novel, near-infrared reflective pigments based on yttrium molybdate doped with metal ions such as Si<sup>4+</sup> or Pr<sup>4+</sup> are described. Replacing Si<sup>4+</sup> for Y<sup>3+</sup> in Y<sub>6</sub>MoO<sub>12</sub> changed the color from light-yellow to dark-yellow and the band gap decreased from 2.60 to 2.45 eV due to O<sub>2p</sub>-Mo<sub>4d</sub> charge transfer transitions. In contrast, replacing Pr<sup>4+</sup> for Y<sup>3+</sup> changed the color from light yellow to dark brown and the band gap shifted from 2.60 to 1.90 eV. The coloring mechanism is based on the introduction of an additional 4f<sup>1</sup> electron energy level of Pr<sup>4+</sup> between the valence and conduction bands. The NIR reflectance of the pigments on asbestos cement sheet was measured. (*Dyes and Pigments*, 2011, 88, 109-15).





## MATERIALS DIVISION

The erstwhile Materials and Minerals Division was rechristened as Materials Division with a major revamp of activities. Research activities were consolidated under areas of metals and composites, superconducting and magnetic materials, electronic materials, nano functional materials, and minerals. This year the emphasis under the superconducting materials was  $MgB_2$  based current leads while multi layer low temperature co-fired ceramic tapes and Rare Earth doped ceramic compositions for optical devices were developed under laboratory conditions and characterized. Nano size cerium oxide nano rods and nano tubes for possible use as chemical mechanical planarisation (CMP), rare earth doped zinc oxide varistors for medium voltage surge protection and magnetic dye adsorbent catalyst with a novel concept of dye removal were also developed in laboratory levels. Sol-gel coating precursors for multi channel ultra filtration ceramic membrane for industrial water recycling in collaboration with BHEL-CTI Bangalore and low temperature curable self cleaning hybrid coatings on solar cell panels were the high light of the nano ceramic activity. Aluminium and magnesium based alloys for automotive applications were attempted. Investigation in to the beach sand placer deposits on coast of Tamil Nadu as well as plasma processing of sillimanite to aluminium silicon alloys were the high light of the minerals activity.

The Division achieved good level of external funded projects, publications and technology transfer as well as maintained some of the major infrastructure facilities such as electron microscopes, XRD, INSTRON and Liquid Nitrogen Plant which catered not only to the need of the laboratory but also to external clientele. The significant R&D achievements of the division can be summarized as below:

- Ultra filtration ceramic membrane through sol-gel coatings on porous ceramic multi channel tubes for integration to a membrane plant capacity 15 CuM/hr for industrial water recycling in BHEL-CTI, Bangalore under design and engineering inputs from BHEL.
- High strength Aluminium and Magnesium alloys for automobile components, and centrifugally cast composites for CVRDE, Chennai
- $MgB_2$  based current leads, 10-20 cm length with 1000 A rating for fusion magnet application
- Magnetic dye adsorbent catalyst with novel concept of dye removal with probable application in treating dye effluents.
- $CeO_2$  nano rods and tubes for application as chemical-mechanical planarisation (CMP)
- Rare earth oxide doped ZnO for medium voltage and high voltage surge protection devices.



## पदार्थ प्रभाग

गतिविधियों में प्रमुख सुधार के साथ तत्कालीन पदार्थ एवं खनिज प्रभाग पदार्थ प्रभाग के रूप में नामकरण किया गया था। अनुसंधान गतिविधियों धातुओं और कंपोजिटों, अतिचालक और चुंबकीय सामग्रियों, इलेक्ट्रॉनिक सामग्रियों, नैनो कार्यात्मक सामग्रियों और खनिजों के अंतर्गत समेकित की गयी थी। अतिचालक सामग्रियों के तहत इस साल जोर  $MgB_2$  आधारित करन्ट लीड्स पर था, जबकि प्रयोगशाला परिस्थितियों के अधीन ऑप्टिकल उपकरणों के लिए बहु परत कम तापमान सह-गलित सिरेमिक टेप और रेअर अर्थ डोपेड सिरेमिक संरचनाओं के विकास और अभिलक्षण किए गए। रासायनिक यांत्रिक प्लेनराइसेशन (सीएमपी) के रूप में संभाव्य उपयोग के लिए आकार नैनो सैरियम ऑक्साइड नैनो छडों और नैनो ट्यूब्स, मध्यम वोल्टेज प्रोत्कर्ष संरक्षण के लिए रेअर अर्थ डोपेड जिंक आक्साइड वैरिस्टर्स और रंजकों को हटाने की नूतन अवधारणा के साथ चुंबकीय रंजक अधिशोषी उत्प्रेरक प्रयोगशाला स्तर में विकसित किए गए। नैनो सिरेमिक गतिविधियों की मुख्य विशेषताएं औद्योगिक जल के रीसाइक्लिंग के लिए बीएचईएल-सीटीआई, बेंगलोर के सहयोग से मल्टी चैनल अल्ट्रा निस्पंदन सिरेमिक झिल्ली के लिए सॉल-जेल कोटिंग पूर्वगामियों तथा सौर सेल पैनलों पर कम तापमान संसाधन योग्य कोटिंग संकर सफाई स्वयं थीं। ऑटोमोटिव अनुप्रयोगों के लिए एल्यूमीनियम और मैग्नीशियम आधारित मिश्रधातु के लिए प्रयास किये गये। खनिजों पर की गई गतिविधियों में तमिलनाडु के समुद्र तट पर पुलिन रेत प्लेसर जमा की जांच तथा एल्यूमीनियम सिलिकॉन मिश्र में सिलिमेनाइट के प्लाज्मा प्रसंस्करण शामिल थी।

प्रभाग ने बाह्य वित्त पोषित परियोजनाओं, प्रकाशन और प्रौद्योगिकी हस्तांतरण के क्षेत्र में अच्छी प्रगति हासिल करने साथ ही साथ की कुछ प्रमुख बुनियादी सुविधाओं, जैसे इलेक्ट्रॉन माइक्रोस्कोप, एक्सआरडी, इन्स्ट्रॉन और तरल नाइट्रोजन संयंत्र बनाई रखी, जिनका उपयोग प्रयोगशाला की जरूरतों के लिए ही नहीं, बल्कि बाह्य ग्रहकों के लिए भी किया गया। प्रभाग की अनुसंधान एवं विकास की महत्वपूर्ण उपलब्धियों को नीचे संक्षेप दिया जा सकता है:

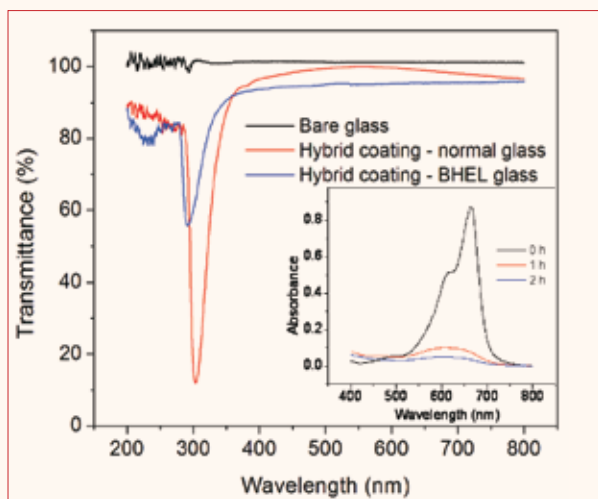
- बीएचईएल-सीटीआई, बेंगलोर में औद्योगिक जल के रीसाइक्लिंग के लिए 15/ क्यू.मी./घंटा क्षमता वाली मेम्ब्राइन संयंत्र में एकीकरण के लिए छिद्रपूर्ण सिरेमिक मल्टी चैनल ट्यूब पर सोल-जेल कोटिंग्स के माध्यम से अल्ट्रा निस्पंदन सिरेमिक झिल्ली बीएचईएल से इंजीनियरी निवेश और डिजाइन के अधीन है।
- ऑटोमोबाइल घटकों के लिए उच्च क्षमता एल्यूमीनियम और मैग्नीशियम मिश्र धातु और सीवीआरडीआई, चेन्नई के लिए अपकेंद्रीकृत कास्ट कंपोजिट
- संलयन चुंबक अनुप्रयोग के लिए 1000 ए रेटिंग के साथ 10-20 से.मी. लंबाई  $MgB_2$  आधारित कर लीड्स,
- रंजक बहिःस्वावी उपचार में संभाव्य अनुप्रयोग के साथ रंजक हटाने की नूतन अवधारणा के साथ चुंबकीय रंजक अधिशोषी उत्प्रेरक
- रासायनिक यांत्रिक प्लेनराइसेशन (सीएमपी) के रूप में अनुप्रयोग के लिए  $CeO_2$  नैनो छडों और ट्यूब्स मध्यम वोल्टेज और उच्च वोल्टेज प्रोत्कर्ष सुरक्षा उपकरणों के लिए रेअर अर्थ ऑक्साइड डोपेड  $ZnO$



## NANOCERAMICS

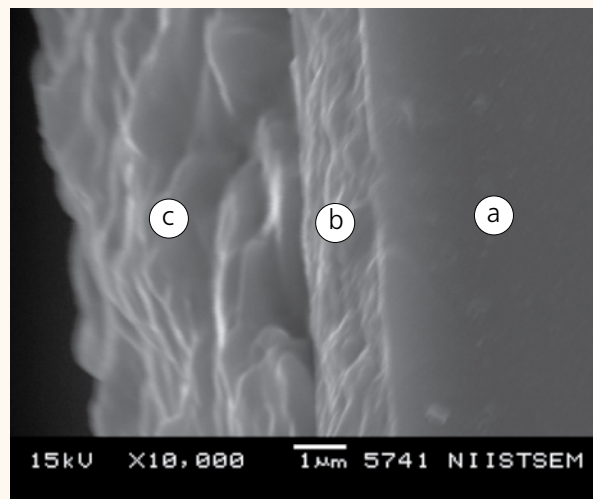
### Development of low temperature healing, self cleaning coatings for solar cell covers and glass surfaces

An organic inorganic hybrid system with organic part providing the low temperature healing property and the inorganic part providing the photoactivity was developed. A UV curable coating composition was identified where the organic part comprised of partially hydrolysed silane and a monomer and the inorganic part being crystalline titania nano particles synthesized through a simple microwave treatment of titania sol. A method to integrate the inorganic part into the organic part of the low temperature healing coating was developed. The final coating comprising of two layers was successfully developed on normal glass slides and the glass substrates provided by BHEL and a transparency of ~99% and ~95% was achieved respectively with methylene blue degradation efficiency of ~95% under UV and ~93% under sunlight within two hours exposure time. Fine tuning of the inorganic part for enhanced photoactivity was done by co-doping the titania nanoparticles with iron and ceria.



A

Transmittance of the hybrid coating developed on normal glass slide and BHEL glass. Absorbance of hybrid coating on BHEL glass contaminated with methylene blue (10<sup>-3</sup> M) after 0, 1 and 2 h exposure to sunlight (inset).



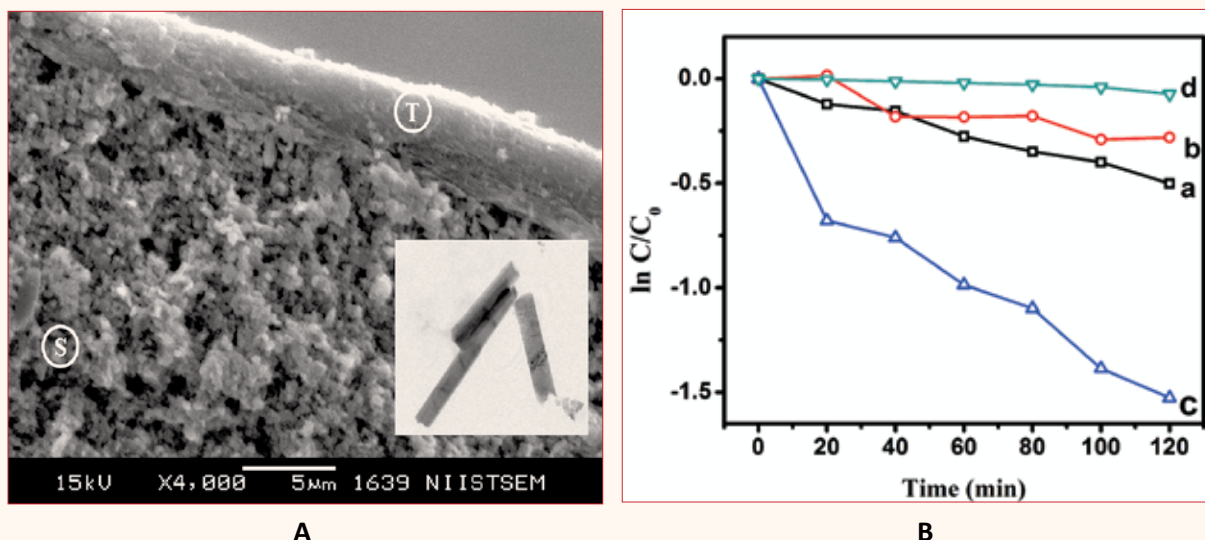
B

SEM image of the hybrid coating showing the two layer coating (a) glass (b) polymer coating and (c) titania coating

### Modified photocatalytic ultrafiltration ceramic membrane involving brookite nano coatings

In continuation of the anatase ultrafiltration membranes developed for BHEL, Bangalore, multi channel alumina tubes provided by BHEL were coated with brookite titanium dioxide prepared by aqueous sol-gel method using hydroxyl ethyl cellulose (HEC) as modifier. The brookite phase was obtained when the samples were calcined at temperature 800°C to 1000°C. The photoactive titania membrane with brookite phase shows 19 nm crystallites and 42% weight fraction of brookite even after heating to 900°C. The membrane shows 88% degradation of methylene blue under UV light. The membrane has

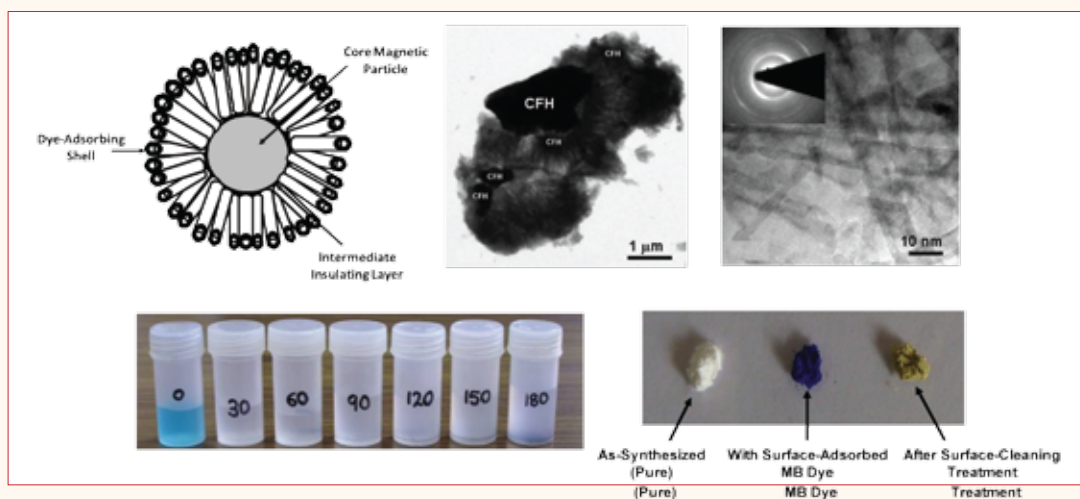
thickness of 4-5  $\mu\text{m}$  and pore size  $< 50\text{ nm}$ . The morphology of the particles characterized by SEM appeared as rod like structures, with varying aspect ratio which is in the range 1 - 2  $\mu\text{m}$  / 0.2 - 0.4  $\mu\text{m}$ .



(A) SEM image of the functional titania coating (T) on a porous substrate (S). TEM image of the titania membrane (T1%HEC) calcined at 900°C is shown in the inset. (B) Photo catalytic activity of Hombikat UV 100 (a), Titania 1% HEC calcined at 800°C (b), 900°C (c), 1000°C (d).

### Novel magnetic dye-adsorbent catalyst

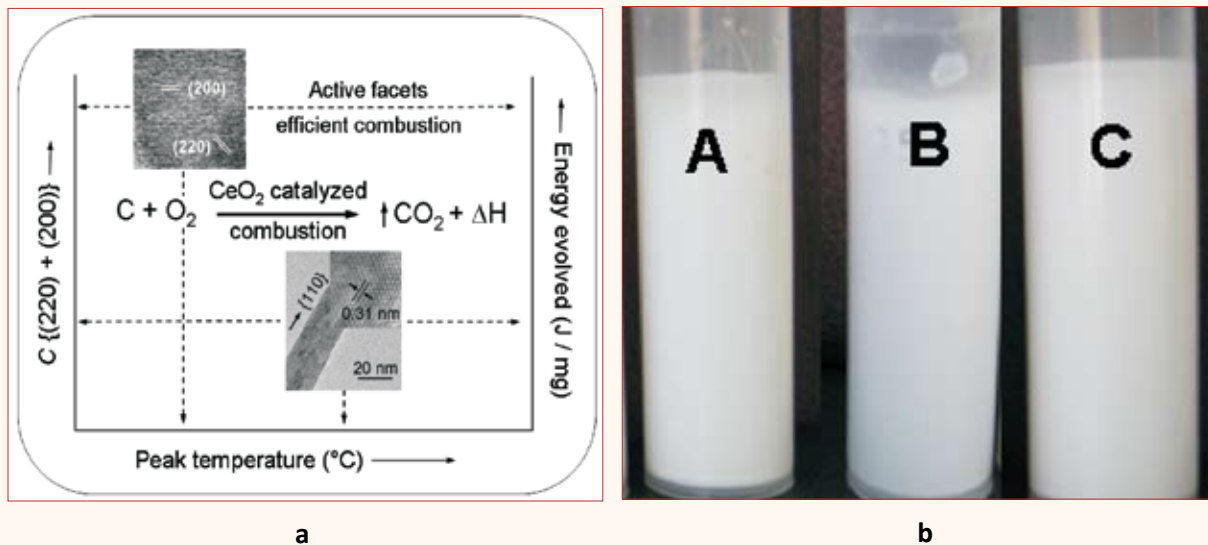
The “Magnetic Dye-Adsorbent Catalyst” is a unique product used as a dye-removal material synthesized through a new process. The product consists of a nano-composite having a “core-shell” structure with the core and shell made up of a magnetic ceramic particle and a dye-adsorbing material in the form of nanotubes. This structure of dye-removal material shows both the dye-adsorption and magnetic properties. It can remove an organic textile-dye (both cationic and anionic) from an aqueous solution (textile-effluent) via surface-adsorption mechanism in the dark-condition. The catalyst when dispersed and stirred in the textile-effluent, quickly adsorbs on to the dye surface and slowly settle down to the bottom due to gravity. An external magnetic field is also effective in settling and separating the catalyst from the top clear-water due to its magnetic nature. The catalyst can be recycled several times in dark condition for decomposing the adsorbed dye from its surface by treating in a typical bath.





## Nanofluids: CeO<sub>2</sub> based chemical mechanical planarization (CMP) slurry and Al<sub>2</sub>O<sub>3</sub> and ZrO<sub>2</sub> based nanofluids for heat transport

Slurries with nanorods and cubes of CeO<sub>2</sub> based CMP reduced the average surface roughness from 250 nm on optical glass slide to 3 nm in 10 min polishing. The activity of nanocrystalline CeO<sub>2</sub> on carbon soot combustion reaction is higher for crystals with higher {100} facets (as in nanocubes) and small crystallites with relatively higher {110} and {100} facets (Fig. a) and not dependent on crystal dimension/surface area. Stable colloidal dispersions alumina and zirconia were achieved with the help of a suitable dispersant (Fig. b) for use as nanofluids for heat transport.



(a) AFM image of glass slide polished with R+C (left) and HR-TEM image of R+C is shown as inset. Right side graph shows the dependence of catalytic activity of ceria nanoparticles on the relative content of active facets.

(b) Photographs of A)  $\alpha$ -alumina B)  $\alpha$ -alumina and C) Zirconia dispersions after 30 days observation period.

## Rare earth oxide varistors for medium and high voltage surge protection

Nanocrystalline La<sub>2</sub>O<sub>3</sub> and CeO<sub>2</sub> based ZnO varistor powder has been processed through sonochemical, urea and glycine decompositions methods. Cylindrical varistors were fabricated and sintered at temperatures 1275, 1300 and 1350°C. A theoretical sintered density of 95 % at 1350 °C was achieved. Such sintered varistors have average grain size of ~3  $\mu$ m. I-V characteristics confirm that a medium voltage surge protection is possible in CeO<sub>2</sub> based varistors where as a high voltage surge capacity can be possibly achieved in ZnO-La<sub>2</sub>O<sub>3</sub> system. The nanocrystalline ZnO-CeO<sub>2</sub> and ZnO-La<sub>2</sub>O<sub>3</sub> varistor powders are mixed with conventional micronized varistor powders up to 10 wt% for achieving dense, sintered varistors with nano/micro composite microstructures at sintering temperatures below 1300°C. These nano/micro composite micro structures resulted in break down field  $V_b = 900$  V/mm with non linearity index  $\alpha = 40$ .

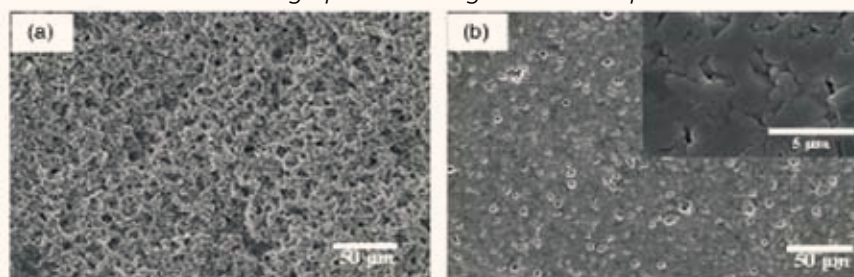
## ELECTRONIC CERAMICS

### Low temperature co-fired ceramic tapes

Strontium zinc silicate and  $\text{LiMgPO}_4$  low temperature cofireable ceramics were prepared by conventional solid state ceramic route. The sintering temperature of  $\text{Sr}_2\text{ZnSi}_2\text{O}_7$  was reduced to  $875^\circ\text{C}$  by the addition of LMZBS glass. The fine ceramic powders with a specific surface area of  $1\text{--}1.8\text{ m}^2/\text{g}$  of the ceramics were mixed with a solution (dispersant) of fish oil dissolved in xylene and ethanol. It was then ball milled for 24 h using agate balls in zirconia bouls. The resulting slurry was mixed with binder polyvinyl butyral, and plasticisers polyalkaline glycol and butyl benzyl phthalate and again ball milled for 24h. The slurry thus obtained was tape cast. The tapes were allowed to dry by keeping in air for about one hour. The tapes were 200 m in thickness. Eight pieces of about 2 cm each in length and breadth were cut from the tapes and stacked together. The stack was then hot pressed at  $70^\circ\text{C}$  for 10 minutes. It was then sintered at temperatures in the range  $800\text{--}850^\circ\text{C}$  for 4 hours. Microstructures of the sintered composites were investigated by recording SEM pictures. The ceramic tapes of thickness about 200 micrometer were cast. The stacked and sintered  $\text{Sr}_2\text{ZnSi}_2\text{O}_7$  tapes exhibited  $\epsilon_r=7$ ,  $\tan\delta=0.001$ . The tapes do not react with the electrode silver material.



Photograph of a cast green LTCC tape



SEM image of  $\text{Sr}_2\text{ZnSi}_2\text{O}_7\text{--LMZBS}$  (a) green tape (b) Sintered ( $825^\circ\text{C}$ ) and stacked tape (8 Nos)

### Crystal structure and microwave dielectric properties of apatite type rare earth silicates



High-resolution image of the composition  $(\text{Sr}_2\text{Pr}_2)(\text{RE}_6)(\text{SiO}_4)_6\text{O}_2$  ceramic

The apatite type rare earth silicates  $(\text{Sr}_2\text{RE}_2)(\text{RE}_6)(\text{SiO}_4)_6\text{O}_2$  ( $\text{RE}=\text{La, Pr, Tb, Tm}$  and  $\text{Y}$ ) ceramics were prepared by the solid state ceramic route. The phase and structure analysis were carried out using powder X-ray diffraction and transmission electron microscopy. Electron diffraction and Rietveld structure refinement of XRD data indicated that  $(\text{Sr}_2\text{RE}_2)(\text{RE}_6)(\text{SiO}_4)_6\text{O}_2$  [ $\text{RE}=\text{La, Pr, Tb, Y}$ ] has a typical





oxyapatite type structure.  $A_4^I A_6^{II} (BO_4)_6 O_2$  in space group P63m where A<sup>I</sup> is occupied by RE ions only, and B is occupied by Si. The Tb based compound is monoclinic with space group P2<sub>1</sub>/m. The compounds have relatively very low dielectric constant and low loss factor in the microwave frequency region and are possible materials for microwave substrate applications.

### Low permittivity SrCuSi<sub>4</sub>O<sub>10</sub> glass composites for low k applications

The tetragonal gillespite type SrCuSi<sub>4</sub>O<sub>10</sub> (belongs to Egyptian blue family) was prepared by the conventional solid state ceramic route. The Egyptian blue sintered at 1100°C /6h showed  $\epsilon_r=4$  and  $\tan \delta=1.1 \times 10^{-3}$  at 5 GHz. The Egyptian blue has a poor sinterability and the addition of lithium magnesium zinc borate glass lowered the sintering temperature and improved densification. The ceramic with 5 wt% LMZBS glass sintered at 900°C has  $\epsilon_r=5$  and  $\tan \delta=1.9 \times 10^{-3}$  at 5 GHz. The composite is chemically compatible with the silver electrode material. The low k SrCuSi<sub>4</sub>O<sub>10</sub> composite is a useful as substrate material for increasing the signal speed in communication devices.

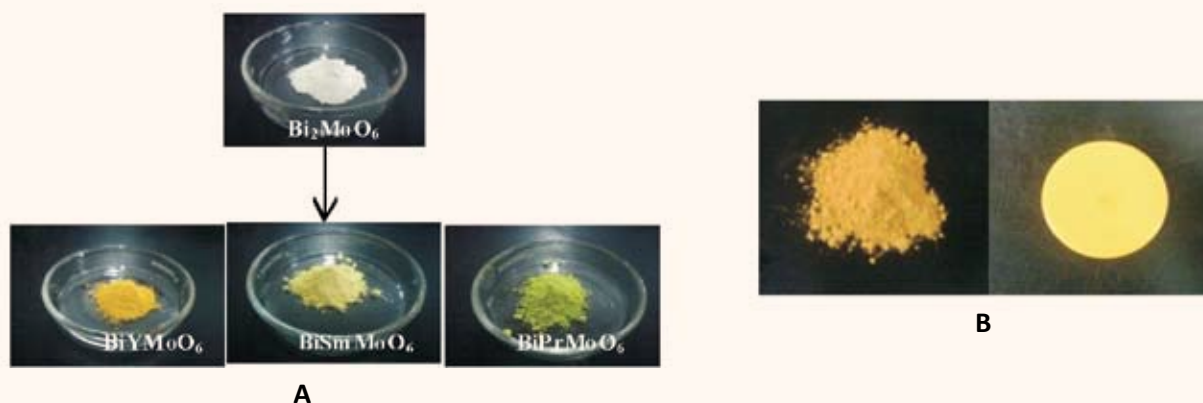
### Polymer-Fosterite composites for electronic packaging applications

Materials used in microelectronic packaging have to simultaneously meet diverse requirements such as low dielectric loss, low dielectric constant, low thermal expansion coefficient, low thermal dependence of permittivity, moisture absorption resistance, and high dimensional stability and mechanical strength. The polymer-ceramic composites are ideal for packaging applications. Composites of polymers such as PTFE, PS, PE, Epoxy with MgSiO<sub>4</sub> ceramics were developed. The properties are given in the table below and compared with commercially available FR4.

polymer	$\epsilon_r$	$\tan \delta$	CTE ppm/°C	TC W <sup>m-1</sup> K <sup>-1</sup>	Water absorption %
PTFE	3.5	0.009	36	1.76	13.05
PE	5.28	0.009	60	2.97	0.30
PS	4.6	0.110	36	0.29	0.41
Epoxy	5.1	0.030	40	1.5	0.20
FR4	4.2	0.020	18	0.35	0.10

### Development of novel functional ceramic oxides for electrical and electro-optical applications

RE-doped Bi<sub>2</sub>MoO<sub>6</sub> (RE = Y, Sm and Pr) yellow pigments for coloration of plastics : New inorganic yellow-pigments: Bi<sub>(2-x)</sub>RE<sub>x</sub>MoO<sub>6</sub> (RE = Y, Sm and Pr; x=0, 0.2, 0.4, 0.6, 0.8, 1.0) have been synthesized and it is suggested that the substitution of rare earth for bismuth red shifted the absorption edge of the colorants leading to yellow color for Y and Sm and greenish yellow color for Pr.

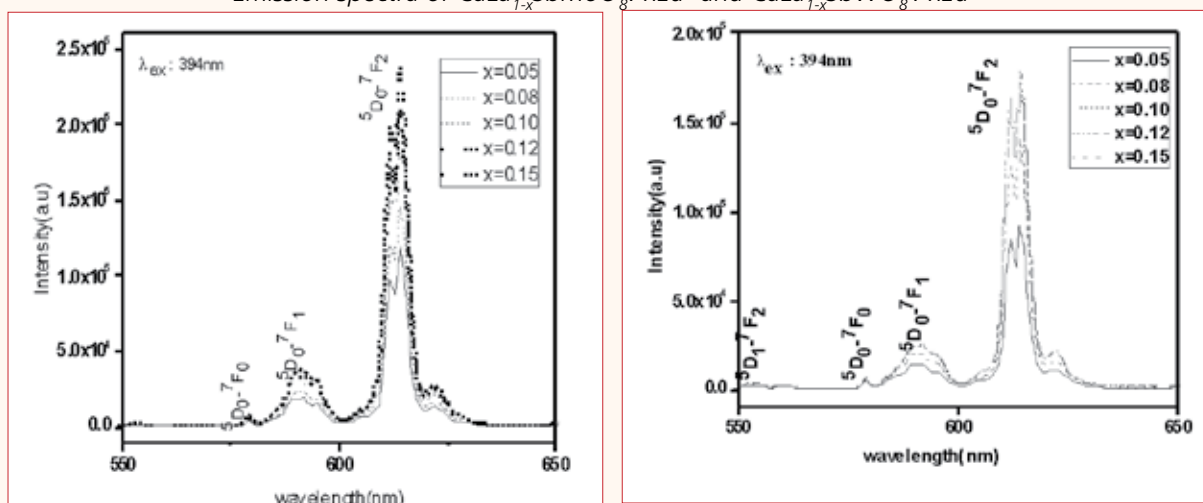


Photographs of (a) Bi<sub>2</sub>MoO<sub>6</sub> and BiREMoO<sub>6</sub> (RE = Y, SM and Pr) pigments and (b) BiYMoO<sub>6</sub> (10%) + PMMA.

These newly developed pigments gave good coloration to plastics and are chemically stable. Evaluation of the properties of the pigments confirmed that these products have potential to be used as an ecofriendly alternative for the existing toxic yellow pigments used as coloring material for plastics.

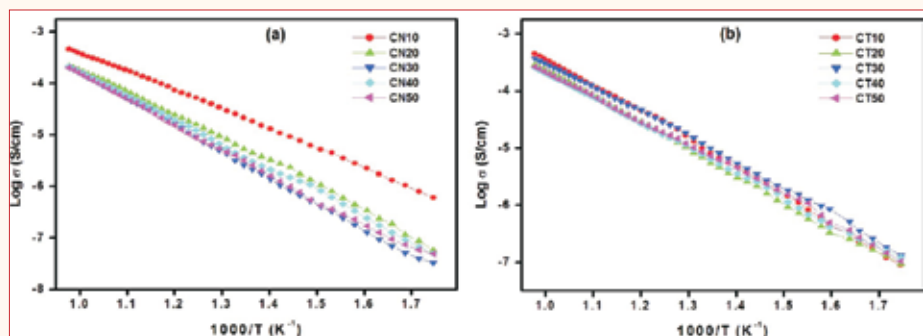
**Novel powellite based red phosphors:  $\text{CaLa}_{1-x}\text{SbMoO}_8 : x\text{Eu}^{3+}$  and  $\text{CaLa}_{1-x}\text{SbWO}_8 : x\text{Eu}^{3+}$  for white light emitting diodes (WLEDs):** New powellite based red phosphors:  $\text{CaLa}_{1-x}\text{SbMoO}_8 : x\text{Eu}^{3+}$  and  $\text{CaLa}_{1-x}\text{SbWO}_8 : x\text{Eu}^{3+}$  ( $x = 0.05, 0.08, 0.10, 0.12, 0.15$ ) were prepared using solid state reaction. In both the emission spectrum of  $\text{CaLa}_{1-x}\text{SbMoO}_8 : x\text{Eu}^{3+}$  and  $\text{CaLa}_{1-x}\text{SbWO}_8 : x\text{Eu}^{3+}$  the major emission peaks are observed at 580, 591, 612, 615 and 623nm which are characteristic emission peaks of  $\text{Eu}^{3+}$  ion and correspond to  $^5\text{D}_J (J=0,1) - ^7\text{F}_J (J=1,2,3,4)$  transitions. Strong red emission intensity is observed under near UV region (394 nm) and blue region 464 nm excitation which are the matching emission wavelengths of blue and near UV LED chips. Properties observed were better than Niobium/molybdenum based phosphores.

Emission spectra of  $\text{CaLa}_{1-x}\text{SbMoO}_8 : x\text{Eu}^{3+}$  and  $\text{CaLa}_{1-x}\text{SbWO}_8 : x\text{Eu}^{3+}$



### Influence of disorder-to-order transition on lattice thermal expansion and oxide ion conductivity in $(\text{Ca}_x\text{Gd}_{1-x})_2(\text{Zr}_{1-x}\text{M}_x)_2\text{O}_7$ pyrochlore solid solutions

Pyrochlore-type solid solutions,  $(\text{Ca}_x\text{Gd}_{1-x})_2(\text{Zr}_{1-x}\text{M}_x)_2\text{O}_7$  ( $x = 0.1, 0.2, 0.3, 0.4, 0.5$  and  $M = \text{Nb}$  or  $\text{Ta}$ ) were prepared through a high temperature solid-state route. The lattice thermal expansion coefficient for pyrochlore-type compounds is of the order of  $10^{-6} \text{ K}^{-1}$  and was found to decrease with decrease in the 48f oxygen x parameter. Ordered pyrochlores were found to have greater temperature stability, as they have a lower lattice thermal expansion coefficient than disordered pyrochlore compositions. From the impedance spectroscopic studies, it is found that structural disorder and bond strength are key parameters deciding the conductivity of pyrochlore-type solid solutions

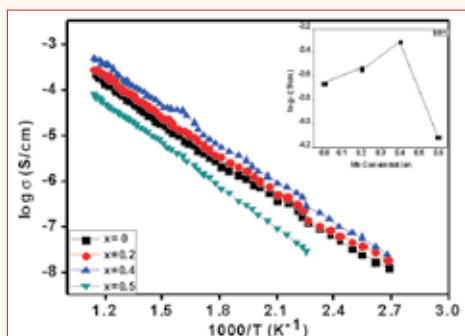


Temperature dependence of total conductivity of (a)  $(\text{Ca}_x\text{Gd}_{1-x})_2(\text{Zr}_{1-x}\text{Nb}_x)_2\text{O}_7$  and (b)  $(\text{Ca}_x\text{Gd}_{1-x})_2(\text{Zr}_{1-x}\text{Ta}_x)_2\text{O}_7$  samples



## Effect of Mn doping on the structure and electrical properties of new pyrochlore type oxides: $\text{CaCe}_{1-x}\text{Mn}_x\text{SnNbO}_7$ for thermistor applications

A series of new pyrochlore structured NTCR semiconducting oxides in  $\text{CaCe}_{1-x}\text{Mn}_x\text{SnNbO}_7$  system is prepared by conventional solid state reaction method. From the electrical conductivity measurements, an increase in conductivity with increase in Mn concentration up to  $x = 0.4$  is observed. The thermistor constant at  $300^\circ\text{C}$  and  $600^\circ\text{C}$  is in the range 6700 – 8400K and the sensitivity values in the range of 1-2%. These compounds, owing to their excellent NTC characteristics in a wide range of temperatures, may find application in devices like high-temperature thermistors.



