वार्षिक प्रतिवेदन 2011-2012

Annual Report 2011-2012

सी एस आई आर - राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान

CSIR - National Institute for Interdisciplinary Science & Technology

(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)

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Editorial Committee	:	Dr. Suresh Das Dr. A.Sundaresan Dr. Ashok Pandey Dr. D. Ramaiah Dr. M.T. Sebastian Dr. (Mrs.) Roschen Sasikumar Dr. U. Syamaprasad Mr. C.K. Chandrakanth Dr. V.G. Mohanan Nair
Hindi Translation	:	Mrs. K.S. Lathidevi
Photography	:	Mr. G. Nagasrinivasu
Design & Printing	:	Akshara Offset, Thiruvananthapuram

CSIR - National Institute for Interdisciplinary Science & Technology

National Institute for Interdisciplinary Science & Technology

Council of Scientific and Industrial Research

Industrial Estate P.O., Thiruvananthapuram-695019, Kerala, India

Tel: +91-471-2490324/ 2515226/ 2515200, Fax: +91-471-2491712

Email: contact@niist.res.in, director@niist.res.in

Website: http://www.niist.res.in

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Foreword

It gives me great pleasure to present the Annual Report of the Institute for the period 2011-2012. I am very happy to note that during this period, CSIR has brought out a bold new vision document entitled CSIR@80: Vision & Strategy 2022. The vision document outlines what CSIR hopes to achieve by the year 2022, which will mark the 75th Anniversary of the Indian independence and also 80 years of existence of CSIR. At CSIR-NIIST we have translated this Vision document into Malayalam and Hindi to ensure that this vision is owned by each and every member of the CSIR-NIIST family. Coincidentally, starting from this year, the period outlined in the Vision document will also cover the next two plan periods of the Country. CSIR has outlined ambitious programs for the 12th plan with the aim of improving the quality and relevance of its research and to help it meet the goals outlined in the Vision document. As a member of the Chemistry Cluster, we at CSIR-NIIST are very happy to have played a role in outlining the programmes for the Cluster of the 12th Plan, and to be contributing significantly in various plan projects of the other clusters.

One of the catch phrases in the Vision document is "A New CSIR for a New India". We would like to contribute to this by building a "New CSIR-NIIST for that New CSIR". To this effect during the last year, we have recruited a number of new scientists and brought about significant improvement in the infrastructure including initiating the construction of new laboratories and completing the construction of a scholar's hostel. These initiatives along with our plan to continuously improve ourselves in all spheres of our activities will help us to contribute significantly in meeting the ambitious goals of CSIR in the coming years.

The year 2011 was also designated as the International Year of Chemistry by the UN General Assembly based on the recommendation of IUPAC with the aim of celebrating the achievements of chemistry and its contributions to the well-being of humankind. During this year, several activities were undertaken to promote awareness of the contributions of chemistry in this region, including lectures by distinguished visitors such as Dr. R. A. Mashelkar, former DG-CSIR, Dr. D. Balasubramanian, former Director CSIR-CCMB and Dr. Tushar Chakravorti, Director CSIR-CDRI. The year of Chemistry also marked the 100th anniversary of the Mme. Curie Nobel Prize in Chemistry. In this connection we were very happy to host a special meeting on Women in Chemistry, where role models like Professor Ila Bhatnagar, JNCASR-Bangalore, Professor Charusita Chakravorti, IIT-Delhi and Dr. Aruna Dhathathreyan, Senior Principal Scientist, CSIR-CLRI, Chennai, spoke about their subject as well as the challenges and excitement of doing science, which proved to be highly inspiring for the target audience, namely students and teachers from the local colleges.

The successful organization of major conferences such as the 14th National Symposium of Chemistry of the Chemical Research Society of India (CRSI) along with the joint Royal Society of Chemistry-UK (RSC-CRSI) meeting as well as the International Conference on New Horizons in Biotechnology also helped in providing exposure to our students to leading experts in these areas.

CSIR-NIIST has continued to excel in the scientific field. A report brought out by NESTA, a UK based organization, in July 2012, has highlighted the high quality publications of our Institute. According to the report "Trivandrum's National Institute for Interdisciplinary Science and Technology (NIIST), part of the CSIR network, publishes the highest proportion of world–class papers of any institute in India – world–class research accounts for 14 per cent of the total institutional output". Our White Pepper technology was recognized with the WIPO gold medal and the NRDC Medal. Several of our scientists have received prestigious awards and recognitions. There have been many more achievements during this year all of which have been described in the report.

I wish to express my deep appreciation to all the members of the CSIR-NIIST family for their contributions in the various spheres and for their sincere effort in helping in the process of building the "New CSIR-NIIST".

Suresh Das
Director

प्राक्कथन

वर्ष 2011-2012 की अवधि के लिए संस्थान की वार्षिक रिपोर्ट प्रस्तुत करने में मुझे अत्यंत खुशी है। यह और भी खुशी की बात है कि इस अवधि के दौरान सीएसआईआर द्वारा 'सीएसआईआर @ 80: विजन और योजना-2022" विषयक एक साहसिक नया विजन दस्तावेज़ निकाला है। विजन दस्तावेज में, वर्ष 2022 तक को सीएसआईआर क्या प्राप्त करने की उम्मीद कर रही है, की रूपरेखा की गयी है, जो भारतीय स्वतंत्रता की 75वीं वर्षगांठ और सीएसआईआर के अस्तित्व के 80 साल को चिह्नित किया जाएगा। सीएसआईआर - एनआईआईएसटी परिवार के हर सदस्य को इस विजन दस्तावेज की निजी प्रति सुनिश्चित करने के लिए हमने विजन दस्तावेज का मलयालम और हिन्दी में अनुवाद किया है। संयोगवश, इस वर्ष से विजन दस्तावेज में उल्लिखित अवधि शुरू होती है और यह देश की अगली दो योजना अवधि को भी कवर किया जाएगा। अपने अनुसंधान की गुणवत्ता और प्रासंगिकता में सुधार लाने और विजन दस्तावेज में उल्लिखित लक्ष्यों को पूरा करने के उद्देश्य के साथ सीएसआईआर ने 12वीं योजना के लिए महत्वाकांक्षी कार्यक्रम को रेखांकित किया है। रसायन विज्ञान क्लस्टर के एक सदस्य के रूप में हमें खुशी है कि 12वीं योजना के क्लस्टर के लिए कार्यक्रमों की रूपरेखा तैयार करने में सीएसआईआर-एनआईआईएसटी ने भूमिका निभाई है और अन्य क्लस्टरों की विभिन्न योजना परियोजनाओं में सीएसआईआर- एनआईआईएसटी द्वारा महत्वपूर्ण योगदान दिया जाएगा।

विजन दस्तावेज का एक आकर्षक वाक्यांश है 'एक नए भारत के लिए एक नई सीएसआईआर'। हम 'उस नई सीएसआईआर के लिए एक नया सीएसआईआर - एनआईआईएसटी' के निर्माण के साथ इसके लिए योगदान देना चाहते हैं । पिछले वर्ष के दौरान, इस आशय में , हम ने असंख्य नए वैज्ञानिकों की भर्ती की है, नई प्रयोगशालाओं के निर्माण की शुरुआत की, और शोधार्थियों के लिए छात्रावास का निर्माण का कार्य पूरा किया और इस प्रकार बुनियादी ढांचे में महत्वपूर्ण सुधार लाया । इन पहलों तथा हमारी गतिविधियों के सभी क्षेत्रों में खुद को लगातार सुधार करने की हमारी योजना, आने वाले वर्षों में सीएसआईआर के महत्वाकांक्षी लक्ष्यों को पूरा करने में काफी योगदान देने में हमें मदद करेगी ।

रसायन शास्त्र की उपलब्धियों और मानव जाति की भलाई के लिए उसके योगदान का जश्न मनाने के उद्देश्य के साथ आईयूपीएसी की सिफारिश के आधार पर संयुक्त राष्ट्र आम सभा ने वर्ष 2011 को रसायन विज्ञान के अंतरराष्ट्रीय वर्ष के रूप में निर्दिष्ट किया गया था । इस वर्ष के दौरान, डॉ. आर.ए. माशेलकर, पूर्व महानिदेशक, सीएसआईआर, डॉ. डी. बालसुब्रमण्यन, पूर्व निदेशक सीएसआईआर - सीसीएमबी और डॉ. तुषार चक्रबर्ती, निदेशक सीएसआईआर – सीडीआरआई जैसे प्रतिष्ठित आगंतुकों के व्याख्यान सहित, इस क्षेत्र में, रसायन शास्त्र के योगदान के बारे में जागरूकता को बढ़ावा देने के लिए कई गतिविधियॉ आयोजित की गयीं । रसायन विज्ञान का वर्ष मैडम क्यूरी को रसायन विज्ञान में नोबेल पुरस्कार प्राप्त होने की 100 वीं वर्षगांठ के रूप में चिह्नित है । इस संबंध में "रसायन विज्ञान में महिलाओं" पर एक विशेष बैठक की मेजबानी करने में हम बहुत खुश थे, जहां प्रोफेसर इला भटनागर, जेएनसीएएसआर, बंगलौर, प्रोफेसर चारुसीता चक्रवर्ति, आईआईटी, दिल्ली और डॉ. अरुणा दथात्रेयन, वरिष्ठ प्रधान वैज्ञानिक, सीएसआईआर – सीएलआरआई, चेन्नई, जैसे रॉल मॉडलों ने अपने विषय तथा विज्ञान की चुनौतियों के बारे में बात की थी, जो लक्षित दर्शकों, अर्थात्स्थानीय कॉलेजों से छात्रों और शिक्षकों के लिए अत्यधिक प्रेरणादायक साबित हुआ ।

भारतीय केमिकल रिसर्च सोसायटी (सीआरएसआई) के रसायन विज्ञान की 14 वीं राष्ट्रीय संगोष्ठी के साथ रसायनविज्ञान की संयुक्त रॉयल सोसाइटी - ब्रिटेन (आरएससी-सीआरएसआई) बैठक तथा जैव प्रौद्योगिकी में नए क्षितिज पर अंतर्राष्ट्रीय सम्मेलन जैसे प्रमुख सम्मेलनों के सफल आयोजन ने हमारे छात्रों को इन क्षेत्रों के अग्रणी विशेषज्ञों के साथ इक्सपोजर के लिए मदद की ।

सीएसआईआर – एनआईआईएसटी ने वैज्ञानिक क्षेत्र में उत्कृष्टता हासिल करने के अपने प्रयास को जारी रखा है । ब्रिटेन का एक संगठन एनईएसटीए द्वारा जुलाई 2012 में प्रकाशित एक रिपोर्ट में हमारे संस्थान के उच्च गुणवत्ता वाले प्रकाशनों पर प्रकाश डाला गया है। रिपोर्ट के अनुसार त्रिवेंद्रम के 'राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान (एनआईआईएसटी), जो सीएसआईआर नेटवर्क का हिस्सा है, भारत में किसी भी संस्थान की तुलना में विश्व स्तरीय कागजात का उच्चतम अनुपात प्रकाशित करता है - कुल संस्थागत उत्पादन के 14 प्रतिशत के लिए विश्व स्तरीय अनुसंधान खाते'। हमारी सफेद मिर्च प्रौद्योगिकी के लिए डब्ल्यूआईपीओ स्वर्ण पदक और एनआरडीसी पदक से मान्यता प्राप्त हुई। हमारे कई वैज्ञानिकों को प्रतिष्ठित पुरस्कार और सम्मान प्राप्त हुए हैं। इस साल के दौरान कई और अधिक उपलब्धियॉ प्राप्त हुई है और इन सब के ब्यौरे रिपोर्ट में दिए गए हैं ।

विभिन्न क्षेत्रों में अपने योगदान के लिए और 'नये सीएसआईआर -एनआईआईएसटी' के निर्माण की प्रक्रिया में मदद करने में अपनी ईमानदारी से प्रयास के लिए सीएसआईआर - एनआईआईएसटी परिवार के सभी सदस्यों को मैं अपनी गहरी प्रशंसा व्यक्त करना चाहता हूँ ।

सुरेश दास
निदेशक

CSIR - National Institute for Interdisciplinary Science & Technology

SIGNIFICANT ACHIEVEMENTS

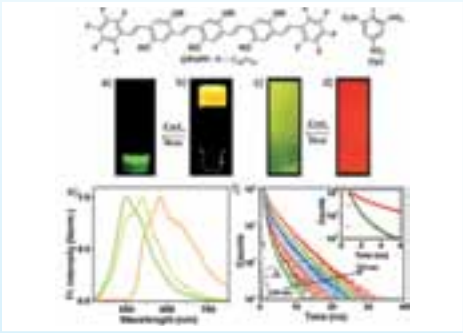
The annual report for the period 2011-12 encompasses the achievements of the Institute's R&D programs and future plans along with the addition of new infrastructure facilities, development of human resources, services rendered to external clientele from industry and academics based on the expertise generated through interdisciplinary research. The year has been of special significance as the final year of the Eleventh Five Year Plan. The quality and quantity of scientific work output from this institute has continuously increased since its inception. Emphasis has been laid to develop synergized core competencies through high quality basic research, as well as industrially and socially relevant application oriented research.

A summary of the salient features of the work done during the year is presented below: -

1. Business Development and Contract Research

The institute has signed various agreements with major industries and small scale industries during the financial year 2011-2012, details thereof are as follows:

- SRANEXIM CORPORATION, Philippines - Licensing of Knowhow for the production of Banana fibre
- 3D Foundry Tech Pvt. Ltd. - Licensing of Intellectual Property in respect of SOLVER module of Virtual Casting
- Confidentiality Agreements with: The Goodyear Tire & Rubber Company, USA; Unilever Industries Private Limited, Mumbai; Satyavathi Titaslag Limited, Hyderabad; Eureka Systems and Electrodes Private Limited, Coimbatore; Maps Enzymes Limited (Formerly Maps (India) Ltd.), Ahmedabad; Reliance Cement Company Pvt. Ltd., Navi Mumbai.
- Setting up demonstration plants with: Kottappuram Integrated Development Society, Thrissur for pineapple leaf fibre and banana fibre extraction; Santhigiri Koottukudumba Coir Unit, Alappuzha for coir fibre extraction.



2. Modernization of Infrastructure Facilities

During the year of report, a new Scanning Electron Microscope with variable pressure and cryo mode operation was installed. This machine operates on LaB_6 electron beam source and can characterize without any pretreatment soft organic materials, biological materials along with normal solid and powder samples. The addition of this machine added leverage to the analytical prowess of the Institute. High speed internet facility was introduced with dedicated 9 mbps internet leased line connectivity through BSNL. Unified Threat Management (UTM) device was implemented for routing, load balancing, fail-over and secured data access.

Work was awarded for the new Silver Jubilee Building which will pave the way for ambitious expansion program of the Institute while continuing its stride to scale new heights in basic and applied research.

3. Progress in R&D Programs

The execution and progress of ongoing projects successfully by all divisions resulted in several break through developments which are highlighted below.

A Technology Business Incubation Center for Agroprocessing Division was envisaged and the implementation steps were initiated. This center will facilitate value addition through unit operation on different products thereby generate market for entrepreneurs.

The main cause of obesity, it is postulated, is due to excess nutrient intake. A consequence to this is ER stress which leads to insulin resistance and inflammation. It is now shown that apigenin and quercetin reduce the adipogenesis during ER stress.

Institute with the support of Bureau of Indian Standards carried out a project to develop data base on the oil content and physico chemical composition of fresh ginger cultivars grown in seven states of north east and its variation at different stages of maturity which revealed the substantial variation of volatile oil content and oil composition between the cultivars collected from different regions of the north east.

In India the major oil consumed in the northern region is soyabean (SOY) and Mustard while in southern region it is coconut (CNO) and palm oil (PLO). A study was carried out to generate designer oil which will meet the requirements of both essential fatty acids (EFA) and medium chain triglycerides (MCT) by blending unsaturated MO and SOY with saturated virgin CNO and PLO that are rich in MCT. SOY/CNO was

found to be the most stable with least FFA (1.12%), peroxide (39.68 meq/kg) and para-anisidiene values (5.92) binding with CODEX standards.

In the area of biotechnology, significant contributions were made in the production of value-added chemicals such as industrial enzymes, biofuels, biopolymers, organic acids, etc from biomass, bio-based processes development involving encapsulated microorganisms for environmental protection, production of exopolysaccharide (EPS) from probiotic lactic acid bacteria and development of formulations with probiotics and/or EPS for health benefits, development of functional foods and their formulations for potential health benefits of common man and development of microbial consortium for the biodegradation of e-plastics and biopolymers.

By cultivating *Streptomyces gedanensis* on polyurethane (PUF) impregnated with a minimal medium a highly efficient bioprocess was developed for the production of L-leucine amino peptidase (489 IU enzyme/g PUF) under solid-state fermentation (SSF). A recombinant strain of *Corynebacterium glutamicum* was constructed which showed a capacity to utilize xylose and arabinose, present either alone or together in pentose sugars hydrolyzate. The cellulase produced by *Penicillium janthinellum* and a glucose-tolerant beta glucosidase (BGL) produced by *Aspergillus niger* were used to prepare an enzyme cocktail, which showed high hydrolysis efficiency when compared with commercially available enzymes in hydrolyzing the steam exploded bagasse.

The foliate production in skimmed milk was enhanced by *Lactococcus lactis* ssp *cremoris* through effective manipulation of medium additives and cultivation conditions. It was also proved that the *Lactococcus lactis* ssp *cremoris* is an excellent source for the enrichment of the foliate content in watermelon and cucumber juice.

The Chemical Sciences and Technology Division which in itself has diversified expertise ranging from Photochemistry, Inorganic Chemistry, Organic Chemistry and Nano Technology, is carrying out its research and development activities through conceited, interdisciplinary collaborative efforts on fundamental and applied aspects of photochemistry and related areas, in developing photonic materials for applications in solar energy harvesting, electro optical devices and photo medicine, 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 in the isolation/synthesis of new bioactive molecules and

to develop state of the art synthetic organic methodologies for the fine chemical industry.

Energy saving non-toxic NIR reflecting yellow inorganic pigments were successfully synthesized by solid-state route for use as surface coating.

The substituent dependent encapsulation of potentially useful squaraine dyes in β-CD was demonstrated, thereby indicating its potential as a carrier system for the squaraine dyes useful in photodynamic therapy.

Superior detection of TNT in record attogram level using fluorescent organogelator, in gel form, was demonstrated. This is a simple and low cost method used for the detection of TNT explosives through contact mode either on surface or in aqueous solution by employing the unique molecular packing of the organogelator and the associated photophysical properties.

A low cost, heterogeneous iodide ion selective electrode (ISE) membrane was fabricated by dispersing conductive AgI crystals in polyvinyl chloride. These crystals were prepared and stabilized in the β-phase by post microwave irradiation under pressurized condition.

As a part of the ongoing research activity on biologically active natural products isolated from medicinal plants used in traditional medicinal systems, *Premna herbacea* used in Ayurveda as an anti-cancer and anti-inflammatory agent was studied in detail from which bharangin, a diterpenoid quinonemethide, was isolated.

In the ongoing program on novel functional materials for applications in energy, electronic and transport sectors, the focus was on the development of electronic materials, advanced superconductors, super ionic conductors, magnetic materials functional ceramics, composites, nano-coatings and porous materials, development of advanced polymers, light alloys and functionally gradient metal matrix composites.

$LiMgPO_4$ based glass free ceramic tape was successfully developed, which showed excellent microwave dielectric properties. In another success story, electro magnet shielding material in the X band was developed from composites of polyvinylidene fluoride (PVDF) with micron and nano sized $BaTiO_3$ powders. In the fast emerging area of flexible electronics, Institute has successfully developed mechanically flexible silicon rubber filled with nano alumina composite. From the dielectric property, coefficient of thermal expansion and moisture absorption measured, it was found that nano

alumina filled silicon rubber composite is an ideal candidate for flexible microwave substrate application.

Several important research programs were undertaken under the main theme of innovative technologies for environmental management and value addition to natural resources. In the quest for an alternative to the fast dwindling fossil diesel, development of algal Biofuel from microalgae is considered to be a potential source. Auto flocculating algal cultures were developed by two methods (patent applied). Extensive studies are underway in this area.

Anaerobic Leach Bed Reactor (ALBR) for treatment of solid wastes was developed to deal with the management of municipal solid wastes containing non-degradable materials such as plastic. Overall moisture balancing to around 60% was achieved from the former value of 85% and this method produced stabilized organic compost.

Environment impact assessment studies were carried out for beach washing and mineral separation plant for Kerala Minerals & Metals Ltd, Kollam, and proposed heavy mineral sand mining at Alappad, Panmana and Ayanivelikulangara, Kollam district.

The software Virtual Casting, for the casting flow process by simulation of mold filling, was developed in 2004. This technology was transferred to 3DFoundryTech, Mumbai.

The planning of R&D projects for the XIIFYP was finalized and draft plan proposals were sent to CSIR for approvals.

4. Publications and Patents

During the period of report, 201 research papers were published in journals of international repute with improved impact factor per paper, as compared to previous years. The year witnessed a significant increase in IPR protection as 7 Indian patents and 19 foreign patents were filed. Number of Indian and foreign patents granted were 3 and 7 respectively.

5. Administrative Reforms

The Institute adopted a new internal review programme by imbibing the essence of ISO certification process which was implemented effectively on all divisions. This has lead to the effective monitoring of statutory and regulatory requirements on the ongoing research and development projects, infrastructure and human resources. This activity is expected to generate superior returns from all ongoing and future programs of the Institute.

CSIR NIIST had undertaken the implementation of Enterprise Resource Planning as a part of CSIR policy and is on the process of integrating our core research and development activities with administration, infrastructure, human resources and finance through single computer system.

6. Technical Services Provided

Institute continued to render stupendous instrumentation support for its in house R&D programs as well as to external clientele ranging from industries to academics. Total revenue of Rs. 16,24,968 was generated from the various analytical instrumentation facilities available within the Institute during the year of this report.

7. Human Resource Development

Human Resource Development Cell of CSIR NIIST continued their sustained contribution to science and technology human resource development. Several training programs were organized in the lab to develop and nourish multifaceted capabilities among staff and students.

Several staff members were nominated and deputed for training programs at CSIR HRDG, DST and LBS National Academy of Administration Mussoorie.

During the year of report, 20 students completed their research work and submitted their theses. A total of 13 students of the Institute were awarded PhD Degree by different universities. Students from various colleges were provided research training for the partial fulfillment of their PG/Degree courses.

AcSIR, the new organ in CSIR system, which was notified in the Gazette on 17 July 2010, is functioning at full swing at the Institute. This year 24 students had enrolled for PhD Degree under various disciplines.

8. Seminars/Symposia/Lectures/Exhibitions

Workshops with titles- Transactional Analysis, Crafting Your Life Story and Team Building were organised in the Institute for the benefit of staff and students. Several internal lectures on diversified topics were also carried out in the Institute.

NIIST and IISER, Thiruvananthapuram jointly organized the 14th National Symposium in Chemistry of the Chemical Research Society of India (CRSI) and 6th CRSI- Royal Society of Chemistry Symposium during February, 2012 at the Institute campus. The Photosciences and Photonics group

organized a three day workshop on Solar cells during January, 2012 in collaboration with the counterparts of the European Union Collaborators.

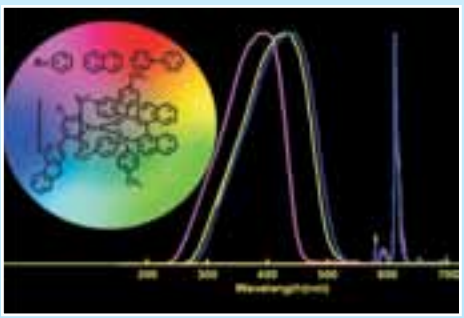
The Institute organized a one day seminar highlighting the role of "Women in Chemistry" on 13th October 2011 as part of the celebrations of the International year of Chemistry 2011 (IYC-2011). The seminar was inaugurated by Prof. H. IIa, Senior Scientist at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore and a specialist in synthetic organic chemistry. Prof. Charusita Chakravarthy from the Indian Institute of Technology (IIT) - New Delhi, Dr.M.Lakshmi Kantam from the Indian Institute of Chemical Technology (IICT), Hyderabad and Dr. Aruna Dhathathreyan from the Central Leather Research Institute (CLRI), handled various technical sessions.

Dr. R.A. Mashelkar former DG, CSIR visited CSIR NIIST and gave a Special Lecture on Indian Science, Technology & Innovation, The Changing Landscape on 18th November 2011.

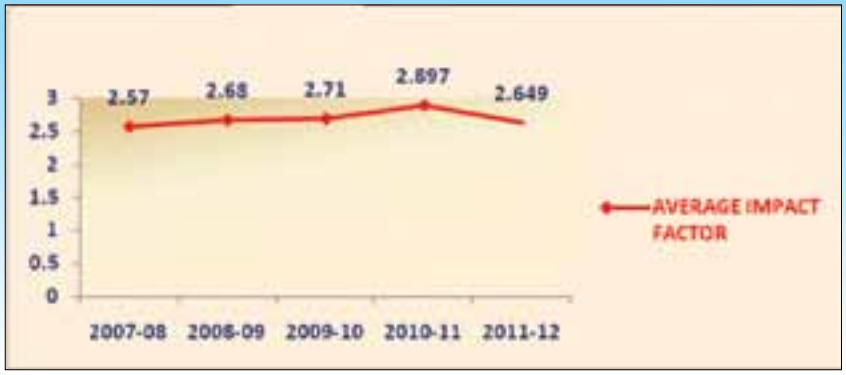
CSIR Foundation Day Celebrations, National Science Day, NIIST Annual Day, Hindi awareness week, Vigilance awareness, Staff Club day, Student Association day etc were the other functions held during the year. The Institute observed open day on the occasion of foundation day celebrations of both CSIR and CSIR NIIST. Students from educational institutes were allowed to visit the laboratory and its infrastructure facility to get a live wire feel of basic and applied scientific research. They were also given an opportunity to interact with scientific and technical personnel to get a better understanding on applied and basic research expertise of CSIR NIIST.

9. Recognition through Honors and Awards

Director, Dr. Suresh Das was elected as member of the editorial board of Langmuir Journal and Dr. D Ramaiah became the council member of Chemical Research Society of India. Dr. A. Ajayaghosh was elected as Fellow of National Academy of Sciences, Allahabad and Dr. M.L.P. Reddy received a Certificate of Appreciation from the American Chemical Society, New York. Dr. Ashok Pandey was nominated as the visiting Professor of Universite Blasie Pascal, Clermont Ferrand, France. Several of NIIST research students also received awards for Best Poster, Oral Presentation, Best Paper and Best Thesis Award (Gold Medal).

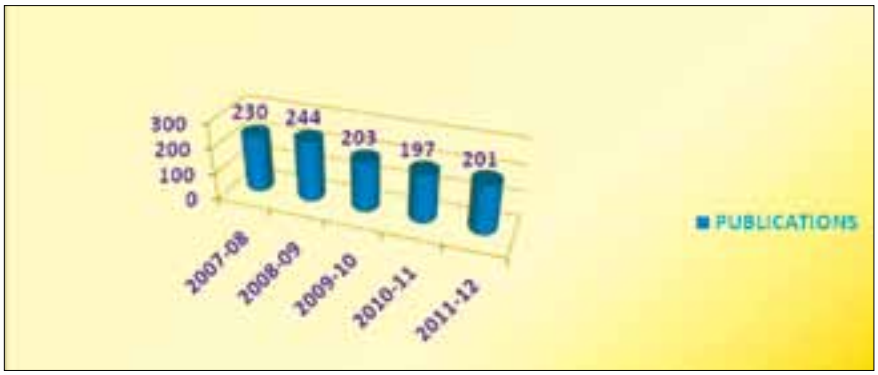


PERFORMANCE AT A GLANCE DURING THE XI PLAN PERIOD



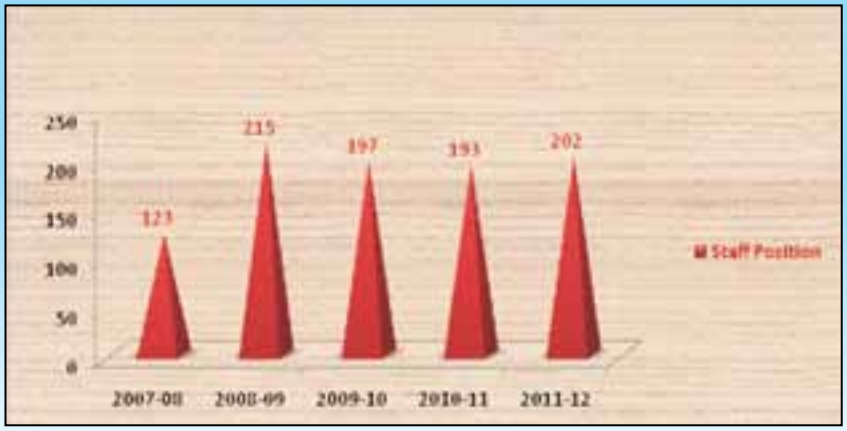
AVERAGE IMPACT FACTOR

PUBLICATIONS



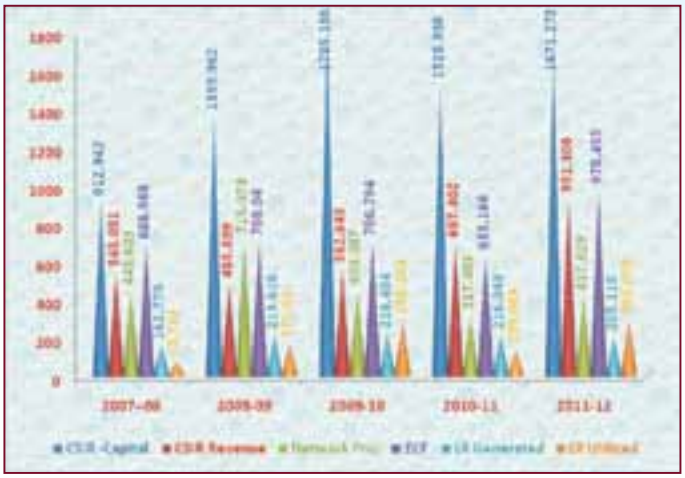
PATENTS

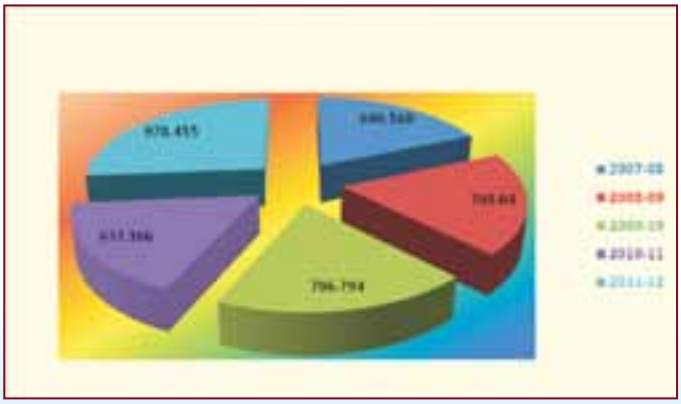
Ph.D. AWARDED



STAFF POSITION

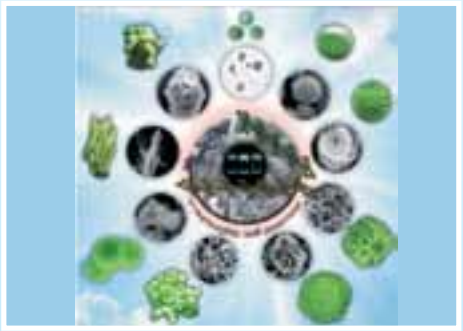
BUDGET 2007-2012 (Rs Lakh)





ECF (Rs. Lakh)

LR Generated (Rs. Lakh)



महत्वपूर्ण उपलब्धियां

वर्ष 2011-12 की वार्षिक रिपोर्ट में संस्थान के अनुसंधान एवं विकास कार्यक्रमों की उपलब्धियों और भविष्य की योजनाओं के अलावा, नई बुनियादी सुविधाओं के परिवर्धन, मानव संसाधनों के विकास और अंतर्विषयी अनुसंधान के माध्यम से उत्पन्न विशेषज्ञता के आधार पर उद्योग और शिक्षाविदों से बाहरी ग्राहकों के लिए प्रदान की गई सेवाएं शामिल हैं। ग्यारहवीं पंचवर्षीय योजना के अंतिम वर्ष के रूप में इस वर्ष को विशेष महत्व है। अपनी स्थापना से, संस्थान से उत्पन्न वैज्ञानिक काम की गुणवत्ता और मात्रा में लगातार बृद्धि हुई है। उच्च गुणवत्तावाले बुनियादी अनुसंधान तथा औद्योगिक और सामाजिक रूप से प्रासंगिक अनुप्रयोग उन्मुख अनुसंधान के माध्यम से सहक्रियात्मक कोर दक्षताओं के विकास पर जोर दिया गया है।

वर्ष के दौरान किए गए कार्य की मुख्य विशेषताओं का सारांश नीचे प्रस्तुत हैः -

1. व्यवसाय विकास और अनुबंध अनुसंधान

वित्तीय वर्ष 2011-2012 के दौरान संस्थान ने प्रमुख उद्योगों और लघु उद्योगों के साथ विभिन्न समझौतों पर हस्ताक्षर किए हैं, तत्संबंधी ब्यौरे निम्न हैं:

- स्रानिक्सिम निगम, फिलिपींस - केले फाइबर के उत्पादन के लिए तकनीकी जानकारी का लाइसेंसिंग
- 3 डी फाउंड्री टेक प्रा. लिमिटेड -वर्चुअल कास्टिंग के सोल्वर मॉड्यूल के संबंध में बौद्धिक संपदा का लाइसेंसिंग
- गोपनीयता समझौतोंः गुडइयर टायर एंड रबर कंपनी, संयुक्त राज्य अमेरिका, यूनिलीवर इंडस्ट्रीज प्राइवेट लिमिटेड, मुंबई, सत्यवती टिटास्लैग लिमिटेड, हैदराबाद, यूरेका सिस्टम्स एंड इलेक्ट्रोड प्राइवेट लिमिटेड, कोयंबटूर, मैप्स एंजाइम्स लिमिटेड (पूर्व मैप्स (इंडिया) लिमिटेड, अहमदाबाद), रिलायंस सीमेंट कंपनी प्रा. लिमिटेड, नवी मुंबई.
- अनानास पत्ती फाइबर और केला फाइबर के निष्कर्षण के लिए कोट्टप्पुरम इंटग्रेटड डिवलपमेंट सोसायटी, त्रिशूर के लिए और शांतिगिरी कूट्टुकुडुबं कॉयर यूनिट, आलप्पुज़ा को कॉयर फाइबर निष्कर्षण के लिए निदर्शन संयंत्र की स्थापना ।