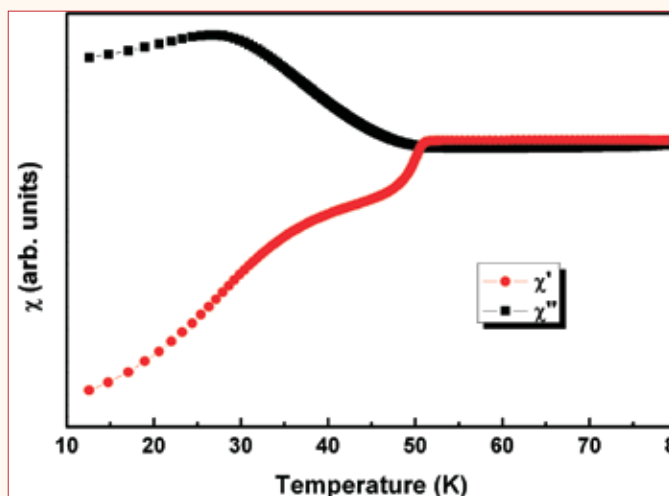
Arrhenius plots of conductivity for different Mn concentration (variation of conductivity with Mn concentration is shown in the inset).

Composition	$\beta_{300/600}$ ( $\text{K}^{-1}$ )	$\alpha$ ( $\text{K}^{-1}$ )	
		$300^\circ\text{C}$	$600^\circ\text{C}$
$\text{CaCeSnNbO}_7$	6706	0.0204	0.0088
Mn 0.2	6810	0.0211	0.0091
Mn 0.4	7141	0.0217	0.0093
Mn 0.6	6974	0.0212	0.0091

## SUPERCONDUCTING AND MAGNETIC MATERIALS

### A novel synthesis route for iron based superconductors

The recent discovery of superconductivity in iron pnictides has generated tremendous interest because of their relatively high critical temperature up to 55 K and very high upper critical field up to around 300 T. NIIST successfully synthesized  $\text{SmFeAsO}_{1-x}\text{F}_x$  (Sm 1111), which is a promising candidate among the iron based superconductors through a novel route. The polycrystalline samples prepared through the new route exhibited the highest critical temperature of 55.3 K, ever reported in the system. Further a transport critical current density of  $750 \text{ A/cm}^2$  at 12 K was achieved for the first time in the F doped Sm 1111 bulk superconductors. The synthesis route is simple and inexpensive and can help in surpassing the most of the existing hurdles like high temperature and pressure requirements in the development of practical conductors for technological applications.



AC Susceptibility vs Temperature plots of  $\text{SmFeAsO}_{1-x}\text{F}_x$



### Development of stabilized multifilamentary superconducting wires and coils

NIIST in collaboration with RRCAT, Indore developed a process for preparation of stabilized multifilamentary (SMF) wires up to a length of 2 m for application in cryogen-free magnets. The SMF wires containing 4 to 16 filaments, Cu stabilizer, Fe barrier and Ni sheath were made by powder-in-tube technique followed wire-in-tube method. The wires were subjected to various tests such as their  $J_c$  variation with temperature, effect of current ramp rate on  $J_c$  and the  $J_c$  homogeneity with respect to the conductor length. The results were highly promising. SMF coils with a conductor length up to 2 m have been developed by wind and react approach. A whole length  $J_c$  of around  $10^5$  A/cm<sup>2</sup> at 4.2 K has been achieved in these coils.

### Development of MgB<sub>2</sub> based conduction cooled current leads (Rating: 1000 A)

As a part of the National Fusion Program (NFP) of the country, NIIST in collaboration with IPR, Gandhinagar developed MgB<sub>2</sub> based superconducting conduction cooled current leads (CCCLs) with a critical current rating of 1000 A and length in the range 10 to 20 cm for application in fusion magnet to confine of plasma. Optimized Cu end-leads designed for the rated current with provision for anchoring to the magnet were fabricated and fixed to both ends of the body of the superconducting lead. The critical current rating and length shall be scaled up to adequate levels for use in the fusion magnet.



*Conduction cooled superconducting current lead*

### Development of room temperature relaxor ferroelectric and spin glass behaving Sr<sub>2</sub>FeTiO<sub>6</sub> double perovskites

The structure, dielectric and magnetic properties of complex Sr<sub>2</sub>FeTiO<sub>6</sub> double perovskite for possible applications as relaxor ferroelectrics were investigated. Reitveld analysis of X-ray powder diffraction pattern revealed that the material is stabilized in a cubic perovskite phase with Pm 3m space group without the B-site cations. Dielectric spectra showed a broad dielectric anomaly coupled with a shift in dielectric maxima towards higher temperature with frequency, exhibiting a typical relaxor ferroelectric behaviour. Furthermore, magnetic characterization exhibited a non-metallic spin-glass-like state below 16 K, driven by competing interactions between the antiferromagnetic and the ferromagnetic states.

## LIGHT METALS, ALLOYS AND COMPOSITES

### Development of high strength aluminium alloys and processes for engineering components

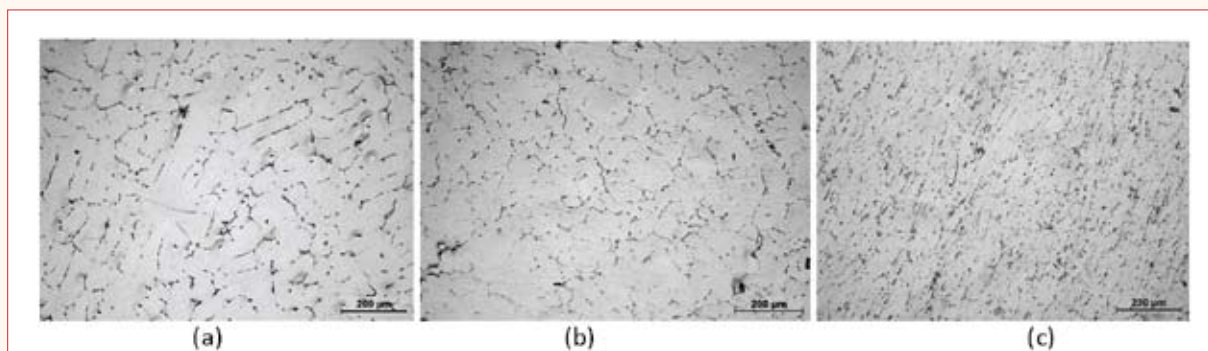
The development of a high strength cast Al alloy by the addition of 0.45 % Mg to Al-Si -Cu alloy (319) was reported last year. The mechanical properties obtained for this alloy were UTS: 339-413 MPa and elongation: 2% as against the targeted properties of UTS > 400 MPa and elongation: 8%. Efforts to improve the elongation capability of this alloy by the addition of Mn resulted in enhancing the



properties to UTS: 425-431MPa and elongation: 2-3%. Further improvement in elongation is possible only through squeeze casting of this alloy. Interaction with the Dept. of Mechanical Engg., Indian Institute of Science, Bangalore is underway for availing their squeeze casting facility for making two wheeler connecting rods using this alloy.

### Equal channel angular pressing of 6061 aluminium alloy

Equal channel angular pressing (ECAP) is a severe plastic deformation technique applied for producing ultra fine grained structure. In this technique the samples are pressed through a die containing a channel with same dimension bent into an L shaped configuration so that intense strain is imposed without incurring any change in the cross sectional dimensions of the sample. It is a useful tool for increasing the strength and toughness of an alloy at ambient temperatures and achieving a potential for super plastic forming of the alloy at rapid strain rate at elevated temperatures. Grain refinement of 6061 alloy by 0.2% Al-5Ti-1B reduced the grain size from 80 to 60  $\mu\text{m}$  and further by ECAP processing

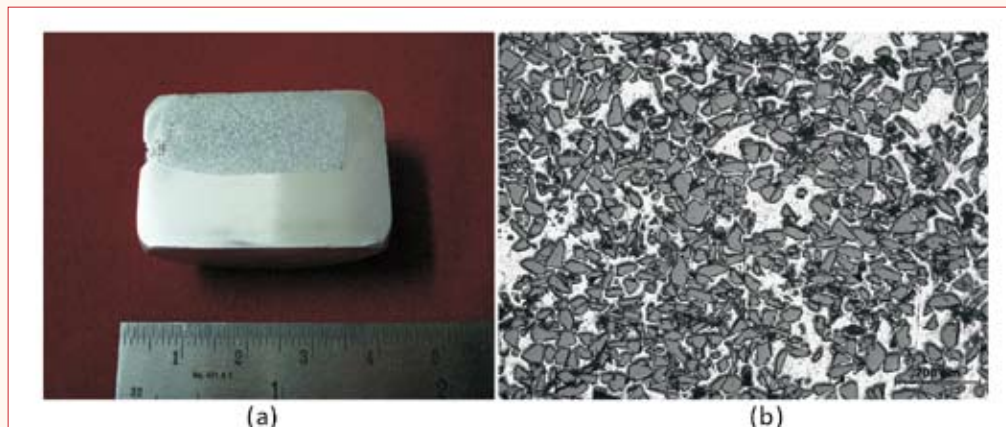


Microstructures of (a) 6061 Al alloy (b) 6061Al alloy with 0.2% Al-5Ti-1B and, (c) ECAP processed alloy

of annealed sample using 90° die angle reduced the grain size to 15  $\mu\text{m}$ . The hardness of 120 BHN was achieved by ECAP processed alloy.

### Squeeze infiltration processing of aluminium based metal-ceramic composite

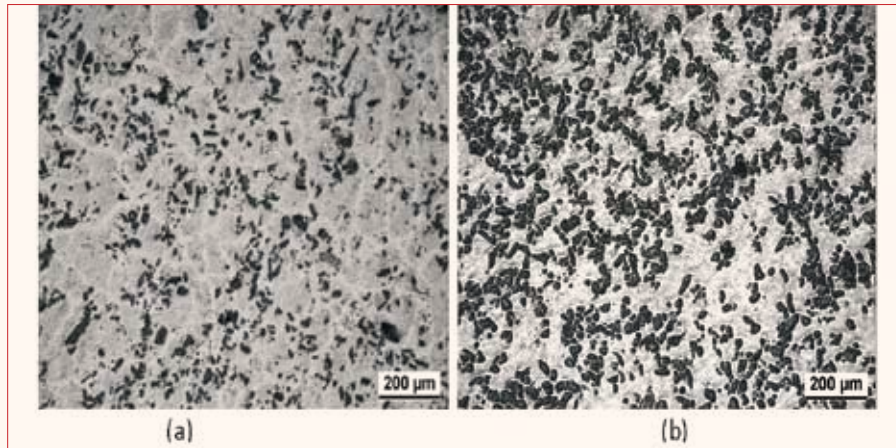
Aluminium based composites with high volume fraction of silicon carbide particles have been fabricated successfully by squeeze infiltration processing technique. Porous SiC preform with 55% porosity synthesised by salt sublimation and leaching method is used for the infiltration. These composite possesses very high hardness and high temperature capability and can be used for high wear resistant components. Figures show the cross section and the microstructure of the Al-SiC infiltrated composite.



(a) Cross section and (b) Optical microstructure of Al-SiC squeeze infiltrated composite

## Synthesis of AZ91 Magnesium matrix composites

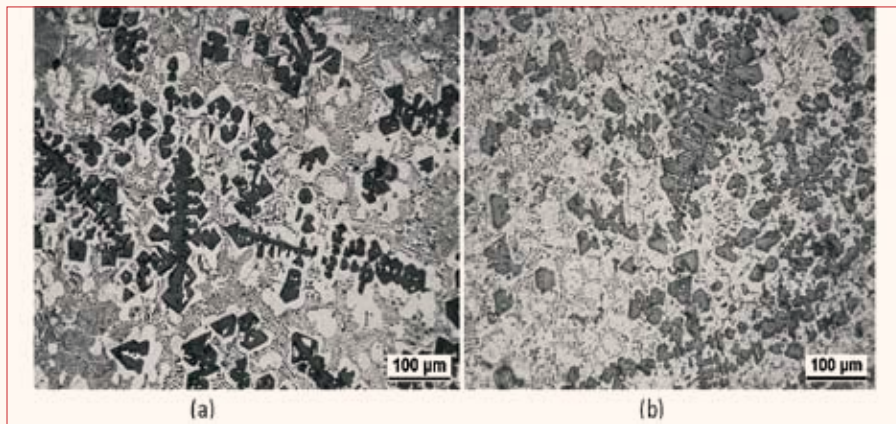
AZ91 Magnesium matrix composites reinforced with varying volume fraction (0.05, 0.10, 0.15 and 0.20) of SiC was synthesised by liquid metal stir casting. Mg MMC with uniform particle distribution and enhanced hardness was achieved by optimised processing conditions.



Microstructures of AZ91 Mg-SiC MMC (a) 10 Vol% (b) 20Vol%

## In-situ processing of Mg-Si composites

In-situ composites with primary silicon reinforced magnesium composites of varying volume fraction has been synthesised by addition of silicon. The hard silicon particles tend to enhance the mechanical properties such as tensile strength and hardness and improves the wear resistance.



Micrographs of in-situ Mg-Si composites (a) Mg-6%Si and (b) Mg-10%Si

## Applications of phosphorylated cashew nut shell liquid prepolymer modified elastomeric contact adhesives

Effect of variation in the composition of adhesives on the T-peel adhesion strength and storage stability studied and compositions were optimized for bonding applications for production of garden pots as well as floor tiles.

## Studies on development of Coir – Rubber composite products

Design of coir rubber composites (CRC) for application at floor/roof tiles and compositions of rubber mixes for the same were optimized. Floor tiles of size 1' x 1' were moulded with external assistance for field trial evaluation.



## MINERALS

### An investigation on the potential beach placer deposits along Tiruchendur coast, Tamil Nadu

A DST funded project under fast track scheme was initiated during the period with an objective to investigate physical, chemical and geological property variations of beach placer deposits along Tiruchendur Coast, Tamilnadu and to assess the quality of the mineral deposit with special reference to heavy minerals such as ilmenite, rutile etc. During the period under report, geomorphic survey for the site has been completed. Surface sampling and a geomorphic map was prepared for the study area. Surface samples were collected from more than 120 locations in Thiruchendur coast from Overi Coast, Berm, low water line and high water line. The samples after initial treatments and preparation were subjected to heavy mineral separation followed by separation by magnetic susceptibility.

### Preparation of Aluminium – Silicon master alloys through plasma processing of sillimanite

During the period under report efforts were focused on the reduction of sillimanite using green petroleum coke as the reductant. Green petroleum coke with very low ash content ( $< 1.5\%$ ) is expected to result in alloy of low iron impurities. Powdered coke and sillimanite were thoroughly mixed and loaded into the plasma reactor crucible and the plasma was struck within the charge. After the reaction, the plasma was withdrawn and the contents in the crucible were allowed to cool in argon atmosphere to avoid reoxidation. It was observed that, the reaction with pet coke has been too vigorous and the reduced metals such as aluminium and silicon evaporated. Many efforts were made to contain the reduction reaction which includes partial replacement of the pet coke with sintered pet coke, providing additional cover of alumina or silica over the reduction charge to avoid the evaporation. However, the alloy yield with green pet coke as the reductant was not satisfactory. The modification of the reactor crucible assembly with a provision for an inert gas chamber for the controlled oxidation of highly reactive pet coke and also to introduce thermodynamic conditions favourable for reduction of alumina and silica without the formation of carbides of aluminium and silicon is being done.

## SOCIETAL MATERIALS ACTIVITY

In continuation of the technology development programme on alternate building components, process optimisation of fly ash for flux bonded products was done under a project sponsored by NTPC Ramagundam Super Thermal Plant. The process can use up to 80 wt% fly ash in making bricks and blocks and glazed ceramic products. The technology was demonstrated and has been transferred to M/s. Navudaya Ceramics, Hyderabad.





## PROCESS ENGINEERING & ENVIRONMENTAL TECHNOLOGY

This Division strives to achieve generation and application of knowledge by interfacing science and engineering with computational modelling leading to processes, technologies, models, software products, high impact publications, patents and also technology up-gradation for industries and rural applications. The four distinct sections working with very clear objectives are:

- **Environmental Technology Section**
- **Computational Modeling & Simulation Section**
- **Chemical and Process Engineering Section**
- **Dioxin Research Section**

### Significant achievements

- Initiated a NMITLI project on biofuel from marine microalgae.
- Successfully developed an autoflocculating microalga for producing biofuel by adopting suitable downstream technology.
- A large gas biofilter treating 34,000 m<sup>3</sup>/h ventilation air from a meat meal plant designed, installed and successfully commissioned at Chalakudy, Kerala.
- The institute's clean bioprocess for the production of white pepper received NRDC Innovation award at the national level and WIPO best invention Gold medal at the international level for the year 2009.
- Violacein, a high value pigment, obtained from chromo bacterium isolate purified and characterized.
- An agent-based stimulation model to study the population dynamics of algal raceway pond developed.
- A hydrogen bond prediction tool developed for detecting structural water molecules and CH $\cdots$  $\pi$  interactions in PDB files of protein-ligand complexes.
- Large scale reverse flow convection driers for ball copra and ground nut commissioned in farms for field trials.
- The amount of dioxins, PCBs and other POPs were found to be more in the entry point than the interiors of Pichavaram mangrove.



*NRDC Award for white pepper technology*





## प्रक्रिया इंजीनियरिंग और पर्यावरण प्रौद्योगिकी

यह प्रभाग कम्प्यूटेशनल मॉडलिंग के साथ विज्ञान तथा इंजीनियरिंग के इंटरफेसिंग द्वारा प्रक्रियाओं, प्रौद्योगिकियों, मॉडलों, सॉफ्टवेयर उत्पादों, उच्च प्रभाव प्रकाशनों, पेटेंटों और उद्योगों और ग्रामीण अनुप्रयोगों के लिए प्रौद्योगिकी उन्नयन के लिए ज्ञान वर्धन और उनके अनुप्रयोग के लिए प्रयासरत है। प्रभाग के अधीन चार अलग अनुभाग निम्नानुसार स्पष्ट उद्देश्यों के साथ काम कर रहे हैं-

- पर्यावरण प्रौद्योगिकी अनुभाग
- कम्प्यूटेशनल मॉडलिंग और सिमुलेशन अनुभाग
- रासायनिक और प्रक्रिया इंजीनियरिंग अनुभाग
- डाइ ऑक्सीन अनुसंधान अनुभाग

### महत्वपूर्ण उपलब्धियाँ

- समुद्री सूक्ष्मशैवाल से जैव ईंधन के उत्पादन पर एनएमआईटीएलआई परियोजना प्रारंभ की।
- उपयुक्त बहाव तकनीक अपनाकर स्वतः उर्णाकारक सूक्ष्मशैवाल को सफलतापूर्वक विकसित किया, जो जैव ईंधन के उत्पादन के लिए एक बुनियादी आवश्यकता है
- एक मांस मील संयंत्र से 34,000 एम<sup>3</sup> / घंटा वेंटिलेशन हवा के उपचार के लिए चालकुडी, केरल में एक बड़े गैस बायोफिल्टर का डिजाइन, संस्थापना सफलतापूर्वक कमीशन किया।
- सफेद मिर्च के उत्पादन के लिए संस्थान द्वारा विकसित बायोप्रोसेस को राष्ट्रीय स्तर पर वर्ष 2009 के एनआडीसी अभिनव पुरस्कार और अंतरराष्ट्रीय स्तर पर सबसे अच्छे आविष्कार के लिए डब्ल्यूआईपीओ स्वर्ण पदक प्राप्त हुए।
- क्रोमो जीवाणु अलग से प्राप्त उच्च मूल्य वर्णक वायोलासिन का शुद्धीकरण और अभिलक्षण किया।
- शैवाल नाला तालाब की पॉप्युलेशन गतिशीलता का अध्ययन एक एजेंट आधारित उद्दीपन मॉडल विकसित किया।
- प्रोटीन लिगन्ट कॉम्प्लेक्सों के पीडीबी फ़ाइलों में संरचनात्मक पानी के अणुओं और सीएच.. π अन्योन्यक्रिया का पता लगाने करने के लिए एक हाइड्रोजन बांड पूर्वानुमेय उपकरण विकसित किया।
- बॉल खोपरा और जमीन अखरोट के लिए बड़े पैमाने पर रिवर्स प्रवाह संवहन ड्रायर्स को क्षेत्र परीक्षण के लिए खेतों में कमीशन किया।
- डाइऑक्सीनों, पीसीबीयों और अन्य सतत् कार्बनिक प्रदूषकों की मात्रा पिचावरम मैट्रोग्रव की अंदरूनी से प्रवेश बिंदु में अधिक पाए गए।



एनआडीसी अभिनव पुरस्कार



## ENVIRONMENTAL TECHNOLOGY

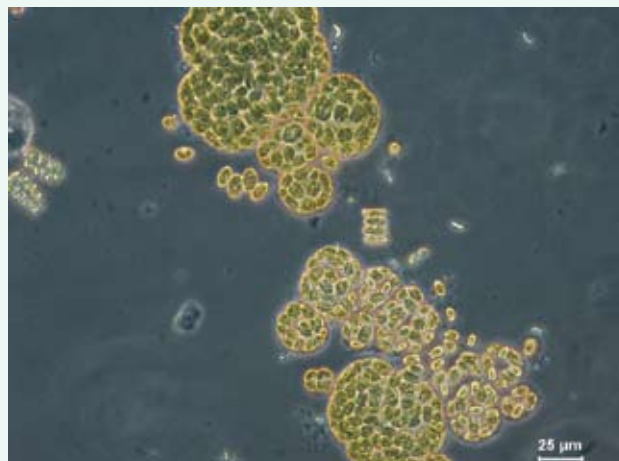
### Biofuel from marine microalgae

This project is taken up under as a national project under the New Millennium Indian Technology Leadership Initiative (NMITLI) scheme of CSIR. There are 9 partner institutes in the project, assigned various aspects of the project.

The project addresses global concerns on CO<sub>2</sub> emissions and the need for non-fossil based transportation fuels. Biodiesel can substitute for diesel fuel, without intervention in engine technology or fuel supply infrastructure. Microalgae is considered as one of the viable alternative sources of oils. Microalgae produce nearly 50% of global primary productivity (conserving solar energy as carbon based molecules). The technological challenge is to produce microalgae at oil yields in excess of agricultural crops. Among the bottlenecks is the development of algal cultures, design of economical reactors or ponds for mass cultivation, development of harvesting systems, and development of oil extraction systems. This project aims to develop a viable and scalable process for the generation of bio-fuel from Indian marine microalgae. NIIST has the following components a) Development of technology for autoflocculating algal cultivation with CO<sub>2</sub> fertilization. b) Development of settler for algal biomass separation. An experimental raceway pond reactor has been installed for carrying out the experiments on algal cultivation. The reactor is instrumented for data collection. Autoflocculating algal cultures have been developed. These are easily separated using an innovative settler and strainer.



*Experimental outdoor raceway pond reactor for algal growth studies*



*Algal growth in dense colonies*



## Anaerobic leach bed technology for treatment of solid wastes

The anaerobic leach bed reactor (ALBR) allows digestion of unsorted municipal solid wastes (MSW) containing non-degradable materials such as plastic. In the ALBR coarsely shredded MSW is contacted with a leach liquor circulated through a UASB reactor. Volatile fatty acids (VFA) formed during rapid decay of MSW are removed with the leach liquor and converted to biogas in a UASB reactor. A process design and basic engineering of a 5 tpd MSW leach bed pilot plant was carried out this year.

## Zero discharge treatment for clay processing

This project aims to process the effluent waters from the nearby clay industry so as to remove the contaminant iron mineral through a bacterial leaching and the make the water reusable.

Thiruvananthapuram district has the best quality china clay deposits in the country. White china clay is used in the paper industry for coating. China clay is processed to improve brightness by chemical bleaching. The mineral deposits contain iron in +3 oxidation state which contributes to light yellow - to - pink shade to the kaolin. Brightness can be improved through dithionite treatment which is performed under acidic conditions during which the ferric ions gets reduced to soluble ferrous ions and gets washed out along with the effluent. This effluent water is highly acidic (pH <3) and rich in soluble Fe (II) and hence is a potent hazard. Iron oxidizing bacteria are grown as biofilm on floating carrier-particles in the Reverse Fluidized Loop Reactor (RFLR). pH requirement of the bacteria is around 2.8 and a temperature range 30-32°C. Microbial oxidation employing RFLR gave a conversion of more than 95% Fe (II) to Fe (III) at a load rate of 6.2 g/day. The iron could be removed by precipitation with small increase in pH. The water was tested for clay bleaching application. In plant application, effluent water from filter presses that are already at sufficiently elevated pH will be treated for iron oxidation and therefore, the iron oxidation and precipitation will occur automatically in the RFLR. There was no measurable loss of brightness when using recycled water as compared with use of fresh water.

## Household wastes & sanitation device (HWSD) with biogas recovery

The project aims to develop a Modular Household Wastes Sanitation Device (HWSD) with biogas recovery. The new system proposed has a combination of anaerobic primary treatment and aerobic secondary treatment. A new model HWSD was made and fabricated in fibre reinforced plastic (FRP) for testing purpose. The model features anaerobic digester for black water and food waste, a secondary anaerobic filter for grey water, integral gas storage and final settling zone. The design does not require gas tight sewerage connections.



*Photograph of HWSD made in FRP for testing*



## Effluent treatment process design for Hindustan Insecticides Ltd (HIL)

A design study is being conducted for effluent treatment at HIL, Udyogamandal. The study is aimed at development of a treatment flowsheet with chemical and biological treatment processes. The recovery and reuse of caustic soda from the effluent of mancozeb manufacturing plant containing a high concentration of sodium sulphates was studied at site. The data collected will be used in the design of the lime treatment reactor, settler and filtration system.

The composite effluent discharged from HIL contains volatile organic compounds (VOCs). The GC-MS analysis of the samples confirmed the presence of monochlorobenzene and toluene as the major VOCs present in the sample and the objective of the work was to develop an air stripping column to remove these organic phases. A pilot air stripper was designed and erected at the HIL premises for design data collection. Pilot plant stripping tests were carried out on composite plant effluent. The data showed that only a minor fraction of the total incoming organic compounds can be removed by stripping. The major fraction of organic compounds have to be removed by biological treatment. A Membrane Bio-Reactor (MBR) pilot plant is to be set up for carrying out the treatability study.

## Odour control system for NGIL ossein factory

The problem of odour from Nita Gelatine India Ltd's (NGIL) ossein manufacturing plant at Koratty Thrissur district, was referred to NIIST. Detailed examination of the manufacturing process and the effluent treatment plant were carried out earlier and a requirement study report for modifying the effluent treatment plant was provided to NGIL.

The company decided to install an odour control system for the meat meal plant. Accordingly, NIIST designed an odour control biofilter for the meat meal plant, housed in a fully closed shed. An odour control biofilter was installed and commissioned successfully. There is no perceptible odour from the meat meal plant ventilation air after biofilter installation.



Testing efficiency at odour control gas biofilter treating 34,000 m<sup>3</sup>/h air from meat meal factory.

## White pepper production

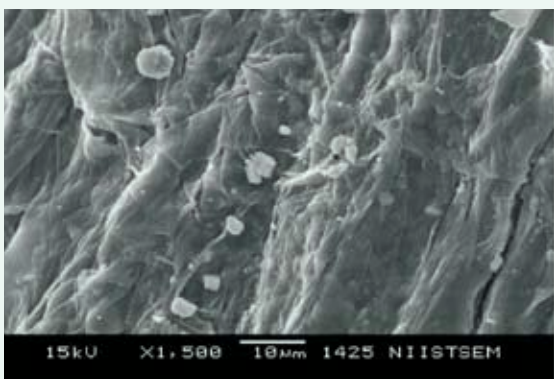
White pepper, made by removing skin from black or fresh pepper (*Piper nigrum* L.) is a highly appreciated form of pepper for a variety of food preparations around the world. Current demand of *white pepper* exceeds 100,000 metric tons per annum. The NIIST's clean bioprocess developed for the production of white pepper continues to attract new entrepreneurs and technical support was



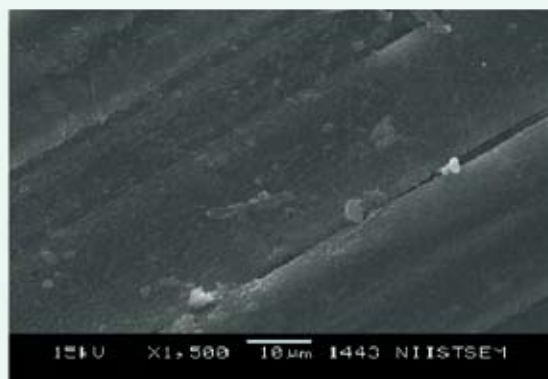
extended during the period for setting up plants. In the reporting period three plants were established for white pepper production in the pepper growing belt of south India. This bioprocess was selected for the NRDC innovation award at the national level and WIPO best invention gold medal of 2009 at the international level.

### Bioextraction of banana fibres

Good quality banana fibre has great demand in the market. Banana fibres are usually extracted from the pseudostem by physical methods either mechanical or manual. These methods of banana fibre extraction have poor strength and poor surface quality because of incomplete removal of vegetable matter. Conventional retting applied for the extraction of coir and jute is rarely used for the fibre extraction from banana pseudostem as the process affects the fibre quality significantly. Extensive research was initiated to study the anaerobic process for banana fibre extraction and it is found suitable for fibre production from banana pseudostem with further modifications. It is observed that the characteristics of the banana pseudostem fibre vary with the position of leaf sheath and method of extraction. The characterization done on different layers of banana pseudostem shows the exterior 11 leaf sheaths in the pseudostem can be used for extracting fibres and the sheaths in the interior fibres have poor strength. Clear distinction of quality is also observed with respect to the method of fibre extraction.



(a) 0.2mm physically extracted fibres



(b) 0.2mm fibres bio extracted fibre

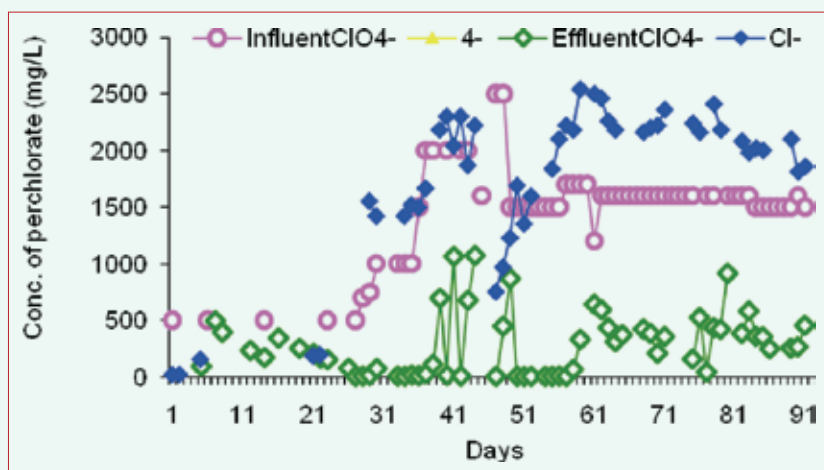
*Scanning electron micrographs of extracted banana fibres*

### Bioremediation of perchlorate

NIIST earlier reported high perchlorate concentration in ground water, public drinking water and surface water sources from selected regions in Kerala. As a part of developing a bioprocess for decontaminating the toxic pollutant, the institute developed a biological process for reducing perchlorate into non-toxic chloride. Studies were conducted in lab scale fed-batch and continuously fed fixed film type bioreactors. A halo tolerant, perchlorate reducing consortium was also developed through slow acclimatization, which tolerates salinity upto 10% and degraded diluted APEP plant effluent. Halotolerant perchlorate reducing cultures were isolated from the consortium and studies are in progress to identify the cultures.



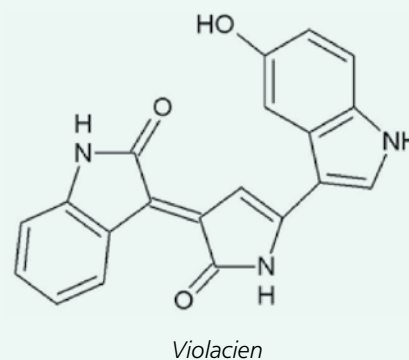
*Lab. scale fed-batch type bioreactors for perchlorate removal*



Performance of the perchlorate removing chemostat during the first three months period

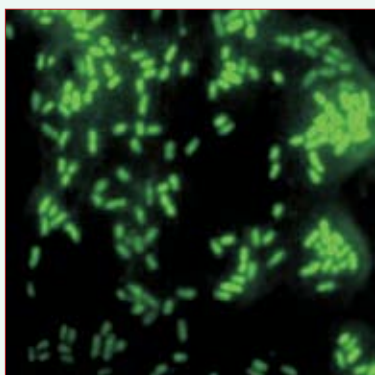
### Violacein from an isolated *Chromobacterium* sp.

Violacein, is a high-value microbial secondary metabolite from an isolated *Chromobacterium* sp. NIIST CKK-01, was produced in pure form during this year. Fermentation steps including ideal media composition and culture conditions were optimized including culture maintenance. Subsequently the crude pigment was purified through TLC and column chromatography using suitable solvent systems and packing material. The various fractions obtained are under detailed characterization and identification. Meanwhile the principal component was purified and characterized through  $H^+$ -NMR and  $C^{13}$ -NMR. The pure violacein obtained is currently under screening for various bioactive properties.



### Microbial ecology of bioreactors

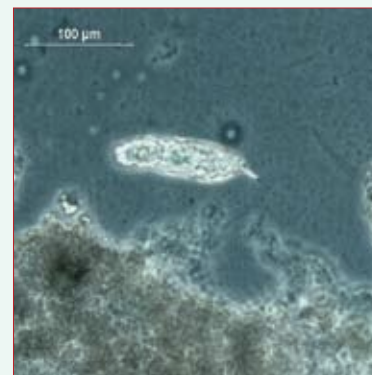
The microbial ecology of bioreactors for wastewater treatment gives insight into the microbial populations involved. Besides, bacteria and archaea, higher trophic organisms are also found in bioreactors for wastewater treatment. Metagenomic approaches like Denaturing Gradient Gel Electrophoresis (DGGE) and whole cell Fluorescent *in-situ* Hybridization (FISH) were done to analyze the microbial community structure and dynamics of bioreactors.



FISH image of perchlorate reducing *Bacillus* sp.



Bacteriovoric nematode (left) and Rotifer (*Philodina*) (right) present in perchlorate reducing biofilm from packed-bed bioreactor





The presence of grazing fauna indicates the stability of the microbial community, helps in nutrient recycling, controlling excess biomass accumulation and improving the effluent quality by controlling free floating cells.

#### Analytical and engineering services

- The section co-ordinates the Testing & Analytical Services Cell (TASC)
- Analytical services for physicochemical and biological characterisation of surface water/ ground water/ waste water/ industrial effluents.
- Engineering drawings carried out for
  - (a) Biofilters for meat meal plant
  - (b) Raceway pond reactor and special settler for algal cultivation experimental plant

### Beach sand mining and erosion at Chavara coast

A report was prepared and submitted on 30 December 2010 on reference of Kerala High Court on public interest writ petition regarding beach sand mining and erosion at Chavara coast. Heavy mineral deposits are available as inland deposits, seasonal beach placer deposits and as sea bed deposits. Seasonal beach placer deposits are recovered by a mining process called “beach washings collection”. It was found that the Chavara coastal stretch is subjected to erosion and that mining increases erosion. Erosion was apparent in mining locations of Ponmana and Anjumanakal.

The following measures were recommended to prevent sea erosion in the area without affecting industrial operations.

- Beach washing collection: ‘Reject sand’ after recovery of heavy minerals must be used to rebuild beaches; gradually beach washing collection must cease and other methods of mining should be adopted.
- Inland mining with dredge concentration plant can be continued without affecting coastal erosion.
- Sea bed mining: New projects must be developed to recover sea bed deposits and rebuild beaches with ‘reject sand’ after recovery of heavy minerals.



*Erosion at Ponmana coast near beach sand mining site at Chavara*

### Marine ecological survey for the proposed Multi-User Liquid Terminal ( MULT) at Puthuvypeen Special Economic Zone (SEZ), Kochi.

Water & Power Consultancy Services Indian Ltd (WAPCOS), under Ministry of Water Resources, has entrusted the institute to conduct the marine Ecological survey for proposed development of a multi-user liquid terminal (MULT) at Puthuvypeen SEZ, Kochi. As part of the study, detailed marine



ecological survey was conducted to establish the existing status of the marine water in and around the Ernakulam-Mattanchery wharf. The study includes data collection and analysis of physico-chemical and biological characteristics of marine water and sediment samples.

### Dust suppression - Field studies in China Clay mine

The institute developed a method for suppression of dust pollution by calcium chloride with a cover of water absorbant coir pith. Rainwater runoff is drastically reduced by this method and long term dust suppression is achieved. Based on the success achieved, another project to conduct large scale trials in a larger mine has been sanctioned and the work is in progress to arrive at a feasible and effective technique for abatement of dust generation in mine roads.