2. बुनियादी सुविधाओं का आधुनिकीकरण

रिपोर्ट वर्ष के दौरान, अस्थिर दबाव और क्रायो मोड आपरेशन के साथ एक नया स्कैनिंग इलेक्ट्रॉन माइक्रोस्कोप संस्थापित किया गया । यह मशीन LaB_6 इलेक्ट्रॉन बीम स्रोत पर चल रही है और किसी भी पूर्वोपचार के बिना इस मशीन द्वारा सामान्य ठोस और पाउडर के नमूने के साथ नरम कार्बनिक सामग्रियों और जैविक सामग्रियों का अभिलक्षण हो सकता है। इस मशीन की संस्थापना ने संस्थान के विश्लेषणात्मक कौशल को उत्तोलक शक्ति प्रदान की है। बीएसएनएल के माध्यम से समर्पित 9 एमबीपीएस इंटरनेट पट्टे लाइन कनेक्टिविटी के साथ हाई स्पीड इंटरनेट सुविधा प्रारंभ की गयी है। रूटिंग, भार संतुलन, फेल-ओवर और सुरक्षित डेटा के उपयोग के लिए एकीकृत ख़तरा प्रबंधन डिवाइस (यूटीएम) कार्यान्वित किया गया है ।

नये रजत जयंती भवन के निर्माण का कार्य अवार्ड किया गया है, जो संस्थान के महत्वाकांक्षी विस्तार कार्यक्रम के लिए मार्ग प्रशस्त करेगा, जबकि बुनियादी और अनुप्रयुक्त अनुसंधान में नई ऊंचाइयों तक पहूँचाने में संस्थान अपनी प्रगति जारी रखेगा ।

3. अनुसंधान एवं विकास कार्यक्रमों में प्रगति

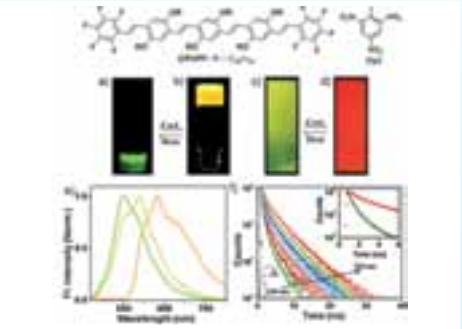
सभी प्रभागों द्वारा चल रही परियोजनाओं के सफलतापूर्वक निष्पादन एवं प्रगति के परिणामस्वरूप निम्नलिखित प्रकट विकास पाया गया है, जिनके ब्यौरे नीचे प्रस्तुत किए जाते हैं:

कृषि प्रसंस्करण प्रभाग के लिए एक प्रौद्योगिकी व्यापार उद्भवन केंद्र की परिकल्पना की गई थी और कार्यान्वयन के लिए कदम उठाए गए थे । इस केन्द्र द्वारा विभिन्न उत्पादों पर यूनिट आपरेशन के माध्यम से मूल्य वर्धन के लिए सुविधा प्रदान की जाएगी, जिससे उद्यमियों को अपने उत्पादों के लिए बाजार उत्पन्न होगा ।

मोटापे का मुख्य कारण अतिरिक्त पोषक तत्वों की खुराक माना जाता है । इसका एक परिणाम ईआर तनाव है, जो इंसुलिन प्रतिरोध और सूजन की ओर ले जाता है । अब यह पता चला है कि एपीजिनिन और क्यूरसिटिन ईआर तनाव के दौरान वसाजनन को कम करता है ।

भारतीय मानक ब्यूरो के समर्थन में संस्थान ने उत्तर पूर्व के सात राज्यों में उगाई ताजा अदरक कल्टीवर्स की तेल सामग्री और भौतिक रासायनिक संरचना का डाटा बेस विकसित करने और परिपक्वता के विभिन्न चरणों की भिन्नता का पता चलाने के लिए एक परियोजना जारी की, जिससे पता चला कि उत्तर पूर्व के विभिन्न क्षेत्रों से एकत्र कल्टीवर्स के बीच तेल संरचना और वाष्पशील तेल सामग्री में पर्याप्त भिन्नता है ।

भारत के उत्तरी क्षेत्र में प्रमुख खपत सोयाबीन सोया और सरसों के तेल हैं, जबकि दक्षिणी क्षेत्र में यह नारियल (सीएनओ) और ताड़ के तेल (पीएलओ) हैं । मध्यम श्रृंखला ट्राइग्लिसराइड्स (एमसीटी) समृद्ध संतृप्त शुद्ध नारियल तेल (सीएनओ) और पीएलओ के साथ असंतृप्त सरसों के तेल (एमओ) और सोया के सम्मिश्रण द्वारा डिजाइनर तेल के



उत्पादन के लिए एक अध्ययन जारी किया गया था, जो आवश्यक फैटी एसिड (ईएफए) और मध्यम श्रृंखला ट्राइग्लिसराइड्स (एमसीटी) दोनों की आवश्यकताओं को पूरा करेगा । सोया / सीएनओ कम से कम एफएफए (1.12%) पेरोक्साइड (39.68 एमईक्यु / कि.ग्रा) और पैरा अनिसिडिन मान (5.92) के साथ सबसे स्थिर तथा कोडेक्स मानकों से बाध्यकारी पाया गया था ।

जैव प्रौद्योगिकी के क्षेत्र में, बायोमास से मूल्य वर्धित रसायनों जैसे औद्योगिक एंजाइमों, जैव ईंधन, बायोपॉलिमरों, कार्बनिक अम्ल, आदि के उत्पादन में तथा पर्यावरण संरक्षण के लिए संपुटित सूक्ष्मजीव शामिल जैव आधारित प्रक्रिया का विकास, प्रोबायोटिक लैक्टिक एसिड बैक्टीरिया से एक्सोपॉलीसैकराइड का उत्पादन तथा स्वास्थ्य लाभ के लिए प्रोबायोक्सि और / या ईपीएस के साथ संरूपणों का विकास, आम आदमी के संभावित स्वास्थ्य लाभ के लिए कार्यात्मक खाद्य पदार्थों और उनके संरूपणों का विकास और ई - प्लास्टिक और बायोपॉलिमरों के जैव निम्नीकरण के लिए माइक्रोबियल कंसोर्शियम का विकास जैसे महत्वपूर्ण योगदान दिए गए थें ।

ठोस अवस्था किण्वन (एसएसएफ) के तहत न्यूनतम माध्यम के साथ अनुप्राणित पॉलीयूरिथेन (पीयूएफ) पर *स्ट्रेप्टोमाइसीज़ गिडेन्सीज़* की खेती के द्वारा एल ल्यूसीन अमीनो पेप्टिडेज़ के उत्पादन के लिए एक अत्यधिक कुशल बायोप्रोसैस विकसित की गयी। (489 आइयू एंजाइम/ग्राम पीयूएफ) *कोरिनिबैक्टीरियम ग्लूटामिकम* के एक रीकॉम्बीनैंट स्ट्रेन का निर्माण किया गया था, जिसने पेंटोस शर्करा जलअपघटज में जाइलोस तथा अरबिनोस को या तो अकेले या एक साथ वर्तमान होने पर उपयोग करने की क्षमता दर्शाया है। *पेन्सिलियम जेंथिनेल्लम* द्वारा उत्पादित सेलुलेस तथा *एस्पर्जिलस नैजर* द्वारा उत्पादित ग्लूकोस-सहिष्णु बीटा ग्लूकोसिडेज को एक एन्जाइम कोकटेल के उत्पादन के लिए इस्तेमाल किया गया, जिन्होंने स्तम्भ विस्फोट खोई के जलापघटन के लिए वाणिज्य तौर पर उपलब्ध एन्जाइमों की तुलना में उच्च जलापघटन क्षमता दर्शायी है ।

मध्यम संयोजियों और खेती की स्थिति की प्रभावी हेर-फेर पर मलाई निकाले दूध में लैक्टोकोक्कस *लैक्टिक्स एसएसपी क्रिमोरिस* ने फोलेट उत्पादन स्तर की वृद्धि की । *लैक्टोकोक्कस लैक्टिक्स एसएसपी क्रिमोरिस* ककड़ी और तरबूज रस में फोलेट सामग्री की वृद्धि के लिए एक उत्कृष्ट स्रोत साबित हुआ ।

रसायन विज्ञान तथा प्रौद्योगिकी विभाग, जिसे अपने आप में प्रकाश रसायनविज्ञान, अकार्बनिक रसायनविज्ञान, जैव रसायनविज्ञान, नैनो प्रौद्योगिकी, जैसे विविध विषयों में विशेषज्ञता है, अपने अंतर्विषयी, सहयोगात्मक प्रयासों के माध्यम से, सौर ऊर्जा संचयन में अनुप्रयोग के लिए फोटोनी सामग्रियों के विकास, इलेक्ट्रो ऑप्टिकल उपकरणों और फोटो दवा, ऊर्जा भंडारण और प्रकाश से संबंधित क्षेत्रों में अनुप्रयोगों के लिए अकार्बनिक सामग्रियों और पॉलिमरों के डिजाइन और विकास,

इमेजिंग और निदान के लिए आणविक संवेदन, नये जैव सक्रिय अणुओं के अलगाव/संश्लेषण और सूक्ष्म रसायन उद्योग के लिए अत्याधुनिक सिंथेटिक कार्बनिक तरीके के विकास के लिए रसायनविज्ञान और संबंधित क्षेत्रों के मौलिक और अनुप्रयुक्त पहलूओं पर अपनी अनुसंधान और विकास गतिविधियॉ जारी रखी है । सतह कोटिंग के लिए ठोस अवस्था मार्ग से ऊर्जा की बचत करनेवाले गैर विषैले एनआईआर परिलक्षित पीले अकार्बनिक पिग्मेंट्स का सफलतापूर्वक संश्लेषित किया गया ।

β सीडी में संभावित उपयोगी स्कुरैन रंगों के प्रतिस्थापी निर्भर संपुटन का निदर्शन किया गया था, जिससे प्रकाशगतिक चिकित्सा में उपयोगी स्कुरैन रंजक के लिए एक वाहक प्रणाली के रूप में इसकी क्षमता का संकेत मिला ।

फ्लोरोसेंट ओर्गानोजलेटर का, जेल रूप में उपयोग करके, रिकॉर्ड ओटोग्राम स्तर में टीएनटी के सुपीरियर डिटेक्शन का प्रदर्शन किया गया था । ओर्गानोजलेटर के अद्वितीय आणविक पैकिंग और संबद्ध प्रकाश-भौतिकीय गुणधर्म को लागू करके या तो सतह पर या जलीय विलयन पर संपर्क मोड के माध्यम से टीएनटी विस्फोटकों का पता लगाने के लिए यह एक सरल और कम लागत तरीका है ।

पॉली विनैल क्लोराइड में चालकीय AgI क्रिस्टल के परिक्षेपण द्वारा एक कम लागत, विषम आयोडाइड आयन चयनात्मक इलेक्ट्रोड झिल्ली (आईएसई) का निर्माण किया गया था । इस प्रकार तैयार किये गये क्रिस्टल दबाव अवस्था के तहत पोस्ट माइक्रोवेव विकिरण द्वारा β प्रावस्था में स्थिर किया गया।

पारंपरिक औषधीय प्रणालियों में इस्तेमाल किये औषधीय पौधों से अलग किए तथा जैविक तौर पर सक्रिय प्राकृतिक उत्पादों पर चल रही अनुसंधान गतिविधियों के भाग के रूप में, आयुर्वेद में कैंसर विरोधी तथा भड़काऊ विरोधी एजेंट के रूप में इस्तेमाल किये प्रेम्ना हेर्बेश्या पर विस्तार से अध्ययन किया गया था, जिसमें से भ्रान्जिन, एक डिटेरपेनोइड क्युनोनिमीथिड पृथक किया गया ।

ऊर्जा, इलेक्ट्रॉनिक और परिवहन के क्षेत्रों में अनुप्रयोगों के लिए नूतन कार्यात्मक सामग्री पर चल रहे कार्यक्रम में, इलेक्ट्रॉनिक सामग्री, उन्नत अतिचालक, सुपर आयणिक कंडक्टर, चुंबकीय सामग्री, कार्यात्मक सिरेमिक, कंपोजिट, नैनो कोटिंग्स और झरझरा सामग्री, उन्नत पॉलिमर, प्रकाश मिश्र धातुओं और कार्यात्मक ढाल धातु मैट्रिक्स कंपोजिट आदि के विकास पर ध्यान केंद्रित किया गया था।

$LiMgPO_4$ आधारित कांच मुक्त सिरेमिक टेप का सफलतापूर्वक विकसित किया गया था, जिसने उत्कृष्ट माइक्रोवेव डाइइलेक्ट्रिक गुणधर्म दर्शाया है । सफलता की और एक कहानी में, माइक्रोन और नैनो आकार के $BaTiO_3$ पाउडर के साथ पॉलीविनैलिडिन फ्लोराइड के कंपोजिट (पीवीडीएफ) से एक्स बैंड में विद्युत चुंबक परिरक्षण सामग्री विकसित की गयी थी । लचीले इलेक्ट्रॉनिक्स के तेजी से उभरते क्षेत्र में संस्थान ने नैनो एल्यूमिना समग्र के साथ भरा यंत्रवत् लचीला सिलिकॉन रबर

विकसित किया है । डाइइलेक्ट्रिक गुणधर्म से थर्मल विस्तार और नमी अवशोषण गुणांक मापा गया और यह पाया गया है कि नैनो एल्यूमिना भरे सिलिकॉन रबर समग्र लचीला माइक्रोवेव सब्सट्रेट अनुप्रयोग के लिए एक आदर्श सामग्री है ।

पर्यावरण प्रबंधन और प्राकृतिक संसाधनों के मूल्य वर्धन के लिए अभिनव प्रौद्योगिकियों के विकास के तहत कई महत्वपूर्ण अनुसंधान कार्यक्रम प्रारंभ किए गए । तेजी से घट रही जीवाश्म डीजल के लिए एक विकल्प की खोज में सूक्ष्मशैवाल से शैवाल जैव ईंधन का विकास एक संभावित स्रोत माना जाता है । दो तरीकों (पेटेंट दायर किया) के द्वारा स्वतः ऊर्णन शैवाल संवर्धन विकसित किए गए । इस क्षेत्र में व्यापक अध्ययन हो रहे हैं ।

प्लास्टिक जैसे गैर निम्नीकरणीय सामग्री युक्त नगरपालिका के ठोस कचरे के प्रबंधन के लिए अवायवीय निक्षालन संस्तरण रिएक्टर (एएलबीआर) विकसित किया गया था । 85% के पूर्व मूल्य से कुल मिलाकर लगभग 60% के नमी संतुलन हासिल किया गया था और इस विधि से स्थिर जैविक खाद का उत्पादन हुआ ।

केरल खनिज एवं धातु लिमिटेड, कोल्लम के समुद्र तट वाशिंग और खनिज जुदाई संयंत्र के लिए और कोल्लम जिले के आलप्पाड, पन्मना और अयनिवेलीकुलंगरा में प्रस्तावित भारी खनिज रेत खनन के लिए पर्यावरण प्रभाव आकलन अध्ययन जारी किया गया था ।

मोल्ड भरने के सिमुलेशन द्वारा फ्लो प्रक्रिया के कास्टिंग के लिए वर्ष 2004 में विकसित वर्चुअल कास्टिंग सॉफ्टवेयर को 3 डी फाउंडरी टेक. मुंबई को हस्तांतरित किया गया ।

बारहवीं पंचवर्षीय योजना के लिए अनुसंधान एवं विकास परियोजनाओं की योजना को अंतिम रूप दिया गया था और मसौदा योजना प्रस्तावों को मंजूरी के लिए सीएसआईआर को भेजा गया था ।

4. प्रकाशन और पेटेंट

रिपोर्ट की अवधि के दौरान, पिछले सालों की तुलना में, प्रति शोधपत्र में, बेहतर प्रभाव कारक के साथ 201 शोध पत्र अंतरराष्ट्रीय ख्याति प्राप्त पत्रिकाओं में प्रकाशित किए गए थें । बौद्धिक संपदा अधिकार के संरक्षण में इस वर्ष में महत्वपूर्ण वृद्धि हुई, 7 भारतीय पेटेंट और 19 विदेशी पेटेंट दायर किये गये । भारतीय और विदेशी पेटेंट प्रदान की संख्या क्रमशः 3 और 7 थीं ।

5. प्रशासनिक सुधार

अनुसंधान एवं विकास में सेवा की गुणवत्ता पर तत्कालीन आईएसओ प्रमाणीकरण की जगह में संस्थान ने आईएसओ प्रमाणीकरण प्रक्रिया के सार का अंतर्ग्रहण करके एक नया आंतरिक समीक्षा कार्यक्रम अपनाया है, जिसका प्रभावी रूप से सभी प्रभागों में लागू किया गया है । इसके परिणामस्वरूप वर्तमान में चल रही अनुसंधान और विकास परियोजनाओं, बुनियादी ढांचे और मानव संसाधन पर वैधानिक और

नियामक आवश्यकताओं की प्रभावी निगरानी के लिए दिशा-निर्देश प्राप्त हुए हैं। इस गतिविधि से संस्थान में हो रहे और भविष्य में होनेवाले कार्यक्रमों से बेहतर राजस्व प्राप्त होने की उम्मीद है ।

सीएसआईआर नीति के भाग के रूप में सीएसआईआर - एनआईआईएसटी ने उद्यम संसाधन योजना का क्रियान्वयन शुरू किया था और एकल कंप्यूटर प्रणाली के माध्यम से प्रशासन, बुनियादी सुविधाओं, मानव संसाधनों और वित्त के साथ संस्थान की कोर अनुसंधान और विकास गतिविधियों को एकीकृत करने की प्रक्रिया हो रही है ।

6. प्रदत्त तकनीकी सेवाएं

संस्थान ने अपने आंतरिक अनुसंधान एवं विकास कार्यक्रमों तथा उद्योगों से लेकर शिक्षाविदों तक बाहरी ग्राहकों के लिए अपना अद्भूत उपकरण समर्थन जारी रखा। इस रिपोर्ट वर्ष के दौरान संस्थान के भीतर उपलब्ध विभिन्न विश्लेषणात्मक उपकरण सुविधाओं से कुल 16,24,968 रूपये का राजस्व उत्पन्न / प्राप्त है ।

7. मानव संसाधन विकास

सीएसआईआर-एनआईआईएसटी के मानव संसाधन विकास सेल ने विज्ञान और प्रौद्योगिकी के क्षेत्र में मानव संसाधन विकास के लिए अपना निरंतर योगदान जारी रखा। स्टाफ और छात्रों के बीच बहुमुखी क्षमताओं का पोषण और विकास के लिए प्रयोगशाला में कई प्रशिक्षण कार्यक्रमों का आयोजन किया गया।

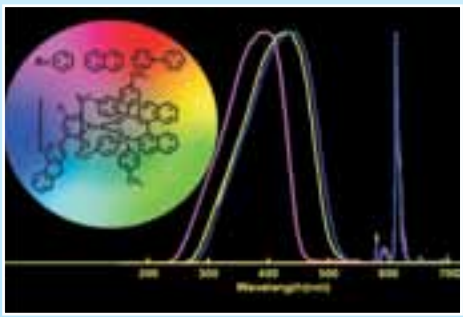
रिपोर्ट वर्ष के दौरान 20 छात्रों ने अपना अनुसंधान कार्य पूरा करके थीसिस प्रस्तुत किये । विभिन्न विश्वाविद्यालयों से संस्थान के 13 छात्रों को पीएच.डी की उपाधि से सम्मानित किया गया । विभिन्न कॉलेजों से छात्रों को अपने स्नातकोत्तर / डिग्री पाठ्यक्रमों की आंशिक पूर्ति के लिए अनुसंधान प्रशिक्षण प्रदान किया गया।

सीएसआईआर प्रणाली का एक नया अंग - वैज्ञानिक तथा अभिनव अनुसंधान अकादमी,17 जुलाई 2010 को राजपत्र में अधिसूचित की गयी थी और यह संस्थान में पूरे जोरों पर कार्य कर रही है । इस वर्ष के दौरान 24 छात्रों ने विभिन्न विषयों के तहत पीएच.डी की डिग्री के लिए दाखिला लिया था ।

8. सेमिनार / संगोष्ठियों / व्याख्यान और प्रदर्शनियों

संस्थान के स्टाफ तथा छात्रों के लाभार्थ ट्रांसाक्शनल विश्लेषण, अपने जीवन की कहानी का क्राफ्टिंग, टीम बिल्डिंग जैसे विषयों पर कार्यशालाएं आयोजित की गयीं । विविध विषयों पर संस्थान में कई आंतरिक व्याख्यान भी आयोजित किए गए।

एनआईआईएसटी और आईआईएसईआर, तिरुवनंतपुरम के संयुक्त तत्वावधान में संस्थान परिसर में फरवरी 2012 के दौरान भारतीय केमिकल रिसर्च सोसायटी (सीआरएसआई) के रसायन विज्ञान की 14वीं राष्ट्रीय संगोष्ठी और रसायन विज्ञान रॉयल सोसाइटी की 6वीं



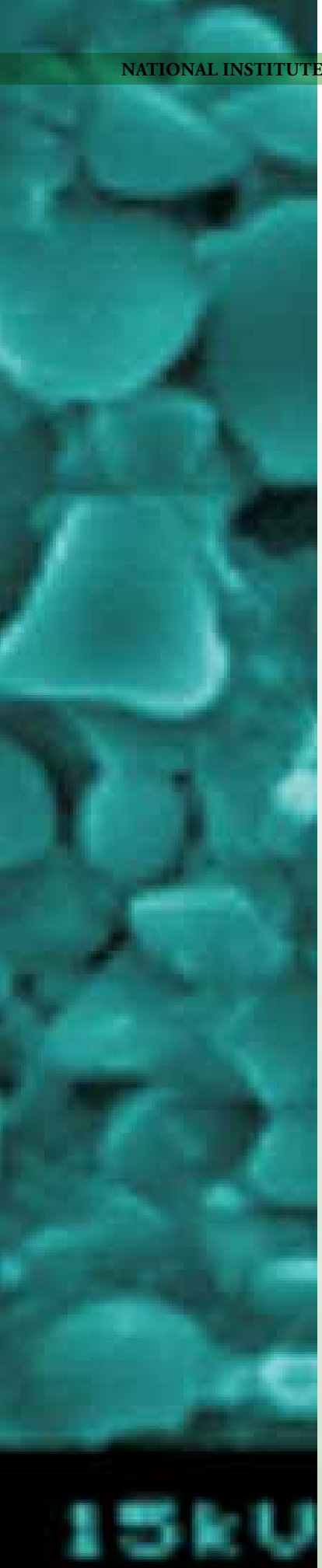
राष्ट्रीय संगोष्ठी का आयोजन किया गया । फोटोसाइन्सेस और फोटोनिक्स ग्रुप ने यूरोपीय संघ के सहयोगी के समकक्षों के साथ सहयोग में जनवरी 2012 के दौरान सौर कोशिकाओं पर तीन दिवसीय कार्यशाला का आयोजन किया।

अंतरराष्ट्रीय रसायन विज्ञान वर्ष - 2011 (आई वाई सी - 2011) के भाग के रूप में संस्थान में 13 अक्टूबर 2011 को " रसायन विज्ञान में महिलाओं की भूमिका" पर प्रकाश डालते हुए एक दिवसीय संगोष्ठी का आयोजन किया। सिंथेटिक कार्बनिक रसायन विज्ञान में एक विशेषज्ञ तथा जवाहर लाल नेहरू एडवांस्ड साइंटिफिक रिसर्च सेंटर (जेएनसीएसआर, बंगलौर) के वरिष्ठ वैज्ञानिक प्रो एच. इला ने संगोष्ठी का उद्घाटन किया। प्रो. एस. चारु सीता चक्रवर्ती, भारतीय प्रौद्योगिकी संस्थान (आईआईटी), नई दिल्ली, डॉ.एम.लक्ष्मी कांतम, भारतीय रासायनिक प्रौद्योगिकी संस्थान (आईआईसीटी), हैदराबाद और डॉ. अरुणा दथात्रेयन, केन्द्रीय चर्म अनुसंधान संस्थान (सीएलआरआई) ने विभिन्न तकनीकी सत्रों को संभाला। सीएसआईआर के भूतपूर्व महानिदेशक डॉ. आर.ए. माशेलकर ने18 नवंबर 2011 को एनआईआईएसटी का दौरा किया और 'भारतीय विज्ञान, प्रौद्योगिकी और नवाचार- बदलते परिदृश्य ' पर विशेष व्याख्यान दिया ।

सीएसआईआर स्थापना दिवस समारोह, राष्ट्रीय विज्ञान दिवस, एनआईआईएसटी स्थापना दिवस, हिन्दी सप्ताह, सतर्कता जागरूकता सप्ताह, स्टाफ क्लब दिवस, छात्र संघ दिवस आदि वर्ष के दौरान आयोजित अन्य समारोह थें। सीएसआईआर और सीएसआईआर-एनआईआईएसटी के स्थापना दिवस, दोनों समारोहों के अवसर पर संस्थान में खुले दिन मनाये गए । नवीन विचारों से भरे हुए कर्मशील व्यक्तियों के बुनियादी और अनुप्रयुक्त वैज्ञानिक अनुसंधान महसूस पाने के लिए और अपनी बुनियादी सुविधा का परिचय कराने के लिए शैक्षिक संस्थानों से छात्रों की प्रयोगशाला के दौरे के लिए अनुमति दी गई थी । उन्हें वैज्ञानिक और तकनीकी कर्मियों के साथ बातचीत करने और सीएसआईआर -एनआईआईएसटी की बुनियादी और अनुप्रयुक्त अनुसंधान विशेषज्ञता पर एक बेहतर समझ पाने का अवसर दिया गया ।

9. सम्मान एवं पुरस्कार के माध्यम से प्रतिष्ठा

निदेशक, डॉ. सुरेश दास लॉगम्यूर जर्नल के संपादकीय बोर्ड के सदस्य चुने गये और डॉ. डी. रामैय्या, भारतीय केमिकल रिसर्च सोसायटी के परिषद सदस्य बने। डॉ. ए. अजयघोष, राष्ट्रीय विज्ञान अकादमी, इलाहाबाद के फेलो चुने गये और डॉ. एमएलपी रेड्डी को अमेरिकन केमिकल सोसायटी, न्यूयॉर्क के प्रशंसा प्रमाण पत्र से सम्मानित किया गया । डॉ. अशोक पाण्डेय, यूनिवर्सिटि ब्लोस पास्कल, क्लरमोनो फेरन्ड, फ्रांस के विजिटिंग प्रोफेसर के रूप में नामित किये गये । एनआईआईएसटी के कई शोध छात्रों ने सर्वश्रेष्ठ पोस्टर, मौखिक प्रस्तुति, बेस्ट पेपर और सर्वश्रेष्ठ थीसिस के लिए पुरस्कार (स्वर्ण पदक) प्राप्त किये ।



AGROPROCESSING AND NATURAL PRODUCTS DIVISION

The Agroprocessing and Natural Products Division continued its main focus in the areas of lipid science and technology, spices and flavor technology and natural products with state of the art pilot plant, analytical testing facilities and expertise to develop new processes and agro products. In order to capitalize this capability, a collaborative programme with Kerala state government was initiated to set up a Technology Business Incubation Centre. Biological testing facilities were upgraded to conduct *in vitro* and cell line studies to screen plant extracts as well as their fractions for anti oxidant, anti diabetic and cardio protective effects. The natural product chemistry and biological areas have been strengthened resulting in chemistry – biology interface research programmes. To prepare draft Indian Standard Specification for ginger and a data base on the quality of ginger of North East, a programme was undertaken. The research activities on natural products area led to new initiatives in Ayurveda programme jointly with M/s Kottakkal Aryavaidyasala and post harvest management of medicinal and aromatic plants.

Highlights

- Technology Business Incubation Centre for Agroprocessing envisaged and implementation steps initiated
- Apigenin and quercetin reduced the adipogenesis during ER stress
- *Boerhaavia diffusa* extract found effective in protecting the myoblast from toxicity of ATO
- Developed selenium incorporated guar gum nanoparticles of around 100-200 nm with a polydispersity index of 0.1-0.4
- EtAc and 90% ethanol fractions of *Aerva lanata* showed promising PTP-1B inhibition
- Punicic acid found to enhance glucose uptake in 3T3 L1 cells
- Two pharmaceutical potential compounds isolated from *Cerbera odollam* and their derivatives synthesized
- Evaluated volatile oil content and variation in the chemical composition of fresh and dried ginger cultivars of North East origin
- A simple HPLC/HPTLC method developed and validated for the simultaneous quantification of three sesquiterpenoids present in *Cyperus rotundus* plant material
- A simple green extraction technique demonstrated to produce high molecular weight β-glucan from oats for nutraceutical applications
- Ethyl acetate fraction of crude methanol extract of pomegranate peel found as a source for preventing typeII diabetes and diabetes induced cardiovascular complications

कृषि प्रसंस्करण तथा प्राकृतिक उत्पाद प्रभाग

कृषि प्रसंस्करण तथा प्राकृतिक उत्पाद प्रभाग ने अत्याधुनिक प्रायोगिक संयंत्र, विश्लेषणात्मक परीक्षण सुविधाओं और नई प्रक्रियाओं और कृषि उत्पादों को विकसित करने के लिए आवश्यक विशेषज्ञता के साथ लिपिड विज्ञान तथा प्रौद्योगिकी, मसाले और स्वाद प्रौद्योगिकी और प्राकृतिक उत्पादों के क्षेत्रों में अपना मुख्य ध्यान केंद्रित करना जारी रखा। इसी क्षमता को मूल बनाने के लिए केरल राज्य सरकार के साथ एक प्रौद्योगिकी व्यापार इन्क्युबेशन केंद्र स्थापित करने के लिए सहयोगी कार्यक्रम शुरू किया गया था। पादप निष्कर्षण और उनके प्रभाजियों को अपने एंटी ऑक्सीडेंट, मधुमेह विरोधी और हृदय सुरक्षात्मक प्रभाव के लिए स्क्रीन करने में इन- विट्रो और सेल लाइन अध्ययन जारी करने के लिए जैविक परीक्षण की सुविधा को उन्नत बनाया गया। प्राकृतिक उत्पाद रसायनशास्त्र और जैविक रसायनशास्त्र के क्षेत्रों को मजबूत किया गया है, जिसके परिणामस्वरूप रसायनविज्ञान- जीवविज्ञान इंटरफ़ेस अनुसंधान कार्यक्रमों की शुरुआत हुई। अदरक के लिए ड्राफ्ट भारतीय मानक विशिष्टता तैयार करने और उत्तर पूर्व की अदरक की गुणवत्ता पर डेटा बेस तैयार करने के लिए एक कार्यक्रम शुरू किया गया था। प्राकृतिक उत्पादों के क्षेत्र की अनुसंधान गतिविधियों ने मेसेर्स कोट्टक्यल आर्यवैद्यशाला के साथ संयक्तरूप से आयुर्वेद कार्यक्रम में नई पहल के लिए और औषधीय और सुगंधित पौधों के फसलोत्तर प्रबंधन के लिए रास्ता खोला।

मुख्य विशेषताएं

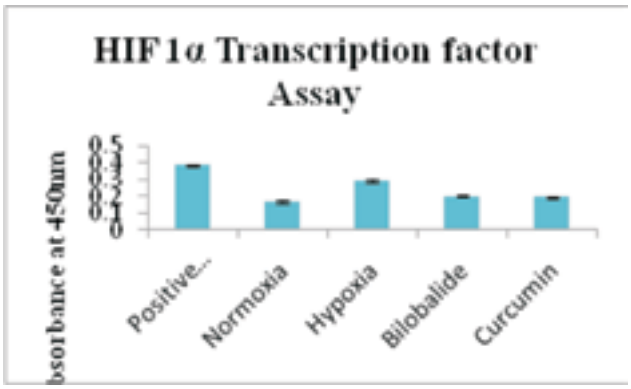
- कृषि प्रसंस्करण के लिए प्रौद्योगिकी व्यापार इन्क्युबेशन केन्द्र की स्थापना पर विचार किया गया और कार्यान्वयन के लिए कार्रवाई प्रारंभ की
- ई आर तनाव के दौरान एपीजिनिन और क्वेरसिटिन ने वसा जनन को कम किया
- बोरहाविया डिफ्यूजा का निष्कर्षण एटीओ की विषाक्तता से पेशीकोरक की रक्षा करने में प्रभावी पाया
- 0.1 से 0.4 के बहुपरिक्षेपिता सूचकांक के साथ लगभग 100-200 नैनोमीटर आकार के सेलेनियम शामिल ग्वार गम नैनोकणों को विकसित किया
- एथानॉल ऐसीटेट और *एरवा लनाता* के 90% एथानॉल अंश ने आशाजनक पीटीपी- आईबी निषेध दर्शाया
- 3 टी 3 एल 1 कोशिकाओं में प्यूनिसिक ऐसिड से ग्लूकोज अंतर्ग्रहण में वृद्धि पायी
- सेर्बेरा ओडोल्लम से दो दवा संभावित यौगिकों को अलग किया और उनके डेरिवेटिव संश्लेषित किया गया
- उत्तर- पूर्व मूल के ताजे और सूखे अदरक प्रजातियों में वाष्पशील तेल सामग्री और रासायनिक संरचना की भिन्नता का मूल्यांकन किया
- *साइप्रीरस रोटन्डस* पादप सामग्री में मौजूद तीन सेस्क्युटर्पेनोइडों के एक साथ प्रमात्रीकरण के लिए एक सरल एचपीएलसी / एचपीटीएलसी पद्धति विकसित की और उसका वैधीकरण किया
- न्यूट्रास्यूटिकिल अनुप्रयोगों के लिए जई से उच्च आणविक भार β-ग्लूकान के उत्पादन के लिए एक सरल हरी निष्कर्षण प्रौद्योगिकी का निदर्शन किया
- टाइप 2 मधुमेह और मधुमेह प्रेरित हृदय जटिलताओं को रोकने के लिए अनार छील के कच्चे मेथनॉल निष्कर्षण के एथिल एसीटेट अंश को एक स्रोत के रूप में पाया

Technology Business Incubation Centre for Agroprocessing (TBIC- A)

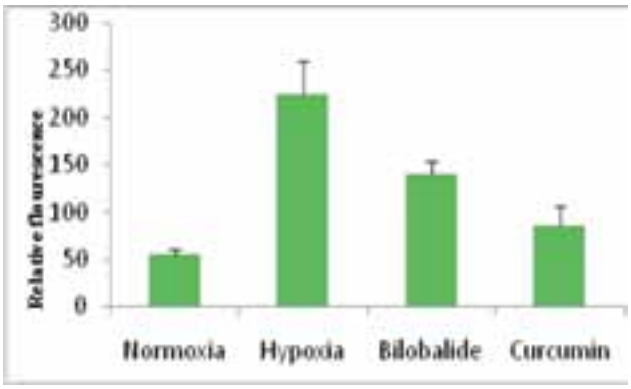
TBIC-A was envisaged and implementation steps initiated at the Institute in collaboration with the Agriculture Department, Government of Kerala. TBIC-A is intended to act as a catalyst for the development of medium and large enterprises for making market driven value added products from the cash crops and other agricultural produce of the state. Facilities for carrying out various unit operations required to add value to a product will be made available to the prospective entrepreneurs. This semi commercial facility will help them to identify any lacunae in the technologies which they are planning to adopt, generate sufficient finished goods to do test marketing and for evaluation of the product. Proximity to multidisciplinary R & D expertise and demonstrated capability to solve technical problems can circumvent any major technical issues during the journey from laboratory to market. The centre will also facilitate in refining an idea floated or brought in from elsewhere by an entrepreneur with or without seeking assistance from outside. Salient features of the TBIC are, EDP programmes resulting in at least one successful entrepreneur a year, process development, demonstration at pilot scale and commercialization of value added products from spices, coconut, jack fruit, banana, natural fiber extraction and other agricultural produce of the state.