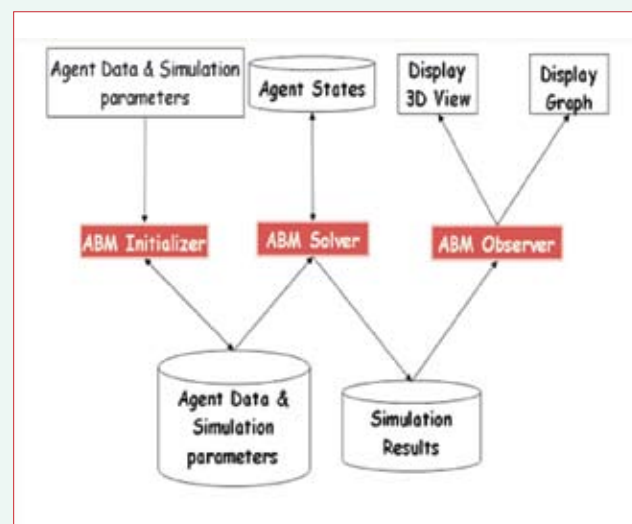


Dust Suppression studies in laboratory and at the mine site (field)

## COMPUTER MODELLING AND SIMULATION (CMS)

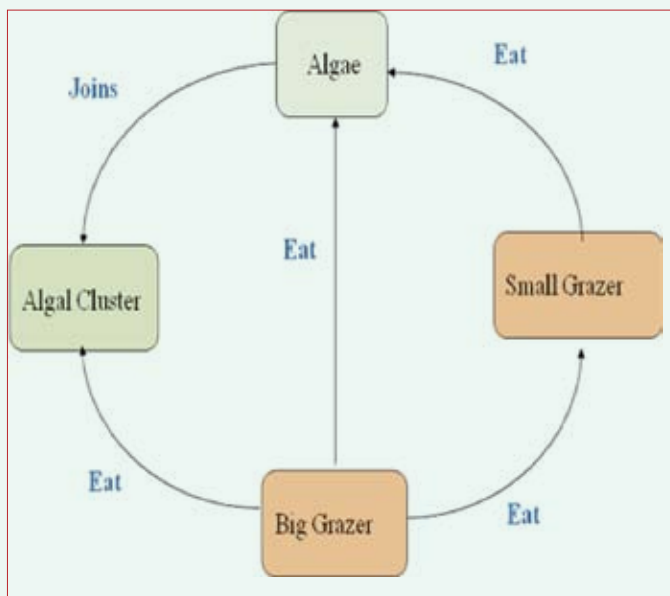
### Platform for development and simulation of agent-based models

Agent-based modelling (ABM) is a computational modelling paradigm that simulates the interactions of autonomous agents with each other and the local environment in which they are situated, to predict higher level emergent patterns. There are three modules required for developing an ABM. The Preprocessor or Initializer module using a GUI defines the agent world which consists of different types of agents, their interaction rules with each other and the environment. The Solver is the core program of the simulation. The solver has a priority-based scheduler which queues the actions of agents. The Solver simulates the agent world and the ABM Postprocessor is called to observe the emerging scenario and analyse the results.



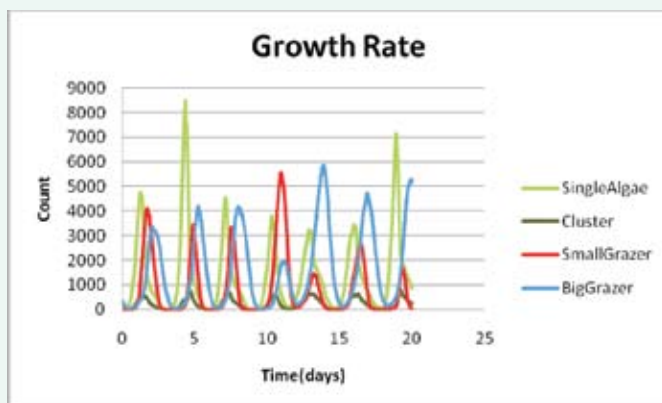
System Architecture



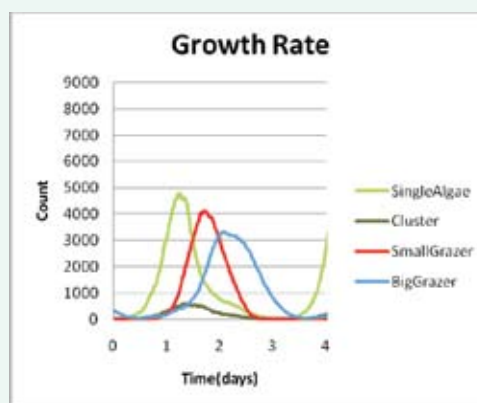


Relationships in the pond

An agent-based model to study the population dynamics of an algal raceway pond has been developed on the platform. The interest in this was generated by an ongoing project in the laboratory on photosynthetic algae that clump together and can be harvested for oil to be used as bio-fuel. The agents in the system are algae, algae clusters and different types of grazers. These agents can eat, move, grow, divide, die of age or starvation or form algal clusters. The classical predator prey relationship has been established using the agent-based model.



Growth Rate curves-1



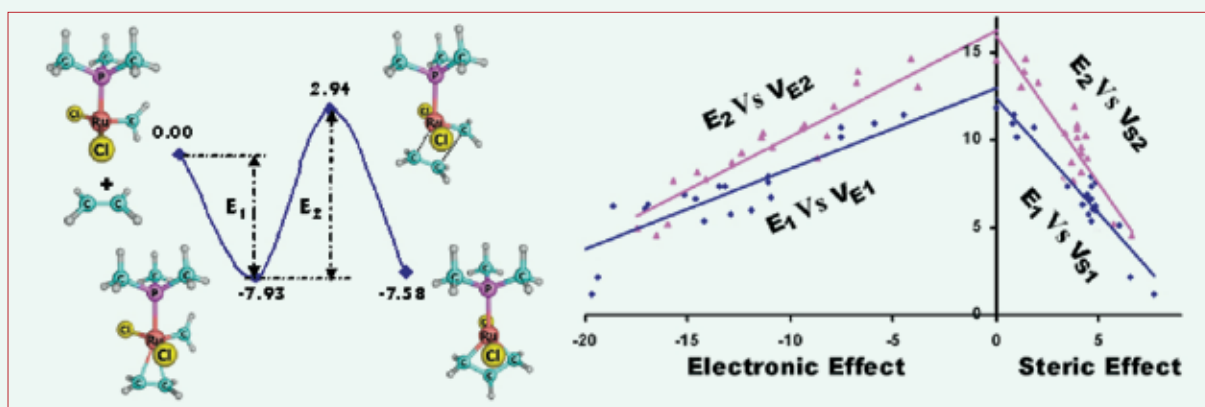
Growth Rate curves -2

## Assessment of stereoelectronic effects in Grubbs first generation olefin metathesis catalysis using molecular electrostatic potential

Quantum mechanically derived molecular electrostatic potential (MESP)-based descriptors have been proposed for the assessment of both steric and electronic effects of phosphines in several first generation Grubbs olefin metathesis catalysts. The MESP at the P nucleus of the active form of the catalyst  $\text{Cl}_2(\text{PR}_3)\text{Ru}=\text{CH}_2$  (1) and its ethylene coordinated complex (2) were determined. Further, frozen structures corresponding to 1 and 2 were located by replacing P-R bonds with P-H bonds. The MESP at the P of a frozen geometry is free from electronic effect of R, but influenced by steric effects due to structural restrictions imposed in the geometry. The difference between the MESP at the P nucleus of  $\text{Cl}_2(\text{PH}_3)\text{Ru}=\text{CH}_2$  and  $\text{Cl}_2(\text{PR}_3)\text{Ru}=\text{CH}_2$  is taken as a measure of the combined steric and electronic

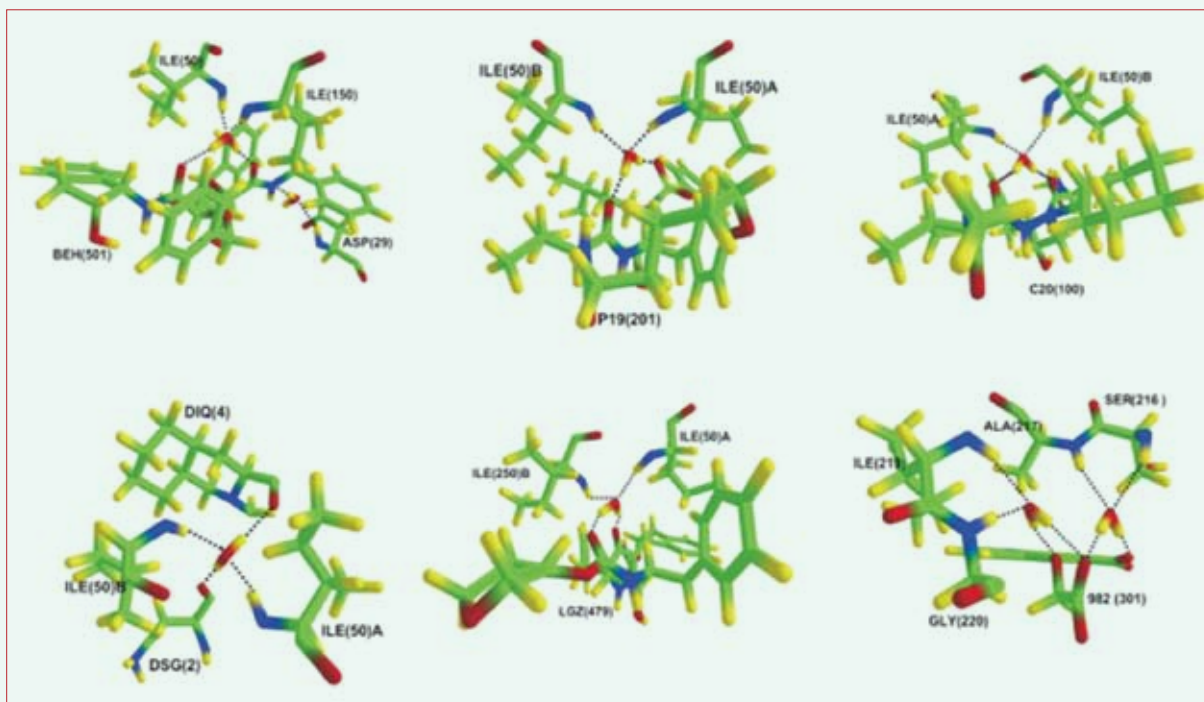


effects of the  $PR_3$  ( $V_{SE1}$ ) in **1**. Similarly, the combined steric and electronic effect of  $PR_3$  in **2** ( $V_{SE2}$ ) is also calculated. The frozen structures allowed the calculation of steric-only effects for **1** ( $V_{S1}$ ) and **2** ( $V_{S2}$ ). Thus, the electronic effect  $V_{E1}$  in **1** is ( $V_{SE1} - V_{S1}$ ) and that  $V_{E2}$  in **2** is ( $V_{SE2} - V_{S2}$ ). Both  $V_{S1}$  and  $V_{S2}$  showed impressive linear correlations with popular geometric steric parameters, viz. Tolman cone angle ( $\theta$ ) and symmetric deformation coordinate ( $S4$ ). Moreover,  $V_{E1}$  and  $V_{S1}$  showed linear relationships to binding energy of ethylene ( $E_1$ ), suggesting that steric effect is 2.91 times more dominant than electronic effect in olefin binding process. Similarly,  $V_{E2}$  and  $V_{S2}$  showed linear correlation with activation energy ( $E_2$ ) for the formation of metallacyclobutane. In both the olefin binding process and the transition state formation leading to C-C bond coupling, drastic reduction in  $E_1$  as well as  $E_2$  was observed with the increase in steric bulkiness of  $PR_3$  while only a moderate decrease in energy parameters was observed with the increase in electron rich character of the  $PR_3$ . The stereoelectronic correlation studies demonstrated that the success of the first generation Grubbs catalysts is primarily due to the choice of the right mix of steric (bulky R substituents on P) and the electronic (electron donating R substituents on P) effects of the  $PR_3$  ligand (*Organometallics*, 2011, 30, 1438–1444).



Analysis of structural water and  $CH\cdots\pi$  interactions in HIV-1 protease and PTP1B complexes using a hydrogen bond prediction tool, HBPredicT

A hydrogen bond prediction tool HBPredicT was developed for detecting structural water molecules and  $CH\cdots\pi$  interactions in PDB files of protein-ligand complexes. The program adds the missing hydrogen atoms to the protein, ligands, and oxygen atoms of water molecules and subsequently all the hydrogen bonds in the complex are located using specific geometrical criteria. Hydrogen bonds are classified into various types based on (i) donor and acceptor atoms, and interactions such as (ii) protein-protein, (iii) protein-ligand, (iv) protein-water, (v) ligand-water, (vi) water-water, and (vii) protein-water-ligand. Using the information in category (vii), the water molecules which form hydrogen bonds with the ligand and the protein simultaneously –the structural water– is identified and retrieved along with the associated ligand and protein residues. For  $CH\cdots\pi$  interactions, the relevant portions of the corresponding structures are also extracted in the output. The application potential of this program was tested using 19 HIV-1 protease and 11 PTP1B inhibitor complexes. All the systems showed presence of structural water molecules and in several cases, the  $CH\cdots\pi$  interaction between ligand and protein were detected. A rare occurrence of  $CH\cdots\pi$  interactions emanating from both faces of a phenyl ring of the inhibitor was identified in HIV-1 protease 1D4L (*J. Mol. Model.*, 2011, 17, 401–41).



*Predicted models*

## CHEMICAL AND PROCESS ENGINEERING

### Development of process & commercial flow sheet for the beneficiation of Guda clays of Rajasthan

This project aims at value addition to the clay deposit in Bikaner, which presently is used only as low grade filler clay. The different samples from the mines were size reduced and blended to prepare uniform raw clay. This was subjected to detailed characterisation. The representative sample was blunged, screened and classified using a 2 inch stub cyclone so as to remove the medium grits above 45 Micron. The finer fraction from this hydrocyclone was subjected to wet high intensity magnetic separation studies for removing the iron & titania minerals. The tests are in progress. A particular fraction of the raw clay was also subjected to various size classifications up to around 5 micron using different types of hydrocyclones with an intention to value add the same to paint or paper coating grade clay. This work is also in advanced stage.

### Development of reverse flow natural convection driers and cottage level processing for rural development

The ball copra drier was shifted to Javarana Hally Horticultural farm in Karnataka for field trials. The drier has been successfully erected and commissioned there for trial runs. The ground nut dryer after some vital modifications was shifted to Palavoor in Thirunelveli District in Tamil Nadu and 4 field trials were carried out with 260, 350, 360 and 500 Kgs. of fresh ground nut. The product with 7-12% moisture content could be produced successfully. The villagers suggested some design modifications which are being taken up presently.

The pappad drier was re-designed and a larger capacity drier (280 Pappads/batch) was fabricated and tested with agri-fuel as the heat source. The earlier version (capacity 84 Pappads/ batch) was with electric heating which was not affordable for the local pappad makers. The drier is being shifted to local pappad makers colony for field trials. Laboratory tests for mango bar drier are underway. Kinetic study has been completed.



500 Kg Ground nut drier (Modified)



Redesigned (large) capacity Pappad drier;  
14 trays, 280 Pappads/ batch

## DIOXIN RESEARCH

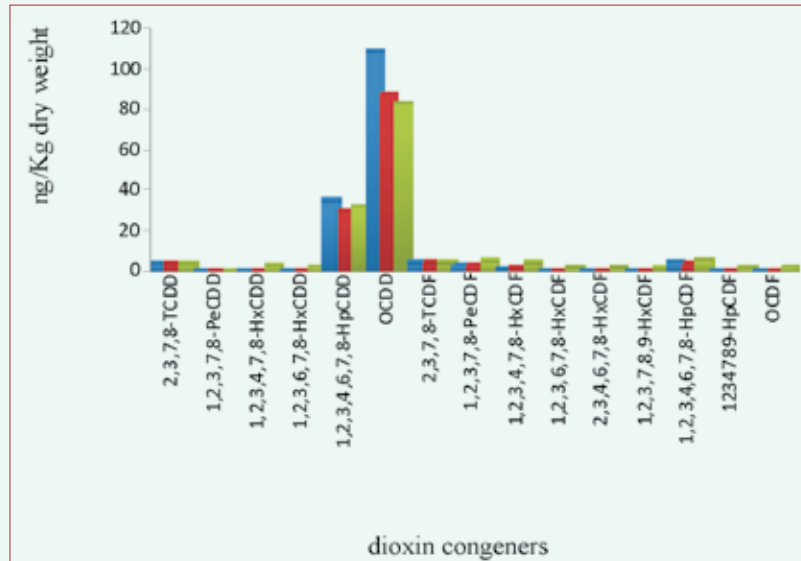
### Finger printing of dioxins in sediments of tropical mangrove system

Mangrove forests are among one of the world's most productive tropical ecosystems. But mangroves are under serious threat of degradation; India has lost about 40% of its mangrove cover within this century. Pichavaram has among one of the best studied mangrove ecosystems in India. The area has already lost 75% of its green cover within this century and about 90% of the forest area is degrading.

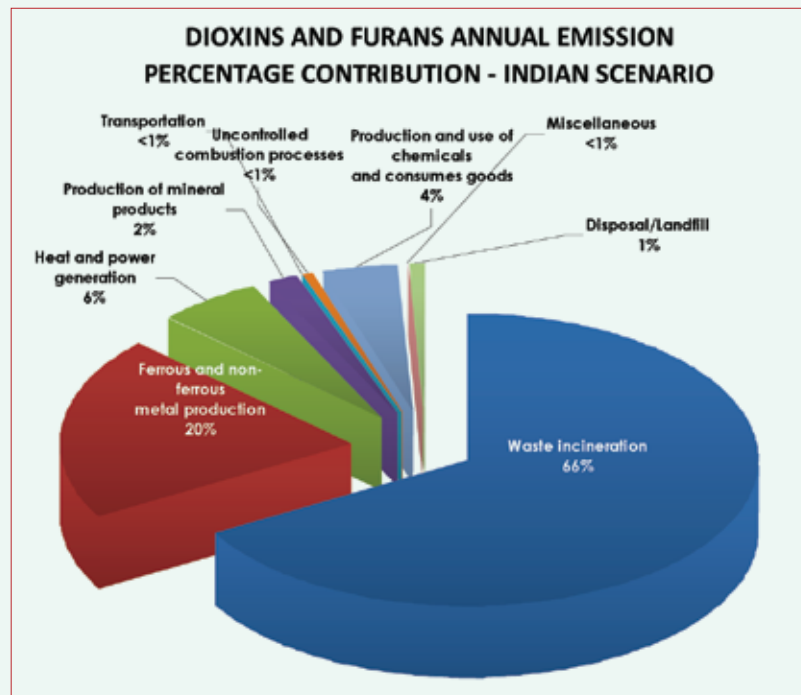


Sample collection for the determination of dioxin

As part of the UNIDO project on dioxins, a study has been carried out to identify chemical contamination of sediment of this system. Sediment samples collected from the Pichavaram Mangrove System have been analysed for dioxins, furans and dioxin like polychlorinated biphenyls (PCBs). Few samples collected at the entry point showed the presence of dioxins and PCBs and the samples collected at the interior area of the mangroves showed no presence of dioxins and PCBs. This is due to the deposition pattern of sediment and transport of pollutants along with the water flow. Most of the pollutants settle at the entry point. Apart from dioxins and PCBs, samples showed presence of pesticides and other persistent organic pollutants (POPs). Extensive study to identify the sources of these contaminants is planned.



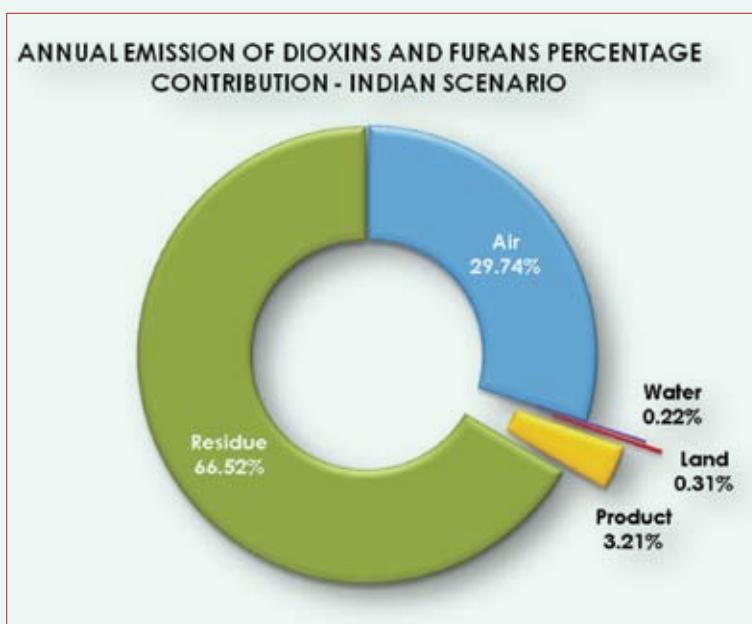
## Development of national implementation plan for the implementation of Stockholm convention in India



The Stockholm Convention on Persistent Organic Pollutants (POPs) is an internationally legal binding treaty that seeks to reduce and ultimately eliminate the release of POPs in the environment. As a party to the Convention, India is committed to compile the National Implementation Plan to meet the obligations to the Convention. Under this component, Ministry of Environment and Forests (MoEF), Government of India and United Nations Industrial Development Organisation (UNIDO) have identified and entrusted the responsibility of preparation of the inventory on industrial and non industrial sources that releases dioxins and furans to various compartments of the atmosphere to four institutions including NIIST.



These agencies have approached various organizations/ stakeholders to successfully cover an average of 60% data base. Secondary data have been collected from various stakeholders and applied screening matrix to consolidate the list of potent dioxin releasing activities or sources. Further, the annual operation capacity of dioxin releasing sources and detail on available pollution control measures/ equipments were collected. The report gives insight into the design, project strategy, implementation strategy, field work and data collection carried out and final outcome "inventory of dioxin sources" from the project activities. The inventory table reflects that the major quantity of dioxin has been released first to residues and secondly to air. The potential contributing categories are waste incineration and ferrous and non-ferrous metal production. An urgent action on control measures have to be designed in order to reduce and phase out dioxins PCDD/Fs to residue and air. A draft Action Plan for Dioxins and other Annex C Chemicals (unintentional POPs) has been prepared to set out India intends to comply with the obligations of Article 5 of the Stockholm Convention.





# S&T SERVICES SECTION एस एंड टी सेवा अनुभाग



## RESEARCH PLANNING AND BUSINESS DEVELOPMENT TECHNOLOGY LICENSING & TRANSFER AGREEMENTS/MOUs SIGNED

Sl.No.	Title	Agency
1	Agreement for licensing of Know-How for black pepper to white pepper	Shri.R.Nagendran, Gnana Soundari pepper processing Unit, Tamil Nadu
2	Agreement for licensing of Know-How for black pepper to white pepper	PDS organic Spices, a unit of Peermade development society, Kerala
3	Agreement for licensing the Know- How of flux bonding technology for producing high volume flyash building components	M/s.Green bricks India Pvt Ltd, Andhra pradesh
4	Agreement for licensing of Know-How for black pepper to white pepper	Shri.S.Vijayan, M/s S.V. Agencies, Netta, Nedumangad P.O., Thiruvananthapuram, Kerala
5	Agreement for licensing of Know-How for black pepper to white pepper	Shri.Ganesh Bhat, M/s E.S.Trading Company, No.3/14, South Godown, APMC Yard, Yeshwanthpur, Bangalore 560 022, Karnataka
6	Agreement for sponsored research in beneficiation studies for Golcha (Gunda) clay	M/s.Associate soapstone distributing company Pvt.Ltd, Jaipur
7	Agreement for engineering consultancy for modernization of nutmeg drying facility	Mr.Sabu Joseph Managing partner,M/s Ann Impex,Kerala
8	Agreement for consultancy service for conducting environmental impact assessment study for the existing beach wash mining &MSP for Kerala minerals and metals Ltd (KMML), Lease hold blocks I,III,V & VII ,Kollam District	Kerala minerals and metals,Chavara,Kerala
9	Agreement for consultancy to provide technical inputs on soil characteristics for adaptation in brick moulding process	The energy and resources institute, New Delhi
10	Agreement for engineering consultancy for setting up organic spice processing plant at Mananthavady	Wayanad social service society, Post Box No. 16, Mananthavady, Kerala
11	Study on use of flyash in ceramic products	NTPC Ltd Ramagundam super thermal power station, Karimnagar. A.P
12	Memorandum of understanding for research collaboration	Network systems and technologies P Ltd
13	Confidentiality agreement for development of ultra light - weight aluminium piston, surface treatments on engine related components and Mg alloy for instrument panel	Ashok leyland Limited No.1, Sardar Patel Road, Guindy, Chennai-600 032
14	Agreement on purchase contract, confidentiality agreements for engineering consultancy for developing detailed engineering drawings for white pepper plant	Shema Building, M.G. Road, Cochin 682 016





## CONTRACT RESEARCH PROGRAMMES Agro Processing Division

Client	Project title	Project Leader
Dir. Vanaspathi, Min.Con. Affairs	Evaluation of trans fatty acids in hydrogenated vegetable oil products and their health implication in the context of Indian food habits	Mrs. Reshma
Dir. Vanaspathi, Min.Con. Affairs	Studies on improving storage stability of refined and unrefined vegetable oils by the addition of micronutrients and antioxidant phytochemicals and the development of a functional vegetable	Dr. (Mrs). Nisha
DST	Evaluation and control of acrylamide formation in traditional deep fried snack products	Dr. (Mrs). Nisha
DST	Synthesis of iminosugar variants of alphagalactosyl ceramide for tuning of selective cytokine release from natural killer T(NKT)cells	Dr. L. RaviShankar
ICMR	Phenolic compds from centalla asiatica, boerhavia diffusa & desmodium gangeticum as protectors against arsenic trioxide induced cardiotoxicity	Dr. K. R. Raghu
KSCSTE	Development of value added products from "Neera" of Palmyrah	Mrs. Reshma

## Biotechnology Division

Client	Project title	Project Leader
CSIR	Bioethanol from lignocellulosic biomass	Dr. Ashok Pandey
DBT	Construction and screening of environmental DNA libraries for novel beta-lactamase inhibitors and lipases	Dr. Ashok Pandey
DBT	Development of thermostable and low pH tolerant phytase from aspergillus niger using site directed mutagenesis	Dr. Ashok Pandey
DBT	Construction and analysis of recombinant pentose utilizing corynebacterium glutamicum strains for amino acid production from hemicellulose containing agro-waste materials	Dr.K.Madhavan Nampoothiri
DBT	Development of a bioprocess for the production of polyhydroxy butyrate(PHB) from biodiesel industry generated glycerol	Dr. Ashok Pandey
DBT	Cost effective production of lactic acid for polylactide synthesis and studies on PLA application and biodegradation	Dr.K.Madhavan Nampoothiri
DBT	Exploiting westernghat biodiversity for antifungal metabolites for plant disease control	Dr.K.Madhavan Nampoothiri



DST	Isolation and cloning of glucose tolerant beta-glucosidase from fungal isolate BTCF-5 and the CBH1 control elements from trichoderma reesei and studies on the properties of the enzyme	Dr. Rajeev K Sukumaran
DST	Centre for bio fuels	Dr. Ashok Pandey
<b>Chemical Sciences &amp; Technology Division</b>		
Client	Project title	Project Leader
BRNS	Study of photoinduced electron transfer in cyclodextrin based supramolecular systems	Dr. Gopidas
DAE	Molecular and supramolecular architectures with optoelectronic functions	Dr. Ajayaghosh
DST	Engaging N-heterocycles and N-heterocyclic carbenes as or as catalysts for novel carbon-carbon and carbon-heteroatom bond forming reactions	Dr. G. Vijayan Nair
DST	Development of sensitizers based on NMR dyes	Dr. Ramaiah
DST	Design and development of efficient light conversion molecular devices based on lanthanide aromatic carboxylates	Dr. MLP Reddy
DST	Molecularly imprinted polymeric single measured sensors for priority environmental markers	Dr. T. Prasada Rao
DST	Development of novel cyclophanes as probes for biomolecular recognition	Dr. Ramaiah
DST	The controlled carbopalladation of heterobicyclic olefins: A novel stereo selective route to functionalized cyclopentanoids	Dr. K. V. Radhakrishnan
DST	Novel synthetic protocol for carbon-carbon and carbon-heteroatom bond forming reactions employing nucleophilic heterocyclic carbene catalysis	Dr. Vijayan Nair
DST	Environmentally secure inorganic colorants	Dr. M.L.P. Reddy
IFCPAR	Functional hybrid nanomaterials of polymeric gels and pi conjugated self assemblies	Dr. A. Ajayaghosh
IPM, Gandhinagar	Characterisation of Mn (II) acetylacetonate in nonylphenol for use in arco L10 cyanate ester & Py360 bisphenol - F blend epoxy resin system appropriate for fusion relevant prototype magnets....	Dr. J. D Sudha
KSCSTE	Microanalytical investigations of urinary stones: FTIR spectroscopy vs SEM-EDAX	Dr. R. Luxmi Verma
KSCSTE	Studies on the development of modified starch micro and nanoparticles and edible films from unique starch resources of Kerala	Dr. (Mrs). Emilia Abraham
M/s. Corning, France	Research project to develop superior photo chromic dyes phase IV	Dr. Suresh Das



M/s. Corning, France	Development of superior photochromic dyes - Phase V	Dr. Suresh Das
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### Materials Division

Client	Project title	Project Leader
BARC, Mumbai	Development of self lubricating Al <sub>2</sub> O <sub>3</sub> /ZrO <sub>2</sub> ceramic composites for journal bearing applications in acid/radiation environment	Dr. Ananthakumar
BHEL	Metal oxide/mixed oxide nanofluids for thermal management applications	Dr. S. K. Ghosh
BRNS	Development of boron carbide reinforced aluminium matrix composites for nuclear applications	Dr. T. P. D. Rajan
BRNS	Investigation on the reactivity and wetting behaviour of molten metals with nano size lanthanum phosphate sintered ceramic and coatings	Dr. K.G.K. Warriar
BRNS, BOMBAY	Ceramic-metal and polymer-metal composites for electromechanical applications	Dr. Jose James
BRNS, MUMBAI	Development of MgB <sub>2</sub> superconducting wires and coils for application in high field magnets	Dr. Syamaprasad
CSIR	Novel micro-nanointegrated composite particles as dye-adsorbent catalyst	Dr. S. K. Shukla
DRDO	Development of ceramics-based nano structured magnetic refrigerators	Dr. Manoj Rama Verma
DRDO	Development of mono and hybrid discontinuously reinforced magnesium metal matrix composites for engineering applications	Dr. U T S Pillai
DRDO	Development of low loss low temperature co-fired ceramic glass composite (LTCC) tapes for future MIC device applications	Dr. M. T. Sebastian
DST	Tunable microwave materials and devices	Dr. Jose James
DST	Optimization of aging parameters and alloy composition for improved age hardening response of AZ91 magnesium alloy	Dr. A. Sreenivasan
DST	Silicate based dielectrics for electronic packaging applications	Dr. M. T. Sebastian
DST	Synthesis and characterization of in-situ magnesium matrix composites	Dr. (Mrs) Sreeja Kumari
DST	An investigation on the potential beach placer deposits along Tiruchendur coast, Tamilnadu	Dr. M. Sundararajan
DST	Development of novel powellite based red phosphor materials: ARMM_00_8: Eu <sup>3+</sup> (A=Mg, Ca, Sr and Ba, R=Y, La and Gd: M=Nb and Ta) for white light emitting diodes (WLED's)	Dr. Prabhakar Rao



DST	Supramolecular polymeric nanomaterials with hierarchical morphologies	Dr. Boje Goud
DST	Preparation of M3AX2 phase ternary carbides and fabrication of its nanocomposites through novel methods	Dr. S. Ananthakumar
DST	Nanostructured double perovskites for spintronic applications	Dr. Manoj Rama Verma
DST	Low temperature healing photocatalytic self cleaning coatings for solar cell covers and glass surfaces	Dr. K G K Warriier
DST	Development of nanostructured spinel oxide materials for spintronic applications	Dr. Savitha Pillai
ICDD	Generation of powder X-ray diffraction patterns for new generation ceramic oxide compounds	Dr. Prabhakar Rao
ICDD	Generation of experimental powder diffraction data of new ceramic complex oxides	Dr. Prabhakar Rao
Institute of Plasma Research	Development of long filamentary MgB2 superconducting wires and tapes for fusion grade magnets and current leads	Dr. Syamprasad
IRE	Development of cerium oxide based nanomaterials for applications as chemical mechanical planarization / polishing slurry	Dr. S. K. Ghosh
ISRO, Dept. of Space	Development of ultrafine grain aluminium alloy and composite through equal channel angular pressing (ECAP) for space applications	Dr. T. P. D. Rajan
KSCSTE	Applications of phosphorylated cashew nut shell liquid prepolymer modified elastomeric contact adhesives	Dr. A.R.R. Menon
M/s CMRL, Alwaye	Rendering scientific and technical support to M/s.CMRL synthetic rutile commercial plant.	Mr.Harikrishna Bhat
M/s. IRELTDC, Kollam	Development of high field composite varistors based on rare earth oxides	Dr. S. Ananthakumar
MHRD	The village community network: Technology development and pilot rollout plan for low cost opportunistic communication networks for rural areas of India	Dr. M. T. Sebastian
NCRMI, Trivandrum	Studies on development of coir-rubber composites products	Dr. A.R.R. Menon
NTPC	Study on use of flyash in ceramic products	Dr. KGK Warriier

### Process Engineering and Environmental Division

Client	Project title	Project Leader
Dept. of Information Technology	An agent runtime environment for biological simulations	Dr. (Mrs). Elizabeth Jacob
Kerala State Pollution control	Dust Suppression: Field study in China clay mine	Dr. Rugmini Sukumaran



KSCSTE	Bioremediation of percholate containing waste water under high saline conditions using chemotrophic mixed microbial system	Dr. Krishnakumar
M/s. General Motors Ltd.	Nucleation, movement and growth of gas bubbles in aluminium castings	Dr. Roschen Sasikumar
Min. of New and Renewable energy	Development of a household wastes & sanitation device with biogas recovery	Dr.V.B.Manilal
MNRE, New Delhi	Anaerobic technology for biogas recovery and stabilization of unsorted municipal solid wastes	Dr. V. B. Manilal
NIIST	Development of a zero discharge process for china clay processing	Dr. Rugmini Sukumaran
NMITLI	Biofuel from marine microalgae	Mr. Ajith Haridas
	Development of national implementation plan in India as first step to implement the stockholm convention on persistent organic pollutants	Dr.M.Anbu
M/s. Associated Soapstone Dist	Beneficiation process development flow sheet design for china clay of Guda mines of M/s. Associated soapstone distn. Co. Pvt.Ltd.	Dr. P. Raghavan
CSIR	Development of homogeneous catalysts for water splitting - A key technology for sustainable energy	Dr. C. H. Suresh



## CONSULTANCY PROGRAMMES

Client	Project title	Project Leader
Ann Impex	Engineering consultancy for technology upgradation	Sri.M.M.Sreekumar
BHEL, Bangalore	Consultancy for sol-gel mullite coatings on porous silicon carbide	Dr. KGK Warriier
BHEL, Bangalore	Preparation of UV curable nano-TiO <sub>2</sub> thin film on glass substrate to induce self cleaning properties	Dr K.G.K. Warriier
Colgate Palmolive	Production of arginine by fermentation and its purification-phase II	Dr. Ashok Pandey
DRDO	Consultancy and report generation for the development of housing first gear and piston using aluminium matrix composites	Dr. T. P. D. Rajan
Environmental Resources Research Centre, TVM	Microstructural analysis of pollens of medicinal plants	Dr. Prabhakar Rao
IRE	EIA study for IRE	Mr. J. Ansari
KMML	EIA for KMML project	Mr. J. Ansari
M/s. Astra Zeneca	Quantitative phase analysis of turbutaline sulphate	Dr. Syamaprasad
M/s.TERI, Delhi	Evalutaion of clay samples for suitability for extrusion & production of hollow blocks	Dr. K.G.K. Warriier
Nita Gelatin India Ltd. Koratty, Trichur	Ossein factory odour control	Mr. Ajith Haridas
VSSC	Surface area analysis of nickel powders	Mr. K. Harikrishna Bhat
VSSC	Surface analysis test samples of copper chromite, ferric oxide, alumina, BN,AIN and indium pellets by 3 point BET method	Mr. K. Harikrishna Bhat
WAPCOS	Marine ecological survey for the proposed multiuser liquid terminal, Kochi	Mr. J. Ansari