In vitro investigation on protective effect of curcumin and bilobalide on hypoxia induced alterations in adipocytes

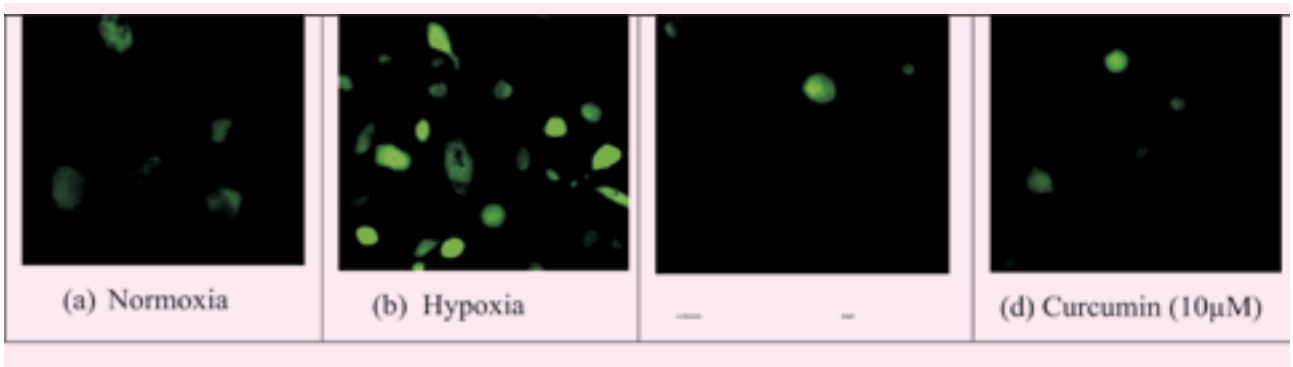
Hypoxia in adipose tissue has been postulated as a possible contributor to obesity-related chronic inflammation, insulin resistance, and metabolic dysfunction. Hypoxias occur in areas within adipose tissue in obesity as a result of adipocyte hypertrophy. It compromises effective O_2 supply from the vasculature, thereby instigating an inflammatory response through recruitment of the transcription factor, Hypoxic Inducible factor (HIF). HIF is an oxygen-sensitive heterodimeric transcription factor that promotes the expression of genes containing Hypoxia Response Element (HRE) in their promoter. These genes generally function to facilitate cell survival in a low-oxygen environment by promoting glycolytic metabolism, angiogenesis, or maintenance of redox status. The objective of the study was to investigate the protective effect of curcumin and bilobalide in hypoxia induced alteration in adipocytes. In hypoxia experiments, differentiated 3T3-L1 adipocytes were maintained in a hypoxic chamber (1% O_2, 94% N_2, and 5% CO_2), New Brunswick, eppendorf for 24 hours. The control cells or normoxic were incubated in an atmosphere with 21% O_2 and 5% CO_2. The cells were cotreated with phytochemicals curcumin (10 µM) and bilobalide (50µM) for 24 hours. HIF 1 α was found to be significantly increased in hypoxia treated cells, compared with normoxia treated cells. The cells treated with the phytochemicals bilobalide (50µM) and curcumin (10µM) showed a reduction in HIF expression. There was a significant Reactive Oxygen Species (ROS) accumulation at 24 hrs after hypoxic exposure. The hypoxia-induced ROS accumulation was largely abolished by the phytochemicals bilobalide (50µM) and curcumin (10µM). Hypoxia also induced mitochondrial dysfunction. It was restored to normal by phytochemical treatment.



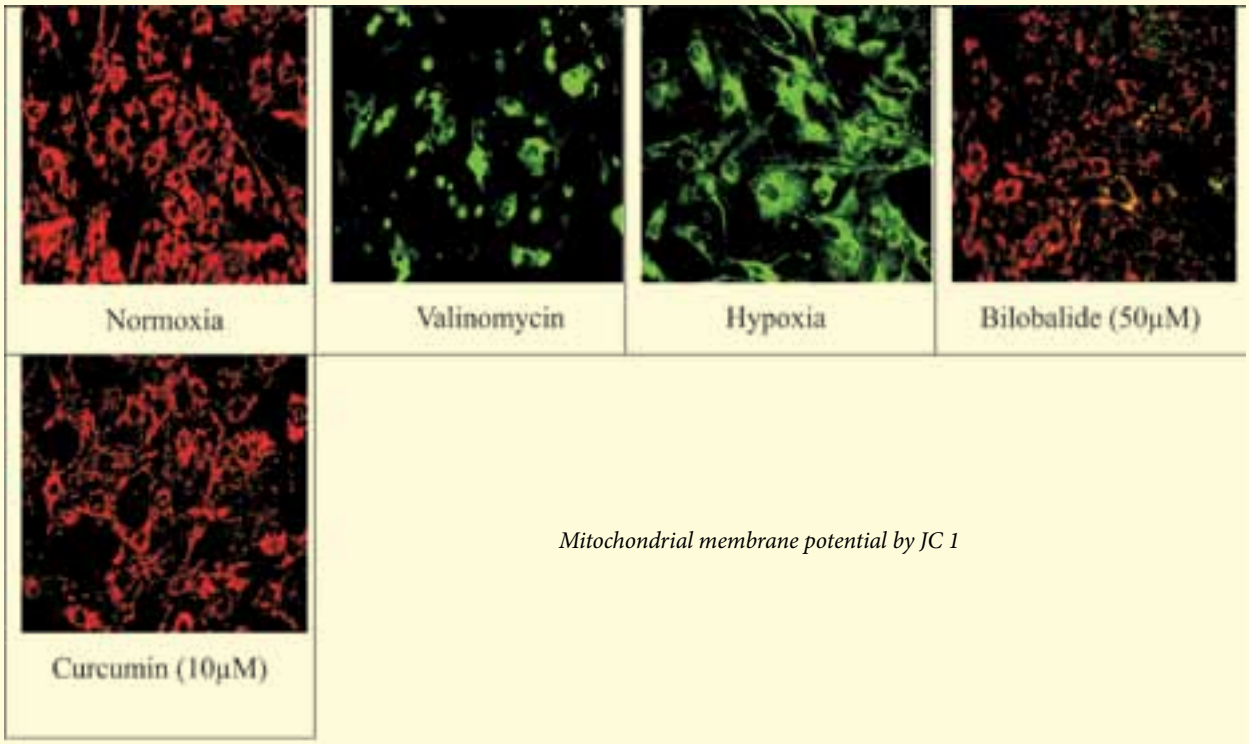
HIF 1α Transcription factor Assay



Fluorometric method



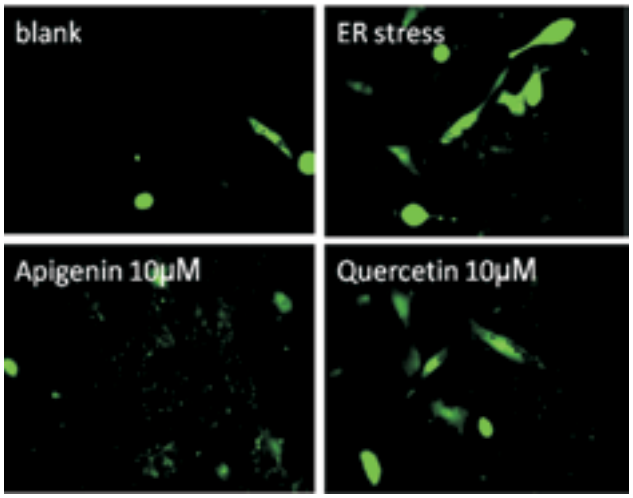
Confocal images



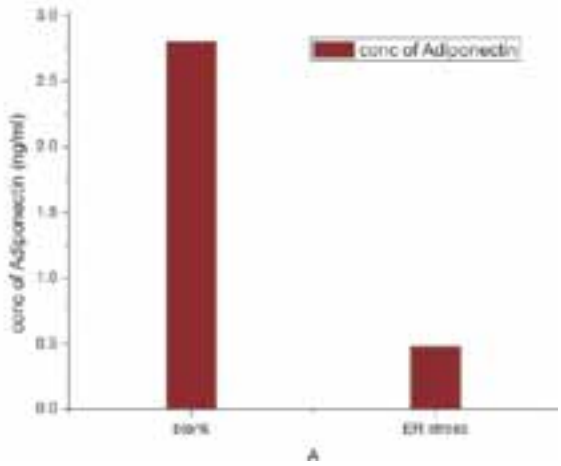
Mitochondrial membrane potential by JC 1

An *in vitro* investigation on molecular mechanism underlying endoplasmic reticulum (ER) stress induced alteration in endocrine function of adiposite and modulation by Apigenin and Quercetin

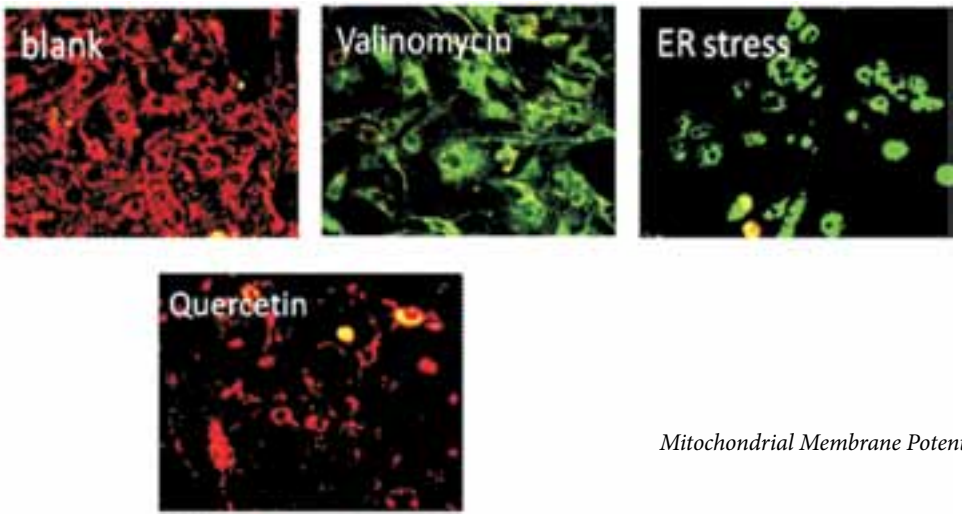
Excess nutrient intake is the main cause for obesity, and several recent studies have implicated ER stress as an early consequence of nutrient excess and a cause for the development of insulin resistance and inflammation. It is activated in various tissues under conditions related to obesity and type-II diabetes. ER stress in enlarged fat tissues induces inflammation and modifies adipokine secretion. The accumulated evidence reveals structural and functional communications between mitochondria and the ER. The study focuses on elucidating the molecular events through which the synthesis and secretion of adipokines are regulated. The alterations in the cell structure and function during ER stress were studied. The level of adiponectin, an unique protein secreted by adipocytes, was decreased in ER stress. Increase in oxidative stress was indicated by raised level of ROS during ER stress and was protected significantly by apigenin and quercetin. ER stress depolarised the mitochondrial membrane. The phytochemicals reversed the mitochondrial membrane potential. Mitochondrial biogenesis was increased in differentiated cells. ER stress reduced the mitochondrial mass which was normalised to a significant level by the phytochemicals. Lipid accumulation in the adipocytes was increased by ER stress. Apigenin and quercetin reduced the adipogenesis.



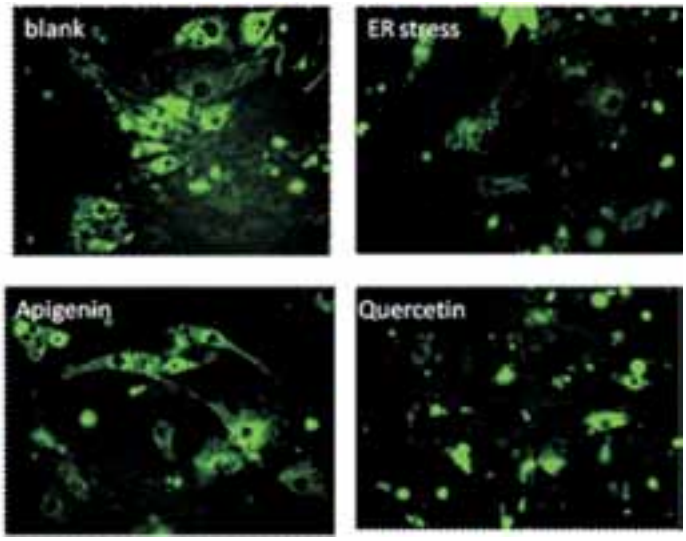
Reactive Oxygen Species



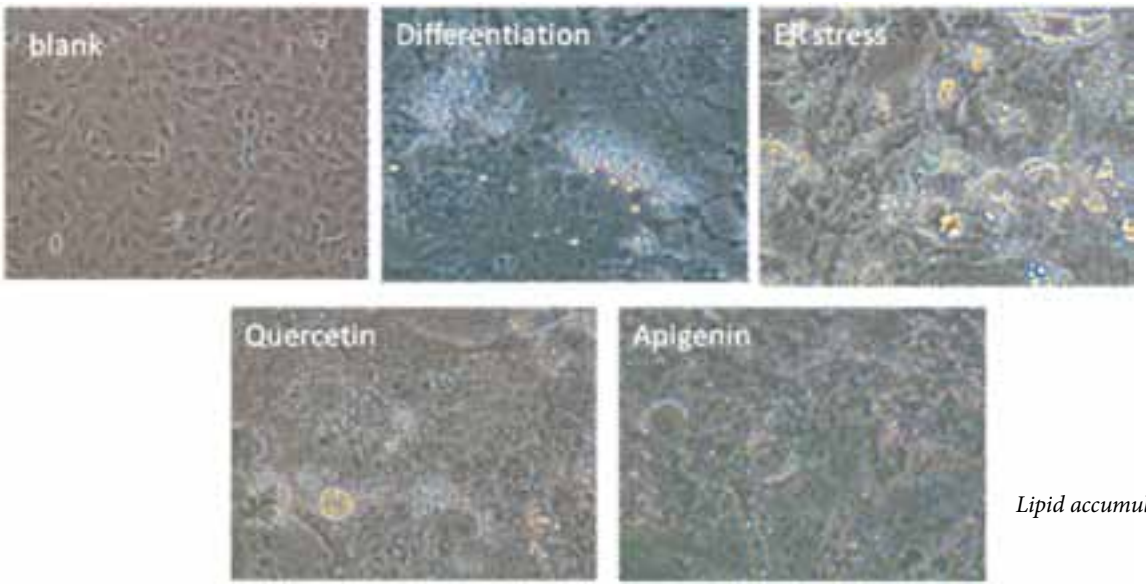
Level of Adiponectin



Mitochondrial Membrane Potential



Mitochondrial Membrane Potential

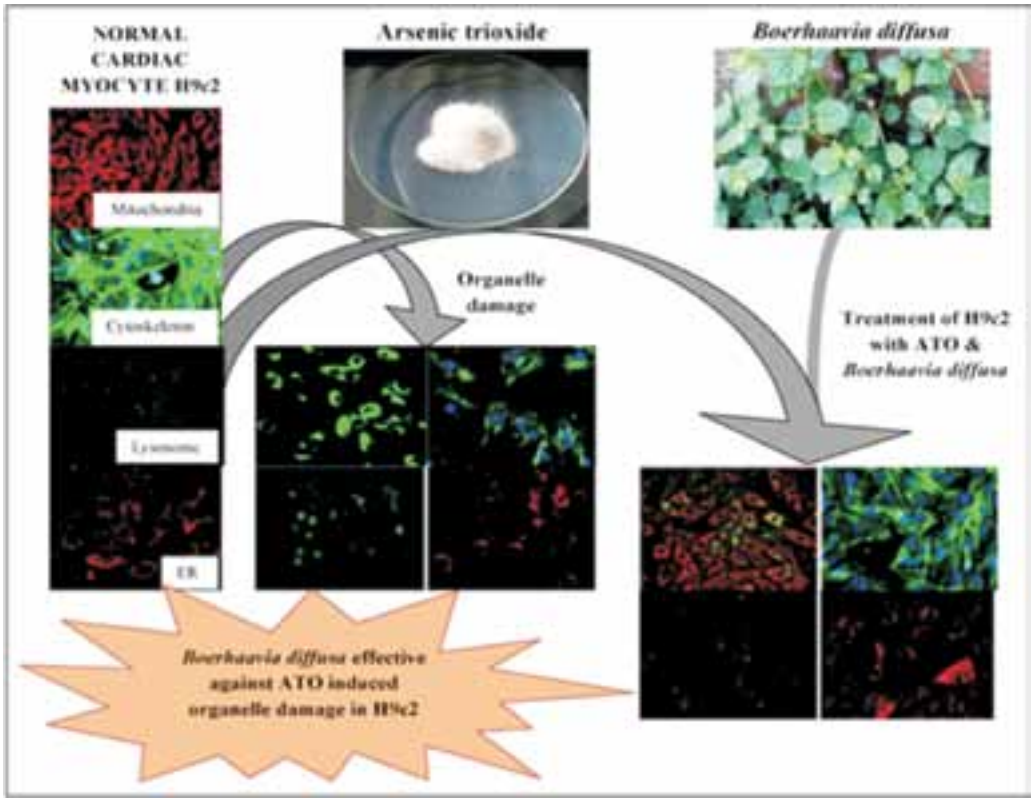


Lipid accumulation

Protective effect of *Boerhaavia diffusa* and *Desmodium gangeticum* on arsenic trioxide induced cardiotoxicity (ATO) in H9c2 cell line

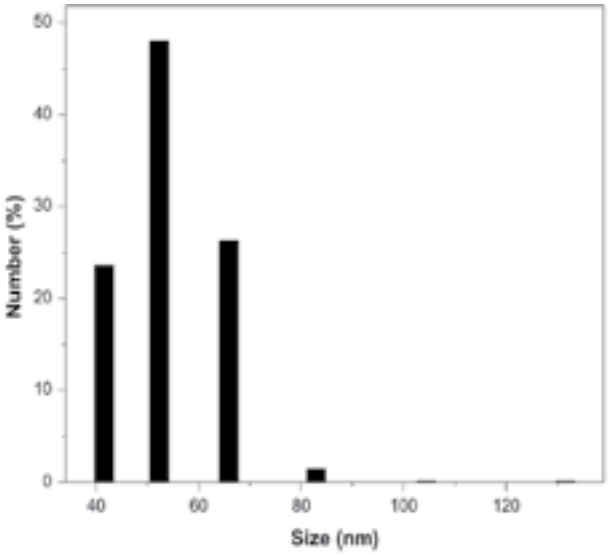
The effect of various doses of ATO (5, 7.5 and10µM/ml) on cardiac myoblast (H9c2) were studied. The antioxidant potential and partial characterization of extracts of two plants *Boerhaavia diffusa* (BD) and *Desmodium gangeticum* were done. In addition, the protective efficiency of phenolic rich extract of *Boerhaavia diffusa* and *Desmodium gangeticum* were also studied. In order to evaluate the toxicity of ATO, H9c2 cell were incubated with different time periods (24 and 48 hrs). Various parameters like cell viability (MTT, neutral red, lactate dehydrogenase), cell integrity, mitochondrial membrane potential, integrity of endoplasmic reticulum and intracellular calcium and reactive oxygen species were studied. ATO treatment caused decrease in cell viability which was evident from all the 3 assays conducted for the same. Change in mitochondrial membrane potential was seen with various doses of ATO and with BD extract. The studies on mitochondrial transmembrane potential change showed depolarization of the potential with all the doses of ATO treatment. ER was also affected adversely with ATO treatment. BD extract was notably effective to protect the myoblast from toxicity of ATO in some of the parameters. Extract

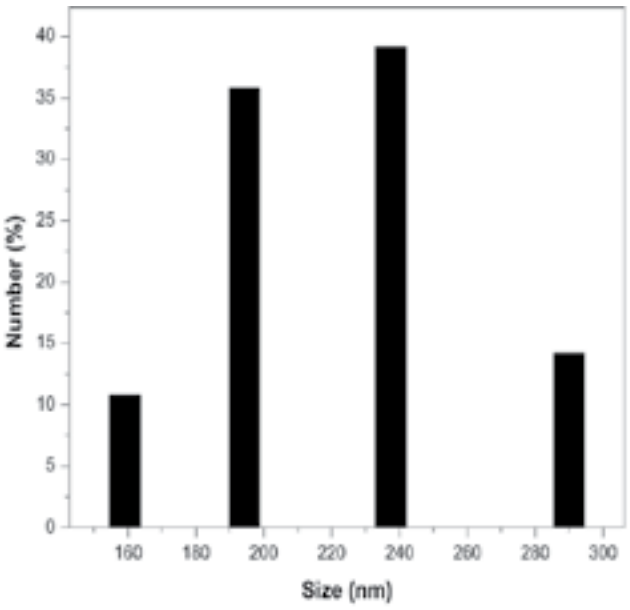
was effective in protecting transmembrane potential only at low doses. Integrity of cardiac myoblast was evaluated by studying cytoskeleton of myoblast and it was found that ATO caused alteration in cytoskeleton. BD extract treatment was effective in low doses to protect cytoskeleton from the toxic effect of ATO.

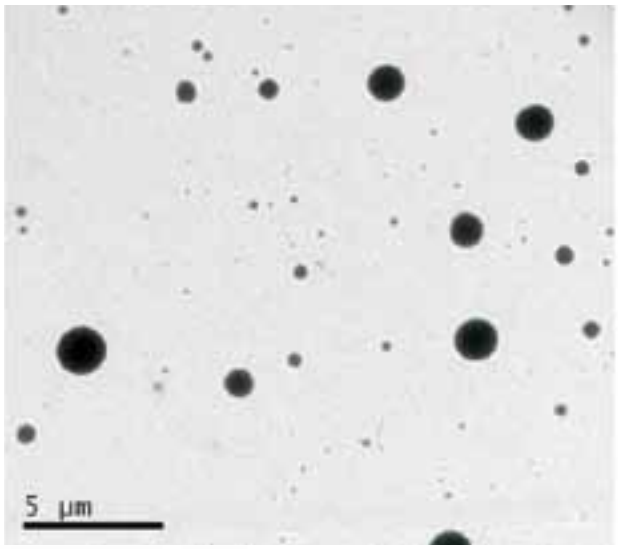


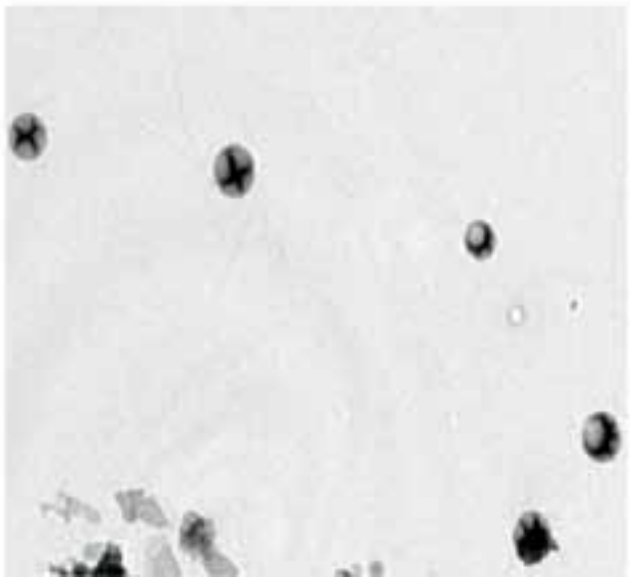
Investigation of guar gum nanoparticle incorporated with selenium against cell line based cardiac ischemic reperfusion injury

Ischemic heart disease, a major heart disorder, is characterized by depletion of oxygen in the heart muscle usually due to coronary artery block .There are some drugs available now for treatment but high cost, inconsistency in result and adverse effect are major issues. The present work focuses to develop selenium incorporated guar gum nanoparticles to screen against cell line based ischemic reperfusion (IR) injury model. The hydrogel nano particles were prepared from neutral biopolymer such as guar gum by nanoprecipitation and cross linking. The particle size was analyzed by DLS and TEM. This method produced spherical nanoparticles of around 100-200 nm with a polydispersity index of 0.1-0.4. Embryonic heart cell line H9c2 was used to develop cell line based IR injury model. Alteration in antioxidant status and mitochondrial functions were studied to assess the protection by guar gum nanoparticle.



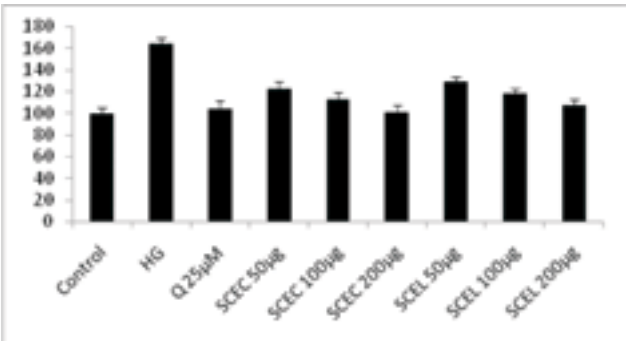






Evaluation of therapeutic properties of *Symplocos cochinchinesis* against various targets relevant to diabetes

The biochemical methods to screen antidiabetic activity of the plant extracts like rat intestinal alpha glucosidase inhibitory property, protein tyrosine phosphatase 1B inhibition etc. were conducted for each extracts of *Symplocos cochinchinesis*. Some of the fractions are found to be highly effective in inhibiting both alpha glucosidase and PTP 1B enzyme. The protective effect of various extracts against hyperglycemia induced oxidative stress was checked in HepG 2 cells. Ethyl acetate fraction reduced high glucose induced reactive oxygen species generation in HepG2 cells. Ethyl acetate fraction (SCEC) (491.59µg/mL) showed significant rat intestinal alpha glucosidase inhibitory potential and the fraction at 63.13µg/mL exhibited potent protein tyrosine phosphatase 1B inhibition. Ethyl acetate and ethanol (SCEC & SCEL) fractions showed significant protective property against hyperglycemia induced oxidative stress after 24h incubation in high glucose. Other fractions were found to be less effective.

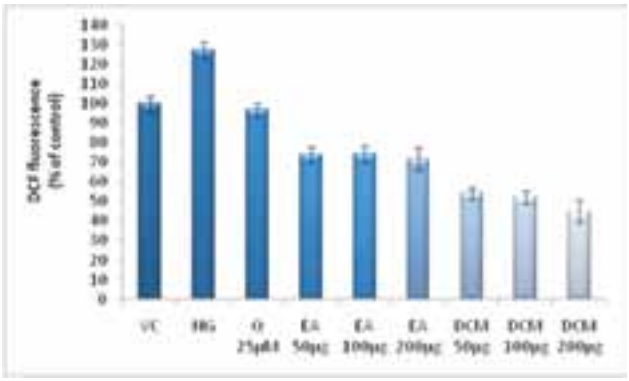


High-glucose-induced intracellular ROS levels in HepG2 cells by DCFDA method -the quantitative analysis of fluorescence.

Evaluation of therapeutic properties of *Aerva lanata* against various targets relevant to diabetes

The four fractions (hexane, dichloromethane, ethyl acetate and 90% ethanol fraction) obtained through sequential extraction of the whole plant of *Aerva lanata* were screened for PTP-1B inhibition property. Both ethyl acetate and 90% ethanol fractions showed promising PTP-1B inhibition.

IC_{50} value for ethyl acetate and 90% ethanol fractions were 65.15µg/ml and 90.7µg/ml respectively. (IC_{50} value of Suramin - 14.01µg/ml). Dichloromethane and ethyl acetate fractions, which showed promising *in vitro* chemical antioxidant potential, were taken for glucose stress-induced ROS generation using cell line model (HepG2). Dichloromethane fraction showed a maximum inhibition of 74% (200µ/ml) and ethyl acetate fraction showed a maximum inhibition of 54% (200µ/ml).



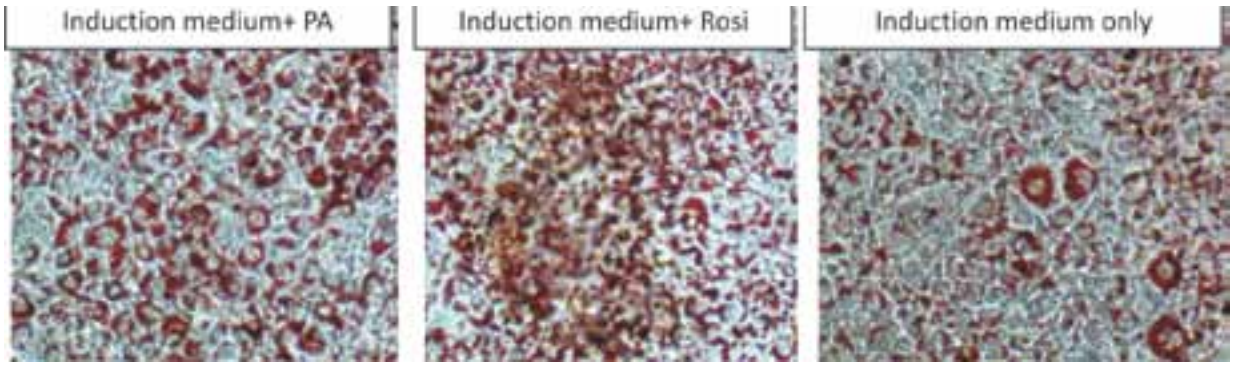
High-glucose-induced intracellular ROS levels in HepG2 cells by DCFDA method

Modulation of oxidative stress in cardiomyoblast hypertrophy by *Desmodium gangeticum*

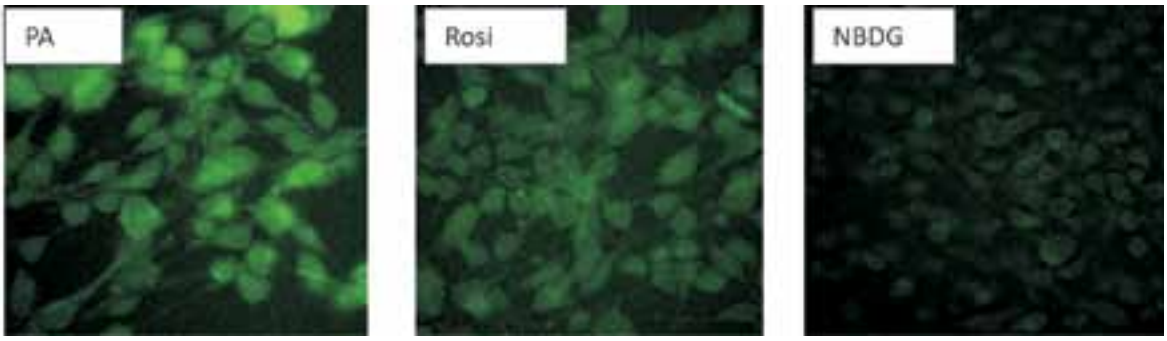
Pathological cardiac hypertrophy occurs in response to increased biomechanical stress such as hypertension/valvular disease. Oxidative stress has been implicated in cardiac hypertrophy and β-adrenergic receptor over activation is one among the many molecular signaling pathways linking ROS to hypertrophy. Prevention of oxidative stress aids prevention of cardiac hypertrophy. In this backdrop, the study was undertaken to evaluate the role of oxidative stress in cardiomyoblast hypertrophy induced by isoproterenol (ISO) and assess the protective effect of *Desmodium gangeticum* (DG) against it. The model used for the study was H9c2 cell line. It was demonstrated that ISO-induced hypertrophy was associated with dissipation of $\Delta\Psi m$ and opening of PTP which were modestly prevented by DG. An increased cytosolic level of calcium was observed in ISO-treated cells. Moreover, pretreatment of ISO-treated cells with bongkrekic acid (inhibitor of PTP opening) and ruthenium red (inhibitor of mitochondrial calcium) individually, resulted in less superoxide anion generation compared to ISO-treated cells in isolation. Thus it is presumed that increased cytosolic Ca^{2+} levels observed in ISO-treated cells would be taken up by mitochondria through an RR-sensitive Ca^{2+} uniporter, resulting in an elevation of mitochondrial Ca^{2+}, which in turn resulted in $\Delta\Psi m$ loss, PTP opening and increased superoxide anion generation. It was demonstrated that DG suppressed superoxide anion generation in ISO-treated cells.

Effect of naturally occurring PPAR modulator on adipogenesis and glucose uptake in 3T3 L1 cells

Punicic acid, a naturally occurring PPAR modulator is found to enhance adipocyte differentiation in 3T3 L1 cells. Cells were induced to differentiate in the differentiation medium in the absence or presence of compound and then maintained in maintenance medium for nine days. Then the cells were stained with oil red O and imaged. Rosiglitazone was used as the positive control



Punicic acid was found to enhance glucose uptake in 3T3 L1 cells. Cells were treated with punicic acid for 3 hours in low glucose DMEM and incubated with NBDG for 1hour before imaging under confocal microscopy.



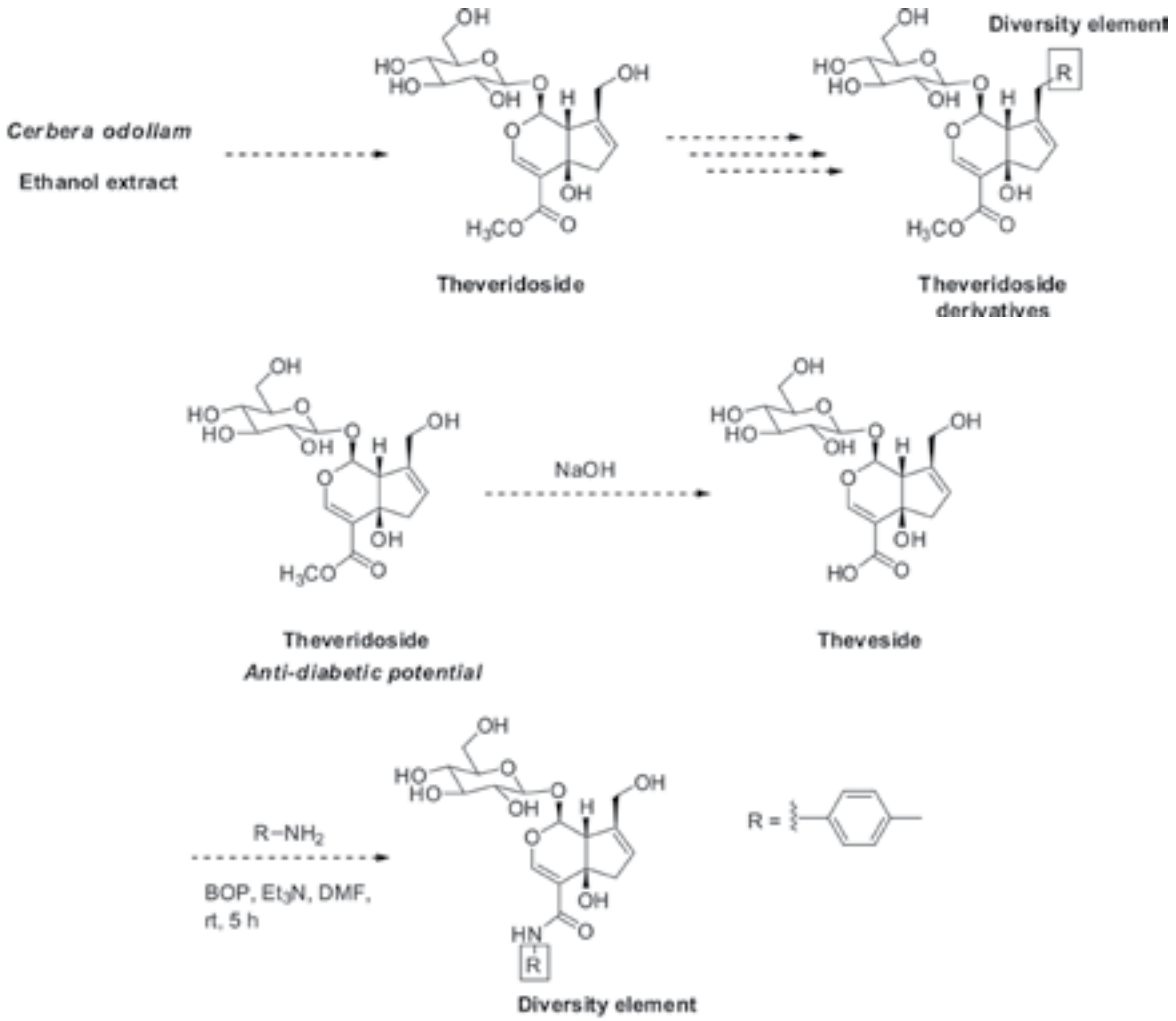
Punicic acid and glucose uptake

Isolation of metabolites from plant growth promoting rhizobacteria (PGPR) and their application as biopesticides

Two plant growth promoting rhizobacterial strains belongs to *Pseudomonas genera*, designated as TR and FR2, were screened for their ability to produce potential bioactive metabolites. Both solid and liquid media were tested for the cultivation of bacterial strains for production of metabolites. For solid media, a lawn of TR and FR2 were prepared by inoculating 18h old respective culture on pseudomonas isolation agar and allowed to grow at 28±2°C. After seven days of growth the medium was cut into small pieces (≈ one cm^2) and extracted in 90% acetone. The acetone was then removed through a rota evaporator. The resultant aqueous fraction was treated three times with equal volume diethyl ether and the ether fraction was collected. The remaining aqueous layer was further extracted with chloroform (1:1 v/v). The chloroform and the diethyl ether fractions were dried for further studies. For liquid media, standard succinate medium was inoculated with 18h old cultures of TR and FR2 and allowed to grow in shaking unit with 250 RPM at 28±2°C for 48 h. Then the culture was centrifuged at 10000 RPM for 20 minutes at 4°C. After centrifuge, the supernatant was collected and extracted with diethyl ether and chloroform as described earlier. The fractions were dried and used for further studies. The biopesticidal activity of the isolated crude fractions and studies on their chemical nature are in progress.

Isolation, characterisation and derivatisation of iridoid glycosides from *Cerbera odallam*

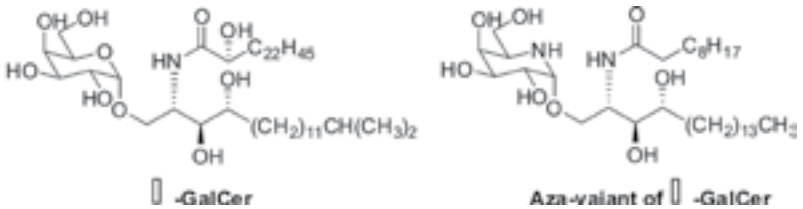
Iridoid glycosides have shown to exhibit antidiabetic, and anti-inflammatory effects. In the present study, dried leaves of *Cerbera odollam (C. odollam)* were subjected to sequential extractions such as hexane, and ethyl acetate to remove all the non-polar components. The residue was then treated with a sequence of solvent mixtures such as chloroform/methanol(15:1), chloroform/methanol /water (65:25:4), ethanol/water (3:2), and also with ethanol. Two major compounds were isolated by HPLC and characterized as Theveridoside and Theveside, which are iridoid glycosides. Realizing the pharmaceutical potential of these compounds, attempts were made to synthesize derivatives of these compounds. Synthesis of theveridoside derivatives resulted in a very poor yield due to high acid sensitivity of the intermediates and starting material. But on the other hand theveside derivatives were accomplished successfully. One such derivative is shown in the following figure. Synthesis of a library of molecules of theveside by introducing different aromatic and aliphatic groups by utilizing ubiquitous amide functionality for incorporating the diversity element is in progress. The resulting derivatives will be evaluated for anti-diabetic screening.



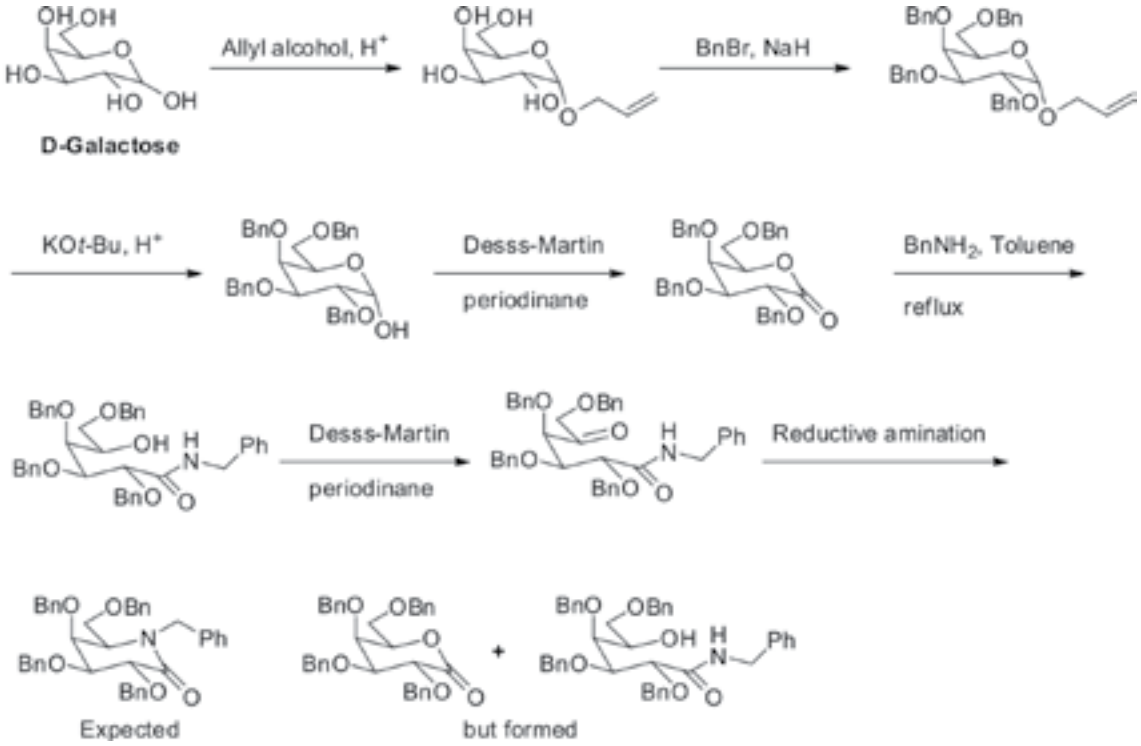
Synthesis of iminosugar variants of α-galactosylceramide for tuning of selective cytokine release from natural killer T (NKT) cells

Th1 (interferon-γ; IFN-γ) cytokines are found to exhibit antitumour, antiviral/antibacterial, and adjuvant effects, while Th2 (interleukin 4; IL-4) cytokines are effective in treating autoimmune and inflammatory diseases. A novel unnatural analog, an aza-variant of α-GalCer as a design to study the resulting immunomodulatory properties is reported here.

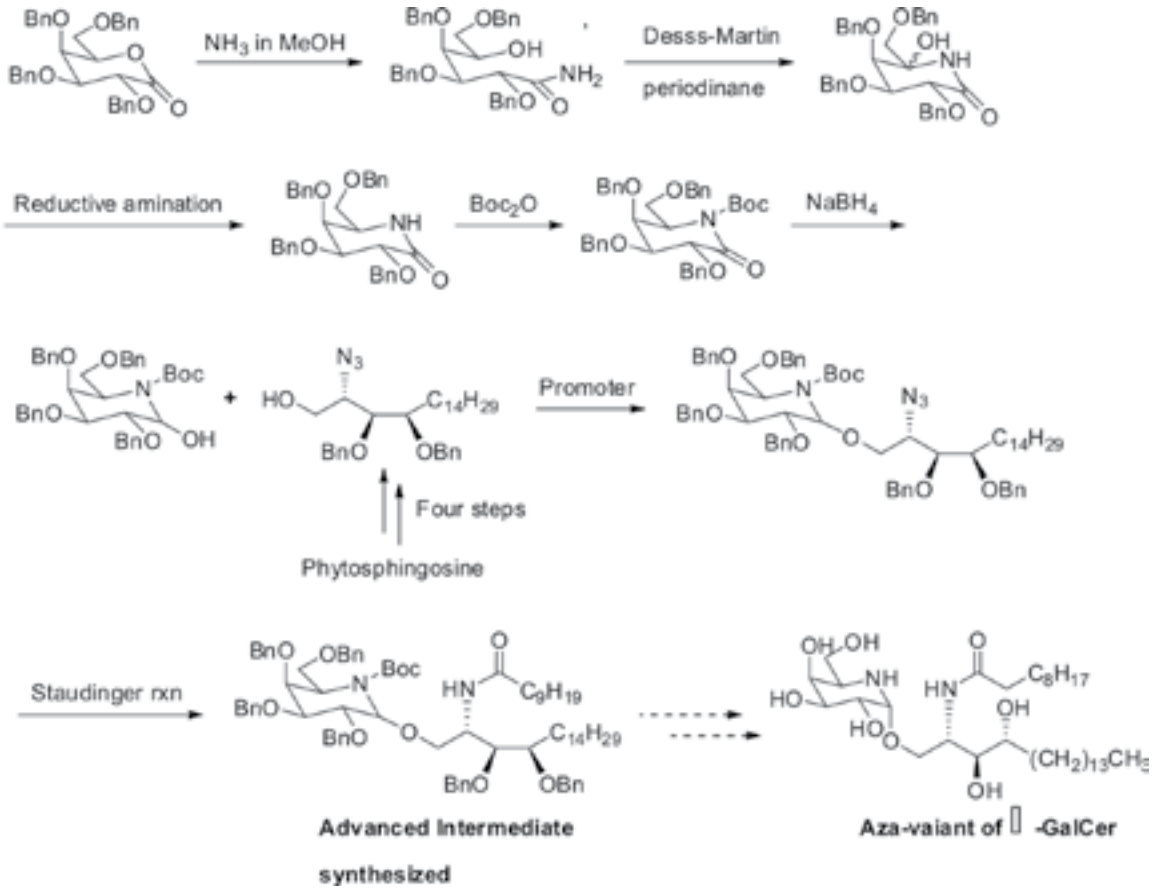
Structures of α-GalCer and its Aza-variant



Attempted synthesis



Current plan and status



Development of Indian Standards for North East Ginger

Bureau of Indian Standards (BIS) have supported a project to prepare draft Indian Standard Specification for ginger of North East (NE) origin (Revision of IS 1908.1993). The major thrust of the project was developing a database on oil content and physico-chemical composition of various fresh ginger cultivars grown in seven states of North East and its variation at different stages of maturity. The matured stage cultivars from all the seven NE states were collected and evaluated for their volatile oil content and variation in the chemical composition of fresh and dried cultivar. The physicochemical composition of samples were also studied for proximate composition, total extractives, detailed HPLC profiling of bio actives like gingerols, shoagols etc. The study revealed that there is substantial variation in the volatile oil content and oil composition between the cultivars collected from different regions of NE. There are variations in total oleoresin content and the active principles such as gingerols between the cultivars screened.

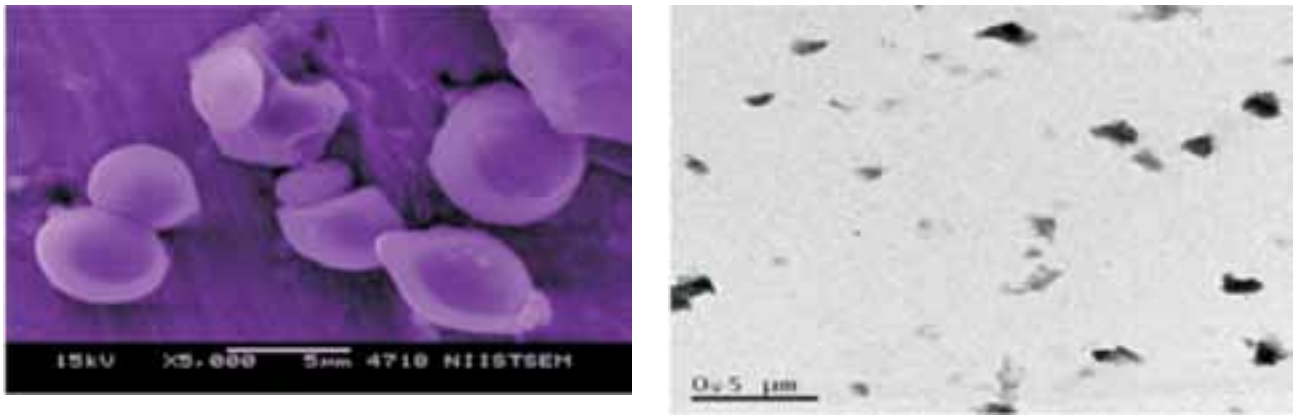
Phytochemical investigation on *Cyperus rotundus*

Cyperus rotundus L. (Family: Cyperaceae) is a perennial plant commonly known as nut grass grown throughout the world. It is well-known for its traditional medicinal uses for anti-inflammatory, antipyretic, analgesic, antidiarrhoeal and antimalarial effects. The tubers are used in Ayurvedic medicine and have been mentioned in ancient texts for various ailments. In the present study rhizomes of *C. rotundus* was extracted with acetone and the extract was subjected to column chromatography using the solvents hexane-ethyl acetate of varying polarity. Three compounds were isolated from different fractions and identified as solavetivone (52 mg), aristolone (56 mg) and nootkatone (326 mg). The structures of all isolated compounds were identified by interpretation of their spectral data *viz*., IR, HR-MS, ^{1}H, ^{13}C and DEPT NMR, as well as by comparison of their spectral data with those reported in the literature. A simple, sensitive and selective HPTLC/HPLC method with ultraviolet detection (265 nm) was developed and validated for the simultaneous quantification of three sesquiterpenoids namely solavetivone (0.2%), aristolone (0.4%) and nootkatone (0.5%) present in the plant material. Antioxidant capacities of these three compounds were studied by phosphomolybdenum reagent and DPPH radical scavenging. Among the three isolated compounds, the most potent radical scavenger was nootkatone (IC_{50} 4.81 µg/ml), followed by aristolone (IC_{50} 5.28 µg/ml) and solavetivone (IC_{50} 6.82 µg/ml). Acetone extract also showed a better antioxidant potential with an IC_{50} value of 4.19 µg/ml compared with standard gallic acid (IC_{50} 0.483 µg/ml). Further biological studies on these compounds are in progress.

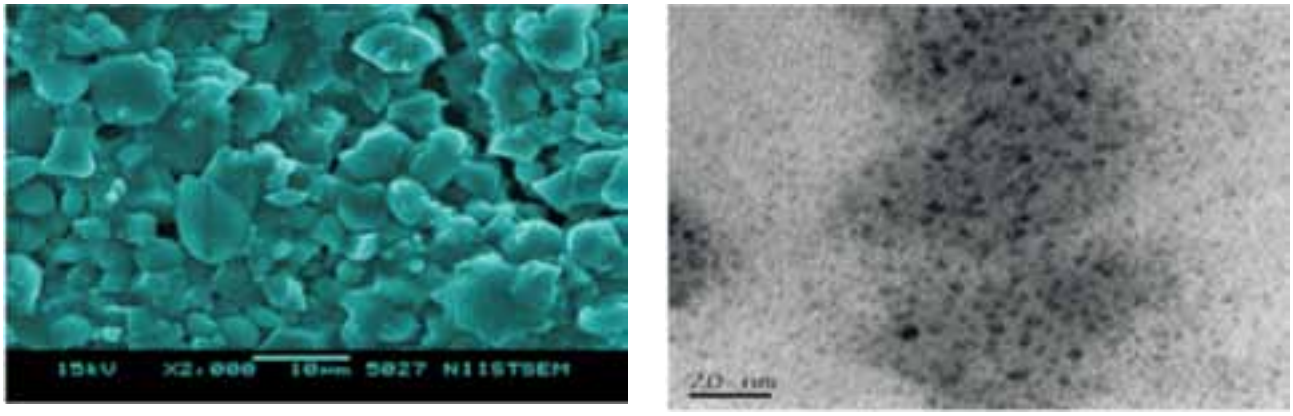
Green extraction techniques, structural analysis and antioxidant activities of β glucan present in oats

This study was aimed at separating β-glucans of high molecular weight from commercially available oats to use as nutraceuticals. Defatted oats was subjected to enzymatic (α-amylase, protease and lipase) as well as chemical extraction techniques. The studies showed that green extraction techniques are ideal for the separation of β -glucan of higher molecular masses with high yield and with better colloidal stability. Enzymatic extraction process appeared more efficient with least amount of protein in β-glucan extract. Yield of β-glucan on enzymatic extraction was found to be 13.9% whereas acidic and alkaline extraction yielded only 6.97 and 5% respectively. The antioxidant activity of the β-glucan isolated by different extraction methods were studied by measuring the radical scavenging effects. β-glucan extracted by amylase at 0.2% concentration exhibited strong antioxidant activity (IC_{50} 17.16 µg /mL) by scavenging DPPH radicals. But β-glucan extracted by protease and lipase had IC_{50} 41.44 and 67.7 µg/mL respectively. The MALDI mass spectral analysis showed that the molecular weight of β-glucan extracted by protease was high and of 41.2 KDa while that by amylase and lipase was lower. The zeta potential measurements of

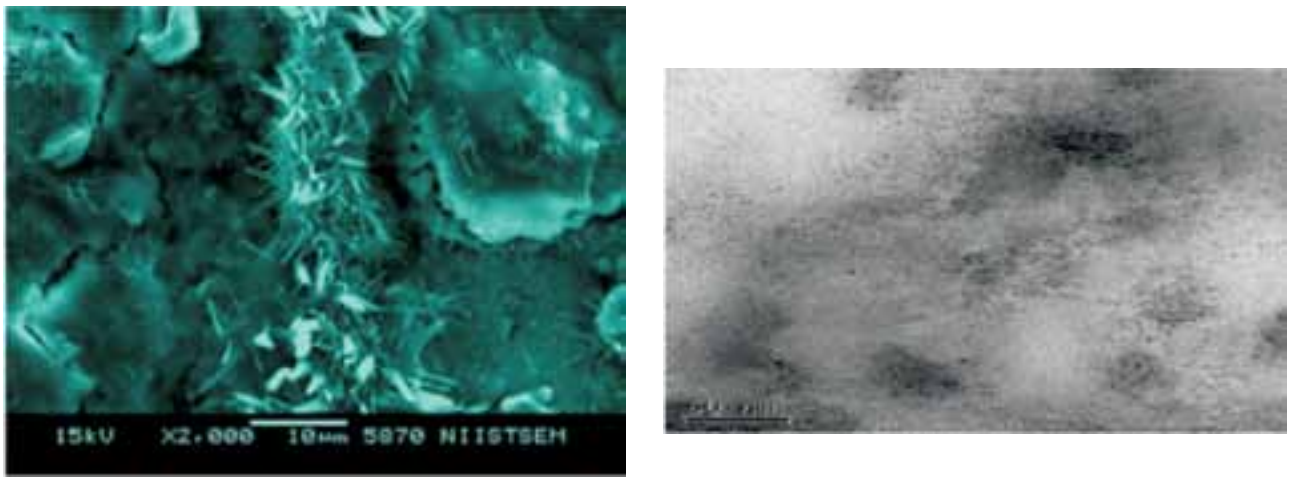
glucan showed that lipase and protease treatments of oats have positive effect on stabilty of β–glucan particles isolated. The SEM and TEM studies showed that the process of extraction of β-glucan from oats has profound effect on its shape and size of the particles. The green extraction techniques reported here are simple and less cumbersome to produce high molecular weight *β*-glucan with high yield and purity for nutraceutical applications.



SEM and TEM images of β -glucan extracted by amylase at 0.1M concentration



β -glucan extracted by amylase at 0.15M concentration



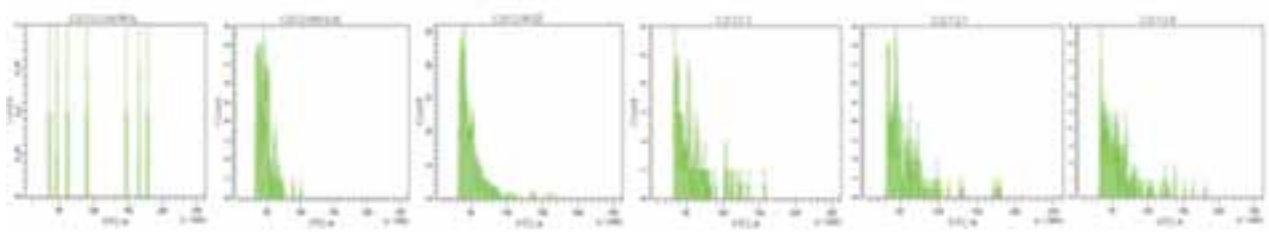
SEM and TEM images β -glucan extracted by protease at 0.05M concentration

Physicochemical and functional properties of designer oil from soybean and mustard oils

In India, major oils consumed in Northern states are soybean (SOY) and mustard (MO), while, it is coconut (CNO) in Kerala and palm oil (PLO) in Western region. The present study aims to develop a designer oil that meet the requirements of both essential fatty acids (EFA) and medium chain triglycerides (MCT) by blending unsaturated MO and SOY with saturated virgin CNO and PLO that are rich in MCT (at a ratio of 60:40). Blends were analysed for physiochemical properties and fatty acid composition, for three months at three different storage conditions. Among the blends, SOY/CNO was found to be the most stable with least FFA (1.12%), peroxide (39.68 meq/kg) and para-anisidiene values (5.92) binding with CODEX standards. The smoke point was found to be 239°C for SOY/CNO and 248°C for MO/CNO indicating a higher value suitable for frying. Among the blends extracts of MO/CNO displayed higher TPC (5.7 mgGAE/100g) followed by SOY/CNO (5.021mgGAE/100g). MO/CNO showed highest activity towards superoxide radicals with IC_{50} 16.75µg/ml. Deep fried chickpea flour based snacks were prepared using the blends and were analysed for their physiochemical parameters and fatty acid composition (C_8- C_{22}).

In vitro evidence for the protective effect of pomegranate peel extracts against type II diabetes and diabetic induced cardio vascular complications

Punica granatum L., commonly known as pomegranate has been extensively used as a folk medicine in many cultures. This study aimed to evaluate the protective effect of pomegranate peel extracts against typeII diabetes and diabetic induced cardiovascular complications. The sequential extracts of pomegranate peel were evaluated for its potential against diabetes and CVD using *in vitro* antioxidant (chemical and cell lines) protocols. Pomegranate peel was sequentially extracted and fractionated and assessed for antioxidant potential in terms of total phenolics (TPC), 2, 2-diphenyl-2-picryl hydrozyl (DPPH), 2,2'-azino-bis(3-ethylbenzothiazoline-6- sulphonic acid) (ABTS), superoxide and nitric oxide (NO) radical scavenging activity. The TPC content was higher for crude methanol extract and its ethyl acetate fraction (21.41 and 57.23%). Water fraction of methanol extract exhibits highest DPPH scavenging activity (IC_{50}-3.69µg). The ethyl acetate fraction of methanol extract showed highest ABTS, superoxide and NO radical scavenging activity (IC_{50}-3.6, 20.89 and 0.124µg). Antidiabetic property was evaluated by α-glucosidase inhibition and glucose uptake assay. The maximum glucose inhibition activity was shown by ethyl acetate fraction of ethyl acetate extract (IC_{50}-0.0066µg). In case of glucose uptake, 100µg of ethyl acetate fraction of methanol extract enhanced 3.3% cells to uptake 2NBDG. The ethyl acetate fraction of methanol extract exhibited maximum inhibition against LDL oxidation (IC_{50}-16.2µg) and this fraction at higher concentration (200) enhanced adipocyte differentiation and significantly reduced lipid accumulation (up to 28%) in 3T3-L1 adipocytes. On the basis of these results it can be concluded that the ethyl acetate fraction of crude methanol extract of pomegranate peel is an auspicious source for preventing typeII diabetes and diabetes induced cardiovascular complications.



FACS based antidiabetic assay: a) control cells b) cells pre-treated with 200 mm insulin c) 100nM rosiglitazone d) ethyl acetate fraction of methanol extract 50µg/ml e) 100µg/ml f) 200µg/ml

BIOTECHNOLOGY DIVISION

Biotechnology Division focuses on high quality R & D in specific frontier areas of Biotechnology. Significant emphasis is put on the exploration and value addition of regional bioresources while ensuring environmental sustainability. The Divisional R& D and industrial consultancy activities are linked with programmes of national importance through networking with national and international organizations. Collaborative research and linkages with reputed national and international institutions are major strength of the Division. The current focus areas of the Division are (i) bioprocess and product development, (ii) energy & environment and (iii) health & genomics. In the area of bioprocesses and bioproducts, the Division's emphasis is on the production of industrial enzymes, biopolymers and amino acids. Considerable success has been achieved in developing microbial – based polymers such as PLA and PHB using agro-residues as feed-stocks. Under the energy sector, the main focus is on developing eco-friendly processes for the production of bioethanol from lignocelluloses. Microbes have been isolated from the Western Ghats in Kerala and deposited in the NII Culture Collection, which is a registered depository for the culture collection having 1200 actinomycetes, yeast, bacterial and fungal cultures.

Highlights

- A highly efficient bioprocess was developed for the production of L-leucine amino peptidase (489 IU enzyme/g PUF) under solid-state fermentation (SSF) by cultivating *Streptomyces gedanensis* on polyurethane (PUF) impregnated with a minimal medium.
- A recombinant strain of *Corynebacterium glutamicum,* showing capacity to utilize arabinose and xylose alone or when present together in pentose sugars hydrolyzate, constructed.
- A proline specific aminopeptidase (PAP), produced by *Streptomyces lavendulae*, purified in sequential steps showed a molecular weight of 60 kDa and Km, Vmax of 0.23 mM and 0.087 µmol/min, respectively using Pro-*p*-NA, the substrate with maximum specificity.
- Two potent cultures obtained from the cow's milk (CM 22 and CM 28) showed more than 98% similarity to *Lactococcus* subsp. *cremoris* and *Lac. lactis* subsp *lactis* by 16s rRNA sequencing. Effective manipulation of the medium additives and cultivation conditions enhanced the folate production (164 ng/ml, deconjugated folate) in skim milk by *Lactococcus lactis ssp cremoris. L. lactis* also proved to be an excellent source for the enrichment of the folate content in cucumber and watermelon juice.
- An efficient enzyme cocktail was prepared using the cellulase produced by *Penicillium janthinellum* and a glucose-tolerant beta glucosidase (BGL) produced by *Aspergillus niger*. The enzyme cocktail was highly efficient in hydrolyzing the steam-exploded bagasse when compared to commercial enzymes available in the market, with equivalent or better hydrolysis efficiency.

जैव प्रौद्योगिकी प्रभाग

जैव प्रौद्योगिकी प्रभाग का ध्यान जैव प्रौद्योगिकी के विशिष्ट सीमांत क्षेत्रों में उच्च गुणवत्ता अनुसंधान और विकास कार्यक्रमों पर केंद्रित है। पर्यावरणीय स्थिरता सुनिश्चित करते हुए क्षेत्रीय जैव संसाधनों की खोज और मूल्यवर्धन में महत्वपूर्ण जोर रखा है। प्रभागीय अनुसंधान एवं विकास और औद्योगिक परामर्श गतिविधियॉ नेटवर्किंग के माध्यम से राष्ट्रीय और अंतरराष्ट्रीय संगठनों के राष्ट्रीय महत्व के कार्यक्रमों के साथ जुड़ी हुई हैं। सहयोगात्मक अनुसंधान और प्रतिष्ठित राष्ट्रीय और अंतरराष्ट्रीय संस्थाओं के साथ संबंध प्रभाग की एक प्रमुख शक्ति है। प्रभाग का ध्यान वर्तमान में इन क्षेत्रों में केंद्रित हैं (i) बायोप्रोसैस और उत्पाद विकास (ii) उर्जा और पर्यावरण और (iii) स्वास्थ्य और जीनोमिक्स। बायोप्रोसैस और बायोउत्पादों के क्षेत्र में, प्रभाग की सक्रियता औद्योगिक एंजाइमों, बायोपॉलिमरों और एमिनो एसिड के उत्पादन पर केंद्रित है। फ़ीड स्टॉक के रूप में कृषि अवशेषों का उपयोग करके पीएलए और पीएचबी जैसे- माइक्रोबियल आधारित पॉलिमरों को विकसित करने में काफी सफलता हासिल की है। ऊर्जा क्षेत्र के अंतर्गत मुख्य ध्यान लिग्नोसेलुलोसस बायोएथेनॉल कार्यक्रम से बायोएथेनॉल के उत्पादन के लिए पर्यावरण की अनुकूल प्रक्रियाओं को विकसित करने पर केंद्रित है। केरल के पश्चिमी घाट से रोगाणुओं को पृथक करके एनआईआई संवर्धन संग्रह में जमा किया गया है, जो 1200 ऐक्टिनोमाइसिटीज, खमीर, बैक्टीरियल और फंगल संवर्धन संग्रह का एक पंजीकृत निक्षेपागार है।

मुख्य विशेषताएं

- एक न्यूनतम माध्यम के साथ संसेचित पॉलीयूरिथेन पर (पीयूएफ) *स्ट्रेप्टोमाइसीज गेडन्सीज* की खेती से ठोस अवस्था किण्वन (एसएसएफ) के तहत एल ल्यूसीन ऐमीनो पेप्टिडेज़ के उत्पादन के लिए एक अत्यधिक कुशल बायोप्रोसैस विकसित की गयी। (489 आइयू एंजाइम / ग्राम पीयूएफ)
- *कोरिनेबैक्टीरियम ग्लूटामिकम* के एक रीकॉम्बीनैंट स्ट्रेन का निर्माण किया गया, जिसमें अरबिनोस और सिलोज़ को अकेले या पेंटोस शर्करा जलापघटनज में एक साथ मौजूद होने पर उपयोग करने की क्षमता वर्तमान है।
- प्रो पीएनए-एक अधिकतम विशिष्टता युक्त सब्सट्रेट का उपयोग करके, *स्ट्रेप्टोमाइसीज लावेन्डुले* द्वारा उत्पादित तथा अनुक्रमिक चरणों में शुद्ध किया गया एक प्रोलाइन विशिष्ट ऐमीनोपेप्टिडेस (पीएपी) ने क्रमशः 60 केडीए आणविक वजन और 0.23 एमएम केएम, वीमैक्स और 0.087 µ मॉल/मिनट दर्शाया है।
- गाय के दूध से प्राप्त दो शक्तिशाली संवर्धन (सीएम 22 और सीएम 28) ने एस16 आरआरएनए अनुक्रमण द्वारा *लेक्टोकोकस* उप जाति *क्रिमोरिस* तथा *लेक. लैक्टिस* उपजाति *लैक्टिस* के बीच 98% से अधिक समानता दिखाया। *लेक्टोकोकस लैक्टिस* उपजाति *क्रिमोरिस* ने मीडियम योगजों और खेती की स्थिति के प्रभावी हेरफेर पर स्किम दूध में फोलेट उत्पादन में वृद्धि की (164 एनजी / मि.ली, डीकॉजुगेटड फोलेट)। ककड़ी और तरबूज के रसों में फोलेट सामग्री के संवर्धन के लिए *एल.लैक्टिस* एक बहुत अच्छा स्रोत साबित हुआ।
- *पेनिसिलियम जेथिंनेल्लम* द्वारा उत्पादित सेलुलेस के इस्तेमाल से एक कुशल एन्जाइम कॉकटाल की तैयारी की और *ऐस्पर्जिलस नाइजर* द्वारा एक ग्लूकोज सहिष्णु बीटा ग्लूकोसिडेस (बीजीएल)का उत्पादन किया। एन्जाइम कॉकटाल स्टेम-विस्फोट खोई के जलापघटन में, बाजार में उपलब्ध वाणिज्यिक एंजाइमों की तुलना में, बराबर या बेहतर जलापघटन दक्षता दिखायी।

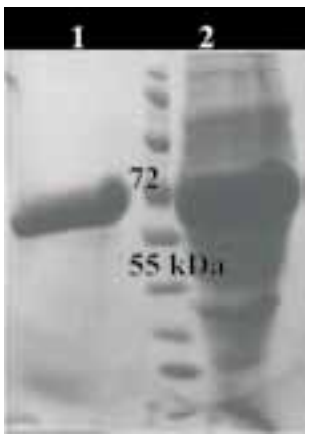
BIOPROCESSES AND PRODUCTS DEVELOPMENT

Industrial enzymes

NIIST Biotechnology is involved in active research on biomass hydrolyzing enzymes and other industrially important enzymes.