## PATENTS

### PATENTS FILED (FOREIGN)

NFNO	Title	Inventors	FILING DATE	APPLICATION NO.
0106NF2007/US	White light emitting organogel and process there of	Ayyappanpillai AjayaghoshHakkooth Vijayakumar, Vakayil K Praveen	28/06/2010	12/810923
0105NF2007/US	Pyrrole end-capped bipyridine assay powder for selective detection of zinc ions and process thereof	Ayyappanpillai Ajayaghosh, Sivaramapanicker Sreejith	28/06/2010	12/811008
0350NF2005/ID	A method for anaerobic process coupled seperation and refining of plant materials	Vattackatt Balakrishnan Manilal, Ajit Haridas	3/9/2010	W-00201003064
0350NF2005/LK	A method for anaerobic process coupled seperation and refining of plant materials	Vattackatt Balakrishnan Manilal, Ajit Haridas	3/9/2010	15971
0350NF2005/PH	A method for anaerobic process coupled seperation and refining of plant materials	Vattackatt Balakrishnan Manilal, Ajit Haridas	3/9/2010	1-2010-502017
0122NF2009/WO	A reusable thiophene end-capped bipyridine fluorescent assay for selective detection of cyanide anions in aqueous and biorelevant samples and process thereof	Ayyapanpillai Ajayaghosh, Sivaramapanicker Sreejith, Kizhumuri P. Divya, Puroshothaman Jayamurthy	15/09/2010	PCT/ IN2010/000623
0109NF2008/WO	Novel surface-modification processes for flyash and industrial applications thereof	Shukla Satyajit Vishnu, Warriar Krishna Gopakumar, Kizhakkelikoodayil Baiju Vijayan, Thachan Shijitha	11/11/2010	PCT/ IN2010/000735
0109NF2008/TW	Novel surface-modification processes for flyash and industrial applications thereof	Shukla Satyajit Vishnu, Warriar Krishna Gopakumar, Kizhakkelikoodayil Baiju Vijayan, Thachan Shijitha	26/11/2010	99140999



0109NF2008/AR	Novel surface-modification processes for flyash and industrial applications thereof	Shukla Satyajit Vishnu, Warriar Krishna Gopakumar, Kizhakkelikoodayil Baiju Vijayan, Thachan Shijitha	17/12/2010	100104718
0147NF2009/WO	Novel porphyrin derivatives for photodynamic therapy (pdt): a process for the preparation thereof and their use as pdt agents and fluorescence probes for biological applications	Danoboyina Ramaiah, Suneesh C Karunakaran, Vadakkancheril S Jisha, Tavarekere K Chandrashekhar, Alagar Srinivasan, Madhavan Radhakrishna Pillai, Sivakumari Asha Nair, Saneesh Babu P Saras, Chintalagiri Mohan Rao, Kunchala Sridhar Rao	21/01/2011	PCT/ IB2011/000085
0052NF2009/CN	Novel imprinted polymer materials for selective detoxification of endosulphan contaminated natural waters and process for preparation thereof	Karamala Prasad, Joseph Mary Gladis, Talasila Prasada Rao	15/02/2011	201110038500.0
0052NF2009/PK	Novel imprinted polymer materials for selective detoxification of endosulphan contaminated natural waters and process for preparation thereof	Karamala Prasad, Joseph Mary Gladis, Talasila Prasada Rao	15/02/2011	97/2011
0033NF2010/WO	Process for the production of violacein and its derivatives containing bioactive pigment from chromobacterium sp. Niist-cck-01	Krishnakumar Bhaskaran	10/3/2011	PCT/ IB2011/000507



**PATENTS FILED (INDIA)**

NFNO	Title	Inventors	COMP. FILING DATE	APPLICATION NO.
0051NF2009/IN	Nanocomposite forming microcapsule useful for guest encapsulation and process thereof	Chorappan Pavithran, Bindu Prasannakumaran Nair	19/04/2010	0969DEL2009
0122NF2009/IN	A reusable thiophene end-capped bipyridine fluorescent assay for selective detection of cyanide anions in aqueous and biorelevant samples and process thereof	Ayyappanpillai Ajayaghosh, Sivaramapanicker Sreejith, Kizhumuri P. Divya, Puroshothaman Jayamurthy	14/09/2010	1899DEL2009
0147NF2009/IN	Novel porphyrin derivatives for photodynamic therapy (pdt): a process for the preparation thereof and their use as pdt agents and fluorescence probes for biological applications	Danoboyina Ramaiah, Suneesh C Karunakaran, Vadakkancheril S Jisha, Tavarekere K Chandrashekhar, Alagar Srinivasan, Madhavan Radhakrishna Pillai, Sivakumari Asha Nair, Saneesh Babu P Saras, Chintalagiri Mohan Rao, Kunchala Sridhar Rao	21/01/2011	0124DEL2010
0052NF2009/IN	Molecular imprinted polymer particles or micro beads for selective detoxification of endosulphan contaminated natural waters and process for preparation thereof	Karamala Prasad, Joseph Mary Gladis, Talasila Prasada Rao	14/02/2011	0314DEL2010
0033NF2010/IN	Process for the production of violacein and its derivatives containing bioactive pigment from chromobacterium sp. Niist-ckk-01	Krishnakumar Bhaskaran	10/3/2011	0577DEL2010

**PATENTS GRANTED (FOREIGN)**

Title	Inventors	GRANT DATE	PATENT NO.
Viologen linked acridine based molecule and process for the preparation thereof	Ramaiah D, Eldho Nv, Joseph J	18/05/2010	2338223 (CA)



A melt transurethane process for the preparation of polyurethanes	Manickam Jayakannan, Deepa Puthaparambil	30/06/2010	GB2445531 (GB)
Multifunctional alcohols from cardanol, its multifunctional acrylic cross-linker and highly pendant phosphorus flame retardant derivatives	Vadakkethonippurathu Sivankutty Nair Prasad, Chennakkattu Krishna Sadasivan Pillai	14/07/2010	GB2447182 (GB)
Melt or solution processable highly conducting polyaniline and process for preparation thereof with pvc and eva	Raji Kannaparampil Paul, Chennakkattu Krishna Sadasivan Pillai	12/8/2010	10014662 (DE)
A process for the production of peroxidase from plant cell and callus cultures	Tholath Emilia Abraham, Nisha Rani Devaki, Thomson Kuruvilla, Jegan Roy Joseph	13/10/2010	2039763 (EP)
Yellow inorganic pigments and process for preparing same	Padala Prabhakar Rao, Mundlapudi Lakshmi pathi Reddy	23/11/2010	7837782 (US)
Synthesis of ion imprinted polymer particles for solid phase extractive preconcentration of erbium ions and a process thereof	Kala Ramakrishnan, Mary Gladis Joseph, Talasila Prasada Rao	8/12/2010	CN101418062B (CN)
A process for the synthesis of telechelic urethane acrylate uv curble pre polymer materials from renewable resources	Syamakumari Asha, Chennakkattu Krishna Sadasivan Pillai	15/12/2010	GB2446353 (GB)

### PATENTS GRANTED (INDIAN)

Title	Inventors	Grant Date	Patent No.
Buoyant filter bioreactor for the anaerobic treatment of complex wastewater	Haridas A	18/08/2010	242196
A process for the preparation of friction dust useful as a friction modifier in brake / clutch facings	Vadakkethonippurathu Sivankutty Nair Prasad, Janardhanan Nair Devaki Amma Sudha, Chennakkattu Krishna Sadasivan Pillai, Ariyappallil Ramankutty Menon Ravindranatha Menon, Alathur Damodaran	20/08/2010	242267
Near infrared absorbing squaraine dyes containing aminoanthracene chromophores and the process thereof for their manufacture	Das S, Thomas Kg, Biju Vp, Sonthosh U, Suresh V	25/08/2010	242404
An alternate process for the preparation of titania rich slag and pig iron from indian ilmenites using plasma	Alathur Damodaran Damodaran, Pawvathu Narayanan Nair Mohan Das, Karval Harikrishna Bhat, Bishnu Charana Rabindha Mohanty, Partha Sarathi Mukherjee	23/03/2011	246958



## KNOWLEDGE RESOURCE CENTRE

The year 2010-11 was a period of major accomplishments for the Knowledge Resource Centre (KRC) both in terms of immediate impact and beneficial changes for the long run. KRC is also committed to provide the best network based services to the S & T Community. The section offers excellent information, literature & IT infrastructure support to the R & D activities of the Institute by housing a specialized collection of documents including books, periodicals, CD-ROM databases etc., and by providing access to a host of e- resources. Significant progress was achieved during the year in strengthening the infrastructure, resources and also in rendering services. Highlights of the achievements include:

### INFORMATION RESOURCE MANAGEMENT

#### Collection strength

The total collection has gone up to 42,000 plus documents which include 12,873 books, 10947 standards and 9780 bound volumes of periodicals. The total number of the print versions of periodicals received during the year was 158 titles (Subscribed: Foreign - 63, Indian – 77 & Gratis -18)

#### Databases and database searches

Updated the in-house databases of books, periodicals, reports/reprints, PhD theses, publications of NIIST scientists, etc. The last two databases are linked to the lab's website as well as intranet.

Conducted regular and extensive CD-ROM and online database searches including those of standards and patents.

#### e-Resources access facility

Trial access followed by regular access to the e-resources under the CSIR e-Journals consortia programme was facilitated through the desktops of all scientists, research students and other functionaries across the lab in IP- enabled mode. The list of access facilities/ publishers whose e-journals full text databases are accessible is furnished below:

- American chemical society
- Annual reviews
- ASCE
- ASME
- AIP
- ACM
- Cambridge University Press
- Elsevier (Science Direct)
- Emerald
- IEEE
- JCCC@INSTIRC
- Nature
- Oxford University Press
- Science Magazine
- SCOPUS
- Springer
- Taylor & Francis
- Wiley Interscience /Blackwell



- Indian Journals.com of Divan Enterprises

Bibliographic & Citation Databases	- Web of science – science citation index expanded
Patent Databases	- Delphion & Derwent Innovations Index
Standards	- ASTM and BIS online

This was in addition to the trial access of INSPEC database and MyiLibrary, the industry-leading e-content aggregation platform for public, academic and professional libraries around the world. The usage of e-resources has been overwhelming particularly those of ACS and Elsevier (Science direct and SCOPUS). The regular monitoring of usage and various promotional programmes have enhanced the level of usage.

### Analysis of Publications

Carried out Bibliometric/ Scientometric/ Impact factor Analysis of NIIST publications using journal Citation Report, Web of Science – Science Citation Index Expanded and SCOPUS. Provided support service for publishing in journals with high impact factor. The total number of SCI Papers (2010) is 197 with an average IF value of 2.897. The total number of SCI papers includes 15 papers published in SCI journals without IF.

### Institutional Repository (IR)

Creation of institutional repository of theses & research papers produced from NIIST is in progress. During the period 83 records were added to the IR, which is now accessible in our intranet only.

### IT-Enabled systems and services

- High speed internet connectivity to staff and students through LAN/WAN segments
- 9 Mbps leased line connectivity of BSNL
- Gigabit connectivity from NIC
- Wi-Fi system facility
- Video Conferencing facility
- Design, development and maintenance of NIIST website
- Design, development of conference websites for various divisions
- E-mail & Messaging System
- Bio Bulletin board for biotechnology division
- Cyber Security
- Storage Devices implemented
- MIS - Intranet Portal to access forms, notices, schedules, e-resources etc.,
- Dedicated Server Room (in progress)
- CSIR-ERP Implementation (in progress)



## LIST OF PUBLICATIONS: 2010 (प्रकाशनों की सूची: 2010)

- 1 **ADARSH (N), REKHA (R A) and RAMAIAH (D)**  
Tuning photosensitized singlet oxygen generation efficiency of novel Aza-BODIPY dyes  
*Organic Letters*  
**12(24):5720-5723; 17 Dec 2010**
- 2 **AFINISHA DEEPAM (L S) and ARUMUGHAN (C)**  
Characterization of sn-2 Alk-1'-Enyl ethers of Glycerol from rice bran oil  
*Journal of Oleo Science*  
**59(10):521-526; Oct 2010**
- 3 **AHMED (S U), RANGANATHAN (P), PANDEY (A), and SAVITHRI (S)**  
Computational fluid dynamics modeling of gas dispersion in multi impeller bioreactor  
*Journal of Bioscience and Bioengineering*  
**109(6):588-597; Jun 2010**
- 4 **AKHILA RAJAN, JAYALAKSHMI (G K) and EMILIA ABRAHAM (T)**  
Solid state production of Manganese Peroxidases using Areca nut husk as substrate  
*Brazilian Archives of Biology & Technology*  
**53(3):555-562; May-Jun 2010**
- 5 **AMBILI RAJ (D B), BIJU FRANCIS, REDDY (M L P), BUTORAC (R R), LYNCH (V M) and COWLEY (A H)**  
Highly luminescent Poly (Methyl Methacrylate)-incorporated Europium complex supported by a Carbazole-based fluorinated Beta-Diketonate ligand and a 4, 5-Bis (diphenylphosphino) -9, 9-dimethylxanthene oxide co-ligand  
*Inorganic Chemistry*  
**49(19):9055-9063; 04 Oct 2010**
- 6 **ANABHA (E R), PAUL (R R), SURESH (E) and VIJAY NAIR (G)**  
Nucleophilic heterocyclic carbene as a novel catalyst for cyclopropanation of cyano acrylates  
*Organic & Biomolecular Chemistry*  
**8(4):901-905; 2010**
- 7 **ANANTHAKUMAR (S), ANAS (S), AMBILY (J) and MANGALARAJA (R V)**  
Microwave assisted citrate gel combustion synthesis of ZnO Part-1: Assessment of structural features  
*Journal of Ceramic Processing Research*  
**11(1):29-34; Feb 2010**
- 8 **ANANTHAKUMAR (S), ANAS (S), AMBILY (J) and MANGALARAJA (R V)**  
Microwave assisted citrate gel combustion synthesis of ZnO Part-II: Assessment of functional properties  
*Journal of Ceramic Processing Research*  
**11(2):164-169; Apr 2010**



- 9 ANAS (S), MANGALARAJA (R V) and ANANTHAKUMAR (S)**  
Studies on the evolution of ZnO morphologies in a thermohydrolysis technique and evaluation of their functional properties  
*Journal of Hazardous Materials*  
**175(1-3):889-895; 15 Mar 2010**
- 10 ANAS (S), METZ (R), SANOJ (M A), MANGALARAJA (R V) and ANANTHAKUMAR (S)**  
Sintering of surfactant modified ZnO-Bi<sub>2</sub>O<sub>3</sub> based varistor nanopowders  
*Ceramics International*  
**36(8):2351-2358; Dec 2010**
- 11 ANAS (S), MUKUNDAN (P), SANOJ (A M), MANGALARAJA (R V) and ANANTHAKUMAR (S)**  
Synthesis of ZnO based nanopowders via a non-hydrolytic sol gel technique and their densification behaviour and varistor properties  
*Processing and Application of Ceramics*  
**4(1):7-14; 2010 Non-sciF**
- 12 ANI K JOHN, SAVITHRI (S), VIJAYALAKSHMI (K P) and SURESH (C H)**  
Density functional theory study of gas phase hydrolysis of Titanium Tetrachloride  
*Bulletin of the Chemical Society of Japan*  
**83(9):1030-1036; 15 Sep 2010**
- 13 ANILKUMAR (P) and JAYAKANNAN (M)**  
A novel supramolecular organogel nanotubular template approach for conducting nanomaterials  
*Journal of Physical Chemistry B*  
**114(2):728-736; 21 Jan 2010**
- 14 ANISHA (G S), ROJAN P JOHN, PREMA (P) and PANDEY (A)**  
Investigation on alpha-galactosidase production by streptomyces griseoloalbus in a forcefully aerated packed-bed bioreactor operating in solid-state fermentation condition  
*Applied Biochemistry and Biotechnology*  
**160(2):421-427; Jan 2010**
- 15 ANJANA (P S), DEEPU (V), UMA (S), MOHANAN (P), PHILIP (J) and SEBASTIAN (M T)**  
Dielectric, thermal and mechanical properties of CeO<sub>2</sub>-filled HDPE composites for microwave substrate applications  
*Journal of Polymer Science Part B: Polymer Physics*  
**48(9):998-1008; 01 May 2010**
- 16 ANJANA (P S), JOSEPH (T) and SEBASTIAN (M T)**  
Microwave dielectric properties of (1-x) CeO<sub>2</sub>-xRE<sub>2</sub>O<sub>3</sub> (RE= La, Nd, Sm, Eu, Gd, Dy, Er, Tm, Yb and Y) (0 ≤ x ≤ 1) ceramics  
*Journal of Alloys and Compounds*  
**490(1-2):208-213; 04 Feb 2010**
- 17 ANJANA (P S), JOSEPH (T) and SEBASTIAN (M T)**  
Low temperature sintering and microwave dielectric properties of Ce<sub>2</sub>(WO<sub>4</sub>)<sub>3</sub> ceramics  
*Ceramics International*  
**36(5):1535-1540; Jul 2010**



- 18 ANJANA (P S), UMA (S), PHILIP (J) and SEBASTIAN (M T)**  
Thermal properties of low loss PTFE-CeO<sub>2</sub> dielectric ceramic composites for microwave substrate applications  
*Journal of Applied Polymer Science*  
**118(2):751-758; 15 Oct 2010**
- 19 ANTONY (M J) and JAYAKANNAN (M)**  
Molecular template approach for evolution of conducting polymer nanostructures: Tracing the role of morphology on conductivity and solid state ordering  
*Journal of Physical Chemistry B*  
**114(3):1314-1324; 28 Jan 2010**
- 20 APARNA MONDAL, ZACHARIAH (A), NAYAK (P) and NAYAK (B B)**  
Synthesis and room temperature photoluminescence of mesoporous zirconia with a tetragonal nanocrystalline framework  
*Journal of the American Ceramic Society*  
**93(2):387-392; Feb 2010**
- 21 ARAVIND (P R), SHAJESH (P), SORARU (G D) and WARRIER (K G K)**  
Ambient pressure drying: A successful approach for the preparation of silica and silica based mixed oxide aerogels  
*Journal of Sol-Gel Science and Technology*  
**54(1):105-117; Apr 2010**
- 22 ARYA NANDAN, GAURAV (A), PANDEY (A) and NAMPOOTHIRI (K M)**  
Arginine specific Aminopeptidase from *Lactobacillus brevis*  
*Brazilian Archives of Biology and Technology*  
**53(6):1443-1450; Nov-Dec 2010**
- 23 ASWATHY (P M), ANOOJA (J B), SARUN (P M) and SYAMAPRASAD (U)**  
An overview on iron based superconductors (Topical Review)  
*Superconductor Science and Technology*  
**23(7): Article No.073001 20(pp); Jul 2010**
- 24 ASWATHY (U S), RAJEEV K SUKUMARAN (R K), LALITHA DEVI (G), RAJASREE (K P), SINGHANIA (R R) and PANDEY (A)**  
Bio-ethanol from water hyacinth biomass: An evaluation of enzymatic saccharification strategy  
*Bioresource Technology*  
**101(3):925-930; Feb 2010**
- 25 BABU (S S), KARTHA (K K) and AJAYAGHOSH (A)**  
Excited state processes in Linear  $\pi$ -system-based organogels  
*Journal of Physical Chemistry Letters*  
**1(23):3413-3424; 02 Dec 2010**
- 26 BAIJU (K V), PERIYAT (P), SHAJESH (P), WUNDERLICH (W), MANJUMOL (K A), SMITHA (V S), JAIMY (K B) and WARRIER (K G K)**  
Mesoporous gadolinium doped titania photocatalyst through an aqueous sol-gel method  
*Journal of Alloys and Compounds*  
**505(1):194-200; 27 Aug 2010**



- 27 **BAKARE (I O), OKIEIMEN (F E), PAVITHRAN (C), KHALIL (H P S A) and BRAHMAKUMAR (M)**  
Mechanical and thermal properties of sisal-fiber reinforced rubber seed oil-based polyurethane composites  
*Materials & Design*  
**31(9):4274-4280; Oct 2010**
- 28 **BEENA JOY, LAKSHMI (S) and BABU (M)**  
Antioxidant and anti cancer activity of Alpinia Galanga attributes to its medicinal potential  
*Medicinal Chemistry Research*  
**19 (S140-S141) Suppl.1; Feb 2010**
- 29 **BEENA JOY, SIVADASAN (R), EMILIA ABRAHAM (T), JOHN (M), SOBHAN (P K), SEERVI (M) and SANTHOSHKUMAR (T R)**  
Lysosomal destabilization and cathepsin B contributes for cytochrome c release and caspase activation in Embelin-induced apoptosis  
*Molecular Carcinogenesis*  
**49(4):324-336; Apr 2010**
- 30 **BERGER (S), SINGH (R), SUDHA (J D), ADLER (H J) and PICH (A)**  
Microgel/clay nanohybrids as responsive scavenger systems  
*Polymer*  
**51(17):3829-3835; 04 Aug 2010**
- 31 **BIJU (A), SHABNA (R), SARUN (P M), VINU (S) and SYAMAPRASAD (U)**  
Effect of Yb,Gd, and Nd substitution at the Sr site on the metal-insulator transition of the (Bi, pb)-2212 system  
*International Journal of Applied Ceramic Technology*  
**7[S1]:E16-E22; 2010**
- 32 **BIJU FRANCIS, AMBILI RAJ (D B) and REDDY (M L P)**  
Highly efficient luminescent hybrid materials covalently linking with europium (III) complexes via a novel fluorinated Beta-diketonate ligand: Synthesis, characterization and photophysical properties  
*Dalton Transactions*  
**39(34):8084-8092; 2010**
- 33 **BINDHUMOL (I) and NAMPOOTHIRI (K M)**  
Exopolysaccharide production and prevention of syneresis in starch using encapsulated probiotic Lactobacillus plantarum  
*Food Technology and Biotechnology*  
**48(4):484-489; Sp Issue S1 Oct-Dec 2010**
- 34 **BINDHUMOL (I) and NAMPOOTHIRI (K M)**  
Production, purification and structural characterization of an exopolysaccharide produced by a probiotic Lactobacillus plantarum MTCC 9510  
*Archives of Microbiology*  
**192(12):1049-1057; Dec 2010**
- 35 **BINDU (P N) and PAVITHRAN (C)**  
Bifunctionalized hybrid silica spheres by hydrolytic cocondensation of 3-Aminopropyltriethoxysilane and vinyltriethoxysilane  
*Langmuir*  
**26(2):730-735; 19 Jan 2010**





- 36 BINDU (P N), PAVITHRAN (C), SUDHA (J D) and PRASAD (V S)**  
Microvesicles through self-assembly of polystyrene-clay nanocomposite  
*Langmuir*  
**26(3):1431-1434; 02 Feb 2010**
- 37 BINDU P N and PAVITHRAN (C)**  
Micropatterned surfaces through moisture-induced phase separation of polystyrene-clay nanocomposite particles  
*Langmuir*  
**26(15):12948-12952; 03 Aug 2010**
- 38 BINOD (P), SINDHU (R), SINGHANIA (R R), VIKRAM (S), DEVI (L), NAGALAKSHMI (S), KURIEN (N), RAJEEV K SUKUMARAN and PANDEY (A)**  
Bioethanol production from rice straw: An overview  
*Bioresource Technology*  
**101(13):4767-4774; Sp.iss Jul 2010**
- 39 BURIANOVA (L), PANOS (S), STENNETT (M C), WEST (A R), SUBODH (G), SEBASTIAN (M T) and KAMBA (S)**  
Piezoelectric and ferroelectric properties of new Pb<sub>9</sub> Ce<sub>2</sub>Ti<sub>12</sub> O<sub>36</sub> and lead-free Ba<sub>2</sub> NdTi<sub>2</sub> Nb<sub>3</sub> O<sub>15</sub> ceramics  
*Journal of Electroceramics*  
**25(2-4):116-121; Oct 2010**
- 40 CHAMESWARY (J), JITHESH (K), GEORGE (S), RAMAN (S), MOHANAN (P) and SEBASTIAN (M T)**  
PTFE-SWNT composite for microwave absorption application  
*Materials Letters*  
**64(6):743-745; 31 Mar 2010**
- 41 CHAMESWARY (J), SHERIN THOMAS and SEBASTIAN (M T)**  
Microwave dielectric properties of Co<sub>2</sub> La<sub>4</sub> Ti<sub>3</sub> Si<sub>4</sub> O<sub>22</sub> ceramics  
*Journal of the American Ceramic Society*  
**93(7):1863-1865; Jul 2010**
- 42 DANIEL (G P), JUSTIN VICTOR (V B), PRABITHA (B N), JOY (K), PETER KOSHY and THOMAS (P V)**  
Effect of annealing temperature on the structural and optical properties of ZnO thin films prepared by RF magnetron sputtering  
*Physica B: Condensed Matter*  
**405(7):1782-1786; 01 Apr 2010**
- 43 DASTAGAER (S G), DEEPA (C K) and PANDEY (A)**  
Isolation and characterization of novel plant growth promoting micrococcus sp NII-0909 and its interaction with cowpea  
*Plant Physiology and Biochemistry*  
**48(12):987-992; Dec 2010**
- 44 DASTAGER (S G), DEEPA (C K) and PANDEY (A)**  
Characterization of plant growth-promoting rhizobacterium Exiguobacterium NII-0906 for its growth promotion of cowpea (*Vigna unguiculata*)  
*Biologia*  
**65(2):197-203; Apr 2010**



- 45 **DASTAGER (S G), LEE (J C), PANDEY (A) and KIM (C J)**  
Nocardioides mesophilus sp. nov., isolated from soil  
*International Journal of Systematic and Evolutionary Microbiology*  
60:2288-2292 Part 10; Oct 2010
- 46 **DEEPA (C K), DASTAGER (S G) and PANDEY (A)**  
Isolation and characterization of plant growth promoting bacteria from non-rhizospheric soil and their effect on cowpea (Vigna unguiculata (L.) Walp.) Seedling growth  
*World Journal of Microbiology & Biotechnology*  
26(7):1233-1240; Jul 2010
- 47 **DEEPA (C K), DASTAGER (S G) and PANDEY (A)**  
Plant growth-promoting activity in newly isolated Bacillus thioeparus (NII-0902) from Western Ghat forest, India  
*World Journal of Microbiology & Biotechnology*  
26(12):2277-2283; Dec 2010
- 48 **DEEPA (K S), PRIYATHA (P L), PARAMESWARAN (P), SEBASTIAN (M T) and JOSE JAMES**  
Ba 0.7 Sr 0.3 TiO<sub>3</sub>-glass-silver percolative composite  
*Ceramics International*  
36(1):75-78; Jan 2010
- 49 **DEEPA (M), PRABHAKAR RAO (P), SUMI (S), RADHAKRISHNAN (A N P) and PETER KOSHY**  
New negative temperature coefficient ceramics in Ca-Ce-Nb-M-O (M=Mo or W) system  
*Journal of the American Ceramic Society*  
93(6):1576-1579; Jun 2010
- 50 **DHANESH (T) and SEBASTIAN (M T)**  
Temperature-compensated LiMgPO<sub>4</sub> : A new glass-free low-temperature cofired ceramic  
*Journal of the American Ceramic Society*  
93(11):3828-3831; Nov 2010
- 51 **DHANYA (G), PRIYA (R), PARAMASAMY (G), PANDEY (A) and NAMPOOTHIRI (K M)**  
Molecular cloning, overexpression and characterization of the raw-starch-digesting  $\alpha$ -amylase of Bacillus amyloliquefaciens  
*Biologia*  
65(3):392-398; Jun 2010
- 52 **DHANYA (G), SWETHA (S), PANDEY (A) and NAMPOOTHIRI (K M)**  
Folate-producing lactic acid bacteria from cow's milk with probiotic characteristics  
*International Journal of Dairy Technology*  
63(3):339-348; Aug 2010
- 53 **DIAS (A), SUBODH (G), SEBASTIAN (M T) and MOREIRA (R L)**  
Vibrational spectroscopic study of Sr<sub>2</sub>ZnTeO<sub>6</sub> double perovskites  
*Journal of Raman Spectroscopy*  
41(6):702-706; Jun 2010



- 54** **DIVYA (K P), SREEJITH (S), BALAKRISHNA (B), JAYAMURTHY (P), ANEES (P) and AJAYAGHOSH (A)**  
A Zn<sup>2+</sup>-specific fluorescent molecular probe for the selective detection of endogenous cyanide in biorelevant samples  
*Chemical Communications*  
**46(33):6069-6071; 2010**
- 55** **DIVYA (K P), SREEJITH (S), SURESH (C H) and AJAYAGHOSH (A)**  
Conformational control in a bipyridine linked  $\pi$ -conjugated oligomer: Cation mediated helix unfolding and refolding  
*Chemical Communications*  
**46(44):8392-8394; 2010**
- 56** **DIVYA (V), BIJU (S), LUXMI VARMA (R) and REDDY (M L P)**  
Highly efficient visible light sensitized red emission from europium tris[1-(4-biphenoyl)-3-(2-fluoroyl) propanedione](1, 10-phenanthroline) complex grafted on silica nanoparticles  
*Journal of Materials Chemistry*  
**20(25):5220-5227; 2010**
- 57** **ELYAS (K K), MATHEW (A), RAJEEV K SUKUMARAN, ALI (P P M), SAPNA (K), KUMAR (S R) and MOL (K R R)**  
Production optimization and properties of beta glucosidases from a marine fungus *Aspergillus* -SA 58  
*New Biotechnology*  
**27(4):347-351 Sp.Iss.SI; 30 Sep 2010**
- 58** **FERNANDEZ (M R), CASABONA (M G), ANUPAMA (V N), KRISHNAKUMAR (B), CURUTCHET (G A) and BERNIK (D L)**  
PDMS-based porous particles as support beds for cell immobilization: Bacterial biofilm formation as a function of porosity and polymer composition  
*Colloids and Surfaces B - Biointerfaces*  
**81(1):289-296; 01 Nov 2010**
- 59** **GEORGE (S C), JOHN (J), ANAS (S), JOHN (J), YAMAMOTO (Y), SURESH (E) and ADHAKRISHNAN (K V)**  
Palladium-catalyzed Bis-functionalization of isatylidenes: A facile route towards spiro-indol-2-ones  
*European Journal of Organic Chemistry*  
**(28):5489-5497; Oct 2010**
- 60** **GEORGE (S D), RAJESH (K), WARRIER (K G K), RADHAKRISHNAN (P), NAMPOORI (V P N) and VALLABHAN (C P G)**  
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*Journal of Sol-Gel Science and Technology*  
**54(2):203-211; May 2010**
- 149 SOCCOL (C R), de SOUZA VANDENBERGHE (L P), SPIER (M R), MEDEIROS (A B P), YAMAGUISHI (C T), De DEA LINDNER (J), PANDEY (A) and THOMAZ-SOCCOL (V)**  
The potential of probiotics: A review  
*Food Technology and Biotechnology*  
**48(4):413-434; Spl Iss Oct-Dec 2010**
- 150 SOLY CHERIAN and EMILIA ABRAHAM (T)**  
Enzymatic bioremediation of cashew nut shell liquid contamination  
*Journal of Hazardous Materials*  
**176(1-3):1097-1100; 15 Apr 2010**



- 151 SOUMYA (R S) and EMILIA ABRAHAM (T)**  
Isolation of beta-mannanase from *Cocos nucifera* linn haustorium and its application in the depolymerization of beta-(1, 4)-linked D-mannans  
*International Journal of Food Sciences and Nutrition*  
**61(3):272-281; May 2010**
- 152 SOUMYA (R S), GHOSH (S K) and EMILIA ABRAHAM (T)**  
Preparation and characterization of guar gum nanoparticles  
*International Journal of Biological Macromolecules*  
**46(2):267-269; 01 Mar 2010**
- 153 SREEJA (T), JISHA (B), BABUKUTTANNAIR (A), SREEMATHI (V) and LUXMI VARMA (R)**  
Direct access to upper rim substituted mono- and diaryloxy calix[4] arenes via bis (spirodienone) route  
*Tetrahedron*  
**66(27-28):5270-5276; 03 Jul 2010**
- 154 SRINIVASAN (A), PILLAI (U T S) and PAI (B C)**  
Effects of elemental additions (Si and Sb) on the ageing behavior of AZ91 magnesium alloy  
*Materials Science and Engineering A: Structural Materials, Properties, Microstructure and Processing*  
**527(24-25):6543-6550; 25 Sep 2010**
- 155 SRINIVASAN (A), SWAMINATHAN (J), GUNJAN (M K), PILLAI (U T S) and PAI (B C)**  
Effect of intermetallic phases on the creep behavior of AZ91 magnesium alloy  
*Materials Science and Engineering A: Structural Materials Properties Microstructure and Processing*  
**527(6):1395-1403; 15 Mar 2010**
- 156 STERNBERG (M), SURESH (C H) and MOHR (F)**  
2-Thia-1, 3, 5-triaza-7-phosphaadamantane-2, 2-dioxide revisited: Computational and experimental studies of a neglected phosphine  
*Organometallics*  
**29(17):3922-3929; 13 Sep 2010**
- 157 SUBHA (K), SAVITHRI (S) and PRAKASH (V S)**  
Stability and vibration analyses of symmetric crossply laminates based on higher order theories  
*Advances in Vibration Engineering*  
**9(4):297-309; Oct-Dec 2010**
- 158 SUDHA (J D), SIVAKALA (S), PATEL (K) and NAIR (P R)**  
Development of electromagnetic shielding materials from the conductive blends of polystyrene polyaniline-clay nanocomposite  
*Composites Part A- Applied Science and Manufacturing*  
**41(11):1647-1652; Nov 2010**
- 159 SUMESH GEORGE and SEBASTIAN (M T)**  
Microwave dielectric properties of novel temperature stable high Q  $\text{Li}_2\text{Mg}_{1-x}\text{Zn}_x\text{Ti}_3\text{O}_8$  and  $\text{Li}_2\text{A}_{1-x}\text{Ca}_x\text{Ti}_3\text{O}_8$  (A=Mg,Zn) ceramics  
*Journal of the European Ceramic Society*  
**30(12):2585-2592; Sep 2010**



- 160 SUMESH GEORGE, ANJANA (P S), SEBASTIAN (M T), KRUPKA (J), UMA (S) and PHILIP (J)**  
Dielectric, mechanical, and thermal properties of low-permittivity polymer-ceramic composites for microelectronic applications  
*International Journal of Applied Ceramic Technology*  
**7(4):461-474; 2010**
- 161 SUMESH GEORGE, DEEPU (V N), MOHANAN (P) and SEBASTIAN (M T)**  
Influence of  $\text{Ca}[(\text{Li}_{1/3}\text{Nb}_{2/3})_{0.8}\text{Ti}_{0.2}] \text{O}_{3-\delta}$  filler on the microwave dielectric properties of polyethylene and polystyrene for microelectronic applications  
*Polymer Engineering and Science*  
**50(3):570-576; Mar 2010**
- 162 SUMI (S), PRABHAKAR RAO (P), DEEPA (M) and PETER KOSHY**  
Electrical conductivity and impedance spectroscopy studies of cerium based aeschynite type semiconducting oxides:  $\text{CeTiMO}_6$  (M=Nb or Ta)  
*Journal of Applied Physics*  
**108(6): Article No.063718; 15 Sep 2010**
- 163 SUNDARARAJAN (M) and HARIKRISHNA BHAT (K) and VELUSAMY (S)**  
Investigation on mineralogical and chemical characterization of Ilmenite deposits of Northern Kerala Coast, India  
*World Applied Sciences Journal* **9(3):333-337; 2010**
- 164 SUNDARARAJAN (M) and HARIKRISHNA BHAT (K), VELUSAMY (S), JANAKI (M E K) and SASIBHOOSHANAN (S)**  
Investigation of physical and chemical characterization of Indian Sillimanite and preparation of aluminium-silicon master alloy  
*World Applied Sciences Journal*  
**8(11):1394-1397; 2010**
- 165 SUNDARARAJAN (M) and USHA (N)**  
Geochemistry of core sediments from Mullipallam creek, South East coast of India  
*Environmental Earth Sciences*  
**61(5):947-961; Sep 2010**
- 166 SUNDARARAJAN (M) and USHA (N)**  
Environmental significance in recent sediments along Bay of Bengal and Palk Strait, East Coast of India: A geochemical approach  
*International Journal of Environmental Research*  
**4(1):99-120; Win 2010**
- 167 SUNDARARAJAN (M) and USHA (N)**  
Geochemistry of elements in core sediments near point claimere, the Southeast Coast of India  
*International Journal of Environmental Research*  
**4(3):379-394; Sum 2010**
- 168 SUNDARARAJAN (M) and SRINIVASALU (S)**  
Geochemistry of core sediments from Gulf of Mannar, India  
*International Journal of Environmental Research*  
**4(4):861-876; Aut 2010**