Production of recombinant L- asparaginase: L-asparaginase II gene of a local isolate (isolated from the cow dung) was cloned in pET20b vector and over-expressed in *E. coli* BL21DE3. The cloned gene was sequenced, which showed 98% similarity towards the L- asparaginase II of *E. coli.* The protein was over-expressed with inducer concentration of 10μM IPTG and was purified through affinity chromatography using the Ni- NTA spin column. The characteristics of the purified recombinant asparaginase such as optimum pH and temperature, thermo-stability and kinetic studies for *Km* and *Vmax* were optimized.

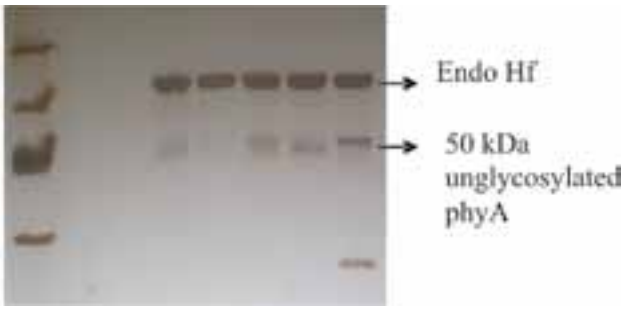
Proline-specific amino peptidases: Among the proline-specific amino peptidases, Xaa-Proline amino peptidase or amino peptidase P (APP) catalyzes the hydrolysis of Xaa-Pro bond at the N-terminus of polypeptides. The Xaa-Pro bond was resistant to other amino peptidases, but not to amino peptidase P (AP-P; EC 3.4.11.9), which cleaved this bond exclusively. The *app* gene from *Streptomyces lavendulae* was identified, cloned and over-expressed in *E. coli* expression system. The recombinant protein was further purified and was used for the substrate hydrolysis by HPLC



SDS-PAGE pattern of the purified (Lane1) and crude (Lane3) recombinant aminopeptidase P with molecular weight marker (Lane2)

Amino peptidase from Streptomyces gedanensis as a useful tool for protein hydrolyzate preparation with improved functional properties: Three proteins, soy, casein and wheat protein were employed to produce their hydrolyzates by applying 2% (w/w) amino peptidase (AP) at optimal conditions of pH 8.5 and temperature 55°C. The results showed that the degree of hydrolysis ranged from 15.93 to 20.68% at 6 h. They also showed better antioxidant activity and functional properties such as solubility, foaming properties, and water holding capacity when compared with the commercial protease treated hydrolyzates. AP treated PHs were enriched in Glu followed by Leu, Tyr, Lys, Phe, Asp, Met, His, Ile, Ala, and Val. Therefore, *S. gedanensis* AP would be an attractive microbial amino peptidase with high potential for the preparation of PHs, which could offer industrial applications, especially for producing food formulations as food additives in medicines.

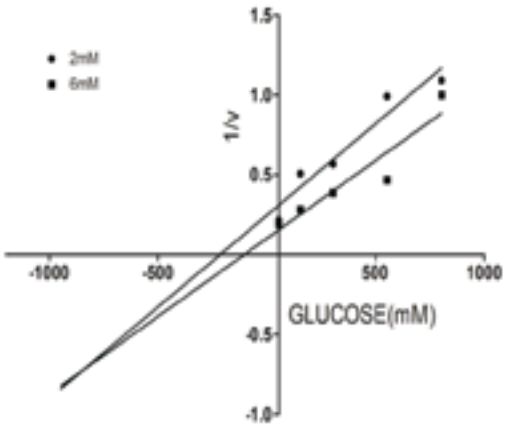
Development of thermostable and low pH-tolerant phytase from Aspergillus niger using site-directed mutagenesis: Phytase gene from *A. niger* was isolated, cloned and characterized. PhyA gene was constructed in to secretion expression vector pKLAC1 of *Kluyveromyces lactis.* Recombinant plasmid was linearized and transformed in to the yeast by electroporation. Transformants obtained on yeast carbon base acetamide selection plates were screened for the secretion of phytase using 4-methyl umbelliferyl phosphate. The colonies that showed fluorescence were selected and multiple integration of expression cassette in yeast genome was confirmed by PCR. Time course analysis for the production of recombinant phyA was carried in yeast extract peptone broth supplemented with casamino acids, which showed the maximum production at 25°C after 24h incubation. Recombinant enzyme was purified from the extracellular fraction by acetone, followed by hydrophobic interaction chromatography. Glycosylated enzyme exhibited an optimum activity at 60°C and retained 30% activity after incubation for 5 min. Optimum pH for activity was determined at pH 3.0 and 5.0. After deglycosylation by Endo Hf, the phytase showed an apparent molecular size of 50 kDa in SDS-PAGE.



Endo Hf cleavage of phyA - Lanes 1-5- Endo Hf treatment at different time intervals (30 min, 2h, 6h, 8h and 12h respectively at 37°C)

β-***Glucosidase:*** Beta glucosidase (BGL) is a key rate-limiting enzyme involved in biomass hydrolysis, since it catalyzes the final step in cellulose to glucose conversion. Glucose tolerant BGLs can improve the sugar yield, however, most of the currently available BGLs are inhibited by low concentrations of glucose (<50mM, 0.9%). NIIST has been working on two different beta glucosidases, each tolerant to >1M (18%) glucose and with high potential to be used in enzyme blends for biomass hydrolysis. These BGLs were produced by *Aspergillus unguis* and *Byssoclamys fulva.*

Aspergillus unguis – conidium (SEM image)



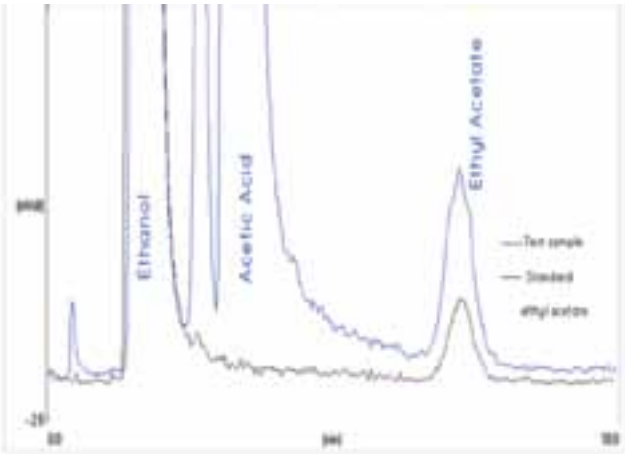
Determination of glucose inhibition constant (Ki) of A unguis BGL (Ki = 0.8M = ~14.5%)

The glucose tolerant BGLs from these fungi were purified to homogeneity. Both the fungi produced multiple isoforms of the enzyme and the low molecular weight isoforms was glucose-tolerant. The purified glucose tolerant BGLs exhibited a glucose inhibition constant *(Ki)* of 0.8M (14.4%), which indicated very high glucose tolerance. Biochemical properties of both the enzymes showed that they shared very similar properties, including an optimal pH and temperature of activity, which was 6.0 and 50°C, respectively. However, the glucose tolerant BGL from *Byssoclamys fulva* had a remarkable thermal stability ($T_{1/2}$ = 66h at 50°C), a property highly desirable in biomass hydrolysis. Partial gene sequences of the BGLs from both the fungi were obtained by PCR amplification using degenerate primers and they showed similarity to previously reported BGLs. Secondary structure of domains and motifs of the major BGL from *B. fulva* were determined using in-silico modeling studies.

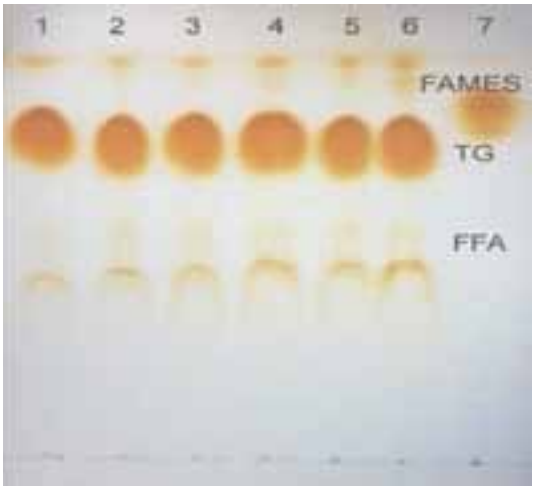
Development of technologies for Target cDNA cloning and heterologous gene expression in fungal host: A novel method was developed for the direct cloning of the cDNAs of interest without needing the construction of a cDNA library (the process called as Target mRNA capture cloning - TmRCC). The method was tested successfully by cloning the mRNA for Green Fluorescent Protein (GFP) from a host bacterium expressing this protein into *E.coli.*

An expression system was developed for the expression of heterologous proteins in a fungal host. The promoter and secretion signal of a highly expressed fungal gene capable on induction was cloned and an expression cassette was constructed with the gene for Green Fluorescent Protein (GFP) ligated down stream of the promoter and secretion signal; downstream, a termination signal was attached. The expression cassette was tested in *Kluveromyces lactis* after incorporating the cassette in a pKlac expression vector and knocking down its promoter system. Successful expression of GFP proved the functionality of the expression system developed.

Lipase: A thermo-, and solvent-tolerant esterase was isolated from a novel strain of *Pseudozyma* sp. The enzyme was also active in 2M NaCl, indicating its suitability for several industrial applications. The enzyme was partially purified and the properties were characterized. The enzyme was immobilized on magnetic nanoparticles and was evaluated successfully for the production of flavor compound – ethyl acetate. Also, the enzyme was successfully tested for transesterification of vegetable oil to fatty acid methyl esters (FAME).



Production of ethyl acetate using magnetic nanoparticle immobilized esterase



Production of FAME by transesterification of vegetable oil using MnP immobilized esterase Lanes 1-6 indicate different time points and lane 7 is the positive control.

In another study, a metagenomics approach was followed for screening of novel lipases from uncultivable microbial biodiversity. BAC and fosmid libraries were constructed using the DNA isolated from a soap factory effluent and the Western *ghats* soil samples. The screening resulted in identification of 18 esterase positive clones. Two of these clones produced esterase that was tolerant to elevated temperatures and solvent concentrations.

Development of enzyme cocktails for biofuels applications: Solid-state fermentation (SSF) processes were developed for the production of cellulase by a mutant stain of *Penicillium janthinellum* (NCIM 1171) and beta glucosidase (BGL) by *Aspergillus niger* (NII strain). These processes were scaled-up successfully at pilot-scale at the enzyme manufacturing facility of a leading enzyme company in the country. About 250 kilograms of enzymes were produced in both the cases. These enzymes were evaluated for the hydrolysis of biomass, which showed more than 60% hydrolysis efficiency. Under the partially optimized scaled-up conditions, ~40 FPUs/gDS cellulase was produced by the *Penicillium janthinellum* (Table 1).

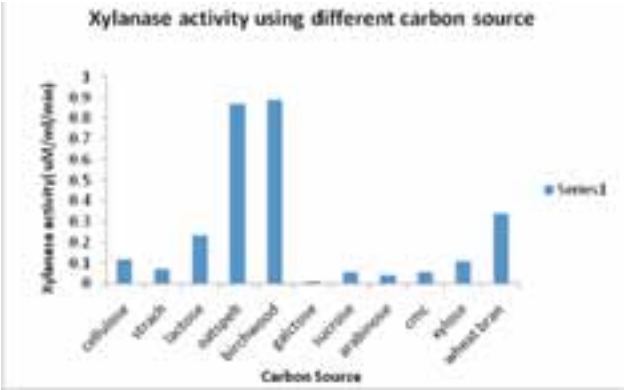
Growth of P. janthinellum under SSF cultivation in Flasks (control) and trays

Table 1. Production of *P.janthinellum* cellulase at 50kg level

Batch no	FPUs/gDS	FPU/ml
1	41	4.10
2	26.4	2.64
3	36	3.60
4	41	4.10
5	41	4.10

Under the partially optimized scaled-up conditions, *Aspergillus niger* produced about 140 IU/gDS BGL was produced.

Alkaline and thermo-tolerant xylanase from *Streptomyces* sp: Several microorganisms were isolated from the mangroves of Kadalundi (Calicut) following the standard protocols. Based on the morphological, biochemical and 16srRNA identification of the isolates, one culture was identified as *Streptomyces* sp. The culture showed varied response for xylinoltic activity on various carbon sources. Birch wood, oatspelt and xylan were most preferred. The culture grew at pH 6.0-12.6, but the enzyme production occurred at pH 8.0-12.0. The crude enzyme was active under extreme alkaline conditions (pH 8.0-12.0) and was stable at 50-70°C.



Carbon spectrum utilization by Streptomyces sp for xylanase production

Production of amino acids: Several starchy and lignocellulosic agro-residues were hydrolyzed enzymatically and the hydrolyzates were tested for the production of amino acids such as L-glutamate, L-lysine and arginine by several *Corynebacterium* strains. Results showed that *C. glutamicum* DM 1729 utilized about 70% sugars present in the jackfruit seed power hydrolyzate and produced 13 mg/ml lysine (0.22g lysine/g reducing sugar). Similarly, from cassava bagasse hydrolyzate medium, *C. glutamicum* ATCC 21831 produced 4.4 mg arginine/ml. The production efficiency was improved when the fermentation was carried out in bioreactors (1-l parallel fermenter and 5-l fermenter) and the arginine yield was 6.2-6.8 mg/ml.

When rice straw hydrolyzate was used for the fermentation (prepared by 4% H_2SO_4 treatment for hemicellulose solubilization), 0.18g lysine/g reducing sugar was produced by *C. glutamicum* DM 1729 and 0.37g glutamate/g reducing sugar was produced by *C. glutamicum* ATCC 13032.

Biopolymers and biosurfactants

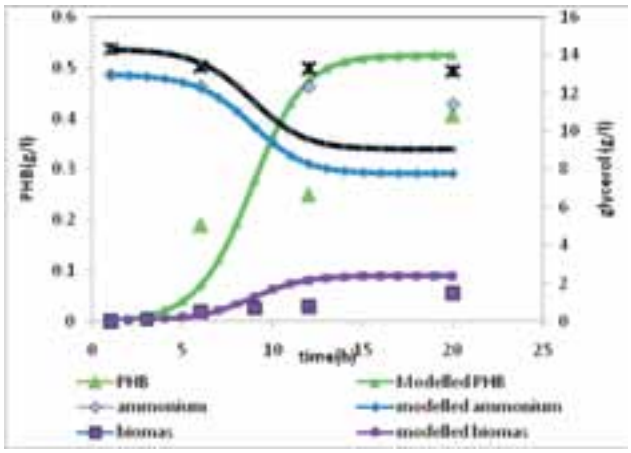
Production of bacterial poly-3-hydroxybutyrate (PHB) from biodiesel industry generated glycerol: Studies were carried out on kinetic modeling of PHB production from biodiesel industry generated glycerol by using three different models which were associated with the growth and product formation by *B. firmus* NII 0830. The time course of calculated concentrations was compared with the experimental values. On simulation, the model showed a good harmony with the experimental data.

The batch-fermentation studies showed a maximum of 60% PHB production. In overall fermentation process, efficient mass transfer between the gas and liquid phase was achieved. Fed-batch process at 1L scale yielded 1.03 g/l PHB at 27th h of fermentation. As the time advanced, there was a gradual decrease in PHB production and by 51st h, there was only 0.289g/l PHB remained in the cells. Scale-up studies at 5L and 20L showed an increased PHB to about 83%.

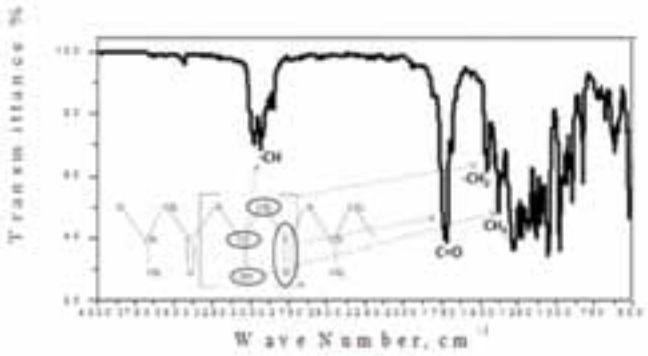
In a study on the production of PHB using the black liquor generated from the acid pretreated rice straw, B. firmus NII 0830 showed the ability to grow in pretreated pentose sugar rich liquor without any detoxification and accumulated about 80% PHB.

The characterization of the PHB by FTIR, ^1H

and ^{13}C NMR showed its properties similar to that of the standard PHB from Sigma. The extracted PHB was blended with other polymers to improve its physical characteristics. Biodegradation studies of PHB-starch blended films using the indigenously developed microbial consortium showed that the film was biodegraded up to 50% in 35 days of incubation. The degradation of the film occurred *via* surface deterioration. Scanning electron microscopy of the PHB film revealed holes in it after burial compared to those smooth unbroken surface of the films before the burial.



Kinetic of PHB production using biodiese industry generated glycerol



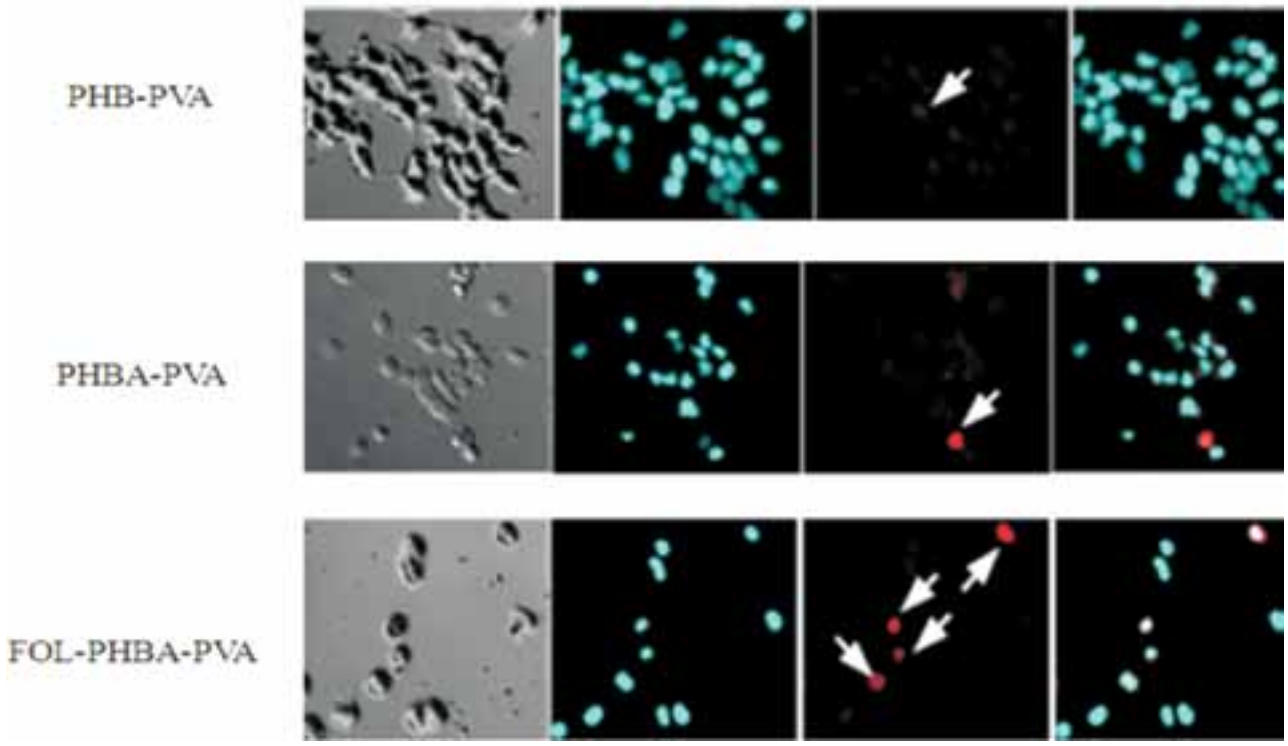
FTIR spectrum of PHB extracted from Bacillus firmus NII 0830

The study concluded that PHB could be produced efficiently by *Bacillus firmus* NII 0830 using untreated crude glycerol generated from biodiesel industry without any pretreatment under submerged fermentation in one step and the produced polymer blend could be degraded biologically. This opens a new avenue for the utilization of biodiesel industry generated glycerol efficiently for techno-economic benefits.

Development of a novel solid-state fermentation strategy for the production of poly-3-hydroxybutyrate using polyurethane foams by Bacillus sphaericus NII 0838: A novel SSF bioprocess was developed using polyurethane foam as an inert support for the production of poly-3-hydroxybutyrate by *B. sphaericus* NII 0838. Media engineering for optimal PHB production using Response Surface Methodology adopting a Box-Behnken design showed the production and biomass as 0.169 g/g and 0.4 g/g, respectively. This is the first report on PHB production using polyurethane foam as an inert support.

Folate conjugated PHB nanoparticles as drug carrier: In order to conduct the studies on the folate receptor-targeted anti-cancer agent delivery, arsenic trioxide loaded biocompatible PHB-PVA nanoparticles (<100 nm in size) surface functionalized with folate were synthesized, using PHB produced from *B. firmus,* following double emulsion solvent evaporation protocol. Folate functionalization was carried using Di-Cyclohexyl Carbodiimide (DCC) as a catalyst and 10-bromodecanol as a linker to conjugate glutamic acid terminal of folate with the hydroxylate groups present on the surface of PHBA-PVA nanoparticles. FOL-PHBA-PVA nanoparticles showed greater extent of cytotoxicity towards HEK293T cells than the PHBA-PVA nanoparticles alone without conjugated folate, indicating the significance of folate as ligand for specific targeting of FR+ cancer cells.

The effect of fabrication parameters on the shape, size distribution and PDI of the PHB nanoparticles were also investigated. It was observed that increase in the sonication time and polyvinyl alcohol (PVA) concentration greatly reduced the size of nanoparticles. The drug release studies on arsenic trioxide incorporated PHB-PVA nanoparticles were conducted at physiological pH and temperature. The percentage of arsenic trioxide released from the PHB-PVA nanoparticles was studied as a function of time. These studies suggested that folate-conjugated PHBA-PVA copolymer nanoparticles could be potentially useful drug delivery systems for FR+ cancer cells.



PI staining technique used to identify dead cells (red) while viable cells were stained (green) with DAPI. (A) HEK293T cells treated with PHB-PVA NPs without drug showed least dead cells, (B) PHBA-PVA NPs treated HEK293T cells showed considerable dead cells while (C) FOL-PHBA-PVA NPs treated HEK293T cells showed greater cytotoxicity among all formulations.

Production, characterization and applications of biosurfactants from Pseudozyma sp. NII 08165: *Pseudozyma* sp. NII08165, a yeast isolate was found to produce large quantities of glycolipids when oil was supplemented into the medium. Detailed structural characterization of the biosurfactant revealed it to contain mannosylerythritol lipids (MELs), one of the most promising biosurfactants ever known. Apart from MELs, *Pseudozyma* sp. NII08156 produced cellobiose lipids and some unknown glycolipids. The crude glycolipids from the *Pseudozyma* sp were studied for the use as additives in laundry detergent formulation. The fabric wash analysis with the laundry detergent showed that it improved the performance in combination with crude biosurfactant produced by the yeast.

Polylactide degradation*:* Polylactic acid degrading organisms were isolated from various soil and compost samples and with a consortium of best isolates degradation studies were conducted on PLA films. By the microbial action, the PLA films were deformed and changed from clear surface to white opaque and brittle surface. There was a weight loss of 47% after six weeks of composting.

BIOENERGY AND ENVIRONMENT

Bioethanol from Lignocellulosic Biomass

Centre for Biofuels Phase I: Commissioning of the Pilot Plant: The Centre for Biofuels project has been established at the CSIR- National Institute for Interdisciplinary Science and Technology, Trivandrum with funding from TIFAC and CSIR to address the technical challenges in biomass to ethanol conversion towards developing a scale-up worthy process for lignocellulosic ethanol production and setting up a pilot plant for demonstrating the process. A bioethanol pilot plant with a capacity process of 80 kg of biomass per batch was designed based on the data obtained for the process for conversion of different selected biomass types to bioethanol. Material flows, volumes, methods of operation, process efficiencies and limitations, etc were all considered while designing a tentative process flow with approximate sizing of reactors. This design was provided to an engineering consultant - M/s Hitech Biosciences Pvt Ltd, Pune who refined the design in consultation with the NIIST team and prepared the engineering specifications and drawings for the pilot plant. The fabrication/ erection and commissioning of the plant was done by M/s Scigenics India Pvt Ltd, Chennai who fabricated the reactors, did the piping and instrumentation, utilities and finally the pilot plant was commissioned for operation.

Pretreatment Reactor

200 L Fermenter for bioethanol production

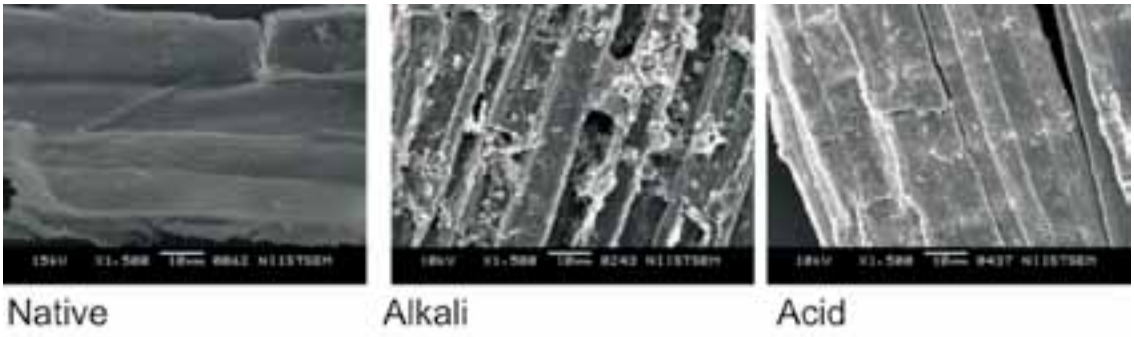
Some equipments of the bioethanol pilot plant

Identification of potent biomasses for ethanol production: Centre for Biofuels (CBF) had conducted a nationwide survey on the availability of feedstock and to identify the most potent feedstocks for bioethanol production. The survey indicated that sugar cane tops was the most abundant feedstock with an annual surplus availability of about 79 MMT. The survey also addressed the regional availability, bulk prices and logistic issues. Based on the surplus availability and the CBF's experimental findings on the process efficiencies, the potential of ethanol generation from the major available feedstocks was calculated to be 10.5 billion liters annually. The estimated production potential can cater to the demand of ethanol for 10% blending of ethanol in gasoline for 2020 and more.

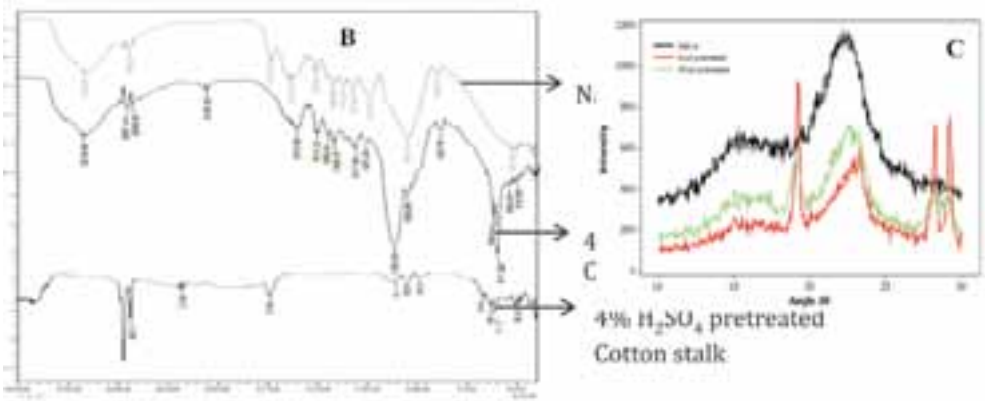
Potential for bioethanol from available biomass residues in India

Agro residue	Annual Availability (MMT)	Cellulose (%)	Alcohol - Theoretical Max (Billion L)	Alcohol -Estimated @35% efficiency (Billion L) *
Rice Straw	8.9	33	2.11	0.737
Wheat Straw	9.1	33	2.15	0.754
Bagasse	6.4	40	1.84	0.643
Corn Stover	1.1	35	0.28	0.097
Sugar Cane Tops	79.5	35	19.96	6.985
Chili PHR	0.5	47	0.17	0.059
Cotton PHR	11.4	31	2.53	0.887
Bamboo	3.3	42	0.99	0.348
TOTAL			30.03	10.51
PHR - Post harvest residue	* Calculations on alcohol yield based on at minimal efficiency obtained for feedstock considered			

Based on the sustainable availability of the agro-industrial residues and the potential for alcohol production from them, CBF identified six biomass types as possible feedstocks for bioethanol production. These biomass types were 1) Rice straw, 2) Sugar cane bagasse, 3) Sugar cane tops, 4) Bamboo, 5) Chili plant Post harvest residue, and 6) Cotton plant post harvest residue. Biochemical and physical characterization of all the selected biomass was performed to understand the composition of each in terms of their cellulose, hemicellulose, lignin, ash contents and the structural features such as crystallinity, surface properties, etc to assess the possible methods of pretreatment, changes during the pretreatment and for estimating the theoretical potential for sugar generation.



Sample SEM images for native and pretreated Rice straw showing structural changes

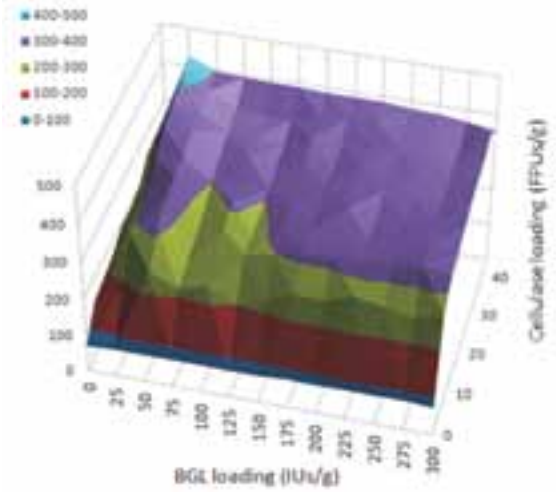


Sample figures showing the FTIR analysis and XRD analyses of biomass respectively indicating removal of lignin and hemicellulose (B) and increase in amorphous region (C) for cotton stalk on dilute acid o alkali pretreatment.

Pretreatment of the identified feedstocks: CBF's R&D focused on hydrothermal methods using dilute acid and alkali as well as other methods such as microwave assisted pretreatment to prepare the biomass for enzymatic hydrolysis. The efficacies of the methods were monitored as susceptibility to enzymatic hydrolysis, which was measured as the total sugars yield after subsequent hydrolysis under identical conditions. The studies resulted in optimized processes for acid/alkali pretreatment at high temperatures. A significant finding was that the microwave assisted dilute acid pretreatment was five times more energy efficient compared to high temperature dilute acid pretreatment. This finding has tremendous implications in design of energy and cost effective pretreatment strategies for large-scale biomass pretreatment.

Enzymatic hydrolysis of the pretreated biomass: Studies were conducted to optimize the conditions of hydrolysis as a preliminary step using a commercial enzyme preparation. Parameters including the biomass to water ratio, enzyme loadings, and addition of facilitators such as surfactants were optimized, which resulted in significant improvements in sugars yields.

Development of enzyme cocktails and processes for hydrolysis of biomass: As part of developing enzyme cocktails for biomass hydrolysis, it was demonstrated that use of glucose tolerant BGLs will help in increasing the hydrolysis rate as well as final yield of sugars. Initial screening program has identified two such enzymes whose inhibition constants were 0.8M (~14% glucose). These enzymes were produced by novel fungal isolates *Aspergillus unguis* and *Byssoclamys fulva* and have been tested in the enzyme blends for biomass hydrolysis; results showed that these were highly effective in improving the hydrolysis efficiencies. Another moderately glucose tolerant (Ki = 0.2M) BGL from *Aspergillus niger* NII 0821 was highly effective for biomass hydrolysis with more than 25% improvement in the hydrolysis.



Graphical representation of the determination of optimal blends for biomass hydrolysis

Hydrolysis of steam-exploded bagasse using P. janthinellum cellulase and A.niger BGL blends: Trials on hydrolysis were conducted to evaluate the performance of enzymes produced by CBF and in flask trials, a sugar yield of 0.431 g /g biomass (64 % efficiency) was obtained after 48h of hydrolysis. Trials conducted at 3-l level in a bioreactor reconfirmed the observations (> 60% efficiency).

Biomass hydrolysis in reactor- 0.5h after enzyme addition

Biomass hydrolysis in reactor- 24h after enzyme addition

Performance of the NIIST-enzymes blends against well-established biomass hydrolyzing enzymes from world's leading enzyme manufacturers in the hydrolysis trials using CT2 and HT2 and also by supplementation of BGL from a different company ("G") to the *P. janthinellum* cellulase instead of *A. niger* BGL was evaluated.

Comparison of the performance of NIIST-enzymes blends against commercial biomass hydrolyzing enzymes (Flask studies)

Time (h)	NIIST	NIIST+BGL (0.2 U/FPU)	NIIST + "G" BGL (1.2 U/FPU)	CT 2	HT2
0	0	0	0	0	0
12	0.146	0.201	0.335	0.309	0.405
24	0.264	0.285	0.440	0.397	0.443
36	0.259	0.288	0.559	0.491	0.473
48	0.277	0.393	0.426	0.483	0.434
*Efficiency (%)	**41.97**	**59.55**	**64.55**	**73.18**	**65.76**

** Efficiency calculated as % of theoretical maximum (0.667 mg/g theoretical max)*

The results indicated that the addition of BGL into *P. janthinellum* cellulase resulted in significant improvements in the sugars yield (41% improvement). Highest efficiencies were obtained with CT2 (73%). HT2, which was a hemicellulase preparation containing cellulase, also showed 66% efficiency. The enzymes were added at equivalent levels of filter paper units (20FPUs/g) but the content of BGL was different which made the difference in efficiencies. It should be noted that CT2 contained ~60 (55.56) IUs of BGL per FPU (1100 IUs BGL/g SEB), which was more than 280 times higher than the NIIST enzyme blend. The ~ 14% improvement in the efficiency of hydrolysis could, therefore, be assumed to be due to the very high BGL content. It was speculated that using very high BGL loading in the *P. janthinellum* cellulase for the hydrolysis would result in efficiencies comparable to CT2 or better.

Steam exploded bagasse (SEB) hydrolysis was performed in the 20-l reactor (15-l working volume) using the conditions optimized earlier resulted in similar efficiencies (61% efficiency and a sugar yield of 0.411 g/g by 48h) confirming that increase in the scales did not affect the hydrolysis performance of enzymes.

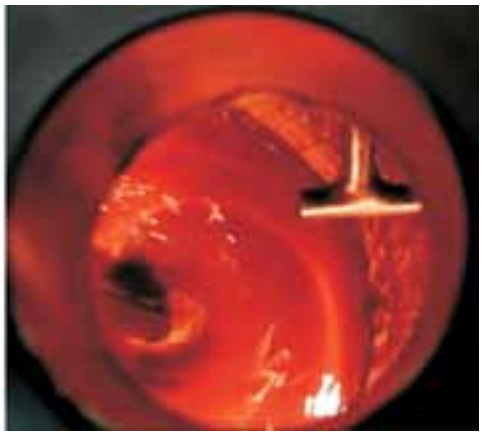
SEB hydrolysis in 20L reactor (15L Reaction)

Time	*Sugar conc. (g/L)	*Sugar Conc. (%)	**Sugar Yield (g/g)	Efficiency (%)
0	15.25	1.5	0	
12	42.01	4.2	0.268	40.1
24	44.34	4.4	0.291	43.1
36	52.21	5.2	0.370	55.4
48	56.36	5.6	0.411	61.6

** includes sugar from enzyme preparations also | ** after correcting for sugar from enzyme preparations*

20L Fermenter in operation

2h after start



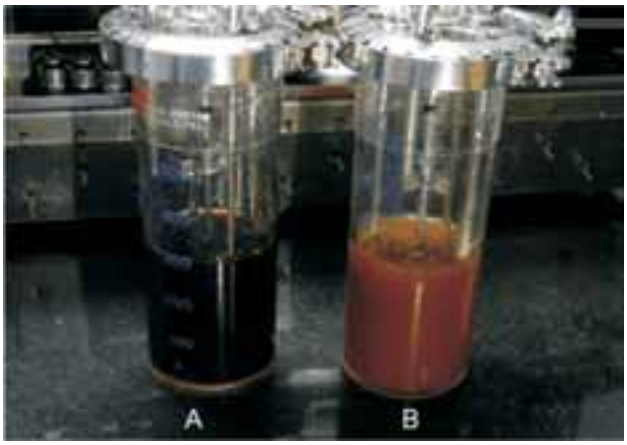
36h after start (Top view)

Fermentation of hydrolyzates to alcohol: Conversion of the sugars generated by the enzymatic hydrolysis of biomass to ethanol though might seem to be relatively simple, but it also has multiple challenges, primarily due to the inability of yeast strains to grow in the hydrolyzates which may contain several inhibitory compounds liberated from biomass particularly during the pretreatment step. Also, the microbes might have additional nutrient requirements and conditions for optimal performance. Table below shows the result of alcohol fermentation by yeast from an alkali-treated bagasse sample.

Alcohol production from biomass (sample data)

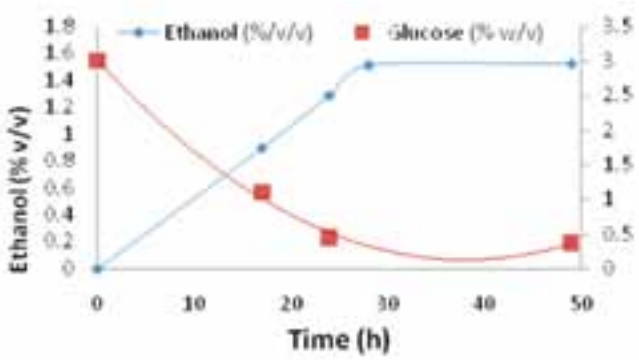
Sample	Alcohol yield (% v/v)	Fermentation efficiencies (% of theoretical maximum)
Alkali treated Bagasse	4.18	74.69
Acid treated Rice straw	4.6	67.34

Alcohol fermentation trials conducted using the SEB hydrolyzate generated by enzymatic hydrolysis was either used as such, or concentrated for fermentation. Sugar concentration in the normal supernatant was 2.79% and in the concentrated hydrolyzate it was 10%. The studies were done at 300ml level in 750ml bioreactors with a high cell density inoculum (4 mg cells/ml) of commercial baker's yeast granules suspended in normal saline. Results showed that there was very less ($\leq$ 0.1%, v/v) alcohol production in concentrated SEB hydrolyzate whereas the un-concentrated hydrolyzate was fermented with high efficiency. With a starting glucose concentration of 3% (w/v), the alcohol yield was 1.52 % (v/v).



Alcohol fermentation using SEB hydrolysates (48h samples)
A: Concentrated SEB hydrolysate
B: Un-concentrated SEB hydrolysate

Ethanol production in normal hydrolyzate

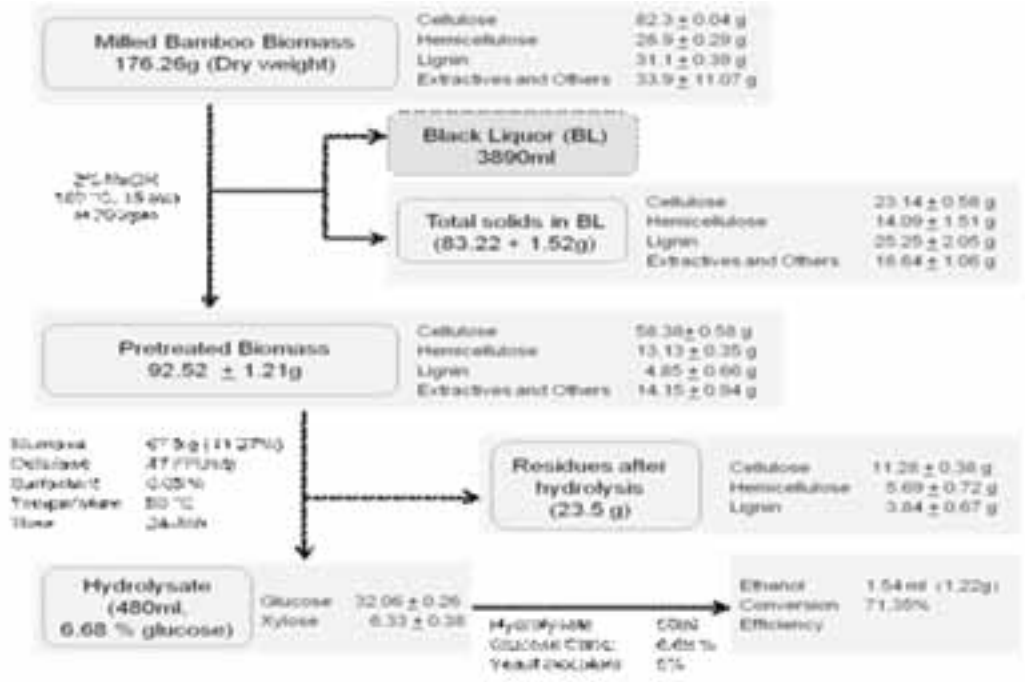


Ethanol production in concentrated hydrolyzate

These results showed that the fermentation should proceed in un-concentrated hydrolyzates. In the case of concentrated samples, the growth of yeast and alcohol production was very low, indicating possible inhibition by some components in the hydrolyzate. When the hydrolyzate was concentrated, these inhibitors were also concentrated, causing the need to detoxify the hydrolyzate.

Development of processes for conversion of pentose sugars (C5) hydrolyzates into value-added products: Typical yeast strains used in ethanol fermentation are incapable of utilizing pentose sugars. Biomass, if pretreated using alkali contains intact hemicellulose and after enzymatic hydrolysis, the hydrolyzate is often a mixture of glucose and the hemicellulose derived pentose sugars – xylose and arabinose. Since the fermentation is normally done with *Saccharomyces cerevisiae* strains, the pentose sugars remain unutilized. One way to tap into this resource is to separate the C6 and C5 sugars streams at the level of pretreatment itself so that each of these sugar stream can be utilized independently. Studies were undertaken on the production of amino acids using the C5 sugars stream by a recombinant *Corynebacterium glutamicum*. Also, studies were undertaken to evaluate the potential of producing itaconic acid from the liquor using *Aspergillus terreus*, sugar alcohols (xylitol, mannitol), algal biomass and algal oil. Such high value byproducts will help to bring down the cost of bioethanol production from biomass on biorefinery concept.

Integration of process scheme for biomass to ethanol conversion: The complete process scheme with material balances was developed for two biomass types (rice straw, and bamboo) with estimates for process efficiencies. This has served as the basis for reactor sizing, design of the process flow, mechanical and process engineering calculations, etc to develop the design of the bioethanol pilot plant. A sample process flow with material balances is given below.



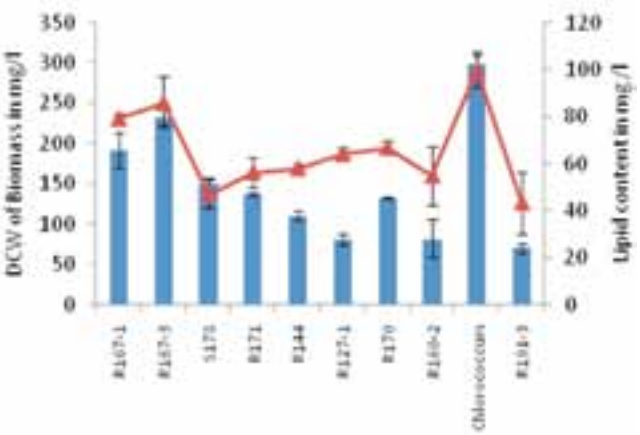
Sample process flow and material balances performed for biomass to ethanol conversion (bamboo)

Production of biobutanol from lignocellulosic biomass using high cell density immobilized cell culture of clostridia

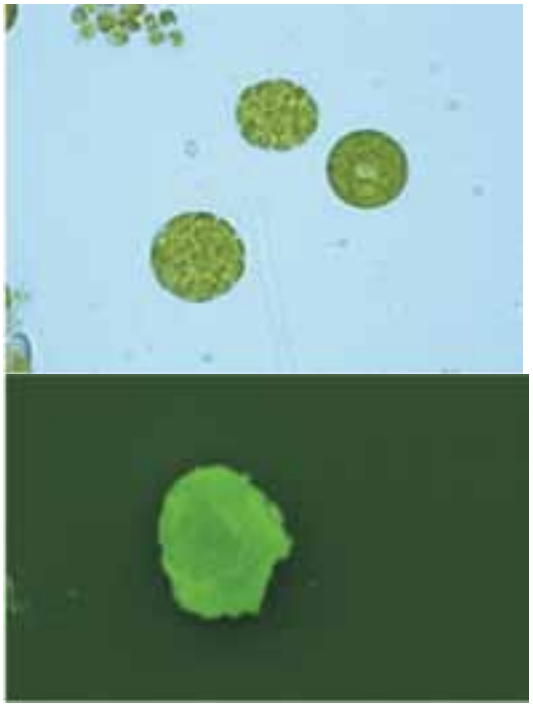
Biobutanol from the lignocellulosic biomass has recently gained much attention due to several advantages it has been claimed to over bioethanol. Though microbial production of butanol through ABE fermentation is an established technology, the use of lignocellulosic biomass as feedstock presents several challenges. Typical challenges in clostridia mediated biphasic fermentation include the cost of the substrate, unproductive sporulation, ineffective carbohydrate utilization and reutilization of end-products, solvent toxicity to the organism and recovery of the alcohol. Studies were conducted on the production of biobutanol from enzymatic hydrolyzate of acid-pretreated rice straw using *Clostridium* sp by anaerobic fermentation. The culture gave an yield of 3.43g/l biobutanol and a total solvent yield of 5.32g/l. Formic acid, an inhibitor of butanol fermentation, was removed from the hydrolyzate by using seralite anionic resin, which resulted the yield of biobutanol to 4.78g/l and total solvent yield of 8.49g/l.

Microalgae oil - potent applications in biofuels and nutraceuticals

A screening of the microbial biodiversity of Silent Valley Biosphere in the Western *ghats* resulted in the isolation of several microalgae, some of which grew both phototrophically and heterotophically in water supplemented with minimal salts. These algae were evaluated for their potential to be used as sources of algal oil. One of the isolates produced about 300mg/L of biomass and it accumulated about 30% of its dry cell weight as lipids. This culture was identified by rDNA sequencing as *Chlorococcum* sp.

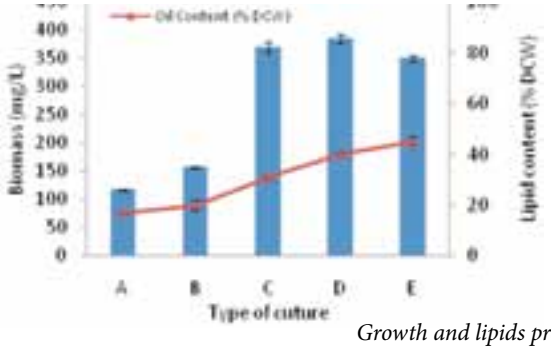


Biomass and oil production by algal isolates



Microscopic and SEM images of Chlorococcum sp

Biomass production was two times higher in heterotrophic condition and it accumulated significant amount of lipid. Fatty acid composition of the lipids extracted from the heterotrophically grown algae (in 5% waste glycerol and 5% glucose as carbon source) showed palmitic acid, stearic acid, oleic acid, linoleic acid and traces of long chain fatty acids of up to C24, which would be suitable for biodiesel application. Phototrophically and heterotrophically grown *Chlorococcum* cells also produced of W-3 PUFAs such as α-linolenic acid with potential application as nutraceuticals.



A:Phototrophic

B: Phototrophic with CO2 bubbling

C: Heterotrophic -Glucose

D: Heterotrophic -Waste glycerol

E: Heterotrophic -Pure Glycerol

Growth and lipids profiles of the alagal culture

Plant-Microbe interaction

Studies on synergistic effect of PGPR treatment on black pepper growth: Based on the single culture effect of PGPR on black pepper, a green net house study was conducted to see the combinational effect of eight black pepper positive PGPR. Six different combinations, each consisting of three isolates in talc-based formulation were prepared and applied to the nodal pepper cuttings. PGPR combinations were prepared on the basis of multiple PGPR attributes such as phosphate solubilization, IAA production, ACC deaminase activity, siderophore production and HCN production. PGPR treatments were compared with the untreated control, positive control comprising *Pseudomonas fluorescens* IISR-6 (commercially available PGPR for black pepper from Indian Institute of Spices Research) and also with the recommended package of chemical fertilizer for black pepper. These included T1 - 0918 + 0912 + 0928; T2 - 0918 + 0943 + 1020; T3 - 0912 + 0906 + 0930; T4 - 0912 + 0930 + 0930; T5 - 0943 + 0928 + 1018; and, T6 - 0943 + 1018 + 1020 (0906 - *Exiguobacterium* sp, 0912 - *Bacillus* sp, 0918 - *Paenibacillus* sp, 0928 - *Serratia* sp, 0930 - *Bacillus* sp, 0943 - *Bacillus* sp, 1018 - *Agromyces* sp, 1020 - *Kocuria* sp.).

Results were statistically analyzed after eight months of planting using ANOVA and DMRT, which showed that the PGPR treatments had significant effect on plant parameters such as root numbers, fresh and dry weight of roots and shoots, leaf surface area and total NPK content of dry matter for all the treatments, except for T5 treatment. T1, T4 and T6 were the best treatments in terms of root numbers, fresh and dry weight of the plant and total NPK content. T6 showed 9% more nitrogen and 46% more phosphorus when compared with chemical fertilizer. T4 had 9.8% more N and T1 had 7.6% more K than chemical fertilizer treated plants.

Effect of PGPR on tapioca growth: Green net house experiment on root initiation of PGPR on tapioca stem cuttings: Field trials were conducted in the experimental farms of the Central Tuber Crop Research Institute in Trivandrum. After three months, two isolates showed very promising results in terms of tuber number, fresh and dry weight of tuber, stem, leaf number when compared to the chemical fertilizer, untreated and farmyard manure treated stem cuttings, except for plant height. Chemical fertilizer treatment showed increased plant height than other treatments. NII 1020 showed 30% more tuber number and 13% more dry weight of tuber than the chemical fertilizer treated tubers.

Tapioca tubers after three months growth under various experimental conditions

Qualitative screening of phytase and stress tolerance evaluation of potent PGPR isolates: Qualitative screening for phytase by the eight potent isolates were done on calcium phytate containing agar plates. NII 0906, 0928 and 1020 were positive for phytate solubilization of phytase. Enzyme work as well as stress tolerance against pH, salinity and temperature are in progress.

Plant growth-promoting novel bacterial strains from mangrove ecosystem: This study aimed at isolating the bacterial strains with plant-growth promoting activities such as to fix atmospheric nitrogen from the Pichavaram mangroves, especially *Avicennia marina*, *Rhizophora* sp and mangrove-associated wild rice. Initial screening was based on *nifH*-PCR based analysis and the isolates, which showed amplification around 390bp were considered as positive. The sequencing results confirmed that the expected amplified PCR products were nitrogenase reductase, which confirmed that these isolates could fix atmospheric nitrogen. The nitrogen-fixing profile of these strains was further determined by growing them in semisolid nitrogen-free medium. The 16S rRNA gene sequencing showed that they belonged to the taxa *Cobetia* (99.3-99.6% sequence similarity), *Vibrio* (99.4% sequence similarity), *Shewanella* (95% sequence similarity), and *Klebsiella* (99-100% sequence similarity). Further detailed taxonomic characterization using a polyphasic approach for strain P2E35 showed 5% dissimilarity in 16S rRNA gene analysis. This novel strain has been named as *Shewanella phytohabitans* sp. nov, and has been deposited at LMG, Beligum and DSMZ, Germany as required by the IJSEM Microbial Committee.

HEALTH AND GENOMICS

Microbial production of folic acid

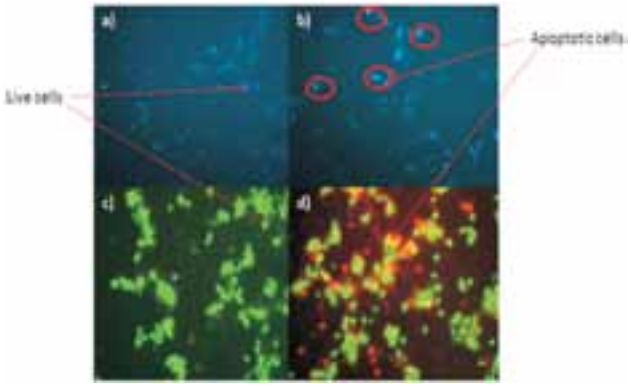
Probiotic properties of two NIIST isolates identified as *Weissella cibaria* (G4) and *Enterococcus faecium* (P8) were evaluated. The cultures produced ~15 ng/ml folate in un-optimized media. The genes (*folKE, folC* and *folA*) involved in the folate biosynthesis were isolated from one of the NIIST isolate (*L. lactis lactis* CM 28) and cloned into pTZ57/RT and sequenced. The gene sequences were confirmed by the BLAST analysis. *folKE gene* was subsequently cloned into the expression vector pNZ8148 for expression studies.

Production of antifungal compounds from lactic acid bacteria

The antimicrobial systems of the lactic acid bacteria offer effective natural preservation of food and thus contribute to food safety and stability. Studies were conducted to isolate lactic acid bacteria having probiotic features, showing antifungal activity against *Fusarium oxysporum*. These isolates belonged to *Lactobacillus plantarum, Enterococcus faecalis, Lactobacillus casei, Pediococcus pentacaseus* and *Lactococcus lactis*.

Exposition of anti-tumour activity of exopolysaccharides (EPS) from probiotic lactic acid bacteria

As majority of the chemical compounds identified as anti-cancerous are toxic to normal cell. Thus, the discovery and identification of new safe drugs has become an important goal of research in the biomedical sciences. Studies were conducted on the production of exopolysaccharides from a strain of *L. plantarum* (NIIST isolate). The EPS showed the presence of 1,3- linkages and had anti-oxidant, anti-tumour and immunomodulating properties under *in vitro* conditions. The immune stimulation studies on the property of the EPS in human lymphocytes showed it to be satisfactory at a concentration of 0.1 mg/ml with 20% proliferation rate. The anti-tumour studies on breast adenocarcinoma cell line (MCF-7) exhibited a higher IC_{50} for the compound. The anti-tumour properties were studied by morphological apoptosis determination and MTT assay. The relatively higher IC_{50} of the EPS makes it a suitable candidate for chemical modification to bring down the IC_{50} for the development of a potent anti-cancer drug having no cytotoxicity and the most preferred water-soluble property.



Hoechst staining a) MCF-7 control cells without treatment b) MCF-7 cells treated with EPS; EB/AO staining c) MCF-7 control cells without treatment d) MCF-7 cells treated with EPS

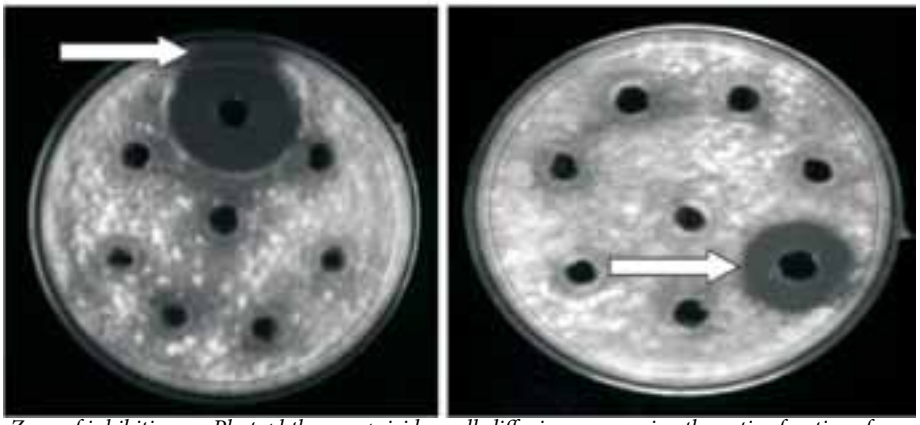
Exploiting Western *ghats* biodiversity for antifungal metabolites for plant disease control

Studies were undertaken to make a collection of antagonistic microorganisms from the Western *ghats* soil samples and to develop potential bioactive molecules for the management of two devastating crop diseases prevalent in Kerala such as foot rot of black pepper caused by *Phytophthora capsici* and collar rot and web blight of cowpea caused by *Rhizoctonia solani*. The isolates identified as *Streptomyces cinnamoneus, Streptomyces costaricanus and Streptomyces hiroshimensis*. *Streptomyces cinnamoneus* and *Pseudomonas fluorescens* showed strong antagonism against fungal pathogens and were selected for further purification and characterization of the antifungal compound.

The molecular characterisation of potent cultures was done by 16S rRNA gene sequencing and the sequences were deposited in the Genbank with accession no NII-1006-HM036676, NII-11113-JN377804, NII-1118- JN377805, NII-11101- JN377806. SEM observations revealed that the test fungus *B. cineria* hyphae was degraded and presented debris when treated with the cell free crude extracellular metabolites of NII 1006, whereas the untreated hyphae exhibited a smooth surface indicating normal growth. The culture extract did not show β-1,4-glucanase activity but was positive for chitinase with 0.05 U/ml activity on the fourth day of culture. Partial purification and characterization of bioactive compound(s) from the culture filtrate of NII 1006 was achieved by column chromatograph, HPTLC profiling and proton NMR. The compound was highly fluorescent and UV active with Rf value 0.6.

NII Culture Collection

The NII-Microbial culture Collection and Gene Bank (NIICC), a national facility established in 2008 is an affiliate member of the World Federation for Culture Collections (WFCC) and is registered with the World Data Centre for Microorganisms (WDCM, registration number 961). This national facility act as a depository especially for actinomycetes, agricultural and industrial important microbes, novel taxa, to supply authentic microbial cultures and to provide related services to the scientists working in research institutions, universities and industries. Presently, the NIICC holds collectively over one thousand cultures, including actinomycetes, bacteria, fungi and yeasts. The NIICC is actively involved in the research program relating to microbial diversity, ecology and taxonomy using both classical and molecular approaches.



Zone of inhibition on Phytophthora capsici by well-diffusion assay using the active fractions from (a) Streptomyces costaricanus (b) Streptomyces cinnamoneus

CHEMICAL SCIENCES AND TECHNOLOGY DIVISION

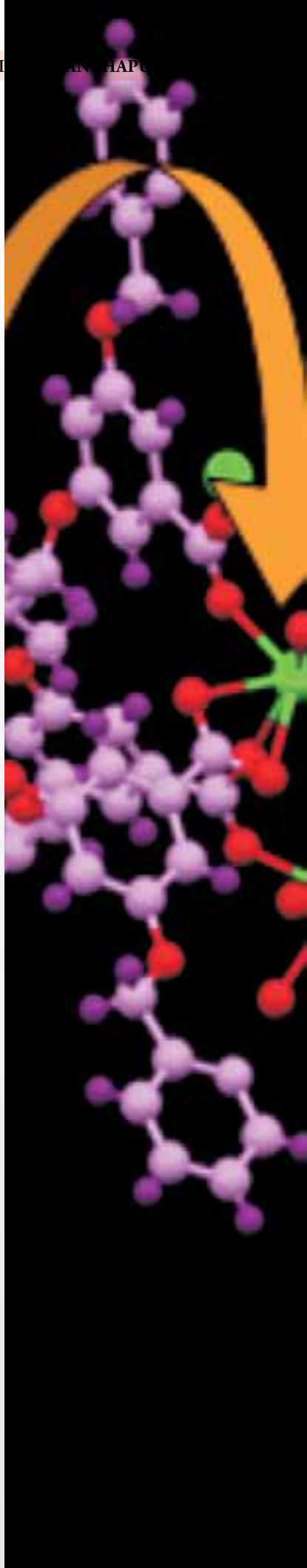
The Chemical Sciences and Technology Division focussed and excelled in three niche areas of frontier research during the reporting period. These are (i) fundamental and applied aspects of photochemistry with the purpose of developing photonic materials for applications in solar energy harvesting, electro-optical devices and photomedicine, (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) isolation and synthesis of new bioactive molecules and development state-of-the-art synthetic organic methodologies for the fine chemical industry. The Division has also initiated new research activities for the XII Five Year Plan in the interdisciplinary areas with a focus on functional advanced materials for affordable health, solar energy, imaging and diagnostic applications.

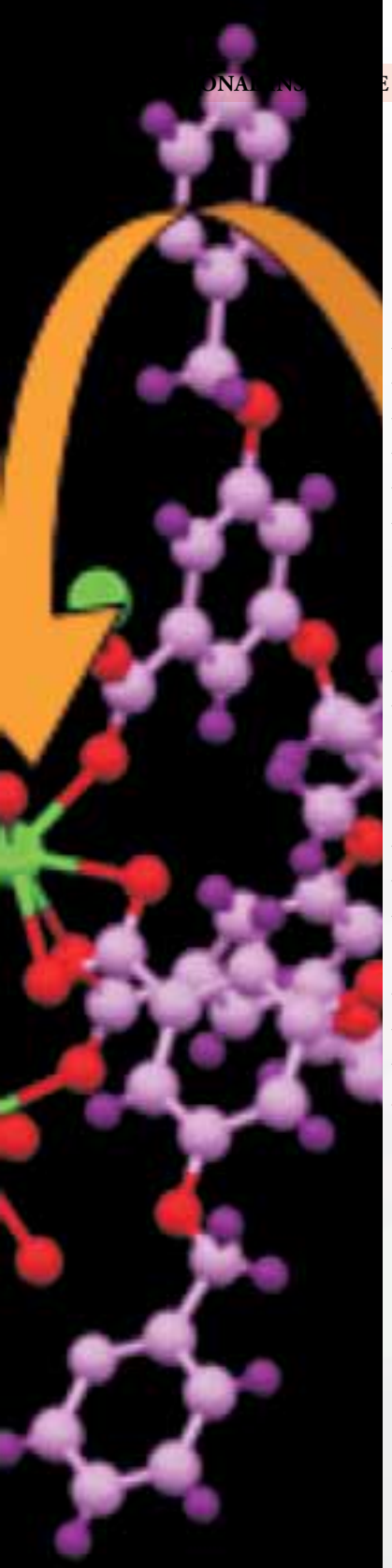
The Division organized two major symposia during 2011-2012 *viz* the 6th CRSI-RSC Symposium in Chemistry (February 2, 2012) and 14th CRSI National Symposium in Chemistry (February 3-5, 2012). About 750 delegates from different parts of India and abroad attended these symposia including renowned scientists like Prof. Daniel G. Nocera (MIT, USA), Prof. Franc Meyer (Germany), Prof.Ayusman Sen (USA), Prof. T. Kitagawa (Japan), Dr. M. A. Subramanian (USA), Prof. K. Kalyanasundaram (Switzerland), Prof. Robert Parker, CEO, RSC (UK), Prof. Anna Peacock (UK), Prof. Jacob Ogweno Midiwo (Kenya) and Prof. Bob Crawford (UK). Invited and medal lectures, poster presentations and a Special Lecture by Prof. C. N. R. Rao were the main features of the scientific event.

Keeping with the performance during last years, the scientific fraternity of the division has been quite successful in publishing their results in high impact journals. Some of the research highlights of the Division during the year 2011-2012 along with brief abstracts of the work published in international journals are presented below.

Highlights

- Energy saving, non-toxic NIR reflecting yellow colored pigment for surface coating and novel green emitting luminescent rare earth based systems for sensing of toxic metal ions developed
- Photoresponsive soft materials and β-cyclodextrin based supramolecular hydrogels developed and their drug/dye/sensitizer carrier properties were investigated
- Self-assembled and photoresponsive molecular gelators for sensing of explosives, nitroaromatics and aromatic solvents developed
- Novel cyclophanes designed that exhibit cavity size and bridging unit dependent recognition of nucleotides in the aqueous and buffer media
- Developed mixed monolayer protected gold atom/oxide cluster, copper quantum cluster-polypyrrole composite and metal and/or metal oxide modified molecularly imprinted polypyrrole films based luminescent/electrochemical sensors for cysteine, glutathione and cysteine and/or tyrosine
- Demonstrated the syntheses and anion and cation binding properties of molecular probes such as dansyl-naphthalimide dyads, nitrostyrylquinoline derivatives, diaryldipyrromethanes, calixpyrroles and calixphyrins
- Pd–nanoparticle cored dendritic structures for catalysing C-C bond forming reactions and Pd-catalyzed method for the synthesis of functionalized cycloheptatrienes developed.





रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग

रिपोर्ट अवधि के दौरान रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग ने सीमांत अनुसंधान के तीन आला क्षेत्रों में अपना ध्यान केंद्रित किया और इन क्षेत्रों में उत्कृष्ट निष्पादन प्रदर्शित किया। ये हैं- (i) सौर ऊर्जा संचयन, विद्युत- ऑप्टिकल उपकरणों और फोटोमेडिसिन के क्षेत्रों में अनुप्रयोगों के लिए फोटोनिक सामग्री के विकास को लक्षित करके फोटोकेमिस्ट्री के मौलिक और अनुप्रयुक्त पहलूओं (ii) ऊर्जा भंडारण, इमेजिंग और निदान के लिए प्रकाश और आणविक संवेदन से संबंधित पहलूओं में अनुप्रयोग के लिए अकार्बनिक पदार्थों और पॉलिमरों के विकास और डिजाइन (iii) नये जैव-सक्रिय अणुओं के अलगाव और उनके संश्लेषण और सूक्ष्म रसायन उद्योग के लिए अत्याधुनिक सिंथेटिक जैविक तरीके का विकास। प्रभाग ने सस्ती स्वास्थ्य, सौर ऊर्जा, इमेजिंग और नैदानिक अनुप्रयोगों के लिए कार्यात्मक उन्नत सामग्री पर ध्यान देते हुए बारहवीं पांच वर्षीय योजना के लिए अंतर्विषयी क्षेत्रों में नई शोध गतिविधियों की शुरूआत की है ।

वर्ष 2011-2012 के दौरान प्रभाग ने दो प्रमुख संगोष्ठियों का आयोजन किया - रसायन विज्ञान में 6वीं सीआरएसआई-आरएससी संगोष्ठी (2.02.2012) तथा रसायन विज्ञान में 14 वीं सीआर एसआई राष्ट्रीय संगोष्ठी (3. 5.2012)। प्रो.डैनियल जी नोज़िरा (एमआईटी, संयुक्त राज्य अमेरिका), प्रो. फ्रैंक मेयर (जर्मनी), प्रो. आयुस्मान सेन (संयुक्त राज्य अमेरिका), प्रो. टी. किटागवा (जापान) डॉ. एम.ए. सुब्रमण्यम (संयुक्त राज्य अमेरिका), प्रो. के.कल्याणसुन्दरम (स्विट्जरलैंड), प्रो. रोबर्ट पार्कर, सीईओ, आरएससी (यूके), प्रो. अन्ना पीकोक (यूके), प्रो. जेकब ओग्वेनो मिडिवो (केनिया) प्रो. बोब क्रोफोर्ड(यूके) जैसे प्रसिद्ध वैज्ञानिकों सहित भारत के विभिन्न राज्यों और विदेशों से लगभग 750 प्रतिनिधियों ने इन दोनों संगोष्ठियों में भाग लिया। आमंत्रित और पदक व्याख्यान, पोस्टर प्रस्तुतियॉ और प्रो. सीएनआर राव द्वारा एक विशेष व्याख्यान वैज्ञानिक घटना की मुख्य विशेषताएं थीं।

पिछले वर्षों के निष्पादन को ध्यान में रखते हुए, प्रभाग के वैज्ञानिक समूह अपने अनुसंधान के परिणामों को उच्च प्रभाव पत्रिकाओं में प्रकाशित करने में काफी सफल निकली है । अंतरराष्ट्रीय पत्रिकाओं में प्रकाशित शोध कार्यों के संक्षिप्त सार के साथ ही साथ वर्ष 2011-2012 के दौरान प्रभाग के कुछ अनुसंधान हाइलाइट्स नीचे प्रस्तुत किए जाते हैं ।

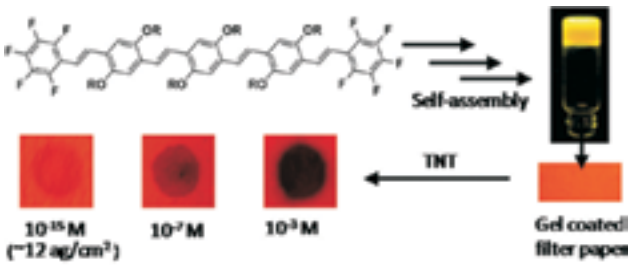
मुख्य विशेषताएं

- सतह कोटिंग के लिए ऊर्जा बचत, गैर विषैले एनआईआर उत्सर्जक पीले वर्णक और विकसित विषाक्त धातु आयनों के संवेदन के लिए नूतन हरी उत्सर्जन संदीप्तिशील दुर्लभ पृथ्वी आधारित प्रणालियॉ विकसित किया
- प्रकाश अनुक्रियाशील नरम सामग्री और β साइक्लोडेक्सट्रिन आधारित सुप्रामोलिकुलर हाइड्रोजेल विकसित किया और उनके दवा/रंजक/सुग्राहीकर वाहक गुणधर्म की जांच की गई
- विस्फोटक, नाइट्रोऐरोमैटिक और खुशबूदार सॉल्वैंट्स के संवेदन के लिए स्वतः समुच्चय और प्रकाश अनुक्रियाशील आणविक जेलीकरें विकसित किये गये
- नूतन साइक्लोफेनों का डिजाइन किया गया जो जलीय और बफर मीडिया में न्यूक्लिओटाइडों के गुहा आकार और ब्रिजिंग इकाई आश्रित पहचान दर्शाता हैं
- मिश्रित एकाणुक- परत संरक्षित स्वर्ण परमाणु/ऑक्साइड क्लस्टर, कॉपर क्वांटम क्लस्टर पॉलिपिरोल संयुक्त विकसित किये गये और सिस्टीन, ग्लूटाथाइओन और सिस्टीन और/या टाइरोसिन के लिए धातु और या/धातु ऑक्साइड संशोधित आण्विक अंकित पॉलिपिरोल फिल्म आधारित संदीप्तिशील/विद्युत रासायनिक सेंसर विकसित किया
- डैंसिल-नैपथालामाइड द्वयक,नाइट्रोस्टाइरिलक्विनोलीन डेरिवेटिव,डाइऐरिलडाइपाइरोमीथेन्स, कैलिक्सपाइरोल्स, तथा कैलिक्सफ्रीनों जैसे आण्विक प्रोब्स के संश्लेषण और उनके ऋणायन और घनायन बाइंडिंग गुणधर्म का डिमोंस्ट्रशन किया
- सी-सी बॉड बनाने वाली अभिक्रियाओं को उत्प्रेरित करने के लिए पी.डी. नैनोकण क्रोड द्रुमाकृतिक संरचनाओं और प्रकार्यीकृत साइक्लोहेप्टाट्राईनों के संश्लेषण के लिए पी.डी. उत्प्रेरित विधि विकसित की

PHOTOSCIENCES AND PHOTONICS

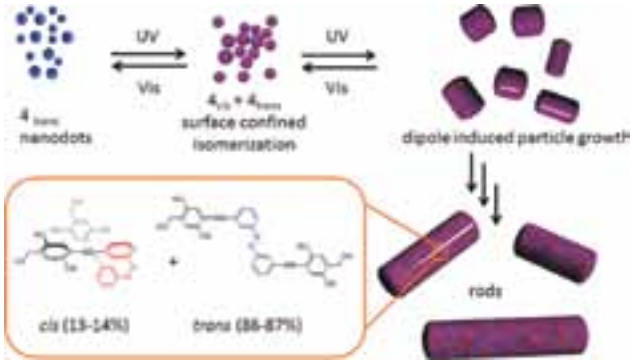
Attogram sensing of trinitrotoluene with a self-assembled molecular gelator

Trinitrotoluene (TNT) is a widely used explosive in landmines and military operations that contaminates the environment and groundwater, posing a threat to human health. Achieving the detection of explosives at a sub-femtogram level using a molecular sensor is a challenge. Further, detection of this explosive is of utmost importance due to illegal transport and terrorist activities. It was demonstrated that a fluorescent organogelator exhibits superior detection capability for TNT in the gel form when compared to that in the solution state. The gel when coated on disposable paper strips detects TNT at a record attogram (ag, 10^{-18} g) level (~12 ag/cm^2) with a detection limit of 0.23 ppq. This is a simple and low-cost method for the detection of TNT on surfaces or in aqueous solutions in a contact mode, taking advantage of the unique molecular packing of an organogelator and the associated photophysical properties (*J. Am. Chem. Soc.* 2012, ***134***, 4834-41).



Light-induced Ostwald ripening of organic nanodots to rods

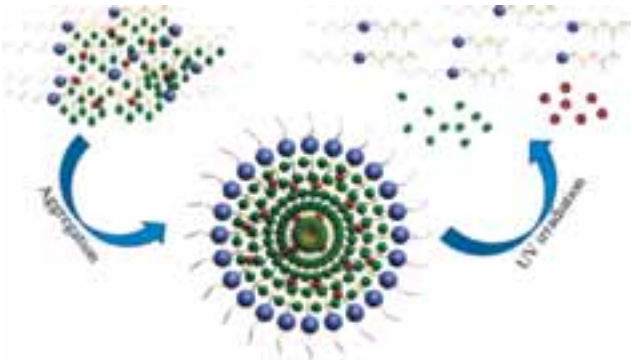
Ostwald ripening allows the synthesis of 1D nanorods of metal and semiconductor nanoparticles. However, this phenomenon is unsuccessful with organic π-systems due to their spontaneous self-assembly to elongated fibers or tapes. It was demonstrated that the uses of light as a versatile tool to control the ripening of amorphous organic nanodots (ca. 15 nm) of an azobenzene-derived molecular assembly to micrometersized supramolecular rods. A surface-confined dipole variation associated with a low-yield (13–14%) *trans–cis* isomerization of the azobenzene moiety and the consequent



dipole–dipole interaction in a nonpolar solvent is believed to be the driving force for the ripening of the nanodots to rods (*J. Am. Chem. Soc.* 2012, ***134***, 7227-30).

Photoresponsive soft materials: Stilbene-based diblock copolymer

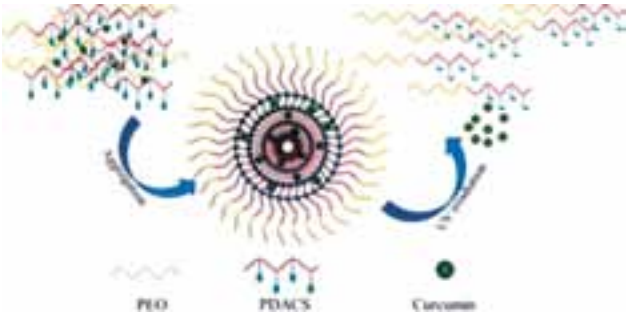
An amphiphilic diblock copolymer composed of a photoresponsive dialkoxycyanostilbene polymethacrylate and poly(ethylene oxide) (PDACS-b-PEO) was synthesized and its photophysical and aggregation properties were investigated. The amphiphilic nature of the polymer caused it to self-assemble in water, and dynamic light scattering studies indicated formation of spherical aggregates with an average size of 160 nm. Atomic force microscopy images of dried films cast from solutions containing the polymer aggregates revealed supramolecular aggregates with a spherical morphology. Photoisomerization of the stilbene chromophore in PDACS-b-PEO on UV irradiation resulted in the destruction of the self-assembled superstructures which could be attributed both to change in shape of the chromophore from the linear *trans* isomer to the bent *cis* isomer which would hinder self-aggregation of the molecules and the higher dipole moment of the cis isomer leading to a reduction of the hydrophobic nature of the stilbene containing block of PDACS-b-PEO. It was observed that hydrophobic dyes such as curcumin could be encapsulated within the hydrophobic interior of the spherical micellar aggregates from which the



encapsulated dye could be released on UV irradiation (*J. Polym. Sci. Part A: Polym. Chem.* 2011, ***49***, 5063 – 73).

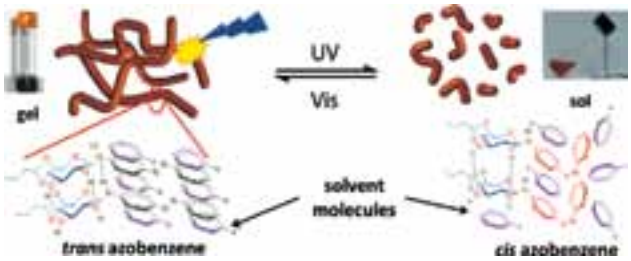
Photoresponsive self-assembling structures from a pyrene-based triblock copolymer

A new photoresponsive amphiphilic triblock copolymer, poly(pyrenylmethyl methacrylate)-block -polystyreneblock-poly (ethylene oxide) (PPy-b-PSt -b-PEO), was synthesized using atom-transfer radical polymerization. Formation of colloidal aggregates of the polymer was observed in solutions under controlled conditions due to the amphiphilic nature of the polymer. Irradiation of the polymer aggregates using UV light resulted in the photodissociation of 1-pyrenemethanol units from the polymer back-bone resulting in break-up of the aggregates mainly due to the hydrophilic nature of the residual polymer. The use of these polymer aggregates to trap hydrophobic fluorescent dyes in water and its controlled release on exposure to UV light has also been explored (*J. Polym. Sci. Part A: Polym. Chem.* 2011, ***49***, 4448 – 57).



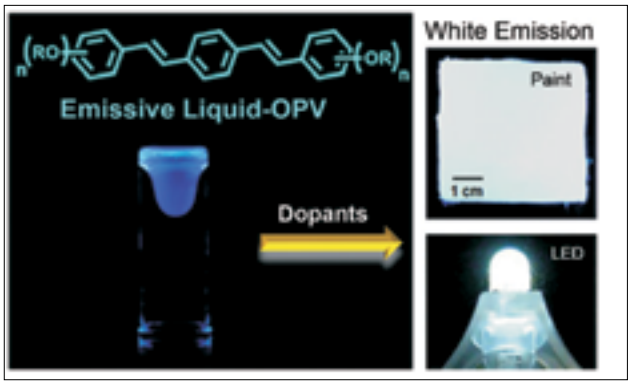
Synthesis and properties of amphiphilic photoresponsive gelators for aromatic solvents

A sugar-based photoresponsive supergelator, N-glycosylazobenzene that shows selective gelation of aromatic solvents is described. The partial *trans-cis* isomerization of the azobenzene moiety allows photoinduced chopping of the entangled gel fibers to short fibers, resulting in controlled fiber length and gel-sol transition. The gelator is useful for the selective removal of toxic aromatic solvents from water (*Org. Lett.* 2012, ***14***, 748-51).



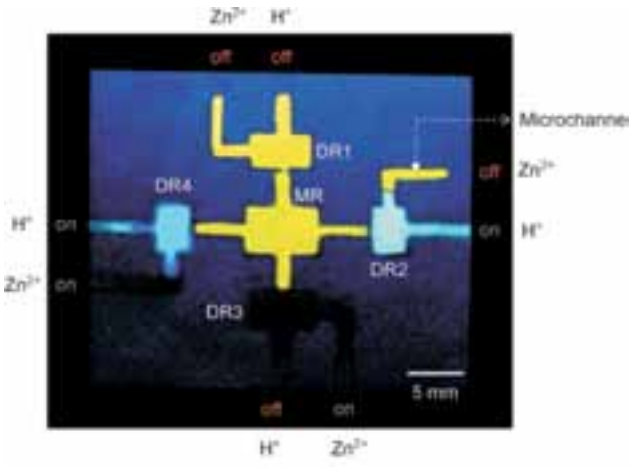
Solvent-free luminescent organic liquids

Isolation of a π-core by covalently attached flexible hydrocarbon chains was employed to synthesize blue-emitting oligo(*p*-phenylenevinylene) (OPV) liquids with tunable viscosity and optical properties. A solvent-free, stable, white-light emitting ink/paint, which can be applied on to various surfaces and even on to LEDs, was made by blending of liquid OPVs with emissive solid dopants (*Angew. Chem. Int. Ed.* 2012, ***51***, 3391-33).



Multiple analyte response and molecular logic operations by excited-state charge-transfer modulation in a bipyridine integrated fluorophore

The excited state intraligand charge transfer (ILCT) modulated fluorescence response of bipyridyl-based fluorophore 1 against various chemical inputs is shown on filter paper using a microfluidic technique (see picture). The three different emission outputs generated from 1 allow five different



Boolean logic operations in independent and integrated modes (*Chem. Asian. J.* 2011, ***6***, 430-37).

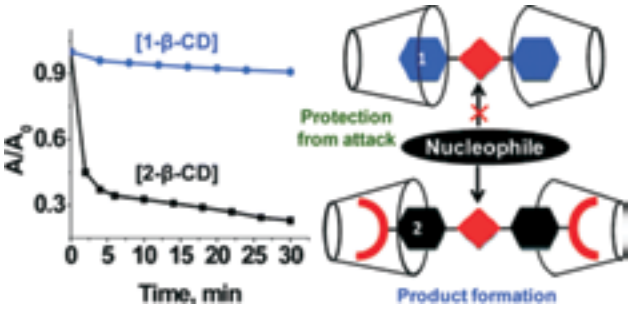
Study of cavity size and nature of bridging units on recognition of nucleotides by cyclophanes

The development of molecular systems capable of recognizing biologically important molecules such as 5'-GTP and 5'-ATP under physiological pH conditions can have potential applications in biology, diagnostics and medicinal chemistry. In this regard, a few novel cyclophanes **CP-1** to **CP-4** containing anthracene units linked together through different bridging and spacer groups were synthesized and investigated their interactions with various nucleosides and nucleotides. Of these systems, **CP-1** and **CP-3** showed selectivity for 5′-GTP and 5′-ATP as compared to other nucleotides and nucleosides, whereas negligible selectivity was observed with **CP-2** and **CP-4**. Interestingly, **CP-1**, **CP-2** and **CP-3** exhibited significant binding interactions with the fluorescent indicator, 8-hydroxy-1,3,6-pyrene trisulfonate (HPTS). Titration of these complexes with nucleosides and nucleotides resulted in the displacement of HPTS, leading to the revival of its fluorescence intensity. It was observed that 5′-GTP induced the maximum displacement of HPTS from the complex [**CP-1**·HPTS] with an overall fluorescence enhancement of *ca.* 150-fold, while 5′-ATP induced *ca.* 45-fold. Although the displacement of HPTS from the complexes [**CP-2**·HPTS] and [**CP-3**·HPTS] was found to be similar to that of [**CP-1**·HPTS], these complexes showed lesser selectivity and sensitivity. In contrast, negligible displacement of HPTS was observed from the complex [**CP-4**·HPTS] under similar conditions. These results indicate that **CP-1**, having a well-defined cavity and good electron acceptor (viologen), is capable of forming selective and stable complexes. Though **CP-2** and **CP-3** retain the good electron acceptor (viologen), reduced aromatic surface and larger cavity, respectively, resulted in lesser sensitivity. In contrast, **CP-4** having a large cavity and a poor acceptor (1,2-bis(pyridin-4-yl)ethene) showed negligible selectivity, thereby indicating the importance of cavity size, bridging unit and aromatic surface on biomolecular

recognition properties of cyclophanes (*Org. Bio. Chem.* 2011, ***9***, 1021-29).

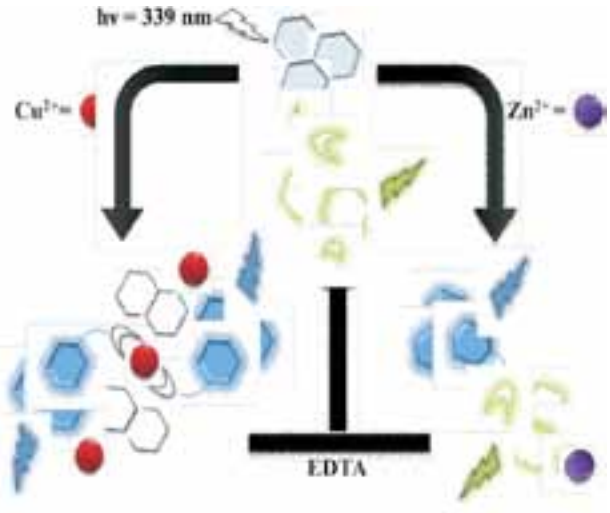
β-Cyclodextrin as a photosensitizer carrier: Effect of spacer on photophysical properties and chemical reactivity of squaraine dyes

With the objective of understanding the utility of β-cyclodextrin (β-CD) as a carrier system, the interactions with a few near-infrared absorbing squaraine dyes through absorption and steady-state and time-resolved fluorescence techniques were investigated. The addition of β-CD to the phloroglucinol dyes resulted in a significant bathochromic shift in absorption, together with a *ca.* 1.5-2.5 fold enhancement in fluorescence intensity, whereas, for the aniline-based dyes a hypsochromic shift in the absorption and a *ca.* 5-12 fold fluorescence enhancement were observed in a 10% (v/v) ethanol/water mixture. Benesi-Hildebrand analysis showed that both the dyes form 2:1 stoichiometric complexes with β-CD. The complex formation was confirmed by competitive binding analysis employing adamantyl-1-carboxylic acid (ACA) and adamantyl-1-ammonium chloride (ADAC). The displacement of the dyes from the [dye-β-CD] complex by ADAC and ACA unambiguously establishes the encapsulation of these dyes in the hydrophobic nanocavity of β-CD. Uniquely, the formation of the inclusion complexes with β-CD provides unusual protection from nucleophilic attack by aminothiols such as cysteine and glutathione for the phloroglucinol dyes, whereas, negligible protection was observed for aniline-based dyes. These results demonstrate the substituent dependent encapsulation of potentially useful squaraine dyes in β-CD, thereby indicating its potential as a carrier system for the squaraine dyes useful in photodynamic therapy (*J. Phys. Chem. B* 2011, ***115***, 7122-28).



Dansyl-naphthalimide dyads as molecular probes: Effect of spacer group on metal ion binding properties

Interaction of a few dansyl-naphthalimide conjugates linked through polymethylene spacer groups with various metal ions was investigated through absorption, fluorescence, NMR, isothermal calorimetric (ITC) and laser flash photolysis techniques. Depending on the spacer group, these dyads interact selectively with divalent Cu^{2+} and Zn^{2+} ions, as compared to other mono and divalent metal ions. Jobs plot analysis showed that these dyads form 2:3 complexes with Cu^{2+} ions, while 1:1 complexes were observed with Zn^{2+} ions. The association constants for the Zn^{2+} and Cu^{2+} complexes were determined and found to be in the order 10^3-10^5 M^{-1}. Irrespective of the length of the spacer group, these dyads interestingly act as fluorescence ratiometric molecular probes for Cu^{2+} ions by altering

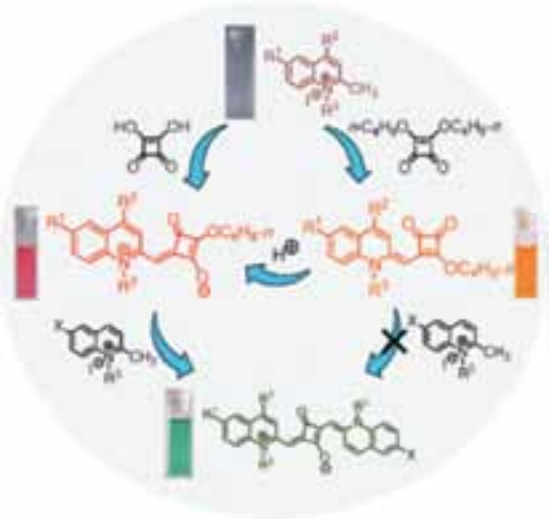


the emission intensity of both dansyl and naphthalimide chromophores. In contrast, only the fluorescence intensity of the naphthalimide chromophore of the lower homologues (n = 1-3) was altered by Zn^{2+} ions. Uniquely, the complexation of the dyads with Cu^{2+} ions affect both PET and SSET processes, while, only the PET process was partially inhibited by Zn^{2+} ions in the lower homologues (n=1-3); and the higher homologues exhibited negligible changes in their emission properties (*J. Phys. Chem. B*

2011, ***115***, 13292–99).

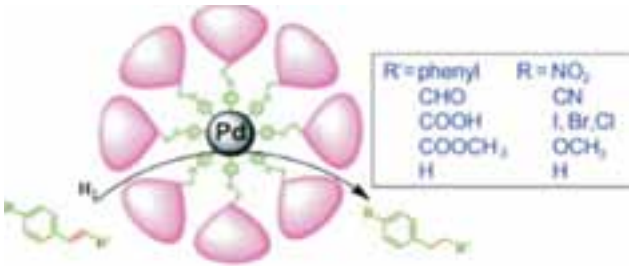
Novel semisquaraine regioisomers: Isolation, divergent chemical reactivity and photophysical properties

Isolation of the semisquaraine intermediates was achieved by employing derivatives of squaric acid like dibutylsquarate and squaryl chloride and they were subsequently used in the synthesis of both symmetrical and unsymmetrical 1,3-squaraine dyes. The identification of semisquaraine 1,3-regioisomers is reported for the first time, which have been believed to be 1,2-regioisomers. The 1,3-isomers exhibit quite distinct photophysical properties and chemical reactivity, when compared to the 1,2-isomers. The reaction of the quinaldinium salts with squaric acid in the presence of quinoline gave the semisquaraine in *ca*. 90% yield. Interestingly, when the same salt was reacted with 3,4-dibutyl squarate using triethylamine as a catalyst, a structurally different semisquaraine was obtained. These structures were, further, unambiguously proved by single crystal X-ray analysis. The zwitterionic structure of the 1,3-isomers was further confirmed from their absorption spectrum. To differentiate the reactivity of the regioisomers with the quinaldinium salts, probable mechanisms were explored in *n*-butanol solvent using the PM6 level of theory. Based on the experimental results and theoretical calculations, the 1,3-regioisomer is proposed to be the intermediate in the dye formation reaction, while the neutral 1,2-isomer should be transformed to the 1,3-isomer to undergo the reaction (*Chem. Commun*. 2011, ***47***, 12822-24).



Dendrimers stabilized by metal–carbon bonds

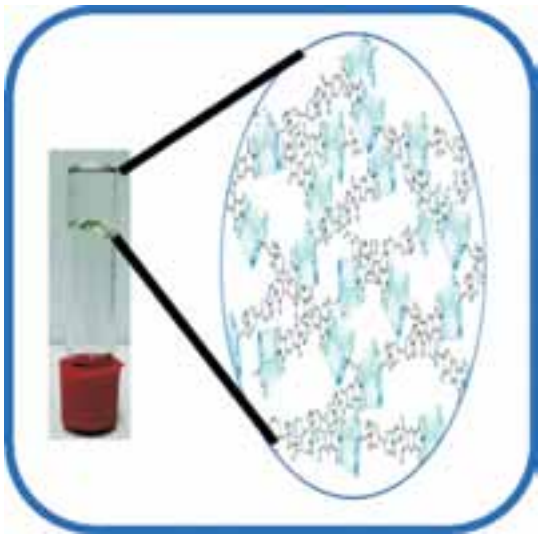
Palladium nanoparticle-cored Fréchet type G_1-dendrimer (**Pd-G_1**) stabilized by Pd–carbon bonds synthesized and characterized by IR, NMR, UV–Vis and TEM. **Pd-G_1** was found to be a highly efficient, chemo-selective and reusable catalyst for room temperature hydrogenation of carbon–carbon multiple bonds. Reducible functionalities like



CHO, CO, COOR, CN, NO_2 and halogens were unaffected. **Pd-G_1** is projected as an efficient catalyst for the selective hydrogenation of carbon-carbon multiple bonds in multifunctional organic molecules (*Tetrahedron Lett.* 2011, ***52***, 3102-05).

β-Cyclodextrin as an end-to-end connector

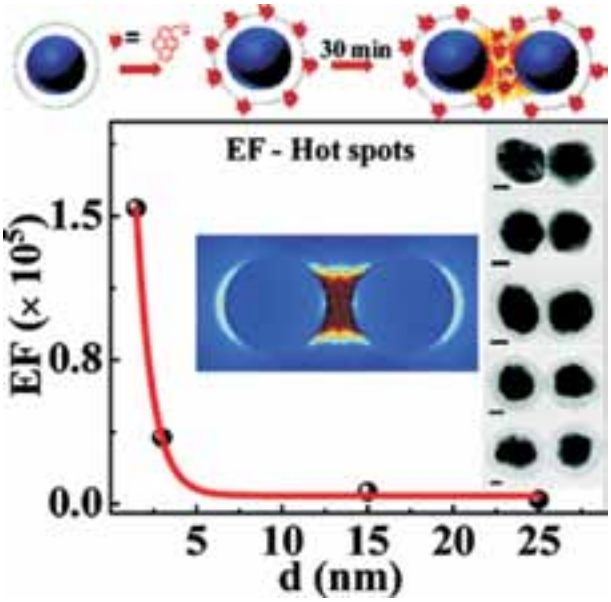
Interaction of β-cyclodextrin (β-CD) with a ditopic molecule having adamantane (AD) at one end and a pyromellitic diimide (PMDI) moiety at the



other end was studied. The AD moiety undergoes inclusion binding with the β-CD cavity, and the PMDI undergoes binding with the primary rim of β-CD. In an equimolar solution of β-CD and the ditopic molecule in water, β-CD accommodates both the modes of complexation simultaneously, leading to the formation of long fibers. The fibers get entangled to give a supramolecular hydrogel with very high water content (*J. Phys. Chem. Lett.* 2011, ***2***, 2094–98).

Ag@SiO_2 Core–shell nanostructures: Distance-dependent plasmon coupling and SERS investigation

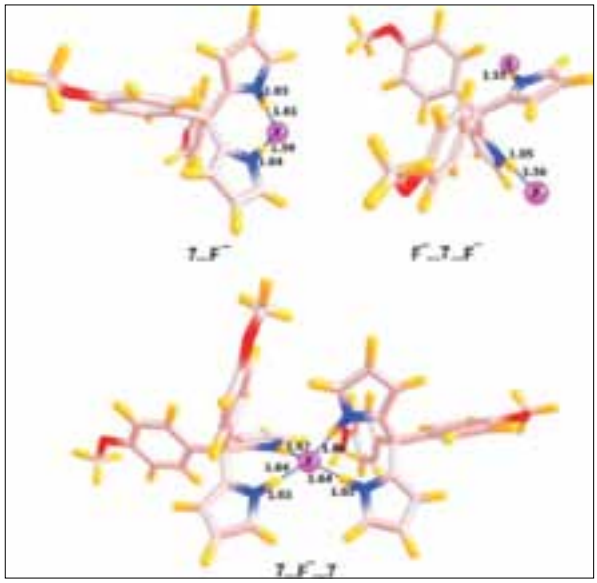
Enhancement of Raman signals of pyrene due to the enhanced electric fields on the surface of silver nanoparticles was investigated by controlling the thickness of the silica shell. Dimeric nanostructures having well-defined gaps between two silver nanoparticles were prepared, and the gap size (d) varied from 1.5 to 40 nm. The molecules trapped at the



dimeric junctions showed higher Raman signal enhancements when the gap was less than 15 nm due to the presence of amplified electric field, in agreement with the theoretical studies. The experimental Raman enhancement factors at the hot spots follow a 1/dn dependence, with n = 1.5, in agreement with the recent theoretical studies by Schatz and co-workers. Experimental results obtained on the distance dependence of surface enhanced Raman spectroscopy (SERS) enhancement at the hot spots can provide insight on the design of newer plasmonic nanostructures with optimal nanogaps (*J. Phys. Chem. Lett.* 2012, ***3***, 1459-64).

5,5-Diaryldipyrromethanes: Syntheses and anion binding properties

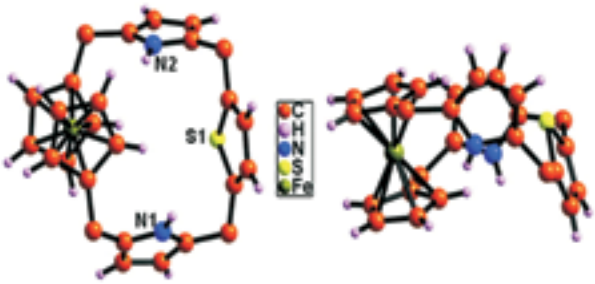
A two-step synthesis of 5, 5-diaryldipyrromethanes by using easily available and stable precursor in comparatively shorter reaction time with high yields demonstrated. The synthetic methodology adopted here is simple and straight forward due to the absence of side products and hence easier for purification. The adopted synthetic strategy can be used to tune the substituent at the meso-carbon very easily by choosing the Grignard reagent of interest. The influence of the incorporation of various



diaryl units at the meso-carbon atom in the inherent anion binding affinities of the dipyrromethanes through hydrogen bonding was studied. Further, the anion binding abilities of these compounds were evaluated, which showed relatively high binding affinity toward fluoride ions with respect to the other anions analyzed. The role of diaryl functionality at the meso-position of the dipyrromethane in the binding process can influence the design of novel macrocycles and supramolecular systems in future (*Tetrahedron Lett.* 2011, ***52***, 5995–99).

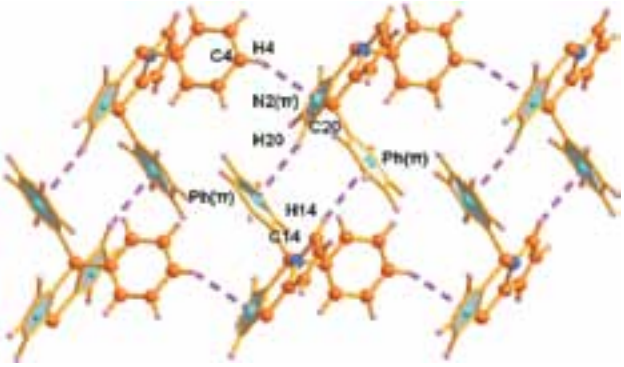
Ansa-ferrocene-incorporated calixpyrroles and calixphyrins: Syntheses and spectral/ structural characterization

Studies on the syntheses and spectral/structural characterization of ansa-ferrocene-incorporated normal calixphyrins and core-modified calixpyrroles and calixphyrins were conducted. Acid-promoted dehydrative condensation of 1,1′-bis-(dimethylpyrrolylmethyl) ferrocene and 2,5-bis -(dimethylhydroxymethyl)-thiophene/furan yielded ansa-ferrocene- based core -modified calixpyrroles. Acid-catalyzed dehydrative condensation of 1,1′-bis (diphenylpyrrolylmethyl) ferrocene with the aryl aldehydes and 2,5-bis-(phenylhydroxymethyl)thiophene followed by DDQ oxidation resulted in the formation of ansa-ferrocene-appended normal and core-modified calixphyrins. The newly synthesized macrocycles were characterized by FAB-MS, NMR, and UV−Vis spectral analyses and finally confirmed by single-crystal X-ray structural analysis. All these studies clearly revealed the introduction of ferrocene in the main framework of the corresponding macrocycles in an ansa-type way. The core-modified calixpyrroles adopted a 1,3-alternate conformation, while the corresponding calixphyrins maintained partial planarity along the tripyrrin plane due to the presence of meso Sp^2 carbon and generated curved staircase conformation. In addition to the intramolecular hydrogen-bonding interactions, calixphyrins generated self-assembled dimers, one- and two-dimensional supramolecular assemblies through intermolecular hydrogen bonding in the solid state (*Organometallics* 2012, ***31***, 4166–73).