- 169 SUNDARARAJAN (M) and USHA (N)**  
Sedimentary processes and mineral dispersion along point calimere, southeast coast of India  
*World Applied Sciences Journal*  
**9(5):514-520; 2010**
- 170 SUNEESH (C V) and GOPIDAS (K R)**  
Long-lived photoinduced charge separation due to the inverted region effect in 1,6-Bis(phenylethynyl)pyrene-phenothiazine dyad  
*Journal of Physical Chemistry C*  
**114(43):18725-18734; 04 Nov 2010**
- 171 SUNEESH (C V), VINAYAK (M V) and GOPIDAS (K R)**  
Photoinduced charge separation in two Bis(phenylethynyl) anthracene-based Triads: Inverted region effect vs distance effect on back electron transfer.  
*Journal of Physical Chemistry C*  
**114(43):18735-18744; 04 Nov 2010**
- 172 SURESH (C H) and FRENKING (G)**  
Direct 1-3 Metal-Carbon bonding and planar tetraordinated Carbon in Group 6 Metallocyclobutadienes  
*Organometallics*  
**29(21):4766-4769; 08 Nov 2010**
- 173 SURESH DAS, VARGHESE (S) and KUMAR (N S S)**  
Butadiene-based photoresponsive soft materials  
*Langmuir*  
**26(3):1598-1609; 02 Feb 2010**
- 174 SYDNEY (E B), STURM (W), de CARVALHO (J C), THOMAZ-SOCCOL (V), LARROCHE (C), PANDEY (A) and SOCCOL (C R)**  
Potential carbon dioxide fixation by industrially important microalgae  
*Bioresource Technology*  
**101(15):5892-5896; Aug 2010**
- 175 TAZAWA (T), YAGAI (S), KIKKAWA (Y), KARATSU (T), KITAMURA (A) and AJAYAGHOSH (A)**  
A complementary guest induced morphology transition in a two-component multiple H-bonding self-assembly  
*Chemical Communications*  
**46(7):1076-1078; 2010**
- 176 THAZHE (L), ANAS (S), SHUKLA (S), RESHMI (C P), MANOJ RAAMA VARMA, SURESH (K G), PATIL (K) and WARRIER (K G K)**  
Magnetic dye-adsorbent catalyst: Processing, characterization, and application  
*Journal of the American Ceramic Society*  
**93(11):3642-3650; Nov 2010**
- 177 UBIC (R), LETOURNEAU (S), SHERIN THOMAS, SUBODH (G) and SEBASTIAN (M T)**  
Structure, microstructure, and microwave dielectric properties of (Sr<sub>2-x</sub>Cax) (MgTe)O<sub>6</sub> double perovskites  
*Chemistry of Materials*  
**22(16):4572-4578; 24 Aug 2010**





- 178 VARGHESE (J), JOSEPH (T), SEBASTIAN (M T), REEVES-McLAREN (N) and FETEIRA (A)**  
Crystal structure and microwave dielectric properties of LaLuO<sub>3</sub> ceramics  
*Journal of the American Ceramic Society*  
**93(10):2960-2963; Oct 2010**
- 179 VARGHESE (N), VINOD (K), CHATTOPADHYAY (M K), ROY (S B) and SYAMAPRASAD (U)**  
Effect of combined addition of nano-SiC and nano Ho<sub>2</sub>O<sub>3</sub> on the in-field critical current density of MgB<sub>2</sub> superconductor  
*Journal of Applied Physics*  
**107(1): Article No.013907 (5pp); 01 Jan 2010**
- 180 VARGHESE (N), VINOD (K), SHIPRA, SUNDARESAN (A) and SYAMAPRASAD (U)**  
Burned rice husk: An effective additive for enhancing the electromagnetic properties of MgB<sub>2</sub> superconductor  
*Journal of the American Ceramic Society*  
**93(3):732-736; Mar 2010**
- 181 VENUGOPAL (V), ANJANA (P S), PRAKASH (O), KUMAR (D) and SEBASTIAN (M T)**  
Synthesis, characterization, and microwave dielectric properties of Sr<sub>2-x</sub>La<sub>2</sub>Mg<sub>1+x</sub>W<sub>2</sub>O<sub>12</sub> (x=0, 1) ceramics  
*Journal of the American Ceramic Society*  
**93(9):2467-2469; Sep 2010**
- 182 VIJAY NAIR (G), PAUL (R R) and SURESH (E)**  
Reaction of Diaryl-1, 2-diones with Homophthalic Anhydride: Efficient formation of Isobenzofuranone derivatives  
*Synthesis-Stuttgart*  
**(21):3741-3744; Nov 2010**
- 183 VIJAY NAIR (G), SREEKUMAR (V), BABU (B P), VARGHESE (V), PAUL (R R) and SURESH (E)**  
NHC-catalysed annulation of enals to tethered dienones: Efficient synthesis of bicyclic dienes  
*Organic & Biomolecular Chemistry*  
**8(21):4861-4866; 2010**
- 184 VIJAY NAIR (G), VARGHESE (V), BABU (B P), SINU (C R) and SURESH (E)**  
A novel pseudo four component reaction involving homoenolate for the synthesis of gamma-aminobutyric acid (GABA) derivatives  
*Organic & Biomolecular Chemistry*  
**8(4):761-764; 2010**
- 185 VIJAY NAIR (G), VARGHESE (V), PAUL (R R), ANU (J), SINU (C R) and RAJEEV S MENON**  
NHC catalyzed transformation of aromatic aldehydes to acids by Carbon Dioxide: An unexpected reaction  
*Organic Letters*  
**12(11):2653-2655; 04 Jun 2010**
- 186 VIJAYALAKSHMI (K P) and SURESH (C H)**  
Pictorial representation and validation of Clar's aromatic sextet theory using molecular electrostatic potentials  
*New Journal of Chemistry*  
**34(10):2132-2138; 2010**



- 187 VIJAYALEKSHMI (V), GEORGE (K E) and PAVITHRAN (C)**  
Studies on maleated natural rubber/organoclay nanocomposites  
*Progress in Rubber Plastics and Recycling Technology*  
**26(4):183-197; 2010**
- 188 VINOD (K) and SYAMAPRASAD (U)**  
Studies on development of MgB<sub>2</sub> superconductor with improved in-field critical current density  
*Advanced Materials Research*  
**117:63-68; 2010**
- 189 VINOD (K), VARGHESE (N), RAHUL (S), DEVADAS (K M), THOMAS (S), GURUSAMY (P), KEDIA (S), PRADHAN (S) and SYAMAPRASAD (U)**  
On the current transfer length and current sharing in short length MgB<sub>2</sub> wires  
*Superconductor Science & Technology*  
**23(10): Article No.105002 Oct 2010**
- 190 VINOD (K), VARGHESE (N), SUNDARESAN (A) and SYAMAPRASAD (U)**  
Highly enhanced in-field critical current density of MgB<sub>2</sub> superconductor by combined addition of burned rice husk and nano Ho<sub>2</sub>O<sub>3</sub>  
*Solid State Sciences*  
**12(4):610-616; Apr 2010**
- 191 VINU (S), SARUN (P M), SHABNA (R), ASWATHY (P M), ANOOJA (J B) and SYAMAPRASAD (U)**  
Suppression of flux-creep in (Bi,Pb)-2212 superconductor by holmium doping  
*Physica B: Condensed Matter*  
**405(20):4355-4359; 15 Oct 2010**
- 192 VINU (S), SARUN (P M), SHABNA (R), BIJU (A) and SYAMAPRASAD (U)**  
Microstructure and transport properties of Bi<sub>1.6</sub>Pb<sub>0.5</sub>Sr<sub>2-x</sub>LuxCa<sub>1.1</sub>Cu<sub>2.1</sub>O<sub>8+δ</sub> superconductor  
*Materials Chemistry and Physics*  
**119(1-2):135-139; 15 Jan 2010**
- 193 VISHNU (V S) and REDDY (M L P)**  
Near infrared reflecting yellow inorganic pigments based on Molybdenum-doped Yttrium Cerate: Synthesis, characterization, and optical properties  
*Chemistry Letters*  
**39(8):820-821; 05 Aug 2010**
- 194 VISHNU (V S), GEORGE (G) and REDDY (M L P)**  
Effect of Molybdenum and praseodymium dopants on the optical properties of Sm<sub>2</sub>Ce<sub>2</sub>O<sub>7</sub>: Tuning of band gaps to realize various color hues  
*Dyes and Pigments*  
**85(3):117-123; May 2010**
- 195 VISWAMBHARAN (B), SELVAKUMAR (K), SUCHITHRA (M) and SHANMUGAM (P)**  
Pyridine core activation via 1,5-electrocyclization of vinyl pyridinium ylides generated from Bromo isomerized Morita-Baylis-Hillman adduct of isatin and pyridine: Synthesis of 3-spirodihydroindolizine oxindoles.  
*Organic Letters*  
**12(9):2108-2111; 07 May 2010**



- 196 YAGAI (S), AONUMA (H), KIKKAWA (Y), KUBOTA (S), KARATSU (T), KITAMURA (A), MAHESH (S) and AJAYAGHOSH (A)**  
Rational design of nanofibers and nanorings through complementary Hydrogen-Bonding interactions of functional  $\pi$  systems  
*Chemistry - A European Journal*  
**16(29):8652-8661; 2010**
- 197 YAHAYA (L E), ADEBOWALE (K O), MENON (A R R), RUGMINI (S), OLU-OWOLABI (B I) and CHAMESWARY (J)**  
Natural rubber/organoclay nanocomposites: Effect of filler dosage on the physicochemical properties of vulcanizates  
*African Journal of Pure and Applied Chemistry*  
**4(9):198-205; Oct 2010**



## GENERAL INFORMATION सामान्य जानकारी

### VISITS ABROAD

Name	Country Visited	From	To	Purpose
Dr. C.H .Suresh	Germany	1.10.2009	30.9.2010	Marburg University. Germany
Dr. Ashok Pandey	Greece	19.4.2010	19.4.2010	To deliver a lecture in the international workshop at University of Patras "Novel technologies in New Research Areas of food production" on April 19 <sup>th</sup>
	France	1.6.2010	30.6.2010	To visit Blaise Pascal University for research under UBP Fellowship
	Australia	26.9.2010	29.10.2010	Key note lecture in the international conference on Challenges in Environmental Science and Engineering (CESE 2010)
	Brazil	5.10.2010	8.10.2010	To attend the international Conference on ICBF-2010
	Taiwan	17.11.2010	20.11.2010	Key note lecture in the 2010 Asian Bio Hydrogen Symposium and APEC advanced Bio hydrogen Technology Conference at Feng Chia University, Taichung, Taiwan
	Switzerland	6.12.2010	24.12.2010	Academic Guest at Energy system Laboratory at the Federal polytechnic school of Lausanne, Switzerland
	Dr. Ajayghosh	Seoul	25.4.2010	30.4.2010
Poland		15.6.2010	20.6.2010	To deliver a talk in Yonsel University
Kyoto, Japan & NIMS Japan		4.7.2010	13.7.2010	To participate in the International Conference on science and technology of Synthetic Metals (ICSM 2010) and to visit NIMS Japan for scientific discussions
France		14.9.2010	17.9.2010	Indo French seminar on Organic synthesis (IFCOS 2010)
Australia		7.11.2010	11.11.2010	Invited talks at School of Chemistry, Canberra, Australia & Research school of chemistry, Canberra, Australia
Dr.M.L.P.Reddy	Korea	3.6.2010	5.6.2010	Invited talk in ICFPM 2010
	Mexico	3.10.2010	10.10.2010	To attend the international Conference on LUMIPHON 2010



Dr.A.Sreenivasan	Germany	3.7.2010	30.6.2012	To visit GKSS research center Geesthacht, Germany for research under Humboldt Fellowship.
Dr. U.T.S.Pillai	Japan	1.9.2010	9.9.2010	To participate in International symposium on explosion shock wave and high energy reaction phenomena 2010, Seoul national University & also to visit Kumamoto University, Kumamoto Japan
Dr.M.Anbu	USA	12.9.2010	17.9.2010	International symposium on halogenated persistent organic pollutants (DIOXIN 2010) San Antonio, Texas, USA
	USA	20.11.2010	18.12.2010	Training programme sponsored by UNIDO at the Department of Health, Wadwarth center, Albany, New York
Dr. Roschen Sasikumar	USA	4.10.2010	31.10.2010	In connection with Sponsored project of GM research center, Warren, USA
Dr.Suresh Das	Singapore	16.10.2010	21.10. 2010	Invited talk at Department of Chemistry, National University, Singapore
Dr.S.Ananthakumar	Italy	23.10.2010	15.12.2010	Institute of Membrane Technology, University of Calabria, Italy Bilateral S&T cooperation between CSIR (India) and CNR (Italy)
Dr. Nisha .P	Ireland	10.11.2010	12.11.2010	Poster Presentation in EFFOST 2010 at Dublin Ireland
Dr.K.Madhavan Nampoothiri	Germany	21.11.2010	6.12.2010	Under Indo German Project with University of Bielefeld, Germany
Dr. D. Ramaiah	Germany	1.3.2011	30.3.2011	To do research work under DST-DAAD Collaborative Program at University of Mainz, Germany



## HONOURS AND AWARDS

Dr. Suresh Das	Fellow of Indian National Science Academy
Dr.M.Sundararajan	Fellow of Geological Society of India
Dr.K.R.Gopidas	Fellow of Indian Academy of Science
Dr.V.B.Manilal	International Award for NIIST (WIPO)
S.Srinivasan	Best Paper Award in 22 <sup>nd</sup> Kerala Science Congress

## PH.D.DEGREE AWARDED

Student	Thesis Title	Supervisor	University
Sreejith. S	Design, Synthesis and Study of a few Donor –Acceptor-Donor(D-A-D) molecules as molecular probes and logic gates	Dr.A.Ajayaghosh	Kerala
Jobi John	Functionalized cyclopentenes via desymmetrization of mesobicyclic hydrazines	Dr.K.V.Radhakrishnan	Kerala
Dhanya Gangadharan	Microbial production of alpha amylase	Dr.K.Madhavan Nampoothiri	Kerala
Ranjith. A	Phytochemical investigation on sea buckthorn (Hippophae rhamnoides) berries	Dr.C.Arumughan	CUSAT
Suneesh. C. V	Phenylethynlarene based donor-acceptor systems: Design, synthesis and photophysical studies	Dr. K. R. Gopidas	Kerala
Swetha Sivaramakrishnan	Biosynthesis of fungal alpha amylase in solid cultures	Dr.Ashok pandey	Kerala
Rekha Rachel Avirah	Synthesis and study of photophysical and metal ion binding properties of a few novel semisquaraine and croconaine dyes	Dr. D. Ramaiah	CUSAT
Sreenath. K	Electron transfer reaction between selected aromatic amines and Cu 2+ in acetonitrile; Kinetic, spectroscopic and mechanistic investigations	Dr. K. R. Gopidas	Kerala
Jayasankar. M	Sol-Gel alumina nano composites for functional applications	Dr.K.G.K. Warriar	CUSAT
Balasubramani. M	Studies on grain refinement and alloying additions on the microstructure and mechanical properties of Mg <sub>8</sub> Zn <sub>4</sub> Al alloy	Dr.U.T.S.Pillai	CUSAT
Sarun. P.M	Studies on development of novel rare earth doped (Bi,Pb)-2212 superconductors with enhanced properties	Dr. U. Syamaprasad	CUSAT



## MEMBERS OF THE RESEARCH COUNCIL

### CHAIRMAN

**Dr. Dipankar Banerjee**

Chief Controller R&D (AMS) & D.S  
Room No.301, DRDO Bhawan  
Defence Research Development Organisation, New Delhi-110 011

### MEMBERS

**Shri.S. Vasudevan**

Professor  
IPC Department, Indian Institute of Science  
Bengaluru-560 012

**Prof.M.K.Mathew**

Dept. of Biochemistry, Biophysics & Bioinformatics  
National Centre for Biological Sciences  
Tata Institute of Fundamental Research  
GKVK, Bellary Road, Bengaluru-560 065

**Prof.Y.N. Mohapatra**

Department of Physics  
Indian Institute of Technology, Kanpur  
Kanpur-208 016

**Dr.L.S. Shashidhara**

Indian Institute of Science Education and Research  
Professor and Coordinator- Biology  
First Floor, Central Tower, Sai Trinity Building  
Garware Circle, Sultarwadi, Pashan, Pune-411 021

**Prof. A .Bhattacharya**

Professor  
School of Life Sciences  
Jawaharlal Nehru University, New Delhi-110 067

**Dr.M. Sastry**

Chief Scientific Officer  
Tata Chemicals Innovation Centre  
Anmol Pride, Pune-411 045

**Dr.M.R.Pillai**

Director  
Rajiv Gandhi Centre for Biotechnology  
Jagathy, Trivandrum-695 014



**AGENCY REPRESENTATIVE**

**Dr.Arvind Duggal**

Adviser  
Department of Biotechnology  
Block No.2, 7thFloor, CGO Complex, Lodi Road  
New Delhi-110 003

**DG NOMINEE**

**Dr.Vijayamohanan**

Physical & Material Chemistry Division  
NCL, Pune

**SISTER LABORATORY**

**Dr.Pushpito.K.Ghosh**

Director  
Central Salt & Marine Chemicals Research Institute  
Gijubhai Badheka Marg, Bhavnagar-364 002

**CLUSTER DIRECTOR**

**Dr.M.O.GARG**

Director  
Indian Institute of Petroleum (IIP)  
P.O.IIP, Mohkampur, Dehradun-248 005

**DIRECTOR**

**Dr.Suresh Das**

Director  
National Institute for Interdisciplinary Science & Technology  
Thiruvananthapuram-695 019

**PERMANENT INVITEE**

**Head or His Nominee**

Planning & Performance Division (PPD)  
Council of Scientific & Industrial Research  
Anusandhan Bhawan, 2, Rafi Marg, New Delhi-110 001

**SECRETARY**

**Dr.A.Sundaresan**

Head  
Agro Processing & Natural Products Division  
National Institute for Interdisciplinary Science & Technology  
Thiruvananthapuram-695 019





## MEMBERS OF THE MANAGEMENT COUNCIL (Period 01/01/2010 to 31/12/2011)

### CHAIRMAN

Director, NIIST

### MEMBERS

Dr. K.R. Gopidas, Scientist, NIIST

Dr. A. Ajayaghosh, Scientist, NIIST

Dr. Elizabeth Jacob, Scientist, NIIST

Dr. K.V. Radhakrishnan, Scientist, NIIST

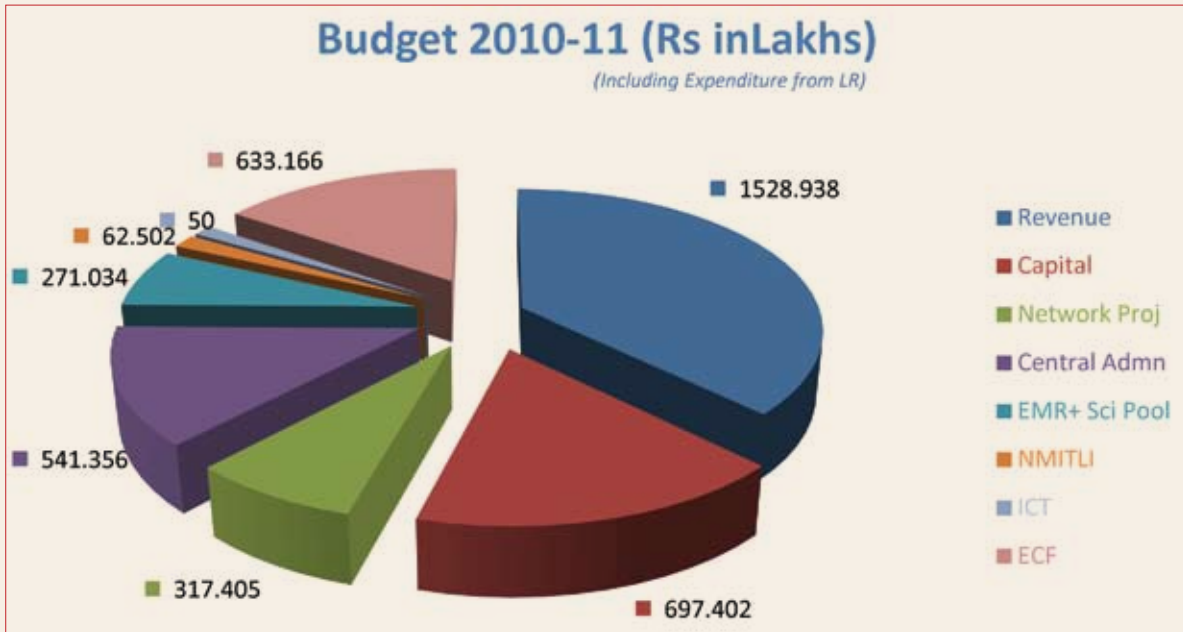
Dr. Nagesh R. Iyer, Director, SERC, Chennai

Head, RPBD, NIIST

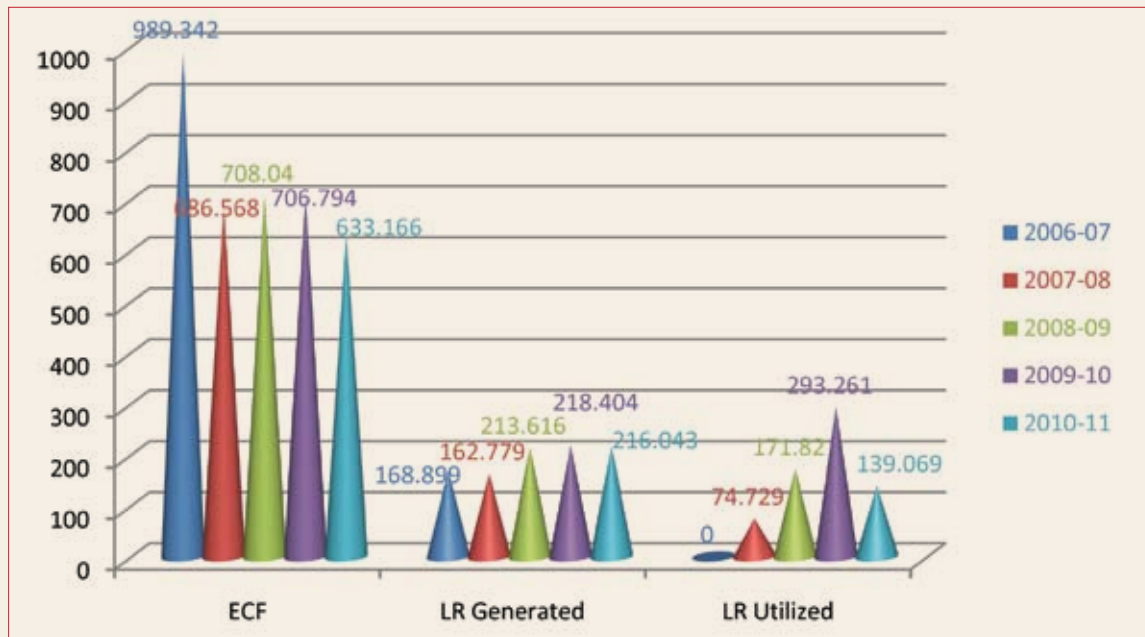
COFA/F&AO, NIIST

### MEMBER SECRETARY

COA/AO, NIIST



### External Cash Flow & Lab Reserve (Rs in Lakhs)





## STAFF LIST as on 31-03-2011

### Director's Office

Dr Suresh Das	Director
Mr S Sureshkumar	Scientist G
Mrs Sarada Nair	Private Sec
Mr B Ajayakumar	Tech Gr 2-3
Mr A Krishnankutty	Tech Gr 1-4
Mr P B Vijayakumar	Tech Gr 1-4

### R&D DIVISIONS

#### AGROPROCESSING & NATURAL PRODUCTS DIVISION

Dr A Sundaresan	Scientist G (Head)
Mr M M Sreekumar	Scientist G
Mrs B Sankarikutty Amma	Scientist F
Dr C Balachandran	Scientist F
Mr Thomas Samuel	Scientist F
Mrs A Nirmala Menon	Scientist EII
Mrs Omanakutty Amma	Scientist E II
Mr V V Venugopalan	Scientist E I
Dr (Mrs) K P Padmakumari Amma	Scientist EI
Dr K G Raghu	Scientist EI
Mrs M V Reshma	Scientist C
Dr (Mrs) P Nisha	Scientist B
Mr P Jayamurthy	Scientist B
Mr R Babu	Prin Tech Off
Dr (Mrs) Beena Joy	Sr Tech Off-3
Mrs L Prasanna Kumari	Sr Tech Off-2
Mr D R Soban Kumar	Tech Off
Mr P V Thampy	Tech Gr 2-4
Mr R Sukumaran	Tech Gr 1-4
Mrs Annamma Mathew	Sr Steno(ACP)

#### BIOTECHNOLOGY DIVISION

Dr Ashok Pandey	Scientist G (Head)
Dr (Mrs) P Prema	Scientist F (Voluntary Retired 02/08/2010)
Dr K Madhavan Nampoothiri	Scientist EII
Dr Rajeevkumar Sukumaran	Scientist C
Dr (Mrs) B Vijayalakshmi Amma	Prin Tech Off (Retired 28/02/2011)
Mr P N Sivankutty Nair	Tech Gr 2-4
Mr K M Prakash	Tech Gr 2-3



## CHEMICAL SCIENCES & TECHNOLOGY DIVISION

Dr Ajayaghosh	Scientist H
Dr D Ramaiah	Scientist G (Head)
Dr T Prasada Rao	Scientist G
Dr M Lakshmipathy Reddy	Scientist G
Dr (Mrs) T Emilia Abraham	Scientist G (Retired 30/04/2010)
Dr (Mrs) Mangalam S Nair	Scientist F
Dr (Mrs) A Jayalakshmi	Scientist F
Dr K R Gopidas	Scientist F
Dr K George Thomas	Scientist F (On Lien From 17/05/2010)
Dr (Mrs) R Luxmi Varma	Scientist F
Dr K V Radhakrishnan	Scientist E I
Mr Chandrakanth C K	Scientist E I
Dr (Mrs) J D Sudha	Sr Tech Off-3
Mrs S Viji	Tech Off
Miss Saumini Mathew	Tech Asst
Mr Robert Phillip	Tech Asst

## MATERIALS DIVISION

Dr K G K Warrior	Scientist G (Head)
Dr M T Sebastian	Scientist G
Dr U Syamaprasad	Scientist G
Dr Peter Koshy	Scientist G (Retired 30/04/2010)
Dr A R R Menon	Scientist F
Mr M C Shaji	Scientist F
Dr P Prabhakar Rao	Scientist F
Mr K Harikrishna Bhat	Scientist F
Dr Jose James	Scientist F
Dr U T S Pillai	Scientist F
Mr K Sukumaran	Scientist F (Retired 31/12/2010)
Mr Swapan Kumar Ghosh	Scientist E II
Dr Manoj Raama Varma	Scientist E II
Dr M Ravi	Scientist E II
Dr S Ananthakumar	Scientist E II
Dr T P D Rajan	Scientist E I
Dr M Sundararajan	Scientist C
Dr S V Shukla	Scientist C
Dr A Srinivasan	Scientist C
Dr S Velusamy	Prin Tech Off
Dr V S Prasad	Sr Tech Off-3



Mr K K Ravikumar	Sr Tech Off-3
Mr M Brahma Kumar	Sr Tech Off-3
Mr P Perumal	Sr Tech Off-2
Mr P Gurusami	Sr Tech Off-2
Mr M R Chandran	Sr Tech Off-1
Mr Peer Mohamed A	Tech Off
Mr S Sasibhushanan	Tech Gr 2-4
Mr T Soman	Tech Gr 2-4
Mr V Antony	Tech Gr 2-3
Mr V Sreekantan	Tech Gr 1-4

### PROCESS ENGINEERING & ENVIRONMENTAL TECHNOLOGY DIVISION

Dr P Raghavan	Scientist G (Head)
Dr (Mrs) Roschen Sasikumar	Scientist G
Mr Ajit Haridas	Scientist F
Mrs Elizabeth Jacob	Scientist F
Dr (Mrs) S Savithri	Scientist F
Dr (Mrs) Rugmini Sukumar	Scientist EII
Dr V B Manilal	Scientist EII
Dr M Anbu	Scientist EII
Mr J Ansari	Scientist EII
Dr C H Suresh	Scientist E I
Mr Abdul Haleem B	Scientist C
Dr B Krishnakumar	Scientist C
Mrs Vijaya Prasad	Sr Tech Off-2
Mr V K Shajikumar	Tech Off
Mr Karoona Shanker Raot	Tech Off
Dr S Ramaswamy	Tech Off
Mr T P Paulose	Tech Gr 2-4
Mr T R Suresh Kumar	Tech Gr 2-3

### S&T SERVICES DIVISIONS

#### CIVIL ENGINEERING & ESTATE MANAGEMENT DIVISION

Mr V P Thomas	Scientist F (Head)
Mr P J Varghese	Sr Super Engr
Mr R Rajeev	Sup Engg
Mr K V Oonnikrishnan	EE
Mr G Chandra Babu	AEE (Civil)
Mr K Prasad	Asst Engr
Mr B Karthik	Jr Engr (Civil)



Mr P Arumugam	Jr Engr (Civil)
Mr M Jayadeep	Tech Gr 2-2
Mr K S Pramod	Tech Gr 2-1
Mr K Suresh Kannan	Tech Gr 2-1
Mr U Dharanipathy	Tech Gr 2-1
Mr B Vikraman	Tech Gr 1-4
Mr C P Narayanan	Tech Gr 1-4
Mr T V Satheesh	Gr C Non-Tech

### KNOWLEDGE RESOURCE CENTRE

Mrs Santosh Babu	Scientist Eii (Head)
Mr V Moni	Scientist B
Mrs S Mini	Sr Tech Off-3
Mr M Ramasamy Pillai	Sr Tech Off-3
Mr G Sudhakaran	Tech Gr 2-4
Mr G Nagasrinivasu	Tech Gr 2-3
Mrs T S Latha	Ast(G)Gr II
Mr Pushpakumar K R Nair	Gr D Non-Tech
Mrs P Savithri	Gr D Non-Tech (Retired 31/05/2011)

### MECHANICAL ENGINEERING SECTION

Mr N J Jacob	Tech Gr 2-4
Mr N Sudhilal	Tech Gr 2-4
Mr S Haridasan Pillai	Tech Gr 2-4
Mr P M Raghavan	Tech Gr 2-4
Mr P Soman	Tech Gr 1-4
Mr T T Rajappan Nair	Gr D Non-Tech

### R&D PLANNING & BUSINESS DEVELOPMENT DIVISION

Dr V G Mohanan Nair	Scientist F (Head)
Dr C Chandrasekara Bhat	Scientist F
Mr D Bheemeswar	Scientist EII
Mr R S Praveen Raj	Scientist C
Dr M Sankaranarayanan	Sr Tech Off-3
Mrs V J Sarojakumari	Sr Steno(ACP)
Mr G Sadasivan	Tech Gr 1-4 (Retired 31/05/2010)
Mr K C Chacko	Gr D Non-Tech



## ADMINISTRATION

Mr N S Raju	AO
Mrs S Sobhana	SO
Mr K F Joseph	SO (G)
Mrs K S Lathidevi	Hindi Officer
Mr T J Babu	Secu Officer
Mr D Jayaprasad	Ast(G)Gr II(ACP)
Mrs Jyothi R Thampi	Ast(G)Gr II
Mr G Ramabhadran	Ast(G)Gr II
Mrs Mercy Joseph	Ast(G)Gr II
Mrs Susan Mathew	Ast(G)Gr II
Mrs K Saraswathy	Ast(G)Gr II(ACP)
Mr R K Ramesh Kumar	Ast(G)Gr II
Mrs Parvathi Rajeevan	Assistant
Mr M K Sivadasan	Ast(G)Gr I
Mrs Sisily Poulouse	Ast(G)Gr I
Mr V Mohanan Nair	Ast(G)Gr I
Mr S Sasi Kumar	Ast(G)Gr I (Retired 30/6/2010)
Mr G K Nair	Sr Steno(ACP)
Mrs Elizabeth Thomas	Sr Steno(ACP)
Mrs Sreeletha Nair	Sr Steno(ACP)
Mr B Venugopal	Tech Gr 2-4
Mr P Surendran	Tech Gr 2-4
Mr M Thomas	Tech Gr 2-4 (Voluntary Retired 31/7/2010)
Mr Praveen Kannal	Tech Gr 2-2
Mr B Radhakrishnan	Tech Gr 2-1
Mr M P Varkey	Tech Gr 1-4
Mrs M Geetha	Tech Gr 1-3
Mr K Madhu	Bearer(ACP)
Mr Sasidharan	Bearer(ACP)
Mr A Sreekumaran	Washboy(ACP)
Mrs S Leela Devi Amma	Gr D Non-Tech
Mr K Unnikrishnan	Gr D Non-Tech
Mr B Satheesh Kumar	Gr D Non-Tech

## FINANCE & ACCOUNTS

Mr T V Sankaran	COFA
Mrs P V Viji	SO(F&A)
Mr A V Thomas	SO(F&A) (Retired 31/05/2011)
Mr C Sivakumaran	Ast(G)Gr II
Mrs Komala Soman	Ast(F&A)Gr II



Mr Sanjeev Sadananthan	Assistant Gr II
Mr K G Pillai	Ast(F&A)Gr I
Mrs Remani Devaraj	Ast(F&A)Gr I
Mrs G Geetha	Ast(F&A)Gr I
Mr S Raju	Sr Steno (ACP)
Mr P Parameswaran Pillai	Gr C Non-Tech
Mrs R Remadevi	Record Keeper

### STORES & PURCHASE

Mr M R Devasis	SPO
Mr Sanjay Suman	Sec Officer
Mr M Anilkumar	Ast(S&P)Gr II
Mr V K Jithesh	Ast(S&P)Gr II
Mr C M Krishnadas	Ast(S&P)Gr I
Mr K Satheesan Nair	Ast(S&P)Gr I
Mr K D Sasidharan	Ast(G)Gr I
Mrs Mariamma Samuel	Sr Steno (ACP) (Retired 31/05/2010)
Mrs L Latha	Tech Gr 2-4
Mr T K Ghosh	Gr C Non-Tech
Mr T K Gopi	Gr D Non-Tech
Mr G Bhakthavalsalam	Gr D Non-Tech





## INSPIRE INTERNSHIP SCIENCE CAMP -2010

The Institute organised a week long INSPIRE Internship Science Camp from September 20-24, 2010. INSPIRE programme is launched by the Department of Science and Technology (DST), Government of India to strengthen the National Science and Technology base by attracting young talents to science. About 200 students with high academic records in their 10th Class streams from State SSLC, CBSE and ICSE and pursuing plus one and plus two in science stream from various schools in Kerala were selected for the above camp.

Dr. B.N. Suresh, Director, Indian Institute for Space Science and Technology (IIST), Trivandrum inaugurated the Camp and delivered the inaugural address. In his address, Dr. Suresh highlighted the original contributions made by ancient India such as decimal systems, zero, metallurgy and astronomy. He also recalled the contributions made by visionaries like Pandit Jawaharlal Nehru in the post independent era in establishing and nurturing a number of S&T institutions and public sector enterprises. He emphasized the immense potential of three T's namely IT (Information Technology), BT (Biotechnology) and NT (nanotechnology) in the future S&T development of the country.

Dr. Suresh Das, Director, NIIST, CSIR delivered the presidential address and mentioned that by 2030, India will outstrip USA, Japan and Germany to become second largest economy in the World next to China. In order to make this into a reality, India has to make major strides in the field of science and technology; for it is well known that every leading nation in the history of mankind has been a leader in science and technology.



*Dr. B.N.Suresh delivering the inaugural address*

The science camp comprised of interactive technical lectures and experimental demonstrations by reputed scientists and academicians to get awareness and inspiration on doing science, laboratory visits and scientific demonstrations to feel the thrill of scientific experiments and research, outdoor visit to other S&T organizations, Science Quiz, video screening of major scientific discoveries and innovations and distribution of educational tools. The valedictory address on September 24, 2010 was delivered by Prof . A. Jayakrishnan, Vice Chancellor, University of Kerala.



## CSIR FOUNDATION DAY CELEBRATIONS

CSIR Foundation Day was celebrated at NIIST on 26th September 2010 to commemorate the foundation of CSIR. The celebration comprised of open day in the forenoon followed by Foundation Day Lecture delivered by Shri.T. Balakrishnan, IAS, Addl. Chief Secretary, Industries and Commerce, Govt. of Kerala. The open day was observed from 9.30 hrs to 13.00 hrs. About 350 students from different colleges and universities have visited the Laboratory. With a brief introduction about CSIR in general and major R & D activities being pursued at NIIST, a video show on the major contribution of CSIR to the society was arranged for the students. Students later visited various laboratories. Shri.Balakrishnan while acknowledging the S&T contributions of CSIR in general and CSIR-NIIST in particular emphasized the need of close interaction between the R&D Institute and industries where innovation is the key for success. He also urged the scientific community to take up challenges of developing many useful gadgets for the mankind in order to improve their life style.



The staff members who have completed 25 years of service in CSIR were felicitated with memento. The chief guest also felicitated the staff members who have retired during the preceding year from the services of CSIR. Cash prize for the children of the staff who have achieved 90% and above marks in all the science subjects in higher secondary examination was also distributed.

## NIIST FOUNDATION DAY CELEBRATIONS

The Institute's Foundation Day was celebrated on 6th October. The celebration comprised of open day in the morning followed by Foundation Day Lecture. The open day was observed from 9.30 hrs to 13.00 hrs. About 300 students from different colleges and universities have visited the Laboratory. A brief introduction about CSIR in general, major R & D activities being pursued at NIIST, a video show on the contribution of CSIR to the society and visited to various laboratories were arranged for the students. Dr. P. G. Rao, Director, North East Institute of Science and Technology (NEIST), Jorhat, Assam was the chief guest. Dr. Rao delivered Foundation Day lecture on a topic entitled "CSIR-800 – Bridging the divides, CSIR's Effort". He emphasized the need of CSIR – 800 programme which is aimed at generating the wealth at the bottom of the pyramid and thereby improve the quality of life. Dr. Suresh Das in his presidential address complimented the staff in placing the Institute in the top 3 of CSIR laboratories and top best in number of publications per scientist and impact of factor. Certificates and Mementoes were also distributed to the staff members selected from the service departments and R& D departments for the appreciation awards by the chief guest.



## OBSERVANCE OF VIGILANCE AWARENESS PERIOD 2010

The Vigilance Awareness Period 2010 was observed in institute from 25th October to 1st November, 2010. The period started with administration of pledge in Hindi & English by the Director at 11am on 25th October, 2010. Various competitions on Essay writing, Elocution, Cartoon Drawing and Slogan writing were conducted for staff members and students inclusive of project students during 25th to 29th October, 2010. The valedictory function and prize distribution was held on 1st November, 2010. Dr. Suresh Das, Director presided over the function. Mr. Harisena Varma, IPS, Joint Director, Intelligence Bureau was the Chief Guest, who delivered a Lecture on corruption and gave away the prizes to the winners of various competitions.



*Mr. Harisena Varma, IPS, Joint Director, Intelligence Bureau delivering the valedictory address*

## FACULTY TRAINING AND MOTIVATION AND ADOPTION OF SCHOOLS AND COLLEGES

As a part of CSIR programme, one day training for higher secondary and college level teachers in the area of chemistry was organized on 17th & 18th of February 2011, respectively. The main objectives of this programme was to promote interest, excitement and excellence in science education at the school



and undergraduate level by taking up training and motivational programme for science teachers to upgrade their knowledge-base in new and emerging areas of science and to provide opportunities for interaction and exchange of ideas with the scientific communities of CSIR labs/institutes.

The first day of the programme was scheduled for higher secondary school teachers. About 25 participants from various schools have participated in the programme. The programme was inaugurated by Dr. Suresh Das, Director, NIIST, Trivandrum. In his address he highlighted the importance of Chemistry in development of mankind. He emphasized the need to attract young talents towards science and the role teachers in developing scientific attitude in students. He also mentioned about the science promotional programmes like CPYLS, INSPIRE supported by Government agencies viz. CSIR and DST to attract school and college students towards science education. The technical sessions addressed various aspects of modern chemistry. The session started with the talk of Dr. M. Padmanabhan, Professor, IISER, Trivandrum. He shared some ideas on "Coordination Chemistry in Perspective". Dr. K. George Thomas, Professor, IISER, Trivandrum in his talk on "Atomic Structure and Chemical Bonding" gave a detailed account on the history and present scenario of atomic structure and chemical bonding research. Dr. K. M. Sureshan, Professor, IISER, Trivandrum, shared ideas on "How to make Chemistry teaching interesting?" with the participants.

The second day of the programme was organized for college teachers. About 15 participants from various colleges have participated in the programme. The technical sessions addressed various fields of chemistry including supra molecular chemistry, magnetic resonance, structure of DNA etc. Dr. Reji Varghese, IISER, Trivandrum spoke on "Supramolecular Chemistry". Dr. Vinesh Vijayan, IISER, Trivandrum narrated about the magnetic resonance-its principle uses and various other aspects. Dr. Mahesh Hariharan, IISER, Trivandrum shared some ideas about "Structure of Natural and Non-Natural DNA". Dr. Swathi, IISER, Trivandrum gave a speech on "Chemistry is not just all about experiments". Dr. Ayan Dutta, IISER, Trivandrum dealt with some issues associated with chemical bonds in his talk "Chemical Bonding - some not so obvious".

After technical session lab visit was arranged for the participants where various instrument techniques were explained to the participants. The Valedictory function was inaugurated by Dr. Suresh Das, Director, NIIST, Trivandrum and certificate were also issued to the participants.

## NATIONAL SCIENCE DAY CELEBRATION

Prof. S. Chandrasekaran, Dean, Faculty of Sciences, Indian Institute of Science, Bangalore was the chief guest for the national science day celebration. The science day function was presided over by Dr. Suresh Das, Director, NIIST. He told that the science day commemorates the legacy of Dr. C.V. Raman's winning of Nobel Prize for Raman Effect. He also praised the wisdom of yesteryear politicians like Jawaharlal Nehru, who always heralded the role of science in transforming the society.

In his science day lecture, Prof. S. Chandrasekaran lauded the efforts of IUPAC and UNESCO in getting 2011 declared as International year of chemistry by United Nations. He stated that Chemistry is an unsung hero, even though it plays a key role in solving energy related problems, development of new materials etc. He hoped that the observation of 2011 as International year of chemistry would, inter alia, help in increasing the public appreciation and understanding of chemistry in meeting world needs. He observed that 2011 also marks the 100th year of Nobel Prize conferment to Madam Curie. He also remarked that the most important challenges in 21st century are 'Energy' and 'Environment' and Chemistry has a major role to play for resolving issues related to both.



## CSIR- HRDC ORIENTATION TRAINING PROGRAMME FOR ASSISTANTS AND STENOGRAPHERS

An orientation training for the benefit of Assistants and Stenographers of the Institute was held by CSIR- HRDC during 21-25 Feb. 2011. The Orientation training was conducted to inculcate good practices among staff members and to foster healthy interpersonal relationships among them, so that the process would pave the way for transforming NIIST to a 'Centre of Excellence'.

Though the programme was meant for Assistants and Stenographers only, nearly 50 staff members were given training covering the entire Administrative, Finance & Accounts and Stores & Purchase personnel of the Institute. Shri R.L. Sharma, Associate Programme Director, Shri K.A. Qurieshi, Assistant Programme Director, and Shri Manu Saxena, Assistant Programme Director from CSIR- HRDC as well as Shri Manuel Thomas, COA, CECRI, Karaikudi, Shri George from IMG, Trivandrum, conducted classes on various topics like inventory management in the context of CSIR, Official Communication-modern trends, Public buying, FAQ in the context of CSIR Transformation, interpersonal relationship skills, etc. Shri T.V. Sankaran CFA of the Institute elucidated on the pensionary benefits consequent of implementation of 6th CPC as well as Travelling Allowance rules. Shri M.R. Devasis, SPO talked about physical verification of Stores. Shri K.F. Joseph, SO (G) explained the duties & responsibilities of Drawing & Disbursing Officer. Smt. S. Sobhana, SO (Estt.) briefed the Leave Rules & joining time and Smt. Lathi Devi, Hindi Officer explained the Official Language Implementation Policy of the Union Government.



*Shri R.L. Sharma, Associate Programme Director, CSIR-HRDC addressing the participants*



# एस एंड टी सेवा अनुभाग

## अनुसंधान योजना और व्यवसाय विकास

2010-2011 के दौरान प्रौद्योगिकी लाइसेंसिंग और हस्ताक्षर किए ट्रांसफर समझौतों / समझौता ज्ञापनों

क्रम सं.	शीर्षक	एजेंसी
1	काली मिर्च को सफेद मिर्च में रूपांतरित करने की तकनीकी जानकारी के लाइसेंसिंग के लिए करार	श्री आर. नागेन्द्रन, ज्ञान सुन्दरी मिर्च प्रसंस्करण यूनिट, तमिलनाडु
2	काली मिर्च को सफेद मिर्च में रूपांतरित करने की तकनीकी जानकारी के लाइसेंसिंग के लिए करार	पीडीएस ओर्गानिक स्पाइसेस ,पीरुमेड विकास सोसाईटी, केरल
3	उच्च वॉल्यूम फ्लाई ऐश इमारती घटकों के लिए फ्लक्स बॉइंग प्रौद्योगिकी की तकनीकी जानकारी के लाइसेंसिंग के लिए करार	मेसेर्स ग्रीन ब्रिक्स इंडिया प्राइवेट लिमिटेड, आंध्र प्रदेश
4	काली मिर्च को सफेद मिर्च में रूपांतरित करने की तकनीकी जानकारी के लाइसेंसिंग के लिए करार	श्री एस. विजयन,मेसेर्स एस वी एजेंसीस,नेट्टा, नेडुमंगाडु पी ओ., तिरुवनंतपुरम,केरल
5	काली मिर्च को सफेद मिर्च में रूपांतरित करने की तकनीकी जानकारी के लाइसेंसिंग के लिए करार	श्री गणेश भट, मेसेर्स ईएसटी ट्रेडिंग कंपनी नं.3/14, दक्षिण गोदाम, एपीएमसी यार्ड, यशवंतपुर, बंगलौर 560022 कर्नाटक
6	गोल्चा (गुण्डा) मिट्टी के इष्टतमीकरण अध्ययन में प्रायोजित अनुसंधान के लिए करार	मेसेर्स एसोशियेट सोपस्टोन वितरण कंपनी प्रा. लिमिटेड, जयपुर
7	जायफल की रंजन सुविधा के आधुनिकीकरण पर इंजीनियरिंग परामर्श के लिए करार	श्री साबु जोसफ, प्रबंध साझेदार, मेसेर्स ऐन इंपेक्स, केरल
8	केरल खनिज एवं धातु लिमिटेड, (केएमएमएल) पट्टेदार ब्लॉक I, III, V एवं VII, कोल्लम जिला, चवरा, के लिए मौजूदा समुद्र तट धोने खनन और न्यूनतम समर्थन मूल्य के लिए पर्यावरण प्रभाव आकलन के अध्ययन के संचालन पर परामर्श सेवा के लिए करार	केरल खनिज एवं धातु लिमिटेड,चवरा, केरल
9	ईट मोल्टिंग प्रक्रिया में अनुकूलन के लिए मिट्टी की विशेषताओं पर तकनीकी निवेश के परामर्श के लिए करार	ऊर्जा एवं संसाधन संस्थान, नई दिल्ली
10	ओर्गानिक मसाले प्रसंस्करण संयंत्र स्थापित करने के लिए इंजीनियरिंग कंसल्टेंसी के लिए करार	वायनाड समाज सेवा सोसाईटी, पोस्ट बॉक्स सं. 16, मानंतवाडी, केरल
11	सिरेमिक उत्पादों में फ्लाई ऐश के उपयोग पर अध्ययन	एनटीपीसी लिमिटेड, रामागुंडम सुपर थर्मल पावर स्टेशन, करीमनगर, आंध्र प्रदेश
12	अनुसंधान सहकारिता पर समझौता का ज्ञापन	नेटवर्क सिस्टम और टेक्नोलॉजीज (प्रा) लिमिटेड
13	अल्ट्रा हल्के वजन एल्यूमीनियम पिस्टन, सतह के उपचार, इंजन से संबंधित घटकों और यंत्रिय पैनेल के लिए मैग्नीशियम मिश्र धातु के विकास पर विश्वस्तता समझौता	अशोक लीलैंड लिमिटेड नंबर 1, सरदार पटेल रोड, गिंडी, चेन्नई 600 032
14	सफेद मिर्च संयंत्र के विस्तृत इंजीनियरिंग आरेखन के विकास पर इंजीनियरी परामर्शिता के लिए खरीद ठेके, विश्वस्तता समझौते पर करार	शेमा बिल्डिंग, , एम.जी.रोड, कोचीन- 682016



## संविदात्मक अनुसंधान कार्यक्रम

### कृषि प्रसंस्करण प्रभाग

ग्राहक	परियोजना शीर्षक	परियोजना प्रधान
वनस्पति निदेशालय उपभोक्ता कार्य मंत्रालय	भारतीय खाद्य आदतों के संदर्भ में हाइड्रोजनीकृत वनस्पति तेल उत्पादों और उनके स्वास्थ्य निहितार्थ में ट्रांस फैटी एसिड का मूल्यांकन	श्रीमती रेश्मा
वनस्पति निदेशालय उपभोक्ता कार्य मंत्रालय	माइक्रो न्यूट्रिएन्ट्स और एंटीऑक्सिडेंट पादप रासायनों के संकलन द्वारा परिष्कृत और अपरिष्कृत वनस्पति तेलों की भंडारण क्षमता पर अध्ययन और एक कार्यात्मक वनस्पति का विकास	डॉ (श्रीमती) निशा
डी.एस.टी	पारंपरिक गहरी तली हुई नाश्ते के उत्पादों में ऐक्रिलामाइड उत्पादन पर नियंत्रण और मूल्यांकन	डॉ श्रीमती निशा
डी.एस.टी	प्राकृतिक हत्यारा टी (एनकेटी) कोशिकाओं से सिटिकाइन निर्मुक्ति के चुनिंदा समस्वरण के लिए ऐल्फा गैलेक्टोसाइल सिरामाइड के इमिनोशर्करा परिवर्त का संश्लेषण	डॉ. एल.रवि शंकर
आईसीएमआर	आर्सेनिक ट्राइ ऑक्साइड प्रेरित कार्डियोविषाक्तता के विरुद्ध रक्षक के रूप में हल्दी, बोरहाविया डिपयूसा और डैस्मोडियम गैन्जेटि कम से फिनाॅलिक संयुक्त ।	डॉ के आर रघु
केएससीएसटीई	पैल्मिरा के “नीरा” से मूल्यवर्धित उत्पादों का विकास ।	श्रीमती रेश्मा

### जैवप्रौद्योगिकी विभाग

ग्राहक	परियोजना शीर्षक	परियोजना प्रधान
सीएसआईआर	लिग्नोसेलुलॉसिक बायोमास से बायोएथेनॉल	डॉ. अशोक पाण्डेय
डीबीटी	नूतन बीटा लैक्टमिस निरोधकों और लइपेसों के लिए पर्यावरणीय डीएनए लाइब्रेरियों का निर्माण और स्क्रीनिंग ।	डॉ. अशोक पाण्डेय
डी बीटी	साइट निर्देशित उत्परिवर्तजनी के इस्तेमाल से ऐस्पेर्जिलस नाइजर से थर्मास्टाइबल और कम पीएच सहिष्णु फाइटेस का विकास	डॉ. अशोक पाण्डेय
डीबीटी स्टेबिल	हेमीसेलुलोस युक्त कृषि अपशिष्ट पदार्थों से ऐमिनो एसिड के उत्पादन के लिए कार्बोने बैक्टीरियम ग्लुटामिसम उपभेदों के इस्तेमाल से पुन संयोजक पेन्टोस का निर्माण और विश्लेषण ।	डॉ. के माधवन नम्पूतिरी
डीबीटी	उत्पन्न बायोडीज़ल उद्योगों से उत्पन्न ग्लिसराल से पॉलिहाइड्रोक्सी ब्यूटीरेट (पीएचबी) के उत्पादन के लिए एक बायोप्रोसेस का विकास	डा. अशोक पाण्डेय
डीबीटी	पॉली लैक्टाइड संश्लेषण के लिए लैक्टिक एसिड के लागत प्रभावी उत्पादन और पीएलए अनुप्रयोग और जैवनिम्नीकरण पर अध्ययन	डॉ. के माधवन नम्पूतिरी
डीबीटी	पादपों के रोग नियंत्रण के लिए एंटीफंगल उपापचयों के लिए पश्चमी घाट की जैव विविधता का संदोहन	डॉ. के माधवन नम्पूतिरी
डीबीटी	कवक वियुक्ति BACF-5 से ग्लूकोज सहिष्णु बीटा - ग्लूकोसिडेस का अलगाव और क्लोनिंग और ट्राइकोडर्मा रीज़े से CBH1 नियंत्रण तत्वों और एंजाइम के गुणों पर अध्ययन ।	डॉ. राजीव के सुकुमारन
डीबीटी	जैव ईंधन के लिए केंद्र	डॉ. अशोक पाण्डेय



## रसायन विज्ञान और प्रौद्योगिकी प्रभाग

ग्राहक	परियोजना शीर्षक	परियोजना प्रधान
बीआरएनएस	साइक्लोडेक्स्ट्रिन आधारित सुप्राआण्विक प्रणालियों में प्रकाश- प्रेरित इलेक्ट्रॉन अंतरण के बारे में अध्ययन.	डॉ. गोपिदास
डीईई	आप्टोइलेक्ट्रॉनिक कार्यों के साथ आण्विक और सुप्राआण्विक स्थापत्यकला	डॉ. अजयघोष
डीएसटी	नूतन कार्बन कार्बन और कार्बन हेटेरोपरमाणु बांड निर्माण अभिक्रियाओं के लिए कार्बउत्प्रेरकों के रूप में एन विषमचक्रों और एन- विषमचक्रीय कार्बिनों का उपयोग	डॉ. जी विजयनायर
डीएसटी	एनएमआर रंजकों पर आधारित संवेदकों के विकास	डॉ. रामय्या
डीएसटी	लैन्थानाइड एरोमैटिक कार्बोक्सिलेट्स पर आधारित कुशल प्रकाश रूपांतरण आणविक उपकरणों के डिजाइन और विकास	डॉ. एम एल पी रेड्डी
डीएसटी	अग्रता वात विषाक्त मार्करों के लिए आण्विक अंकित बहुलक एकल मापक सेंसर	डां. टी प्रसाद राव
डीएसटी	जैवआणविक पहचान के लिए प्रोब्स के रूप में नूतन साइक्लोफॉन्स का विकास	डॉ. रामय्या
डीएसटी	विषम द्विचक्रीय ऑलिफिन के नियंत्रित कार्बोपल्लार्डेशन प्रकार्यत्मक साइक्लोपेंटनॉइड के लिए एक नूतन स्टीरियो चयनात्मक मार्ग	डॉ के वि राधाकृष्णन
डीएसटी	न्यूक्लिओफिलिक विषमचक्रिय कार्बोन कैटलिसीस के इस्तेमाल से कार्बन -कार्बन और कार्बन विषम परमाणु बांड निर्माण प्रतिक्रियाओं के लिए नूतन सिंथेटिक प्रोटोकॉल ।	डॉ. जी विजयनायर
डीएसटी	पर्यावरण सुरक्षित अकार्बनिक वर्णक	डॉ. एम एल पी रेड्डी
आई एफ सीपीए आर	बहुलक जेल और पीआई संयुग्मित स्वतः असुंभ्लियों के कार्यात्मक संकर नैनोधातुओं	डॉ. अजयघोष
आई पी एम गॉंधी नगर	संलयन प्रासंगिक प्रोटोटाइप मैग्नेट..... के लिए उपयुक्त ऐको एल10 साइनाइट एस्टर तथा पीवाइ360बिस्फिनॉल एफ मिश्रित एपॉक्सी रेज़िन सिस्टम जो संलापन संबद्ध प्रोटोटाइप मैग्नेट में अपयोग केलिए उपयुक्ता है, केलिए के लिए नोनिलफिनॉल में Mn(II) ऐसिटिलऐसिटोनेट का अभिलक्षण	डॉ. जे डी सुधा
के एस सी एस टीई	मूत्राशय के पथरों के सूक्ष्म विश्लेषिक जांच FTIR स्पेक्ट्रोस्कोपी बनाम SEM-EDAX	डॉ. आर लक्ष्मी वर्मा
के एस सी एस टीई	केरल के अद्वितीय स्टार्च संसाधनों से संशोधित सूक्ष्म और नैनोकण स्टार्च और खाद्य तेल के विकास पर अध्ययन	डॉ. श्रीमती एमिला एब्रहाम
एम / एसकोर्निंग, फ्रांस	बेहतर फोटो क्रोमिक रंजक- चरण iv के विकास के लिए अनुसंधान प रियोजना	डॉ. सुरेश दास
एम / एस एसकोर्निंग फ्रांस	बेहतर फोटो क्रोमिक रंजक- चरण v के विकास के लिए अनुसंधान प रियोजना	डॉ. सुरेश दास





## पदार्थ प्रभाग

ग्राहक	परियोजना शीर्षक	परियोजना प्रधान
बीएआरसी, मुंबई	एसिड / विकिरण वातावरण में जर्नल अनुप्रयोगों के लिए स्वत स्नेहन AL2O3/ZrO2 सिरैमिक कंपोजिटों का विकास ।	डॉ अनन्तकुमार
बीएचईएल	थर्मल प्रबंधन अनुप्रयोगों के लिए धातु आक्साइड / मिश्रित ऑक्साइड नैनोतरल.	डॉ एस के घोष
बीआरएनएस	परमाणु अनुप्रयोगों के लिए बोरॉ कार्बाइड प्रबलित एल्यूमीनियम मैट्रिक्स कंपोजिटों के विकास ।	डॉ टी.पी.डी राजन
बीआरएनएस	नैनो आकार लैन्थानम फॉस्फेट सिन्ट्रित सिरैमिक एवं कोटिंग के साथ पिघलो हुए धातुओं की अभिक्रियाशीलता और गीले व्यवहार पर जांच ।	डॉ के जी के वार्यर
बी आर एन एस, मुंबई	विद्युत यांत्रिक अनुप्रयोगों के लिए सिरैमिक धातु और बहुलक धातु कंपोजिटों	डॉ जोस जेइम्स
बी आर एन एस, मुंबई	उच्च क्षेत्र मैग्नेट में अनुप्रयोग के लिए MgB2 अतिचालक वायेर्स और कॉइल के विकास ।	डॉ यु श्यामप्रसाद
सी एस आइ आर	डाई अधिशोषक उत्प्रेरक के रूप में नुतन माइक्रो नैनो कंपोजिट	डॉ एस के शुक्ला
डी आर डी ओ	सिरैमिक - आधारित नैनो संरचित मैग्नेटिक रेफ्रिजरेटर का विकास	डॉ मनोज रामवर्मा
डी आर डीओ	इंजीनियरिंग अनुप्रयोगों के लिए मोनो और संकर असंतत प्रबलित मैग्नीशियम धातु मैट्रिक्स कंपोजिटों के विकास	डॉ यु टी स पिल्लै
डीआरडीओ	भविष्य एमआईसी डिवाइस अनुप्रयोगों के लिए कम नुकसान कम तापमान सह -ज्वलित सिरैमिक कांच कंपोजिट टेप (LTCC) का विकास	डॉ एम टी सेबास्टियन
डीएसटी	समस्वरणीय माइक्रोवेव सामग्री और उपकरणों	डॉ जोस जेइम्स
डीएसटी	AZ91 मैग्नीशियम मिश्र धातु के काल कठोरण प्रतिक्रिया में सुधार के लिए कालप्रभावन मापदंडों और मिश्र धातु संरचना का अनुकूलन	डॉ ए श्रीनिवासन
डीएसटी	इलेक्ट्रॉनिक पैकेजिंग अनुप्रयोगों के लिए सिलिकेट आधारित परावैधुतिकी ।	डॉ एम टी सेबास्टियन
डीएसटी	मैग्नीशियम मैट्रिक्स कंपोजिट की मूल स्थिति में संश्लेषण और अभिलक्षण ।	डॉ श्रीमती श्रीजाकुमारी
डीएसटी	तिरुचेंदूर तट, तमिलनाडु के एक छोर से दूसरे छोर तक संभावित समुद्र तट प्लेसर निक्षेप के बारे में जांच ।	डॉ एम सुंदर राजन
डीएसटी	नूतन पावेलइट आधारित लाल फोस्फोर सामग्री का विकास सफेद प्रकाश उत्सर्जन डायोड (WLED) के लिए ARMM_00_8& Eu <sup>3+</sup> (A=Mg,Ca,Sr तथा Ba, R=Y,La and Gd& M=Nb and Ta)	डॉ प्रभाकर राव
डीएसटी	पदानुक्रमित आकृति के साथ अतिआण्विक बहुलक नैनोधातुओं	डॉ बोज गोड
डीएसटी	नुतन विधि के माध्यम से त्रिअंगी कार्बिड के M3AX2 चरण की तैयारी और उनके नैनो कंपोजिट के निर्माण	डॉ स अनन्तकुमार
डीएसटी	स्पिन्ट्रॉनिक अनुप्रयोगों के लिए नैनोसंरचित डबल पेरोवस्काइट	डॉ मनोज रामवर्मा



डीएसटी	सौर सेल आवरण और गिलास सतहों के लिए कम तापमान सुरक्षित प्रकाश उत्प्रेरक स्वयं सफाई कोटिंग्स।	डॉ के जी के वार्यर
डीएसटी	स्पिन्ट्रॉनिक अनुप्रयोगों के लिए नैनोसंरचित खनिज पदार्थ ऑक्साइड पदार्थों का विकास	डॉ सविता पिल्लै
आईसीडीडी	नई श्रेणी के सिरैमिक ऑक्साइड यौगिकों के लिए पाउडर एक्स - किरन विवर्तन पैटर्न का निर्माण।	डॉ प्रभाकर राव
आईसीडीडी	नए सिरैमिक कॉम्प्लेक्स आक्साइड के प्रयोगात्मक पाउडर विवर्तन डेटा का निर्माण	डॉ प्रभाकर राव
प्लाज्मा अनुसंधान संस्थान	संलयन ग्रेड मैग्नेट और करेन्ट लीड्स के लिए लंबे फिलमेन्टरी MgB2 अतिचालक वायेर्य एवं टेप्स का विकास	डॉ श्यामप्रसाद
आईआरडी	रासायनिक यांत्रिक प्लैनेराइसेशन / प्रमार्जक कर्दम के रूप में अनुप्रयोगों के लिए सैरियम ऑक्साइड आधारित नैनो धातुओं के विकास।	डॉ एस के घोष
आई एस आरो अंतरिक्ष विभाग	अंतरिक्ष अनुप्रयोगों के लिए बराबर चैनल एल्यू मीनियम मिश्र धातु और कंपोजिटों के विकास	डॉ टी पी डी राजन
के एस टी एस सीई	प्री- पॉलिमर संशोधित इलेस्टोमेरिक संपर्क आसंजक के लिए फ्रॉस्फोरिलेटेड काजू तेल का अनुप्रयोग।	डॉ .ए .आर.आर मेनोन
मेसेर्स सी एम आर एल आलुवाय	मेसेर्स सीएमआरएल सिंथेटिक रूटाइल वाणिज्यिक संयंत्र को वैज्ञानिक और तकनीकी सहायता	श्री. हरिकृष्णभट्ट
मेसेर्स आई आई एलटी डीसी, कोल्लम	दुर्लभ मृदा ऑक्साइडों पर आधारित उच्च क्षेत्र कंपोजिट वारिस्टेर्स के विकास	डॉ. स अन्नतकुमार
एमएचआरडी	ग्रामीण समुदाय नेटवर्क: भारत के ग्रामीण क्षेत्रों के लिए कम लागत के उपयुक्त संचार नेटवर्क के लिए प्रौद्योगिकी विकास प्रारंभिक रॉल आउट योजना ।	डॉ. एम टी सेबास्टियन
एसी आर एम आई तिरुवनन्त-पुरम	कॉयर रबड़ सम्मिश्र उत्पाद के विकास पर अध्ययन	डॉ. ए .आर.आर मेनोन
एनटीपीसी	सिरैमिक उत्पादों में फ्लाइ ऐश के उपयोग पर अध्ययन	डॉ के जी के वार्यर



## प्रोसेस इंजीनियरिंग और पर्यावरण डिवीजन

ग्राहक	परियोजना शीर्षक	परियोजना के नेता
सूचना प्रौद्योगिकी विभाग	जैविक सिमुलेशन कंपोजिट उत्पादों के लिए एजेंट रन टाइम वातावरण	डॉ. श्रीमती एलिसबत जेकब
केरल राज्य प्रदूषण नियंत्रण	धूल दमन : चीन मिट्टी खदान में क्षेत्र अध्ययन	डॉ. रुगाश्रेणी सुकुमारन
केएसटीएससीई	रसायन अनुवर्ती मिश्रित माइक्रोबियल सिस्टम के इस्तेमाल से उच्च नमकीन अवस्था में अंतःस्राव युक्त अपशिष्ट जल का जैवउपचार	डॉ. कृष्णकुमार
मेसेर्स जनरल मोटर्स लिमिटेड	एल्यूमीनियम कास्टिंग में न्यूक्लियेशन, गैस बुलबुले का संचलन और वृद्धि	डॉ. रोशन शशिकुमार
नया और नवीकरणीय ऊर्जा मंत्रालय	बायोगैस वसूली के साथ धरेलु कचरे और स्वच्छता डिवाइस का विकास	डॉ वी बी मणीलाल
एमएनआरई नईदिल्ली	अ-पृथक्कृत नगरपालिका ठोस कचरे के स्थिरीकरण और बायोगैस की वसूली के लिए अवायवीय प्रौद्योगिकी	डॉ वी बी मणीलाल
एनआईआईएसटी	चीनी मिट्टी के प्रसंस्करण के लिए शून्य डिस्चार्ज प्रक्रिया का विकास	डॉ रुग्मिणी सुकुमारन
एनएमआईटी पीएलआई	समुद्री सूक्ष्म सैवाल से जैव शैधन	श्री.अजित हरीदास
यूएनआईडीओ, वियना, अस्ट्रिया,	सतत कार्बनिक प्रदूषकों पर स्टॉकहोम समझौता को लागू करने के पहले कदम के रूप में भारत में राष्ट्रीय कार्यान्वयन योजना का विकास	डॉ एम अन्बु
मेसेर्स एसोशियेटेड सोपस्टॉण डिस्ट्रिब्यूटर्स जिला सेलखड़ी	मेसेर्स एसोशियेटेड सोपस्टॉण डिस्ट्रिब्यूटर्स कंपनी(प्रा.) लिमिटेड के गुडा खानों के चीनी मिट्टी के फ्लो शीट के डिजाइन के लिए लाभकारी प्रक्रिया का विकास।	डॉ पी राघवन
सीएसआईआर	जल बंटवारे के लिए सजातीय उत्प्रेरक का विकास - धारणीय ऊर्जा के लिए एक प्रमुख प्रौद्योगिकी	डॉ सी एच सुरेश



## कंसल्टेंसी कार्यक्रम

ग्राहक	परियोजना शीर्षक	परियोजना प्रधान
एन्न इंपेक्स	प्रौद्योगिकी उन्नयन के लिए इंजीनियरिंग परामर्श	श्री एम.एम. श्रीकुमार
बीएचईएल, बंगलोर	संरंध्री सिलिकॉन कार्बाइड पर सॉल जेल मलाइट कोटिंग्स के लिए कंसल्टेंसी	डॉ के जी के वार्यर
बीएचईएल, बंगलोर	स्वयं सफाई गुणधर्मों को उत्पन्न करने के लिए गिस सबस्ट्रेट पर यूवी संसाधनयोग्य नैनो TiO <sub>2</sub> की पतली फिल्म की तैयारी	डॉ. के.जी.के. वार्यर
कोलगेट पामोलिव	किण्वन के द्वारा अर्जिनिन का उत्पादन और इसका शुद्धीकरण - द्वितीय चरण	डॉ.अशोक पाण्डेय
डीआरडीओ	एल्यूमीनियम मैट्रिक्स कंपोजिट का उपयोग करके पहली गियर और पिस्टन हाउसिंग के विकास के लिए कंसल्टेंसी और रिपोर्ट की तैयारी	डॉ. टी. पी. डी. राजन
पर्यावरण संसाधन रिसर्च सेंटर, तिरुवनंतपुरम	औषधीय पौधों के परागों का सूमसंरचनात्मक विश्लेषण	डॉ. प्रभाकर राव
आईआरई	आईआरई के लिए ईआईए अध्ययन	श्री. जे अन्सारी
केएमएमएल	केएमएमएल परियोजना के लिए ईआईए अध्ययन	श्री. जे अन्सारी
मेसेर्स एस्ट्रा सिनीका	टर्बूटालाइन सल्फाइड के मात्रात्मक प्रावस्था विश्लेषण	डॉ. श्यामप्रसाद
मेसेर्स टीईआर आई, दिल्ली	खोखले ब्लॉक्स के बहिर्वेधन और उत्पादन की उपयुक्तता का पता लगाने के लिए मिट्टी के नमूनों का मूल्यांकन	डॉ. के.जी.के. वार्यर
नीता जिलेटिन इंडिया लिमिटेड कोरट्टि, त्रिचूर	ओसीन कारखाने का गंध नियंत्रण	श्री अजित हरिदास
वीएसएससी	निकैल पाउडर के पृष्ठीय क्षेत्रफल का विश्लेषण	श्री के. हरिकृष्णा भट्ट
वीएसएससी	3 बिंदु बीईटी विधि द्वारा तांबे, क्रोमाइट, फेरिक ऑक्साइड, एल्युमिना, बीएन, एआईएन और इण्डियम पेलेट के परीक्षण नमूनों का पृष्ठीय विश्लेषण	श्री के.एच.भट्ट
वैपकोस	प्रस्तावित बहुउपयोगकर्ता तरल टर्मिनल, कोच्चि के लिए समुद्री पारिस्थितिकी सर्वेक्षण	श्री जे अन्सारी



## पेटेंट

### फाइल किए गए पेटेंटों ( विदेशी)

एनएफएनओ	शीर्षक	आविष्कारकों	दाखिल करने की तारीख	आवेदन सं.
0106 एनएफ 2007/ युएस	सफेद प्रकाश उत्सर्जक ऑर्गेनोजेल और तत्संबंधी प्रक्रिया	अय्यप्पनपिल्लै, अजयघोष, च्चकूत विजयकुमार, वाकयिल के प्रवीण	28/06/2010	12/810923
0105एनएफ 2007/ युएस	जस्ता आयनों के चुनिंदा संसूचन और तत्संबंधी प्रक्रिया के लिए पिरोल अंत्य-आच्छद द्वि-पिरिडीन आमामन पाउडर	अय्यप्पनपिल्लै, अजयघोष, शिवरामपण्णिकर श्रीजित	28/06/2010	12/811008
0350एनएफ2005/ आईडी	पादप सामग्री के युग्मित जुदाई और शोधन के लिए अवायवीय प्रक्रिया आधारित विधि	वट्टाक्काट्टु बालाकृष्णन मणिलाल, अजित हरिदास	3/9/2010	डब्ल्यू-00201003064
0350एनएफ200 एलके	पादप सामग्री के युग्मित जुदाई और शोधन के लिए अवायवीय प्रक्रिया आधारित विधि	वट्टाक्काट्टु बालाकृष्णन मणिलाल, अजित हरदास	3/9/2010	15971
0350एनएफ2005/ पीएच	पादप सामग्री के युग्मित जुदाई और शोधन के लिए अवायवीय प्रक्रिया आधारित विधि	वट्टाक्काट्टु बालाकृष्णन मणिलाल, अजित हरदास	3/9/2010	1-2010-502017
0122एनएफ2009/ डब्ल्यूओ	जलीय और जैवसुसंगत नमूनों में साइनाइड ऋणायन के चुनिंदा संसूचन और तत्संबंधी प्रक्रिया के लिए एक पुनः प्रयोज्य थायोफोन अंत्य आच्छद द्वि-पिरिडीन फ्लोरोसेंट आमामन	अय्यप्पनपिल्लै अजयघोष, शिवरामपण्णिकर श्रीजित, किष्मुमुरि पि. दिव्या, पुरुषोत्तमन जयमूर्ति	15/09/2010	पीसीटी/आईएन 2010/000623
0109एनएफ 2008/ डब्ल्यूओ	फ्लाइ ऐश के लिए नूतन सतह संशोधन प्रक्रियाएं और तत्संबंधी औद्योगिक अनुप्रयोगों	शुक्ला सत्यजित विष्णु, वार्यर कृष्णा गोपकुमार, किषक्केलिकूडायिल बैजु विजयन, तच्चन शिजिता	11/11/2010	पीसीटी /आईएन 2010/000735
0109एनएफ 2008/ टीडब्ल्यू	फ्लाइ ऐश के लिए नूतन सतह संशोधन प्रक्रियाएं और तत्संबंधी औद्योगिक अनुप्रयोगों	शुक्ला सत्यजित विष्णु, वार्यर कृष्णा गोपकुमार, किषक्केलिकूडायिल बैजु विजयन, तच्चन शिजिता	26/11/2010	99140999
0109एनएफ2008/ एआर	फ्लाइ ऐश के लिए नूतन सतह संशोधन प्रक्रियाएं और तत्संबंधी औद्योगिक अनुप्रयोगों	शुक्ला सत्यजित विष्णु, वार्यर कृष्णा गोपकुमार, किषक्केलिकूडायिल बैजु विजयन, तच्चन शिजिता	17/12/2010	100104718



0147एनएफ 2009/ डब्ल्यूओ	प्रकाशगतिक (पीडीटी) चिकित्सा के लिए नूतन पॉर्फिरिन व्युत्पन्न ; जैविक अनुप्रयोगों के लिए पीडीटी एजेंट और प्रतिदीप्ति प्रोब्स के रूप में उसकी तैयारी और उपयोग के लिए एक प्रक्रिया	डानबोयिना रामय्या, सुनीश सी करुणाकरन, वडक्कनचेरिल एस जिशा, तवारेक्कर के चन्द्रशेकर अलगर श्रीनिवासन, माधवन राधाकृष्णा पिल्लै, शिवकुमारी आशा नायर, सनीश बाबु पी सारास, चिन्तलागिरि मोहन राव, कुन्चाला श्रीधर राव	21/01/2011	पीसीटी / आईबी2011/000085
0052 एनएफ 2009/ सीएन	एन्डोसल्फान दूषित प्राकृतिक जल के चुनिंदा निराविषीकरण के लिए नूतन अधिमुद्रित बहुलक सामग्री और उसकी तैयारी के लिए प्रक्रिया	करमलाप्रसाद, जोसफ मेरी ग्लाडिस, तलशीलाप्रसादा राव	15/02/2011	20111003 8500.0
0052एनएफ2009/ पीके	एन्डोसल्फान दूषित प्राकृतिक जल के चुनिंदा निराविषीकरण के लिए नूतन अधिमुद्रित बहुलक सामग्री और उसकी तैयारी के लिए प्रक्रिया	करमलाप्रसाद, जोसफ मेरी ग्लाडिस, तलशीलाप्रसादा राव	15/02/2011	97/2011
0033एनएफ 2010/ डब्ल्यूओ	क्रोमोबैक्टीरियम स्पीशीज़ से जैवसक्रिय वर्णक- युक्त वयोलेसिन और इसके व्युत्पन्नों की तैयारी के लिए प्रक्रिया एनआईआईएसटी-सीकेके-01	कृष्णकुमार भास्करन	10/03/2011	पीसीटी / आईबी 2011/000507

### फाइल किए गए पेटेंटों ( भारतीय)

एनएफएनओ	शीर्षक	आविष्कारकों	दाखिल करने की तारीख	आवेदन सं.
0051एनएफ2009/ आईएन	गेस्ट संपुटन और तत्संबंधी प्रक्रिया के लिए उपयोगी सूक्ष्मसंपुटिका बनानेवाला नैनोकंपोज़िट	चोरप्पन पवित्रन, बिंदु प्रसन्नकुमारन नायर	19/04/2010	0969 डीईएल 2009
0122 एनएफ 2009/IN	जलीय और जैवसंगत नमूनों में साइनाइड श्रृणायनों के चुनिंदा संसूचन और तत्संबंधी प्रक्रिया के लिए एक पुनः प्रयोज्य थायोफीन अंत्य आच्छद द्वि-पिरिडीन फ्लोरोसेंट आमापन	अय्यप्पनपिल्लै, अजयघोष, शिवरामपण्क्कर श्रीजित, किष्मुमुरि पि. दिव्या, पुरुषोत्तमन जयमूर्ति	14/09/2010	1899 डीईएल 2009



0147एनएफ2009/ आईएन	प्रकाशगतिक चिकित्सा (पीडीटी) के लिए नूतन पोरफ्रीन व्युत्पन्न: इसकी तैयारी और तत्संबंधी प्रक्रिया और जैविक अनुप्रयोगों के लिए पीडडीपी एजेंट और प्रतिदीप्ति प्रोब्स के रूप में उनके उपयोग:	डानबोयिना रामय्या, सुनीश सी करुणाकरन, वडक्कनचेरिल एस जिशा, तवारेक्कर के चन्द्रशेखर, अलगर श्रीनिवासन, माधवन राधाकृष्णा पिल्लै, शिवकुमारी आशा नायर, सनीश बाबु पी सारास, चिन्तलागिरि मोहन राव, कुन्चाला श्रीधर राव	21/01/2011	0124 डीईएल 2010
0052एनएफ2009/ आईएन	एन्डोसल्फेन दूषित प्राकृतिक जल के चुनिंदा निराविषीकरण के लिए आणविक अंकित बहुलक कणों या सूक्ष्म बीडों की तैयारी और तत्संबंधी प्रक्रिया	करमलाप्रसाद, जोसफ मेरी ग्लाडिस, तलशीलाप्रसादा राव	14/02/2011	0314 डीईएल 2010
0033एनएफ2010/ आईएन	क्रोमोबैक्टीरियम स्पीशीज़ से जैवसक्रिय वर्णक- युक्त वयोलिसिन और इसके व्युत्पन्नों की तैयारी के लिए प्रक्रिया एनआईआईएसटी-सीकेके-01	कृष्णकुमार भास्करन	10/03/2011	0577 डीईएल 2010

### फाइल किए गए पेटेंटों (विदेशी)

शीर्षक	आविष्कारकों	अनुदान तारीख	पेटेंट सं.
वायोलोजन संबद्ध ऐंक्रिडीन आधारित अणु और उसकी तैयारी के लिए प्रक्रिया	रामय्या डी, एल्दो एम वी, जोसफ जे.	18/05/2010	2338223 (सीए)
पॉलीयूरीथेन्सडों की तैयारी के लिए एक मेल्ट ट्रान्सयूरीथेन प्रक्रिया	माणिक्यम जयाकण्णन, दीपा पुत्तनपरंबिल	30/06/2010	जीबी2445531 (जीबी)
कार्डिनॉल, इसके बहुप्रकार्यात्मक ऐंक्रिलिक क्रास बंधक तथा अत्यधिक पेन्टेंट फास्फोरस ज्वाला मंदक व्युत्पन्नों से बहुप्रकार्यात्मक एल्कहॉल	वडक्केतोणिप्पुरतु शिवनकुट्टि नायर प्रसाद, चेन्नेकाट्टु कृष्णा सदाशिवन पिल्लै	14/07/2010	जीबी2447182 (जीबी)
पीवीसी और ईवा के साथ पिघल या विलयन प्रक्रिया योग्य उच्च चालक पॉलीऐनिलीन और तत्संबंधी प्रक्रिया	राजी कन्नापरंबिल पॉल, चेन्नेकाट्टु कृष्णा सदाशिवन पिल्लै	12/08/2010	10014662 (डीई)
पादप सेल और कैलोस संवर्धनों से पेरऑक्साइडों के उत्पादन के लिए प्रक्रिया	थोलत एमिलिया अब्राहम, निशा रानी देवकी, थॉमसन कुरुविला, जगन रॉय जोसफ	13/10/2010	2039763 (ईपी)
पीला अकार्बनिक वर्णक और इसकी तैयारी के लिए प्रक्रिया	पडला प्रभाकर राव मुण्डलापुडी लक्ष्मीपति रेड्डि	23/11/2010	7837782 (यूएस)



अर्बियम आयनों के ठोस चरण निष्कर्षण पूर्वसांद्रिकरण के लिए आयन अंकित बहुलक कणों का संश्लेषण और उसकी प्रक्रिया	कला रामकृष्णन मेरी ग्लाडिस तलशिला प्रसाद राव	08/12/2010	सीएन 101418062 बी(सीएन)
नवीकरणीय संसाधनों से टेलिचेलिक यूरीथेन ऐक्रिलेट यूवी संसाधन योग्य पूर्व बहुलक सामग्री के संश्लेषण के लिए प्रक्रिया	श्यामाकुमारी आशा, चेन्नेकाट्टु कृष्णा सदाशिवन पिल्लै	15/12/2010	जीबी2446353 (जीबी)

### पेटेंट दायर (भारतीय)

शीर्षक	आविष्कारकों	अनुदान तारीख	पेटेंट सं.
जटिल अपशिष्ट जल के अवायवीय उपचार के लिए बायन्ट फिल्टर	हरिदास ए.	18/08/2010	242196
ब्रेक/क्लच फेसिंग में घर्षण संशोधक के रूप में उपयोग के लिए घर्षण धूल की तैयारी के लिए प्रक्रिया	वडक्केतोणिइप्पुरतु शिवनकुट्टिनायर प्रसाद, जनार्दनन नायर देवकिअम्मा सुधा, चेन्नेकाट्टु कृष्णा सदाशिवन पिल्लै, अरियापल्लिल रामनकुट्टि मोनोन रवीन्द्रनाथ मेनोन, आलत्तूर दामोदरन दामोदरन	20/08/2010	242267
ऐमीनो ऐन्थ्रसीन क्रोमोफोर युक्तनिकट इन्फ्रारेड अवशोषण स्वयुरैन रंजक और उनके निर्माण के लिए प्रक्रिया	दास एस, थोमस.के.जी. बिजु.वी.पी., संतोष.यू., सुरेश.वी.	25/08/2010	242404
प्लाज्मा के इस्तेमाल से भारतीय इल्मेनाइट से टाइटेनिया समृद्ध लावा और पिग आयरन की तैयारी के लिए एक वैकल्पिक प्रक्रिया	आलत्तूर दामोदरन दामोदरन, पोवत्तु नारायणन नायर मोहन दास, कार्वल हरिकृष्ण भट्ट , बिष्णु झारना रबिंथा मोहंती, पार्थसारथी मुखर्जी	23/03/2011	246958





## ज्ञान संसाधन केंद्र

वर्ष 2010-11 ज्ञान संसाधन केन्द्र के लिए (केआरसी) तत्काल प्रभाव और लंबे समय के लिए लाभकारी परिवर्तन दोनों के मामले में प्रमुख उपलब्धियों की अवधि थी। वैज्ञानिक तथा तकनीकी समुदाय के लिए सबसे अच्छी नेटवर्क आधारित संभव सेवाएं प्रदान करने के लिए केआरसी प्रतिबद्ध है। किताबों, पत्रिकाओं, CD-ROM के डेटाबेस आदि सहित दस्तावेजों के एक विशेष संग्रह के द्वारा और ई - संसाधनों के लिए पहुँच प्रदान करके क. आर सी संस्थान के अनुसंधान एवं विकास गतिविधियों के लिए उत्कृष्ट जानकारी, साहित्य और आईटी बुनियादी सुविधाओं का समर्थन प्रदान करता है। इस साल बुनियादी सुविधाओं और संसाधनों को मजबूत बनाने में और सेवा प्रदान करने में महत्वपूर्ण प्रगति हासिल की थी। उपलब्धियों की मुख्य विशेषताओं में शामिल हैं :

### सूचना संसाधन प्रबंधन

#### संग्रह शक्ति

कुल संग्रह 42,000 दस्तावेज से अधिक तक बढ़ गया जिसमें 12,873 पुस्तक, 10947 मानक और 9780 जिल्दवाली पत्रिकाएं शामिल हैं। वर्ष के दौरान प्राप्त पत्रिकाओं के प्रिंट संस्करणों की कुल संख्या 158 टाइटिल्स हैं (सब्सक्राइब्ड: विदेश: - 63, भारतीय - 77 और मुफ्त -18)

#### डेटाबेस और डेटाबेस खोजों

एनआईआईएसटी के वैज्ञानिकों के प्रकाशनों तथा किताबों, पत्रिकाओं, रिपोर्टों / पुनर्मुद्रणों पीएचडी शोध प्रबंधों आदि के इन-हाउस डेटाबेस अपडेट किया। अंतिम दो डेटाबेस प्रयोगशाला की वेबसाइट और इंटरनेट से जुड़े हैं। मानकों और पेटेंटों सहित नियमित और व्यापक सीडी-रोम और ऑनलाइन डेटाबेस खोज आयोजित किया।

#### ई - संसाधन पहुँच सुविधा

आईपी सक्षम मोड में सभी वैज्ञानिकों, शोध छात्रों और अन्य पदाधिकारियों के डेस्कटॉप के माध्यम से प्रयोगशाला के सभी कर्मचारियों के लिए सीएसआईआर ई - पत्रिका भागीदारी कार्यक्रम के तहत ई -संसाधनों के लिए परीक्षण अभिगमन और बाद में नियमित रूप से उपयोग के लिए सुविधाएं प्रदान की गईं। अभिगमन सुविधाओं / प्रकाशकों, जिनके ई- पत्रिका पूर्ण पाठ डेटाबेस सुलभ हैं, की सूची नीचे दी गयी है:

- अमेरिकन केमिकल सोसाइटी
- वार्षिक समीक्षा
- एएससीई
- एएसएमई
- एआईपी
- एसीएम
- कैम्ब्रिज यूनिवर्सिटी प्रेस
- एल्सेवियर (विज्ञान प्रत्यक्ष)
- एमराल्ड
- आईईईई
- जेसीसीसी आईएनएसटीआईआरसी



- प्रकृति
- ऑक्सफोर्ड यूनिवर्सिटी प्रेस
- विज्ञान पत्रिका
- एससीओपीयूएस
- स्प्रिंगर
- टेलर और फ्रांसिस
- विले इंटर साइन्स / ब्लैकवेल
- दिवान उद्यम के भारतीय जर्नल्स.कोम

ग्रन्थसूची और प्रशस्ति पत्र डेटाबेस - विज्ञान के वेब - विज्ञान प्रशस्ति पत्र- विस्तारित सूचकांक पेटेंट डेटाबेस - डेलिफियोन और डरवेन्ट नवाचार सूचकांक मानक - एएसटीएम और बीआईएस ऑनलाइन

यह दुनिया भर में सार्वजनिक, शैक्षणिक और पेशेवर पुस्तकालयों के लिए उद्योग की अग्रणी ई - सामग्री एकत्रीकरण मंच के आईएनएसपीईसी डेटाबेस और मईई लाईब्रेरी के अतिरिक्त था । ई - संसाधनों का , विशेष रूप से एसीएस और एल्सेवियर (विज्ञान प्रत्यक्ष और स्कोपस ) का उपयोग अत्यधिक भारी थी। उपयोग की नियमित निगरानी और विभिन्न प्रचार कार्यक्रम उपयोग के स्तर को बढ़ावा किय है ।

### प्रकाशनों का विश्लेषण

जर्नल प्रशस्ति पत्र की रिपोर्ट, विज्ञान की वेब -विज्ञान प्रशस्ति पत्र सूचकांक विस्तारित और स्कोपस के माध्यम से एनआईआईएसटी के प्रकाशनों के ग्रंथमापीय / साइनटोमेट्रिक/ प्रभाव फैक्टर विश्लेषण किया गया । उच्च प्रभाव फैक्टर युक्त पत्रिकाओं में प्रकाशन के लिए सहायता सेवा प्रदान की । 2.897 के औसत मूल्य के साथ एससीआई पत्रों (2010) की कुल संख्या 197 है । एससीआई कागजात की कुल संख्या में एससीआई पत्रिकाओं में प्रकाशित बिना औसत मूल्य के 15 पत्र शामिल है ।

### संस्थागत रिपोजिटरी (आईआर)

एनआईआईएसटी से तैयार किए शोधप्रबंध और अनुसंधान पत्रों के संस्थागत भंडार का निर्माण प्रगति पर है। रिपोर्ट अवधि के दौरान हमारे आईआर में 83 रिकॉर्ड जोड़ा गया था, जो अब केवल हमारे इंटरनेट में अभिगम्य है ।

### आईटी सक्रिय सिस्टम और सेवाएँ

- कर्मचारीगण और छात्र को लैन / वैन खंडों के माध्यम से हाई स्पीड इंटरनेट कनेक्टिविटी
- किराए पर बीएसएनएल की 9 एमबीपीएस लाइन कनेक्टिविटी
- एनआईसी से जिगाबिट कनेक्टिविटी
- वाई - फाई सिस्टम सुविधा
- वीडियो कॉन्फ्रेंसिंग सुविधा
- एनआईआईएसटी वेबसाइट के डिजाइन, विकास और रखरखाव
- विभिन्न प्रभागों के लिए सम्मेलन वेबसाइटों के डिजाइन तथा विकास
- ई - मेल और मैसेजिंग सिस्टम
- जैव प्रौद्योगिकी प्रभाग के लिए जैव बुलेटिन बोर्ड
- साइबर सुरक्षा
- संग्रहण उपकरण कार्यान्वित
- एमआईएस - प्रपत्र, नोटिस, अनुसूचियों और ई संसाधनों आदि का उपयोग करने के लिए इंटरनेट पोर्टल
- समर्पित सर्वर कक्ष (प्रगति में)
- सीएसआईआर - ईआरपी कार्यान्वयन (प्रगति में)



## विदेश यात्राओं

नाम	दौरा किया गया देश	से	तक	उद्देश्य
डॉ. सी.एच. सुरेश	जर्मनी	1.10.2009	30.9.2010	मारबर्ग विश्वविद्यालय, जर्मनी
डॉ. अशोक पाण्डेय	ग्रीस	19.4.2010	19.4.2010	अप्रैल 19 को पैट्रई विश्वविद्यालय में आयोजित अंतरराष्ट्रीय कार्यशाला "खाद्य उत्पादन के नये अनुसंधान क्षेत्रों में नूतन प्रौद्योगिकियों" विषय पर व्याख्यान देने के लिए
	फ्रांस	1.6.2010	30.6.2010	यू बी पी फेलोशिप के तहत अनुसंधान के लिए ब्लेस पास्कल विश्वविद्यालय का दौरा
	ऑस्ट्रेलिया	26.9.2010	29.10.2010	पर्यावरण विज्ञान और इंजीनियरिंग में चुनौतियों पर आयोजित अंतरराष्ट्रीय सम्मेलन में मूल व्याख्यान ( सीईएसई 2010)
	ब्राज़िल	5.10.2010	8.10.2010	आईसीबीएफ -2010 पर अंतरराष्ट्रीय सम्मेलन में भाग लेने के लिए
	ताइवान	17.11.2010	20.11.2010	फेंग चिया विश्वविद्यालय, ताइचुंग, ताइवान में 2010 एशियाई जैव हाइड्रोजन संगोष्ठी और एपीईसी उन्नत जैव हाइड्रोजन प्रौद्योगिकी सम्मेलन में मूल व्याख्यान देने के लिए
	स्विट्जरलैंड	6.12.2010	24.12.2010	लॉज़ेन, स्विट्जरलैंड के फेडरल पोलिटेक्निक स्कूल में ऊर्जा प्रणाली प्रयोगशाला में शैक्षणिक अतिथि
	डॉ.अजयघोष	सियोल	25.4.2010	30.4.2010
पोलैंड		15.6.2010	20.6.2010	योन्सेल विश्वविद्यालय में व्याख्यान देने के लिए
क्योटा, जापान तथा एनआईएमएस, जापान		4.7.2010	13.7.2010	सिंथेटिक पदार्थों के विज्ञान तथा प्रौद्योगिकी पर आयोजित अंतरराष्ट्रीय सम्मेलन में भागलेने के लिए (आईसीएशएम-2010) और वैज्ञानिक विचार- विमर्श के लिए एनआईएमएस, जापान का दौरा ।
फ्रांस		14.9.2010	17.9.2010	कार्बनिक संश्लेषण पर इंडो- फ्रेंच सेमिनार (आईएफसीओएस)
ऑस्ट्रेलिया		7.11.2010	11.11.2010	स्कूल ऑफ केमिस्ट्री, कैनबरा, ऑस्ट्रेलिया तथा रिसर्व स्कूल ऑफ केमिस्ट्री, कैनबरा, ऑस्ट्रेलिया में आमंत्रित व्याख्यान देने के लिए
डॉ.एम.एल.पी. रेड्ड	कोरिया	3.6.2010	5.6.2010	आईसीएफपीएफएम- 2010 पर आमंत्रित व्याख्यान देने के लिए
	मेक्सिको	3.10.2010	10.10.2010	ल्यूमिफोन -2010 पर आयोजित अंतरराष्ट्रीय सम्मेलन में भाग लेने के लिए



डॉ.ए. श्रीनिवासन	जर्मनी	3.7.2010	30.6.2012	जीकेएसएस अनुसंधान केंद्र, गीसथाच, जर्मनी में हम्बोल्ट फैलोशिप के अंतर्गत अनुसंधान के लिए
डॉ. यू.टी.एस. पिल्लै	जापान	1.9.2010	9.9.2010	सियाँल राष्ट्रीय विश्वविद्यालय में विस्फोट प्रघाती तरंग और उच्च ऊर्जा प्रतिक्रिया घटना-2010 पर आयोजित अंतर्राष्ट्रीय संगोष्ठी में भाग लेने के लिए और कुमामोटो विश्वविद्यालय, कुमामोटो जापान की यात्रा के लिए.
डॉ. एम. अन्बु	अमेरिका	12.9.2010	17.9.2010	सैन एंटोनियो, टेक्सास, संयुक्त राज्य अमरीका में हालोजनेटड सतत् कार्बनिक) डाइऑक्सीन 2010- प्रदूषकों पर अंतर्राष्ट्रीय संगोष्ठी ।
	अमेरिका	20.11.2010	18.12.2010	स्वास्थ्य विभाग, वाडवार्त केंद्र, अल्बेनी, न्यूयॉर्क में संयुक्त राष्ट्र औद्योगिक विकास संगठन द्वारा प्रायोजित प्रशिक्षण कार्यक्रम
डॉ.रोशन शशिकुमार	अमेरिका	4.10.2010	31.10.2010	जीएम अनुसंधान केन्द्र, वॉरेन, संयुक्त राज्य अमेरिका की प्रायोजित परियोजना के संबंध में
डॉ. सुरेश दास	सिंगापुर	16.10.2010	21.10.2010	रसायन विज्ञान विभाग, नेशनल यूनिवर्सिटी, सिंगापुर में आमंत्रित व्याख्यान
डॉ.एस. अनंतकुमार	इटली	23.10.2010	15.12.2010	मेम्ब्रेन प्रौद्योगिकी संस्थान, कालाब्रिया विश्वविद्यालय, इटली और सीएसआईआर के बीच द्विपक्षीय एस एण्ड टी सहयोग (भारत)
डॉ.पी. निशा	आयरलैंड	10.11.2010	12.11.2010	डब्लिन, आयरलैंड में ईएफएफओएसटी 2010 में पोस्टर प्रस्तुतीकरण के लिए
डॉ. के. माधवन नंबूतिरि	जर्मनी	21.11.2010	6.12.2010	बाइलफेल्ड विश्वविद्यालय, जर्मनी के साथ इंडो जर्मन परियोजना के तहत
डॉ.डी.रामय्या	जर्मनी	1.3.2011	30.3.2011	मेइंस विश्वविद्यालय, जर्मनी में डीएएडी के तहत सहयोगात्मक कार्यक्रम के संबंध में अनुसंधान कार्य करने के लिए



## सम्मान और पुरस्कार

डॉ. सुरेश दास	फेल्लो ऑफ़ इंडियन नेशनल साइन्स अकादेमी
डॉ. एम.सुन्दराराजन	भारतीय जियोलाजिकल सोसाइटी के फेलो
डॉ. के.आर.गोपीदास	भारतीय विज्ञान अकादमी के फेलो
डॉ. वी.बी.मणिलाल	निस्ट के लिए अंतराष्ट्रीय पुरस्कार (डब्ल्यूआईपीओ)
एस.श्रीनिवासन	22वीं केरल विज्ञान कांग्रेस में उत्कृष्ट शोध पत्र पुरस्कार

## पीएचडी डिग्री पुरस्कृत

छात्र	थीसिस शीर्षक	पर्यवेक्षक	विश्वविद्यालय
श्रीजित्त एस	आणविक प्रोब्स और लोजिक गेट्स के रूप में कुछ दाता-ग्राही-दाता अणुओं के डीज़ाइन और संश्लेषण पर अध्ययन।	डॉ. अजयघोष	केरल
जोबी जोन	मध्य चाक्रीय हाइड्रोजीन के डीसिमैट्राइसेशन मार्ग से प्रकार्यात्मक साइक्लोपेन्टेस	डॉ. के वी राधाकृष्णन	केरल
धन्या गंगाधरन	अल्फा ऐमिलेस के माइक्रोबियल उत्पादन	डॉ. के मधननंबूतिरि	केरल
रजित्त ए	समुद्र आधारक थॉन बेरीस की पादप रासायनिक जांच (हिप्पोफी रैम्नाइडज़)	डॉ. सी आरुमुखन	कुसाट
सुनीष. सी.वी	फिनाइल एथिनलारिन आधारित दाता ग्राही प्रणालियों: - डिजाइन, संश्लेषण और प्रकाशभौतिक अध्ययन	डॉ. के आर गोपिदास	केरल
शेवता शिवरामकृष्णन	टोस सावर्धन में कवक एल्फा ऐमिलेस के जैवसंश्लेषण।	डॉ. अशोक पाण्डेय	केरल
रेखा रायचन अविरा	कुछ नूतन सेमीस्करैन और क्रोकोनाइन रजकों के संश्लेषण और उनके फोटोफिसिकल और धातु आयन बाध्यकारी गुणधर्मों पर अध्ययन	डॉ. डी. रामय्या	कुसाट
श्रीनीथ के	चयनित सुरभित ऐमिन और एसटोनाइट्रिल $Cu_2+$ के बीच इलेक्ट्रॉन अंतरण अभिक्रिया:- काइनेटिक, स्पेक्ट्रोस्कोपिक और यात्रवत जांच	डॉ. के. आर गोपिदास	कुसाट
जयशंकर एम	कार्यात्मक अनुप्रयोगों के लिए सोल जेल एल्यूमिना नैनो कंपोजिट।	डॉ. के. जी. के वार्यर	कुसाट
बालसुब्रमणी. एम	Mg8 Zn4 Al मिश्र धातु के सुक्ष्म संरचनात्मक और यात्रिक गुणों पर कण शोधन धातुमिश्रण परिवर्धन पर अध्ययन	डॉ. यू. टी. एस पिल्लै	कुसाट
सरुण पी. एम	वर्धित गुणों के साथ नूतन रेअर अर्थ डोप्पड (Bi,Pb)-2212 अतिचालकों के विकास पर अध्ययन	डॉ.यु.श्यामप्रसाद	कुसाट



## अनुसंधान परिषद के सदस्य

### अध्यक्ष

#### डॉ.दिपंकर बानर्जी

मुख्य नियंत्रक अनुसंधान व विकास (एएमएस) एवं उप सचिव  
कमरा नं. 301, डीआरडीओ भवन  
रक्षा अनुसंधान एवं विकास संगठन  
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### सदस्य

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प्रोफेसर एवं समन्वयक - जीवविज्ञान  
प्रथम तल, केन्द्रीय टॉवर, साई ट्रिनिटी बिल्डिंग  
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**डॉ. एम.आर.पिल्लै**

निदेशक

राजीव गांधी जैव प्रौद्योगिकी केंद्र

जगति, तिरुवनन्तपुरम - 695 014

**एजेंसी के प्रतिनिधि**

**डॉ. अरविन्द दुग्गल**

सलाहकार

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ब्लॉक नं.2, 7वाँ तल, सीजीओ कॉम्प्लेक्स, लोदी रोड

नई दिल्ली - 110 003

**महानिदेशक नामांकित**

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भौतिक एवं पदार्थ रसायन विज्ञान विभाग, एनसीएल, पुणे

**सहोदर प्रयोगशाला**

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निदेशक

केंद्रीय नमक एवं समुद्री रसायन अनुसंधान संस्थान

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तिरुवनन्तपुरम-695 019

**स्थायी आमंत्रित**

**प्रधान या उनके नामित**

योजना एवं निष्पादन प्रभाग(पीपीडी)

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प्रधान

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## प्रबंधन परिषद के सदस्य (1/1/2010 से 31/12/2011 तक की अवधि)

### अध्यक्ष

**निदेशक**, एनआईआईएसटी

### सदस्य

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**सीएफए / एफएओ**, एनआईआईएसटी

### सदस्य सचिव

**सीओए / एओ**, एनआईआईएसटी





## कर्मचारियों की सूची 31-3-2011 को

### निदेशक का कार्यालय

डॉ. सुरेश दास	निदेशक
श्री एस.सुरेशकुमार	वैज्ञानिक जी
श्रीमती शारदा नायर	निजी सचिव
श्री बी.अजयकुमार	तकनीकी ग्रेड 11 (3)
श्री ए.कृष्णनकुट्टी	तकनीकी ग्रेड1 (4)
श्री पी.बी.विजयकुमार	तकनीकी ग्रेड1 (4)

### आर एण्डी विभाग

#### कृषि संसाधन एवं प्राकृतिक उत्पादन विभाग

डॉ. ए.सुन्दरेशन	वैज्ञानिक जी (प्रधान)
श्री एम.एम.श्रीकुमार	वैज्ञानिक जी
श्रीमती बी.शंकरिकुट्टि अम्मा	वैज्ञानिक एफ
डॉ. सी.बालचन्द्रन	वैज्ञानिक एफ
श्री तॉमस सामुअल	वैज्ञानिक एफ
श्रीमती ए.निर्मला मेनोन	वैज्ञानिक ई 11
श्रीमती ओमनाकुट्टि अम्मा	वैज्ञानिक ई 11
श्री वी.वी.वेणुगोपालन	वैज्ञानिक ई 1
डॉ. (श्रीमती) के.पी.पत्माकुमारी अम्मा	वैज्ञानिक ई 1
डॉ. के.जी.रघु	वैज्ञानिक ई 1
श्रीमती एम.वी.रेश्मा	वैज्ञानिक सी
डॉ. (श्रीमती) पी.निशा	वैज्ञानिक बी
डॉ. पी.जयमूर्ती	वैज्ञानिक बी
श्री आर.बाबु	प्रिंसिपल तकनीकी अधिकारी
डॉ. (श्रीमती) बीना जोय	वरिष्ठ तकनीकी अधिकारी-3
श्रीमती एल.प्रसन्नाकुमारी	वरिष्ठ तकनीकी अधिकारी-2
श्री डी.आर.शोभन कुमार	तकनीकी अधिकारी
श्री पी.वी.तम्पी	तकनीकी ग्रेड 2-4
श्री आर.सुकुमारन	तकनीकी ग्रेड 1-4
श्रीमती अन्नम्मा मात्तू	वरिष्ठ आशुलिपिक(एसीपी)

### जैवप्रौद्योगिकी प्रभाग

डॉ. अशोक पाण्डेय	वैज्ञानिक जी (प्रधान)
डॉ. (श्रीमती) पी.प्रेमा	वैज्ञानिक एफ (02-08-2010 को स्वैच्छिक सेवानिवृत्त)
डॉ. के.माधवन नंपूतिरि	वैज्ञानिक ई 11
डॉ. राजीव कुमार सुकुमारन	वैज्ञानिक सी
डॉ. (श्रीमती) बी.विजयलक्ष्मी अम्मा	प्रिंसिपल तकनीकी अधिकारी(28-02-2011 को सेवानिवृत्त)
श्री पी.एन.शिवनकुट्टि नायर	तकनीकी ग्रेड 2-4
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### रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग

डॉ. ए.अजयघोष	वैज्ञानिक एच
डॉ. डी.रामय्या	वैज्ञानिक जी (प्रधान)
डॉ. टी.प्रसादारावु	वैज्ञानिक जी
डॉ. एम.लक्ष्मीपति रेड्डी	वैज्ञानिक जी
डॉ. (श्रीमती) टी.एमिलिया एब्रहाम	वैज्ञानिक जी (30-4-2010 को सेवानिवृत्त)
डॉ. (श्रीमती) मंगलम एस.नायर	वैज्ञानिक एफ
डॉ. (श्रीमती) ए.जयलक्ष्मी	वैज्ञानिक एफ
डॉ. के.आर.गोवीदास	वैज्ञानिक एफ
डॉ. के.जोर्ज तॉमस	वैज्ञानिक एफ (17-05-2010 से पूर्णग्रहणाधिकार पर)
डॉ. (श्रीमती) आर.लक्ष्मी वर्मा	वैज्ञानिक एफ
डॉ. के.वी.राधाकृष्णन	वैज्ञानिक ई ।
श्री चन्द्राकान्त.सी.के	वैज्ञानिक ई ।
डॉ. (श्रीमती) जे.डी.सुधा	वरिष्ठ तकनीकी अधिकारी-3
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श्री रोबर्ड फिलिप	तकनीकी सहायक

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डॉ. के.जी.के.वार्यर	वैज्ञानिक जी (प्रधान)
डॉ. एम.टी.सेबास्ट्यन	वैज्ञानिक जी
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डॉ. पीटर कोशी	वैज्ञानिक जी (30-4-2010 को सेवानिवृत्त)
डॉ. ए.आर.आर.मेनोन	वैज्ञानिक एफ
श्री एम.सी.शाजी	वैज्ञानिक एफ
डॉ. पी.प्रभाकर रावु	वैज्ञानिक एफ
श्री के.हरिकृष्ण भट्ट	वैज्ञानिक एफ
डॉ. जोस जेइम्स	वैज्ञानिक एफ
डॉ. यु.टी.एस.पिल्लै	वैज्ञानिक एफ
श्री के.सुकुमारन	वैज्ञानिक एफ (31-12-2010 में सेवानिवृत्त)
श्री स्वपनकुमार घोष	वैज्ञानिक ई ॥
डॉ. मनोज रामावर्मा	वैज्ञानिक ई ॥
डॉ. एम.रवि	वैज्ञानिक ई ॥
डॉ. एस.अनन्तकुमार	वैज्ञानिक ई ॥
डॉ. टी.पी.डी.राजन	वैज्ञानिक ई ।
डॉ. एम.सुन्दरराजन	वैज्ञानिक सी
डॉ. एस.वी.शुक्ला	वैज्ञानिक सी
डॉ. ए.श्रीनिवासन	वैज्ञानिक सी
श्री एस.वेलुसामी	प्रिंसिपल तकनीकी अधिकारी
डॉ. वी.एस.प्रसाद	वरिष्ठ तकनीकी अधिकारी-3
श्री के.के.रविकुमार	वरिष्ठ तकनीकी अधिकारी-3
श्री एम.ब्रह्माकुमार	वरिष्ठ तकनीकी अधिकारी-3
श्री पी.पेरुमाल	वरिष्ठ तकनीकी अधिकारी-2



श्री पी.गुरुसामी	वरिष्ठ तकनीकी अधिकारी-2
श्री एम.आर.चन्द्रन	वरिष्ठ तकनीकी अधिकारी-1
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श्री पी.राघवन	वैज्ञानिक ज (प्रधान)
डॉ. (श्रीमती) रोशन शशिकुमार	वैज्ञानिक जी
श्री अजित हरिदास	वैज्ञानिक एफ
डॉ. (श्रीमती) एलिज़बत जेकब	वैज्ञानिक एफ
डॉ. (श्रीमती) रुग्मिणी सुकुमार	वैज्ञानिक ई II
डॉ. वी.बी.मणिलाल	वैज्ञानिक ई II
डॉ. (श्रीमती) एस.सावित्री	वैज्ञानिक एफ
डॉ. एम.अंबू	वैज्ञानिक ई II
श्री जे.अंसारी	वैज्ञानिक ई II
डॉ. सी.एच.सुरेश	वैज्ञानिक ई I
श्री अब्दुल हलीम.बी	वैज्ञानिक सी
डॉ. बी.कृष्णकुमार	वैज्ञानिक सी
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डॉ. एस.रामस्वामी	तकनीकी अधिकारी
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श्री पी.जे.वर्गिस	वरिष्ठ अधीक्षक इंजीनियर
श्री आर.राजीव	अधीक्षक इंजीनियर
श्री के.वी.उष्णिक्कृष्णन	कार्यपालक इंजीनियर
श्री जी.चन्द्रबाबु	सहायक कार्यपालक इंजीनियर(सिविल)
श्री के.प्रसाद	सहायक इंजीनियर
श्री बी.कार्तिक	कनिष्ठ इंजीनियर(सिविल)
श्री पी.अरुमुखम	कनिष्ठ इंजीनियर(सिविल)
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श्री टी.वी.सतीश

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श्री एम.रामसामि पिल्लै  
श्री जी.सुधाकरन  
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श्री पुष्पकुमार.के.आर.नायर  
श्रीमती पी.सावित्री

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### यांत्रिकी इंजिनियरिंग अनुभाग

श्री एन.जे.जेकब  
श्री एन.सुधिलाल  
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### अ. एवं वि. योजना तथा व्यवसाय विकास प्रभाग

डॉ. वी.जी.मोहनन नायर  
डॉ. सी.चन्द्रशेखराभट्ट  
श्री डी.भीमेश्वर  
श्री आर.एस.प्रवीण राज  
डॉ. एम.शंकरानारायणन  
श्रीमती वी.जे.सरोजाकुमारी  
श्री जी.सदाशिवन  
श्री के.सी.चाक्को

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### प्रशासन

श्री एन.एस.राजु  
श्रीमती एस.शोभना  
श्री के.एफ.जोसफ  
श्रीमती के.एस.लतीदेवी  
श्री टी.जे.बाबु  
श्री डी.जयप्रसाद  
श्रीमती ज्योति आर.तम्पी  
श्री जी.रामभद्रन  
श्रीमती मेर्सी जोसफ  
श्रीमती सूसन मात्यू

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श्रीमती के.सरस्वति	सहायक (सा) ग्रेड II (एसीपी)
श्री आर. के. रमेशकुमार	सहायक (सा) ग्रेड II
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श्री एम.के.शिवदासन	सहायक (सा) ग्रेड I
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श्री एस.शशिकुमार	सहायक (सा) ग्रेड I (30-06-2010 को सेवानिर्वत)
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श्री प्रवीण कण्णाल	तकनीकी ग्रेड 2-2
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श्री शशिधरन	बेयरर(एसीपी)
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### वित्त एवं लेखा विभाग

श्री टी.वी.शंकरन	वित्त एवं लेखा नियंत्रक
श्रीमती पी.वी.विजि	अनुभाग अधिकारी(वित्त एवं लेखा विभाग)
श्री ए.वी.तामस	अनुभाग अधिकारी(वित्त एवं लेखा विभाग)(31-05-2011 को सेवानिवृत्त)
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श्रीमति आर.रमादेवी	रिकॉर्ड कीपर

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श्री एम.आर.देवासीस	भण्डार एवं क्रय अधिकारी
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श्री जी.भक्तवल्सलम	ग्रुप डी गैर तकनीकी



## इन्सपॉयर इंटरनशिप विज्ञान शिविर - 2010

संस्थान 20-24 सितंबर 2010 के दौरान सप्ताह लंबे **इन्सपॉयर** इंटरनशिप विज्ञान शिविर आयोजित किया। युवा प्रतिभाओं को विज्ञान की ओर आकर्षित कराने और राष्ट्रीय विज्ञान और प्रौद्योगिकी आधार को मजबूत कराने के लिए विज्ञान तथा प्रौद्योगिकी विभाग (डीएसटी), भारत सरकार द्वारा इन्सपॉयर कार्यक्रम शुरू किया है। केरल के विभिन्न स्कूलों से दसवीं कक्षा में अच्छे अकादमिक रिकॉर्ड प्राप्त तथा विज्ञान विषयों में ग्यारहवीं और बारहवीं कक्षा में पढनेवाले राज्य एसएसएलसी, सीबीएससी, आईसीएससी धारकों के करीब 200 छात्रों को उपर्युक्त शिविर में भाग लेने के लिए चयन लिया गया था।

डॉ. बी.एन. सुरेश, निदेशक, इंडियन इंस्टिट्यूट ऑफ स्पेस साइन्स एवं तकनॉलजी, (आईआईएसटी) तिरुवनन्तपुरम ने शिविर का उद्घाटन किया और उद्घाटन भाषण दिया। अपने भाषण में डॉ. सुरेश ने दशमलव प्रणाली- “शून्य”, धातु विज्ञान और खगोल विज्ञान जैसे क्षेत्रों में प्राचीन भारत द्वारा किए गए मूल योगदान पर प्रकाश डाला। उन्होंने स्वतंत्रोत्तर युग में अनुसंधान एवं विकास तथा सार्वजनिक क्षेत्र के असंख्य उद्यमों की स्थापना और पोषण में पंडित जवाहरलाल नेहरू जैसे आदर्शवादियों द्वारा किए गए योगदान की याद की। भारत में विज्ञान तथा प्रौद्योगिकी के विकास में तीन “टी” यानी - आईटी (सूचना प्रौद्योगिकी) बीटी(जैवप्रौद्योगिकी) तथा एनटी (नैनोतकनॉलजी) की अपार क्षमता पर भी उन्होंने प्रकाश डाला।

डॉ. सुरेश दास, निदेशक, एनआईआईएसटी ने समारोह की अध्यक्षता की और उन्होंने अपने अध्यक्षीय भाषण में बताया कि वर्ष 2030 तक भारत, अमरीका, जापान और जर्मनी के आगे बढ़कर चीन के बाद दुनिया की दूसरी सबसे बड़ी अर्थव्यवस्था बन जाएगी। इसे वास्तव बनाने के लिए भारत को विज्ञान तथा प्रौद्योगिकी के क्षेत्र में भारी प्रगति करनी होगी। यह सर्वविदित है कि मानव जाति के इतिहास में हर एक प्रमुख राष्ट्र ने विज्ञान और प्रौद्योगिकी के क्षेत्र में नेतृत्व किया है।



विज्ञान शिविर का उद्घाटन करते हुए डॉ. बी.एन. सुरेश, निदेशक, इंडियन इंस्टिट्यूट ऑफ स्पेस साइन्स एवं तकनॉलजी, तिरुवनन्तपुरम

## सीएसआईआर स्थापना दिवस समारोह

सीएसआईआर स्थापना दिवस की याद में 26 सितम्बर 2010 को एनआईआईएसटी में सीएसआईआर स्थापना दिवस मनाया गया। स्थापना दिवस समारोह के पूर्वाह्न को खुला-दिन मनाया गया और बाद में श्री टी. बालकृष्णन, आईएस, अपर मुख्य सचिव, उद्योग और वाणिज्य, केरल सरकार का स्थापना दिवस व्याख्यान



आयोजित किया गया। पूर्वाह्न 9.30 बजे से मध्याह्न 1.30 बजे तक खुला दिन मनाया गया और इसके दौरान विभिन्न कॉलेजों एवं विश्वविद्यालयों से लगभग 350 छात्रों ने प्रयोगशाला का दौरा किया। सीएसआईआर के संबंध में सामान्य जानकारी तथा एनआईआईएसटी में अपनाई जा रही प्रमुख अनुसंधान एवं विकास गतिविधियों के संबंध में संक्षिप्त परिचय देने के साथ, समाज के लिए सीएसआईआर के प्रमुख योगदानों पर छात्रों को एक वीडियो क्लिपिंग दिखाने की व्यवस्था की गयी। बाद में, छात्रों ने विभिन्न प्रयोगशालाओं का दौरा किया।



श्री टी. बालकृष्णन, आईएस, अपर मुख्य सचिव, उद्योग और वाणिज्य, केरल सरकार  
स्टाफ सदस्यों को संबोधित करते हुए

श्री बालाकृष्णन ने अपने भाषण में विज्ञान तथा प्रौद्योगिकी के क्षेत्र में सीएसआईआर के योगदान पर सामान्य और सीएसआईआर-एनआईआईएसटी के योगदान पर विशेष अभिस्वीकृति दी और अनुसंधान एवं विकास संस्थानों और उद्योगों के बीच घनिष्ठ संपर्क स्थापित करने की जरूरत पर जोर दिया, जहाँ नवाचार सफलता का मूल सिद्धान्त है। उन्होंने वैज्ञानिक समुदाय से यह भी आग्रह किया कि मानव जाति की जीवन शैली में सुधार करने के लिए उपयोगी अधिक से अधिक प्रौद्योगिकियों के विकास के लिए चुनौतियों स्वीकार कर लें।

सीएसआईआर में सेवा के 25 साल पूरा कर लिये स्टाफ सदस्यों को स्मृति चिन्ह के साथ सम्मानित किया गया। मुख्य अतिथि ने पूर्ववर्ती वर्ष के दौरान सीएसआईआर की सेवाओं से सेवानिवृत्त स्टाफ सदस्यों को भी सम्मानित किया। उच्चतर माध्यमिक परीक्षा में विज्ञान के सभी विषयों में 90s और ऊपर अंक प्राप्त कर्मचारियों के बच्चों को नकद पुरस्कार वितरित किया गया।

### एनआईआईएसटी स्थापना दिवस समारोह-

6 अक्टूबर 2010 को संस्थान का स्थापना दिवस मनाया गया। समारोह के दौरान प्रातः 9.30 बजे से मध्याह्न 1 बजे तक खुला दिन मनाया गया और बाद में स्थापना दिवस व्याख्यान आयोजित किया गया। इसके दौरान विभिन्न कॉलेजों एवं विश्वविद्यालयों से लगभग 300 छात्रों ने प्रयोगशाला का दौरा किया। सीएसआईआर के संबंध में सामान्य जानकारी तथा एनआईआईएसटी में अपनाई जा रही प्रमुख अनुसंधान एवं विकास गतिविधियों के संबंध में संक्षिप्त परिचय देने के साथ, समाज के लिए सीएसआईआर के प्रमुख योगदानों पर छात्रों को एक वीडियो क्लिपिंग दिखाई गई और बाद में छात्रों के विभिन्न प्रयोगशालाओं के दौरे के लिए व्यवस्था की गयी। डॉ. पी. जी राव, निदेशक, पूर्वोत्तर विज्ञान और प्रौद्योगिकी संस्थान (एनआईआईएसटी), जोरहाट, असम समारोह का मुख्य अतिथि थे। डॉ. राव ने “सीएसआईआर-800 – विभाजितों के ब्रिजिंग - सीएसआईआर के प्रयासों” विषय पर





स्थापना दिवस व्याख्यान दिया। उन्होंने सीएसआईआर- 800 कार्यक्रम की जरूरत पर बल दिया जिसका उद्देश्य है पिरामिड के नीचे तल पर धन पैदा करने और इस तरह जीवन की गुणवत्ता में सुधार लाना है। डॉ. सुरेश दास ने अपने अध्यक्षीय भाषण में सीएसआईआर प्रयोगशालाओं के शीर्ष तीन में संस्थान के उन्नयन के लिए तथा प्रति वैज्ञानिक प्रकाशनों की संख्या में तथा इंपैक्ट फैक्टर में संस्थान को सबसे प्रथम बनवाने के लिए संस्थान के पूर्व और वर्तमान सहयोगियों की बधाई की। मुख्य अतिथि द्वारा उत्कृष्ट निष्पादन के लिए सर्विस विभाग तथा अनुसंधान एवं विकास प्रभाग से चयनित सदस्यों को प्रमाण-पत्र और स्मृति-चिह्न वितरित किया गया



डॉ. पी.जी राव, निदेशक, पूर्वोत्तर विज्ञान और प्रौद्योगिकी संस्थान (एनआईआईएसटी), जोरहाट, असम कर्मचारियों को संबोधित करते हुए

### सतर्कता जागरूकता अवधि का आयोजन

संस्थान में 25 अक्तूबर से 1 नवंबर 2010 तक सतर्कता जागरूकता अवधि के रूप में मनाया गया। सतर्कता जागरूकता वधि का प्रारंभ तारीख 25 अक्तूबर 2010 को 11.00 बजे पूर्वाह्न को निदेशक द्वारा स्टाफ सदस्यों को हिंदी और अंग्रेजी दोनों भाषों में सतर्कता जागरूकता प्रतिज्ञा दिलाने के साथ हुआ। 25 अक्तूबर से 29 अक्तूबर 2010 तक स्टाफ सदस्यों एवं अनुसंधान छात्रों के लिए निबंध लेखन, वक्तृता, कार्टून चित्रण तथा नारा लेखन प्रतियोगिता पर प्रतियोगितायें आयोजित की गयीं। 1 नवंबर 2010 को समापन समारोह तथा पुरस्कार वितरण संपन्न हुआ। डॉ. सुरेश दास, निदेशक ने समारोह की अध्यक्षता की। श्री हरिसेना वर्मा, आई पी एस एवं संयुक्त निदेशक, इंटेलिजेन्स ब्यूरो समारोह के मुख्य अतिथि थे और उन्होंने निवारक सतर्कता पर व्याख्यान दिया तथा प्रतियोगिताओं के विजेताओं को पुरस्कार वितरित किया।



श्री हरिसेना वर्मा, आईपीएस, संयुक्त निदेशक, इन्टेलिजेन्स ब्यूरो समापन भाषण देते हुए



## क्षमता प्रशिक्षण और अभिप्रेरणा और सीएसआईआर प्रयोगशालाओं द्वारा स्कूलों और कॉलेजों के अगीकार

सीएसआईआर कार्यक्रम के एक भाग के रूप में, संस्थान में उच्च माध्यमिक और कॉलेज स्तर के शिक्षकों के लिए क्रमशः 17 एवं 18 फरवरी 2011 को रसायन शास्त्र के क्षेत्र में एक दिवसीय प्रशिक्षण कार्यक्रम आयोजित किया गया। इस कार्यक्रम के आयोजन का मुख्य उद्देश्य विज्ञान शिक्षकों को विज्ञान के नए और उभरते क्षेत्रों में अपने ज्ञान के आधार के उन्नयन के लिए प्रशिक्षण और प्रेरक कार्यक्रम जारी रखकर स्कूल और पूर्व स्नातक स्तर पर विज्ञान की शिक्षा में अभिरुचि, उत्तेजना और उत्कृष्टता बढ़ाना और सीएसआईआर प्रयोगशालाओं / संस्थानों के वैज्ञानिक समुदाय के साथ जानकारी के आदान-प्रदान और अन्योन्यक्रिया के लिए अवसर प्रदान करना था।

कार्यक्रम का पहला दिन उच्चतर माध्यमिक विद्यालय के शिक्षकों के लिए निर्धारित था। विभिन्न स्कूलों के लगभग 25 प्रतिभागियों ने कार्यक्रम में भाग लिया है। डॉ. सुरेश दास, निदेशक, एनआईआईएसटी, तिरुवनंतपुरम द्वारा कार्यक्रम का उद्घाटन किया गया। अपने संबोधन में उन्होंने मानव जाति के विकास में रसायन विज्ञान के महत्व पर प्रकाश डाला और युवा प्रतिभागियों को विज्ञान की ओर आकर्षित कराने की आवश्यकता पर तथा छात्रों में वैज्ञानिक दृष्टिकोण विकसित कराने में शिक्षकों की भूमिका पर जोर दिया। उन्होंने सरकारी एजेंसियों, सीएसआईआर, डीएसटी आदि द्वारा समर्थित विज्ञान के प्रचार कार्यक्रम जैसे सीपीवाईएलएस, इन्स्पायर आदि के बारे में उल्लेख किया और बताया कि इन कार्यक्रमों के आयोजन का उद्देश्य विज्ञान शिक्षा की ओर स्कूल और कॉलेज के छात्रों को आकर्षित करना है। तकनीकी सत्रों में आधुनिक रसायन विज्ञान के विभिन्न पहलुओं पर विचार किया गया। डॉ. एम. पद्मनाभन, प्रोफेसर, आईआईएसईआर, तिरुवनंतपुरम के व्याख्यान के साथ सत्र शुरू हुआ। उन्होंने “समन्वय कैमिस्ट्री-परिप्रेक्ष्य में” विषय पर अपना विचार प्रकट किया। डॉ. के. जॉर्ज थॉमस, प्रोफेसर, आईआईएसईआर, तिरुवनंतपुरम ने “परमाणु संरचना और रासायनिक बॉन्डिंग” पर प्रस्तुत अपने व्याख्यान में परमाणु संरचना और रासायनिक बॉन्डिंग अनुसंधान के इतिहास और वर्तमान परिदृश्य पर विस्तृत ब्योरा प्रस्तुत किया। डॉ. के.एम. सुरेशन, प्रोफेसर, आईआईएसईआर, तिरुवनंतपुरम ने “रसायन विज्ञान शिक्षण कैसे रोचक बनाया जाए?” विषय पर प्रतिभागियों के साथ अपना विचार व्यक्त किया।

कार्यक्रम का दूसरा दिन महाविद्यालय के शिक्षकों के लिए आयोजित किया गया। विभिन्न कॉलेजों से लगभग 15 प्रतिभागियों ने कार्यक्रम में भाग लिया। तकनीकी सत्र सूत्रा-आणविक रसायन शास्त्र, चुंबकीय अनुनाद, डीएनए की संरचना आदि सहित रसायन विज्ञान के विभिन्न क्षेत्रों को संबोधित किया। डॉ. रेजी वर्गिस, आईआईएसईआर, तिरुवनंतपुरम ने “सूत्रा-आणविक रसायन विज्ञान” पर व्याख्यान दिया। डॉ. विनीष विजयन, आईआईएसईआर, तिरुवनंतपुरम ने चुंबकीय अनुनाद - मुख्य उपयोग और विभिन्न अन्य पहलुओं के बारे में बताया। डॉ. महेश हरिहरन, आईआईएसईआर, तिरुवनंतपुरम ने “प्राकृतिक और गैर प्राकृतिक डीएनए की संरचना के बारे में अपनी जानकारी व्यक्त की। डॉ. स्वाति, आईआईएसईआर, तिरुवनंतपुरम ने कैमिस्ट्री सिर्फ सभी प्रयोगों के बारे में नहीं है” विषय पर भाषण दिया। डॉ. अयन दत्ता, आईआईएसईआर, तिरुवनंतपुरम ने - “रासायनिक बॉन्डिंग-कुछ तो स्पष्ट नहीं हैं” विषय के अपने व्याख्यान में रासायनिक बॉन्डिंग के साथ जुड़े कुछ मुद्दों पर विचार व्यक्त किया। तकनीकी सत्र के बाद प्रतिभागियों के लिए प्रयोगशाला का दौरा आयोजित किया गया, जहां प्रतिभागियों को विभिन्न यंत्रिय तकनीक समझाया गया। डॉ. सुरेश दास, निदेशक, एनआईआईएसटी, तिरुवनंतपुरम ने समापन समारोह का उद्घाटन किया और प्रतिभागियों को प्रमाणपत्र भी जारी किए गए ६

## राष्ट्रीय विज्ञान दिवस समारोह

राष्ट्रीय विज्ञान दिवस समारोह में भारतीय विज्ञान संस्थान के डीन एवं विज्ञान संकाय प्रो. एस. चन्द्रशेखरन समारोह में मुख्य अतिथि थे। डॉ. सुरेश दास, निदेशक, एनआईआईएसटी ने विज्ञान दिवस समारोह की अध्यक्षता की। उन्होंने बताया कि रमन प्रभाव के लिए नोबेल पुरस्कार विजेता डॉ. सी.वी. रमन की स्मृति में विज्ञान दिवस मनाया जाता है। उन्होंने जवाहर लाल नेहरू जैसे पुराने राजनीतिज्ञों के ज्ञान की सराहना की, जिन्होंने समाज



को बदलाने में विज्ञान की भूमिका पर हमेशा उद्घोषणा की है ।

अपने विज्ञान दिवस व्याख्यान में प्रो एस चंद्रशेखरन ने संयुक्त राष्ट्र द्वारा वर्ष 2011 को रसायन शास्त्र के अंतर्राष्ट्रीय वर्ष के रूप में घोषित होने में आईयूपीएसी और यूनेस्को के प्रयासों की सराहना की । उन्होंने कहा कि कैमिस्ट्री एक अकीर्तित हीरो है, यद्यपि यह ऊर्जा से संबंधित समस्याओं को सुलझाने में तथा नई सामग्री आदि के विकास में महत्वपूर्ण भूमिका निभाता है । उन्होंने आशा व्यक्त की कि वर्ष 2011 को रसायन विज्ञान के अंतरराष्ट्रीय वर्ष के रूप में मनाने से, अन्य बातों के साथ दुनिया की जरूरतों को संतुष्ट कराने में रसायन शास्त्र की भूमिका को समझने में तथा सार्वजनिक सराहना बढ़ाने में सहायता मिलेगी । उन्होंने कहा कि वर्ष 2011 मैडम क्यूरी को नोबेल पुरस्कार प्रदत्त करने की शताब्दी भी है । उन्होंने यह भी कहा कि 21 वीं सदी की सबसे महत्वपूर्ण चुनौतियां हैं 'एनर्जी' और 'पर्यावरण' और इन दोनों से संबंधित मुद्दों के समाधान के लिए रसायन विज्ञान को एक प्रमुख भूमिका निभानी है ।

### सीएसआईआर- एचारडीसी द्वारा सहायकों और आशुलिपिकों के लिए अभिमुखीकरण प्रशिक्षण कार्यक्रम आयोजित किया गया ।

संस्थान के सहायकों /आशुलिपिकों के लिए तारीख 21-25 फ़रवरी 2011 के दौरान सीएसआईआर-एचारडीसी द्वारा पांच-दिवसीय अभिमुखीकरण प्रशिक्षण आयोजित किया गया । स्टाफ सदस्यों के बीच अच्छी प्रथाएं विकसित करने और उनके बीच अच्छे पारस्परिक संबंधों को बढ़ावा देने के लिए अभिमुखीकरण कार्यक्रम का आयोजन किया गया था , ताकि यह प्रक्रिया एनआईआईएसटी को 'उत्कृष्टता के केंद्र' के रूप में बदलने के लिए मार्ग तैयार करें ।

यद्यपि कार्यक्रम सहायकों और आशुलिपिकों के लिए आयोजित था, संस्थान के प्रशासनिक, वित्त एवं लेखा और भंडार एवं क्रय अनुभागों के पूरे कर्मियों को शामिल करके लगभग 50 स्टाफ सदस्यों ने प्रशिक्षण में भाग लिए । कार्यक्रम के संचालन के लिए सीएसआईआर-एचारडीसी से श्री आर एल शर्मा, एसोसिएट कार्यक्रम निदेशक, श्री के.ए. खुरैशी, सहायक कार्यक्रम निदेशक, और श्री मनु सक्सेना, सहायक कार्यक्रम निदेशक, उपस्थित थे । श्री मैनुअल थॉमस, सीओए, सिक्री, कारैकुडी और सरकारी प्रबंधन संस्थान, तिरुवनंतपुरम से सेवानिवृत्त सहायक प्रोफेसर श्री जार्ज विशेष आमंत्रित व्याख्याता थे । इनके द्वारा सीएसआईआर के संदर्भ में माल सूची प्रबंधन, सरकारी संचार- आधुनिक प्रवृत्तियों, सार्वजनिक खरीद, सीएसआईआर परिवर्तन के मामले में अकसर पूछे गए सवाल , पारस्परिक संबंध कौशल, अनुशासनिक कार्यवाहियों, तथा प्रबंधन की नीतियाँ जैसे विभिन्न विषयों पर कक्षाएं चलाई गयीं । श्री टी.वी शंकरन , वित्त एवं लेखा नियंत्रक ने 6वें सीपीसी के कार्यान्वयन के संदर्भ में पेंशनरी लाभ तथा यात्रा भत्ता नियमावली पर स्पष्टीकरण दिया । श्री एम.आर. देवासिस, एसपीओ ने भंडार के भौतिक सत्यापन के बारे में विशदीकरण दिया । श्री के.एफ. जोसफ, अनुभाग अधिकारी (सा.) ने आहरण और संवितरण अधिकारी के कर्तव्यों और दायित्वों पर प्रतिभागियों को जानकारी दी । श्रीमती. एस. शोभना , अनुभाग अधिकारी( स्थापना) ने अवकाश नियमावली तथा कार्यग्रहण समय पर कक्षा चलाई और श्रीमती लती देवी, हिंदी अधिकारी ने संघ सरकार की राजभाषा नीति के कार्यान्वयन की संवैधानिक अपेक्षा के बारे में प्रतिभागियों को बताया ।



श्री आर एल शर्मा, एसोसिएट कार्यक्रम निदेशक, सीएसआईआर-एचारडीसी प्रतिभागियों को संबोधित करते हुए ।  
मंच पर बैठे हैं बाईं ओर से - श्री के.ए. खुरैशी, डॉ. सुरेश दास और श्री टी.वी. शंकरन

### हिंदी दिवस एवं हिंदी सप्ताह-2010

संस्थान में दिनांक 14 सितंबर 2010 को हिंदी दिवस के रूप में तथा बाद के एक सप्ताह को हिंदी सप्ताह के रूप में समुचित ढंग से मनाया गया । पूरे सप्ताह के दौरान राजभाषा के प्रचार-प्रसार के लिए परियोजना स्टाफ, अनुसंधान छात्र आदि सहित संस्थान के संपूर्ण स्टाफ सदस्यों तथा उनके स्कूली छात्रों के लिए अनेक प्रतियोगिताएं आयोजित की गईं । कार्यक्रम का शुभारंभ सुश्री प्रीती एवं सुश्री अपर्णा के वंदन गीत से हुआ। डॉ. एस. के. नस्कर, निदेशक केंद्रीय कंद फसल अनुसंधान संस्थान, तिरुवनंतपुरम समारोह में मुख्य अतिथि थे ... संस्थान के निदेशक डॉ. सुरेश दास ने समारोह की अध्यक्षता की । हिंदी सप्ताह आयोजन समिति के अध्यक्ष डॉ. अशोक पाण्डेय ने मुख्य अतिथि, निदेशक तथा समारोह में उपस्थित सभी प्रतिभागियों का स्वागत किया । मुख्य अतिथि ने दीप प्रज्वलित करके समारोह का औपचारिक उद्घाटन किया और हिंदी दिवस व्याख्यान दिया । उन्होंने अपने भाषण में केंद्रीय कंद फसल अनुसंधान संस्थान में हो रहे अनुसंधान कार्य एवं उपलब्धियों का संक्षिप्त परिचय दिया और प्रतिभागियों से यह अपील किया कि कार्यालय में केंद्र सरकार की राजभाषा नीति के प्रभावी कार्यान्वयन के लिए सभी प्रयास किए जाएं और कार्यालय के अधिकांश कार्य हिंदी में करके राजभाषा के प्रयोग को बढ़ावा दें ।

चित्र-1 हिंदी दिवस का औपचारिक उद्घाटन करते हुए मुख्य अतिथि डॉ. एस.के.नस्कर, निदेशक, सी टी सी आर आई, तिरुवनंतपुरम। सामने खड़े हैं बायीं ओर से आयोजन समिति के अध्यक्ष डॉ. अशोक पाण्डेय, निदेशक डॉ. सुरेश दास और हिंदी अधिकारी



संस्थान के निदेशक डॉ. सुरेश दास ने समारोह की अध्यक्षता की ... उन्होंने प्रतिभागियों को संबोधित करके हुए कहा कि भारतीय संविधान में किए गए उपबंधों एवं उनके आधार पर बनाए गए अधिनियम एवं नियमों के अनुरूप हिंदी का प्रयोग एवं प्रचार-प्रसार सुनिश्चित करना भारत सरकार के सभी कार्यालयों का दायित्व है। इस दायित्व के आलोक में आमतौर पर भारत सरकार की राजभाषा नीति का समुचित अनुपालन केंद्रीय सरकार के सभी कार्यालयों में सुनिश्चित किया जाता है।

उन्होंने अपने भाषण में आगे बताया कि संस्कृत और हिंदी देश के दो भाषा रूपी स्तंभ हैं, जो देश की संस्कृति, परंपरा और सभ्यता को विश्व के मंच पर बखूबी प्रस्तुत करते हैं। आज विश्व के कोने-कोने से विद्यार्थी हमारी भाषा और संस्कृति को जानने के लिए हमारे देश का रुख कर रहे हैं। हिंदी भाषा विश्व में सबसे ज़्यादा बोली जाने वाली तीसरी भाषा है। अब हमारी हिंदी भाषा अंतरराष्ट्रीय स्तर पर भी बहुत पसंद की जाती है। इसका एक कारण यह है कि हमारी भाषा हमारे देश की संस्कृति और संस्कारों का प्रतिबिंब है। उन्होंने आगे हिंदी की महत्ता पर प्रकाश डालते हुए बताया कि हिंदी भाषा भारतीय संस्कृति की धरोहर है जिसे बचाना भारतवासियों का परम कर्तव्य है। ध्यान, योग आसन और आयुर्वेद विषयों के साथ-साथ इनसे संबंधित हिंदी शब्द आदि, ऐसी संस्कृति है, जिसे पाने के लिए हिंदी के रास्ते से ही पहुंचा जा सकता है। लगभग हर देश में योग, ध्यान और आयुर्वेद के केन्द्र खुल गए हैं, जो दुनिया भर के लोगों को भारतीय संस्कृति की ओर आकर्षित करते हैं, जो स्वयं हमारी हिंदी भाषा और संस्कृति से प्रभावित हैं। उन्होंने सभी प्रतिभागियों से हिंदी दिवस पर हिंदी भाषा तथा अपनी संस्कृति को बचाने के लिए सभी संभव प्रयास करने का दृढ़निश्चय लेने का आग्रह किया।



उद्घाटन समारोह में अध्यक्षीय भाषण देते हुए निदेशक डॉ. सुरेश दास

समारोह के दौरान मुख्य अतिथि ने संस्थान के रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग की गतिविधियों पर विशेषांक के रूप में प्रकाशित अर्धवार्षिक हिंदी पत्रिका- आईआईएसटी समाचार के चौथे अंक की प्रथम प्रति निदेशक को सौंपकर पत्रिका का लोकार्पण किया ।



पत्रिका का लोकार्पण करते हुए मुख्य अतिथि डॉ. एस.के. नस्कर

श्री संजय सुमन, सदस्य, आयोजन समिति ने धन्यवाद ज्ञापित किया । उद्घाटन सत्र के बाद सी-डैक, तिरुवनंतपुरम के सहयोग से कंप्यूटरों पर हिंदी के प्रयोग से संबंधित डिमोन्स्ट्रेशन कार्यक्रम का आयोजन किया गया । कार्यक्रम के संचालन के लिए सी-डैक, तिरुवनंतपुरम से उपस्थित वैज्ञानिक श्रीमती शोभना वर्मा ने प्रतिभागियों को संबोधित करते हुए बताया कि सूचना-प्रौद्योगिकी ने आज हमारे जीवन के समस्त पहलुओं को प्रभावित किया है । भाषाओं के विकास की दिशा में यह वरदान साबित हुआ है । सूचना प्रौद्योगिकी के क्षेत्र में कार्यरत विशेषज्ञों का ध्यान भाषाओं की ओर भी आकृष्ट हुआ है । परिणामतः भाषाओं के विकास में उपयोगी कई उपकरण इनके द्वारा विसर्जित किए गए हैं । इनके प्रयोग से हम अपने कामकाज में गतिशीलता एवं गुणात्मकता सुनिश्चित कर सकते हैं । राजभाषा के रूप में हिंदी के प्रयोग एवं प्रचार-प्रसार के लिए आज कई साधन उपलब्ध



हैं। ऐसे साधनों एवं उपकरणों के प्रति जागरूकता के अभाव में इनका प्रयोग एवं सदुपयोग नहीं हो पाता है। इस ओर ध्यान देकर इस संबंध में स्टाफ सदस्यों को आवश्यक दिशा-निर्देश देना यह डिमोणस्ट्रेशन कार्यक्रम का उद्देश्य है। भारतवर्ष हिंदी भाषी राष्ट्र है, उसको हिंदी के प्रचार व प्रसार पर ध्यान देना चाहिये। इस दिशा में किए गए प्रयास का परिणाम है-

इंटरनेट के माध्यम से हिंदी भाषा का प्रचार-प्रसार व प्रयोग। उन्होंने कंप्यूटरों पर हिंदी के प्रयोग से संबंधित सैद्धांतिक पक्ष पर प्रतिभागियों को समझाया और श्रीमती मुन्तास, संकाय सदस्य, सी.ई.टी. ने कंप्यूटरों पर यूनिकोड भाषा इन्कोडिंग, गूगल की सहायता से अनुवाद, राजभाषा विभाग के हिंदी पोर्टल, यूनिकोड के लिए यूनिवर्सल फ्रॉन्ट की संस्थापना, कंप्यूटरों पर ध्वन्यात्मक, इंस्क्रिप्ट, टाइपराइटर, जैसे विभिन्न प्रकार के कुंजी बोर्डों का उपयोग आदि पर प्रतिभागियों को प्रशिक्षण दिया और अभ्यास करवाया।



डिमोणस्ट्रेशन कार्यक्रम का संचालन करती हुई श्रीमती शोभना वर्मा

हिंदी सप्ताह के दौरान राजभाषा के प्रचार-प्रसार को लक्ष्य करके स्टाफ सदस्यों के बीच निम्नलिखित प्रतियोगिताएं आयोजित की गईं -

- 14 सितंबर 2010 को हिंदी में टिप्पण एवं आलेखन प्रतियोगिता
- 15 सितंबर 2010 को हिंदी कवितापाठ प्रतियोगिता
- 16 सितंबर को हिंदी प्रश्नोत्तरी तथा
- 17 सितंबर को हिंदी पठन तथा सृजनात्मक लेखन प्रतियोगिता

स्टाफ सदस्यों के स्कूली छात्रों के लिए निम्नलिखित प्रतियोगिताएं तीन ग्रुपों में आयोजित की गईं -

- हिंदी निबंध लेखन
- हिंदी अनुवाद
- हिंदी कवितापाठ

सभी प्रतियोगिताओं में स्टाफ सदस्यों तथा स्कूली छात्रों ने सक्रिय रूप से भाग लिया। निदेशक डॉ. सुरेश दास की अध्यक्षता में दिनांक 20 सितंबर 2010 को समापन समारोह आयोजित किया गया। डॉ. अशोक पाण्डेय ने समारोह में उपस्थित सभी का स्वागत किया। हिंदी सप्ताह के सफल आयोजन के लिए स्टाफ सदस्यों तथा उनके स्कूली छात्रों द्वारा दिए गए सौहार्दपूर्ण सहयोग के लिए निदेशक ने सभी को धन्यवाद दिया और उन्होंने विभिन्न प्रतियोगिताओं के विजेताओं को पुरस्कार एवं प्रमाणपत्र से सम्मानित किया।



पुरस्कार वितरित करते हुए निदेशक डॉ. सुरेश दास श्रीमती एस. शोभना, अनुभाग अधिकारी के धन्यवाद ज्ञापन के साथ समापन समारोह संपन्न हुआ ।

### संस्थान के अधिकारियों / कर्मचारियों के लाभार्थ “बोलचाल की हिन्दी” पर कार्यशाला आयोजित की गई

संस्थान के अधिकारियों तथा कर्मचारियों को आपस में हिंदी में वार्तालाप करने में होनेवाली झिझक को दूर करने के लिए दिनांक 17/2/2011 को बोलचाल की हिन्दी पर कार्यशाला का आयोजन किया गया । इसमें कुल 34 प्रतिभागियों ने बड़े उत्साह से भाग लिया । श्री डी.कृष्ण पणिक्कर, उपनिदेशक (रा.भा.) (सेवानिवृत्त), अतिथि वक्ता के रूप में आमंत्रित किए गए ।

संस्थान की हिन्दी अधिकारी श्रीमती लतीदेवी ने श्री डी.कृष्ण पणिक्कर का तथा उपस्थित सभी प्रतिभागियों का स्वागत किया । इसके पश्चात अतिथि वक्ता ने राजभाषा कार्यान्वयन की संवैधानिक अपेक्षा, कार्यान्वयन की सामान्य जिम्मेदारी आदि पर विस्तार से चर्चा की । बाद में प्रतिभागियों को बोलचाल की हिन्दी पर परिचय करवाया गया । अपने दैनिक जीवन में विभिन्न स्थानों पर जैसे अस्पताल में, डाक-घर में, काफी हाउस में, बस स्टैंड में अजनबी मुसाफिर के साथ तथा दूकान में (बाज़ार में) अनौपचारिक वार्तालाप, तथा संसदीय राजभाषा समिति के साथ औपचारिक वार्तालाप की तरीका आदि पर अतिथि वक्ता ने प्रतिभागियों को बताया ।



कार्यशाला में व्याख्यान देते हुए श्री डी.कृष्ण पणिक्कर, उपनिदेशक (रा.भा.) (सेवानिवृत्त)



प्रतिभागियों की झलक





अतिथि वक्ता ने कार्यालय में प्रयुक्त होनेवाली कुछ सामान्य टिप्पणियों, हिंदी व्याकरण तथा कुछ मानक अंग्रेज़ी टिप्पणियों का हिंदी में रूपांतरण आदि पर प्रतिभागियों को समझाया और बाद में कुछ अंग्रेज़ी टिप्पणियों के हिंदी अनुवाद पर प्रतिभागियों को अभ्यास करवाया गया।  
अंत में धन्यवाद ज्ञापन के साथ कार्यशाला संपन्न हुई ।

### राजभाषा कार्यान्वयन के लिए पुरस्कार

वर्ष 2009-10 के दौरान राजभाषा कार्यान्वयन से संबंधित उत्तम निष्पादन के लिए पांचवें स्थान प्राप्त करने के उपलक्ष्य में तिरुवनंतपुरम नगर राजभाषा कार्यान्वयन समिति की तरफ से संस्थान को योग्यता प्रमाण पत्र प्रदान किया गया।

तिरुवनंतपुरम नगर राजभाषा कार्यान्वयन समिति की तरफ से संस्थान की हिंदी गृह पत्रिकाएन आई आई एस टी समाचार को सदस्य उपक्रमों द्वारा प्रकाशित पत्रिकाओं में से तृतीय सर्वश्रेष्ठ पत्रिका चुन ली गयी और इसके उपलक्ष्य में प्रमाण पत्र प्रदान किया गया ।



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