4,4,9,9-Tetraphenylpyrroloindolizine: A structural analogue of calix[2]pyrrole

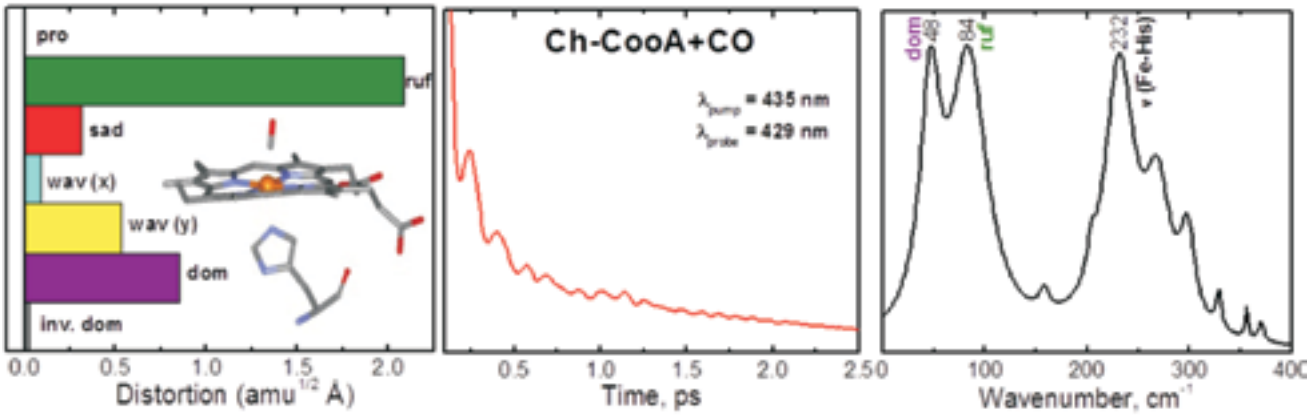
Synthesis, spectral and structural characterization of a pyrroloindolizine derivative having structural similarity with calix[2]pyrrole were studied. The molecule can be considered as the smallest congener of the corresponding porphyrinogen family, containing only two pyrrole rings connected through meso-carbon atoms substituted with bulky phenyl groups. In addition to the spectroscopic evidence, single crystal X-ray analysis revealed the assigned structure of the molecule. Here, two pyrrole rings are connected with two meso-carbon atoms having an N,α-linkage and an α,β-linkage to afford the smallest analogue in the calixpyrrole family. This example may pave the way towards the synthesis of meso-octaaryl calix[4]pyrroles and similar porphyrinoids which are unprecedented in the literature (*Org. Bimol. Chem*. 2012, ***10***, 3600-05).



The coherent vibrational motion of the heme domain in the CO-sensing transcriptional activator CooA

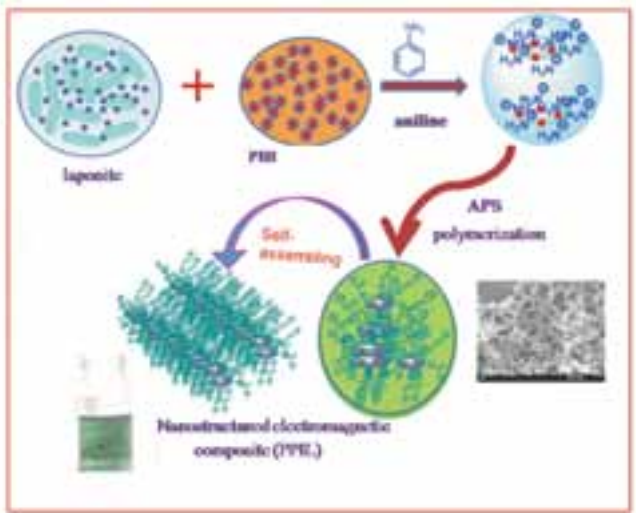
Femtosecond vibrational coherence spectroscopy was used to investigate the low frequency vibrational dynamics of the heme in the carbon monoxide oxidation activator protein (CooA) from the thermophilic anaerobic bacterium *Carboxydothermus hydrogenoformans* (Ch-CooA). Low frequency vibrational modes are important because they are excited by the ambient thermal bath (k_BT = 200 cm^{-1}) and participate in thermally activated barrier crossing events. The low frequency coherence spectra of the ferric, ferrous, and CO-bound forms of Ch-CooA are presented in order to compare the protein-induced heme distortions in its active and inactive states. A strong mode near ~90 cm^{-1} in the ferrous form of Ch-CooA is suggested to contain a

large component of heme ruffling, consistent with the imidazole bound ferrous heme crystal structure, which shows a significant protein-induced heme distortion along this coordinate. The observation of the Fe-His mode in the ferrous form indicates that photolysis of the N-terminal a-amino axial ligand takes place. Upon CO binding, disappearance of a coherent mode near 112 cm^{-1}, associated with heme saddling, reflects change in the heme environment and geometry associated with the conformational transition activating the DNA binding domain (*J. Am. Chem. Soc.* 2011, ***133***, 18816).



Water-dispersible multifunctional polyaniline-laponite-keggin iron nanocomposite through template approach

Nanostructured multifunctional materials have received considerable attention in both science and technology due to their unusual commercial exploitation in sensors, electromagnetic/radio frequency interference filters, batteries, colour imaging, magnetic refrigeration, drug targeting, cell separation, enzyme immuno assay and so forth. The main challenge is to design the multifunctional polymeric composite which will have the greatest effect on the magnetic and conducting properties with environmental stability and thermo-mechanical stability in the protonated state. Water dispersible nanostructured multifunctional polyaniline-laponite-keggin iron cation composites were prepared by the oxidative polymerization of aniline in presence of aqueous dispersion of keggin iron-laponite at room temperature. Negatively charged ions on the surface and residual positive charges on the edges of the laponite disc adsorb both keggin iron and aniline through ion-dipole and ionic interactions and can act as micellar template during polymerisation. It is suggested that Keggin cages act as linkages between disorganized laponite sheets. During polymerisation, the disorganised PIL discs co-structured/engulfed PANI layers. Later they rolled to form electromagnetic nanotubes. These multifunctional composites exhibited electrical conductivity~5.7 x10^{-1} S/cm, saturation magnetization ~9.0 x10^{-1} emu/g with coercivity 8.2Oe and thermal stability~300°C revealing its utility as a novel precursor for many high technological applications (*J. Mater. Chem.* 2011, ***21***, 16642).



INORGANIC CHEMISTRY

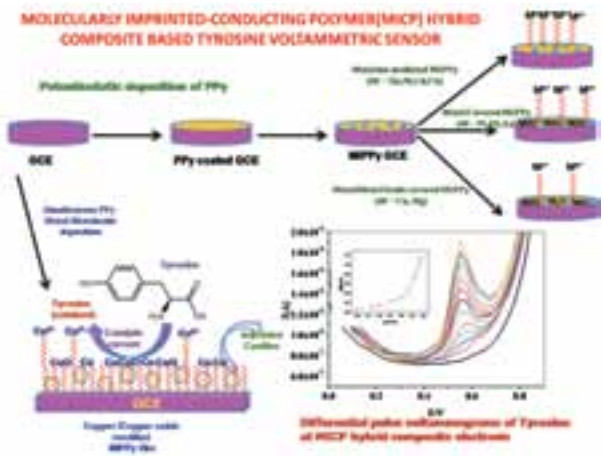
Post MW irradiated β-AgI crystals based potentiometric iodide sensor

Conductive AgI crystals were prepared and stabilized in the β-phase by post microwave irradiation under pressurized condition. A low cost, heterogeneous iodide ion selective electrode (ISE) membrane was fabricated by dispersing the above prepared β-AgI crystals in polyvinyl chloride. The developed ISE could respond to $1x10^{-8}$ to 1M of iodide (response time = 60 s.) with a detection limit of $1x10^{-8}$ M and possessed high selectivity for iodide in presence of interfering ions. Performance of this ISE in the analysis of natural and sea water,

table salt and human urine samples were quite encouraging (*Electrochim. Acta. 2012,* ***66****, 340-46*).

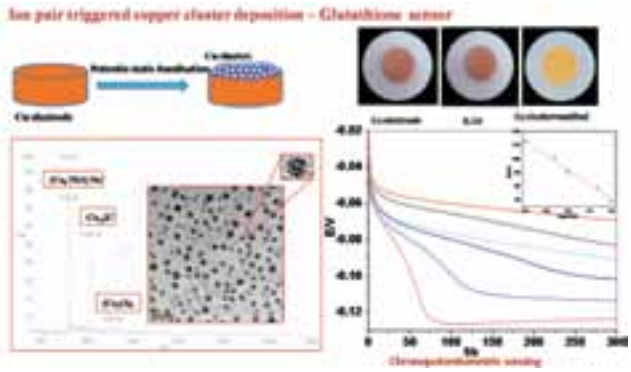
Mechanistic aspects of tyrosine sensing on *in situ* copper ion mediated or copper oxide modified molecularly imprinted polypyrrole coated glassy carbon electrode

A response mechanism of tyrosine sensing at *in-situ* copper oxide modified molecularly imprinted polypyrrole coated glassy carbon electrode in phosphate and acetate buffered media is proposed. It is a combination of complexation, and electrocatalytic mechanisms. Complexation mechanism takes in to account the formation of both binary and ternary complexes of copper with tyrosine and/or phosphate. Electrocatalytic mechanism invokes the formation of copper(I) species *(J. Electroanal. Chem. 2011,* ***663,*** *53-58).*



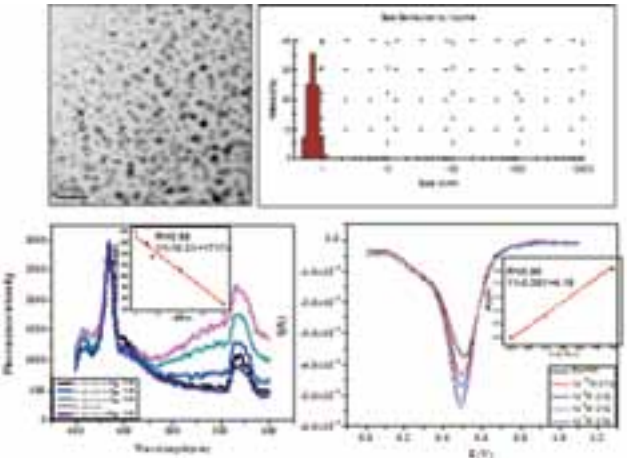
Copper quantum cluster-polypyrrole composite film based zero current chronopotentiometric sensor for glutathione

For the first time, potentiostatically deposited copper quantum cluster (CuQC) and CuQC-polypyrrole composite film modified copper disc electrodes were prepared under a seemingly unlike conditions of holding at + 0.8 V Vs Ag/Ag Cl for 100 s from tetrabutyl ammonium bromide($R_4N^+Br^-$) and $R_4N^+Br^-$ and pyrrole solutions. On employing zero current chronopotentiometry, the latter electrode responds from 10^{-6} to 10^{-4} M amounts of glutathione with a detection limit of $2.6x10^{-7}$ M and a precision of 4.3% (at 10^{-6} M). Spectral and morphological characterizations revealed that each quantum cluster is an aggregate of ~ 2 nm size consisting of several sub-nm sized particles. Furthermore, the designed glutathione sensor is selective with respect L-tyrosine, L-phenyl alanine, L-leucine, L-serine, L-valine and L-tryptophan. The quantification of glutathione in human urine samples was successfully tested (*Analytical Methods* 2012, ***4***, 1976-82).



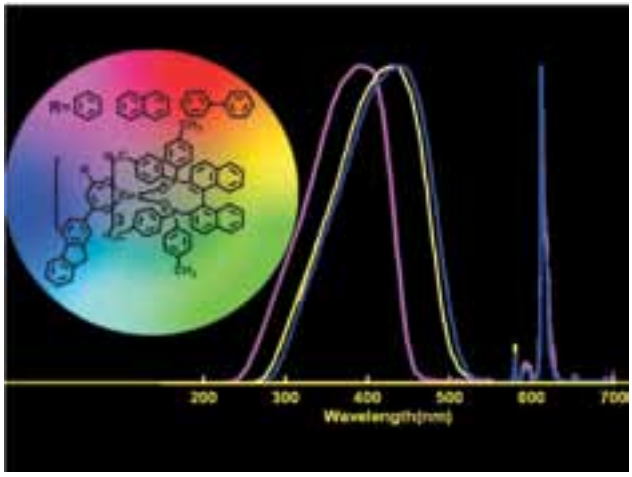
Mixed monolayer protected gold atom/ oxide cluster synthesis and characterization

Small atomic gold clusters in solution, Au_n, stabilized by cetyl trimethylammonium bromide (CTAB) and cysteine, synthesized potentiodynamically in quiescent aqueous solutions. The electrodissolution of gold to gold ions during anodic scan and subsequent cluster formation during cathodic scan in under potential (UPDD) and over potential dissolution/deposition (OPDD) regions were studied. The experimental potentiodynamic I-E profiles and chronoamperometric i-t transients fit into reported theoretical models of adsorption and electrocrystallization. The plausible application of clusters/cluster film to cysteine sensing based on fluorescence quenching and square wave stripping voltammetry demonstrated (*Nanoscale* 2012, ***4***, 4130-37).



Tuning of the excitation wavelength from UV to visible region in Eu^{3+}-*ß*-diketonate complexes

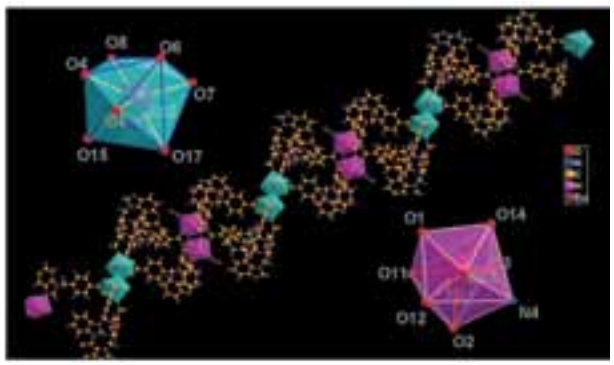
A novel class of efficient visible light sensitized antenna complexes of Eu^{3+} based on the use of a series of highly conjugated β-diketonates, namely, 1-(1-phenyl)-3-(2-fluoryl) propanedione, 1-(2-naphthyl)-3-(2-fluoryl)propanedione,1-(4-biphenyl) -3-(2-fluoryl) propanedione, and 2,2'-bis(di-*p*-tolylphosphino)-1,1'-binaphthyl oxide as an ancillary ligand has been designed, synthesized, characterized and their photophysical properties investigated. The replacement of the phenyl group with the naphthyl or biphenyl groups in the 3-position of the fluoryl based β-diketonate ligand remarkably extends the excitation window



of the corresponding Eu^{3+} complexes towards the visible region (up to 500 nm). The highly conjugated β-diketonate ligands sensitize efficiently the luminescence of Eu^{3+} ions with quantum yields ranging from 19 to 43% in the solid state, which is among the highest reported for a visible sensitized Eu^{3+}complex (*Dalton Trans.* 2011, ***40***, 3257–68).

Unique luminescent coordination polymer constructed from unsymmetrical dinuclear lanthanide building blocks

A new chromophore ligand 4-((1H-benzo[d] imidazol-1-yl)methyl)benzoic acid designed for the indirect excitation of lanthanide metal center. Single crystal X-ray diffraction analysis revealed that different coordination modes of the carboxylate ligand with Eu^{3+} ion could promote the formation of a unique 1D coordination polymer, con-



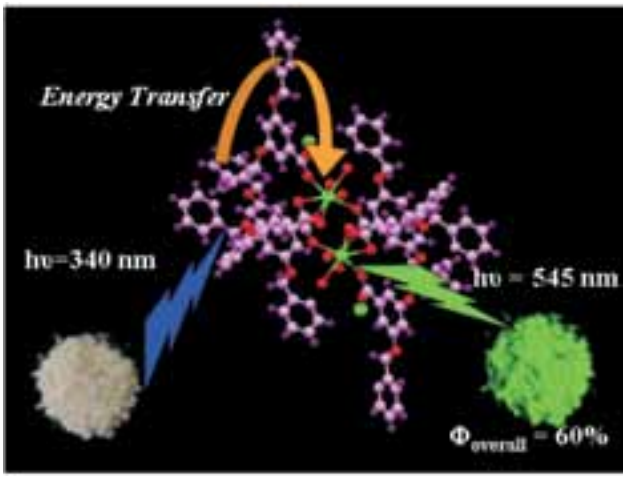
structed from unsymmetrical dinuclear lanthanide building blocks. The Tb^{3+}complex exhibited bright green luminescence efficiency in the solid state with a quantum yield of 15% thus rendering it as a promising candidate for use in various photonic applications. (*Cryst. Growth Des.* 2011, ***11***, 857-64).

Novel environmentally benign yellow inorganic pigments

A new class of yellow inorganic pigments based on $Sm_{6-x}W_{1-y}Zr_xMo_yO_{12+}$ (x ranges from 0 to 0.6 and y ranges from 0 to 1) synthesized by solid-state route. The systematic substitution of Mo^{6+} for W^{6+} in Sm_6WO_{12} shifted the absorption edge from 374 to 460 nm and consequently the designed compounds exhibited colours ranging from white to yellow. The band gap of the resultant pigments varied from 3.29 to 2.69 eV. The colouring mechanism is based on the O_{2p}–Mo_{4d} charge transfer transitions. Furthermore, the doping of Zr^{4+} for Sm^{3+} in Sm_6MoO_{12} lattice produced intrinsic strain, which further red shifted the absorption edge to 479 nm. This intensified the yellow hue of the resultant compounds with band gap decreasing to 2.58 eV. The colouring performance of the developed yellow pigment was evaluated by incorporating it into a polymer substrate material (*J. Am. Ceram. Soc.* 2011, ***94***, 997–1001).

Lanthanide coordination polymers assembled from derivatives of 3,5-dihydroxy benzoates

Two new aromatic carboxylic acids, *viz.* 3,5-bis (benzyloxy)benzoic acid and 3,5-bis(pyridine-2-ylmethoxy)benzoic acid prepared which form luminescent coordination polymers with trivalent lanthanides and the Tb^{3+} complexes exhibited bright green luminescence with high quantum yield values in the solid state (as high as 60%). The most noteworthy structural feature of Ln^{3+}-3,5-bis(pyridine-2-ylmethoxy) benzoates is the presence of free Lewis basic pyridyl sites within the 1-D coordination polymer which in turn, augurs well for the potential utility of these compounds for the recognition and sensing of metal ions. (*Inorg. Chem.* 2011, ***50***, 4882-91).



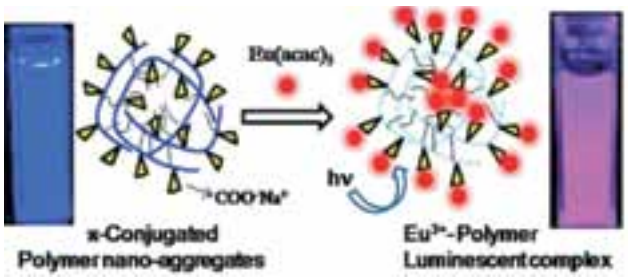
NIR reflecting inorganic colorants: Energy saving materials

Novel, environmentally benign near-infrared (NIR) reflecting inorganic pigments based on yttrium cerate doped with metal ions such as Mo^{6+} or Pr^{4+} s synthesized. The substitution of Mo^{6+} for Ce^{4+} in $Y_2Ce_2O_7$ changed the colour from ivory-white to yellow and the band gap decreased from 3.01 to 2.44 eV due to O_{2p}–Mo_{4d} charge-transfer transitions. Replacing Pr^{4+} for Ce^{4+} drastically shifts the absorption edge of the pigments from 410 to 725 nm. As a result the band gap of the compounds changes from 3.01 to 1.70 eV due to the introduction of an additional $4f^1$ electron energy level of Pr^{4+} between the valence and conduction bands. The

ability of the pigments to transfer their NIR reflectance properties to a roofing material like asbestos cement sheet was evaluated (*Solar Energy Materials & Solar Cells* 2011, **95**, 2685–92).

Amphiphilic π-conjugated poly (M-phenylene) photosensitizer for the Eu^{3+} ion: The role of macromolecular chain aggregation on the colour tunability of lanthanides

New carboxylic functionalized poly-(phenylene)s and their oligomers as selective and efficient photosensitizers for Eu^{3+} ions were investigated. Photoexcitation of the oligomer-Eu^{3+} complexes resulted in magenta color emission as a result of the combination of partial blue self-emission from the

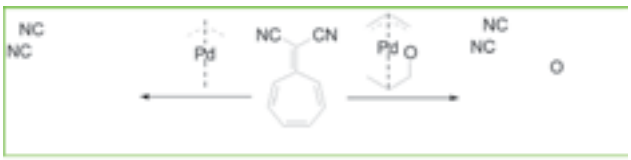


chromophores along with the red colour from the metal center. The polymers possessed typical amphiphilic structures via a rigid aromatic hydrophobic core and hydrophilic anionic periphery for self organization in water. The molecular self-organization of the polymers played a crucial role on the efficient energy transfer from the polymer chain to metal center, more specifically Eu^{3+} ion-based red emission (*J. Phys. Chem. B*. 2011, ***115***, 10789–800).

ORGANIC CHEMISTRY

1,8-Conjugate addition to heptafulvene *via* bis- π -allyl palladium complexes: Facile route towards bis-functionalized cycloheptatriene (CHT) derivatives

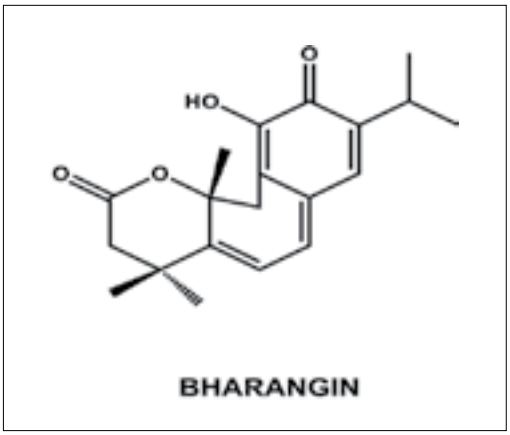
Transformations utilizing bis-π-allylpalladium complexes represent one of the most important areas of homogeneous catalysis. Over the past two decades, bis-π-allylpalladium and related complexes have effectively been utilized for the functionalization of highly activated olefins. These olefins undergo efficient bis-functionalizations including bis-allylation, alkoxy-allylation, cyanoallylation, acetonation-allylation, amino-allylation, and alkyl-allylation to afford α,β functionalized products in high yields under mild conditions with high atom economy. An efficient synthesis of 3,3-disubstituted indole-2-ones from isatylidenes by utilizing amphiphilic bis-π-allylpalladium and related intermediates were already demonstrated. The palladium catalyzed 1,8-conjugate addition of heptafulvene, an antiaromatic conjugated 8π-electron system was utilized for the concise synthesis of bis-functionalized cycloheptatriene (CHT) derivatives. The regiochemistry of CHT derivatives was established



by utilizing Diels-Alder cycloaddition strategy on CHT derivatives obtained. The bis-functionalization reaction reported here is the first application of palladium catalyzed reaction on a cyclic conjugated system (*Organic Letters* 2011, ***13***, 4984-87).

Natural Products Research

Search for biologically active natural products from medicinal plants used in traditional medicinal systems has been continuing at NIIST. Accord-



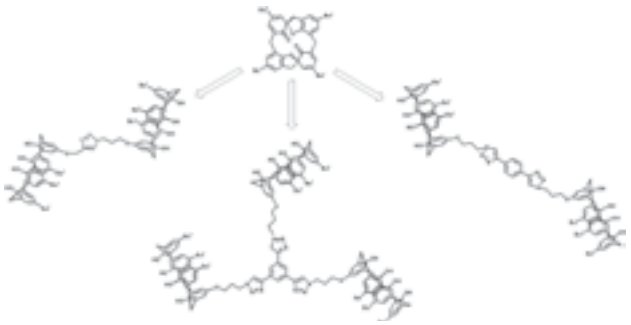
ingly, *Premna herbacea* which is used in Ayurveda as an anti-cancer and anti-inflammatory agent was studied in detail from which bharangin, a diterpenoid quinonemethide, was isolated. The quinonemethide inhibited NF-kB activation, phosphorylation and degradation of IkBα, p65 nuclear translocation, phosphorylation and acetylation, and NF-kB dependent reporter gene transcription. Results demonstrated that bharangin is a potent inhibitor of NF-kB activation that may provide molecular basis for the anti-tumorigenic potential of *P. herbacea.* (*Molecular Pharmacology* 2011**, *80,*** 769-81).

In an another study, Ethyl *p*-methoxycinnamate isolated from the traditional anti-tuberculosis medicinal herb *Kaempferia galanga* was shown to inhibit drug resistant strains of *Mycobacterium tuberculosis in vitro* (*Fitoterapia* 2011, ***82***, 757-61).

The three important bioactive compounds namely, Tricin and the two flavonolignans identified in 'Njavara', the unique medicinal rice variety of Kerala region, were found to be efficient radical scavengers in the order : tricin > tricin 4'-O-(*threo*-*β*-guaiacylglyceryl) ether > tricin 4'-O-(*erythro*-*β*-guaiacylglyceryl) ether. In order to gain insight into the stability of the radicals formed and the ease with which it is formed from the above three active compounds, theoretical studies were carried out by computational methods using Density Functional Theory (DFT). Free-radical scavenging activity based on DPPH radical scavenging of tricin and the two flavonolignans (tricin conjugates) were explained theoretically in conjunction with isodesmic approach for hydrogen transfer mechanism and compared with standard quercetin by the critical evaluation of the factors such as bond dissociation enthalpy (BDE), ionisation potential (IP) and spin density distribution of its radical. The theoretical studies agree with the results of DPPH radical scavenging activities of the three compounds, in the same order as mentioned above (*J. Agric. Food Chem.* 2012, ***60***, 3693–99).

Calix{4}bis(spirodienone) as a versatile synthon for upper rim alkoxylation of calixarenes and synthesis of novel triazole-based biscalixarene

Biscalixarenes have garnered considerable interest as fascinating calixarene derivatives for the study of various aspects of their supramolecular applications like host-guest interactions, as artificial sensors, synthetic receptors for biological agents etc. As part of the ongoing research on the chemistry of bis(spirodienones), the highly versatile molecules obtained by the oxidative cyclisation of *p-tert*-butyl calix[4]arene, a methodology for the selective upper rim-substituted mono and 1,3-di-



alkoxy calixarenes in a single step was developed. The above methodology was further extended for the synthesis of azido and propargyl derivatives of calix[4]arene substituted at the upper rim. These molecules were further subjected to copper(I) assisted azide-[3+2] alkyne cycloaddition (CuAAc) to obtain triazole-based biscalixarenes. The methodology has been further validated by successfully synthesizing bis- and tris-calixarenes by reacting azidocalixarene with diacetylene and triacetylene benzenes (*Supramolecular Chemistry* 2011, ***23***, 501-08).

MATERIAL SCIENCES AND TECHNOLOGY DIVISION

In functional materials research three core areas namely nano ceramics, electro ceramics and advanced superconductors and magnetic materials are actively considered for energy and environment applications. Flexible polymer-ceramic composite and hard ceramic substrates for microwave electronic circuits, electromagnetic shielding materials, iron and magnesium boride based advanced superconductors, ceramic oxides for thermistors, white-LEDs and red/orange phosphors, magnetic ceramics, rare earth based varistors, photoactive, self cleaning nano coatings on glass surfaces, nano zirconia thermal fluids, alumina/silica sol gel sorbents, sol gel meso/micro porous nano zinc oxide and magnetic titania catalysts for environmental cleaning, and rare earth phosphates for thermal barrier and thermal protection applications are being attempted and investigated. New initiatives like development of rare earths based high energy magnets, inorganic nanoporous hybrids for gas adsorption, high dielectric alumina substrates for space-electronics are also finalized. The section signed MOU for developing nano ceramic fillers for high thermal conducting epoxy polymer insulators with multinational company. The division has also developed high strength aluminium alloy castings by the addition of 0.4-0.45% Mg to Al-Si-Cu (319) alloy and fabricated a two wheeler connecting rod by the indirect squeeze casting of the above alloy. A process developed for preparation of titanium feedstock for the welding electrode flux. New facilities like H_2 reduction firing, thermal conductivity measurement unit and tape casting facility were installed. The division maintains major equipments like XRD's, SEM's, liquid nitrogen plant etc.

Highlights

- Glass-free $LiMgPO_4$ based LTCC tapes for microwave substrate applications developed
- Developed PVDF-$BaTiO_3$ based polymer-ceramic composite for electromagnetic shielding materials
- Silicone rubber based flexible and stretchable microwave packaging materials prepared and properties evaluated
- Developed vapor cooled MgB_2 current leads and Nd based bulk superconductor
- $NaGdSnMO_7$ based novel inorganic oxide phosphors for electrical and electro-optical applications prepared and luminescence properties evaluated
- $La_{2/3}Ca_{1/3}MnO_3$ based magnetic refrigeration and spintronics developed, its electrical and magnetic properties investigated
- Developed a new ZnO-La_2O_3-CeO_2 composition for high energy varistor applications
- Large scale low temperature coatings of photo active nano titanium oxide on solar panels demonstrated
- SiO_2 doped TiO_2 ceramic membranes for lower ultra-filtration achieved through multilayer coating
- Synthesis of high temperature non-reactive Lanthanum Phosphate composites completed
- Surface grafted mesoporous alumino-siloxane sol gel sorbents prepared by sol-gel assisted coagulation and co-condensation reaction
- Innovative dark-catalysis process for the industrial dye-removal application developed
- PLA/Natural fibre Composite Plates and Biodegradation of PLA/Fibre Composites fabricated and mechanical properties studied
- Mechanical properties of a high strength cast aluminium alloy by the addition of 0.4-0.45% Mg to Al-Si-Cu (319) alloy evaluated and a two wheeler connecting rod by the indirect squeeze casting of the above alloy fabricated
- Centrifugally cast LM13 Aluminum alloy prototype cylinder liners with high strength and hardness fabricated
- Process developed for preparation of titanium feedstock for the welding electrode flux

पदार्थ विज्ञान तथा प्रौद्योगिकी प्रभाग

कार्यात्मक सामग्रियों के अनुसंधान के तहत उर्जा और पर्यावरण अनुप्रयोगों के लिए तीन मुख्य क्षेत्रों अर्थात् नैनो सिरेमिक्स, इलेक्ट्रो सिरेमिक्स और उन्नत अतिचालकों और मैग्नेटिक सामग्रियों पर सक्रिय रूप से विचार किया जाता है। माइक्रोवेव इलेक्ट्रॉनिक सर्किट के लिए लचीले पॉलिमर सिरेमिक सम्मिश्र और कठोर सिरेमिक क्रियाधार, विद्युत मैग्नेटिक परिरक्षण सामग्रियों, लोहा और मैग्नीशियम बोराइड आधारित उन्नत अतिचालकों, ऊष्म प्रतिरोधकों के लिए सिरेमिक ऑक्साइड, सफेद एल ई डी और लाल/नारंगी संदीपकों, मैग्नेटिक सिरेमिक्स, रेअर अर्थ आधारित वैरिस्टरों, कांच की सतहों पर प्रकाश सक्रिय स्वयं सफाई नैनोकोटिंग्स, नैनो जर्कोनिया, थर्मल तरल पदार्थ, एल्यूमिना/सिलिका सोल जेल शोषी, सोल-जेल मीसो/माइक्रो सरंध्र नैनो जिंग ऑक्साइड और पर्यावरण की सफाई के लिए मैग्नेटिक टाइटेनिया उत्प्रेरकों और थर्मल बाधा और थर्मल सुरक्षा अनुप्रयोगों के लिए रेअर अर्थ्स फॉस्फेट पर प्रयास और जांच की जा रही है। रेअर अर्थ्स आधारित उच्च ऊर्जा मैग्नेट, गैस अधिशोषण के लिए अकार्बनिक नैनोसरंध्र संकर, अंतरिक्ष इलेक्ट्रॉनिक्स के लिए उच्च डाइइलेक्ट्रिक एल्यूमिना क्रियाधार के विकास की तरह नई पहल को भी अंतिम रूप दिया जाता है। अनुभाग ने एक बहुराष्ट्रीय कंपनी के साथ उच्च तापीय चालक एपोक्सी पॉलिमर इन्सुलेटरों के लिए नैनो सिरेमिक फिल्लरों के विकास पर समझौता ज्ञापन हस्ताक्षर किए। प्रभाग ने Al-Si-Cu (319) मिश्रधातु के साथ 0.4-0.45% मिलीग्राम मैग्नीशियम के संकलन द्वारा उच्च शक्ति एल्यूमीनियम मिश्र धातु कास्टिंग विकसित किया है और उपर्युक्त मिश्रधातु के अप्रत्यक्ष निचोड़ कास्टिंग द्वारा एक दोपहिया कनेक्शन रॉड का संविरचन किया। इलेक्ट्रॉड फ्लक्स के वेल्डन के लिए टाइटेनियम फीडस्टॉक की तैयारी के लिए एक प्रक्रिया विकसित की गयी।

हाइड्रोजन अपचयन फायरिंग और तापीय चालकता माप इकाई, टेप कास्टिंग सुविधा जैसी नई सुविधाओं की स्थापना की गयी। प्रभाग द्वारा प्रमुख उपकरणों, जैसे एक्सआरडी, एसईएम, तरल नाइट्रोजन संयंत्र आदि का रखरखाव किया जाता है।

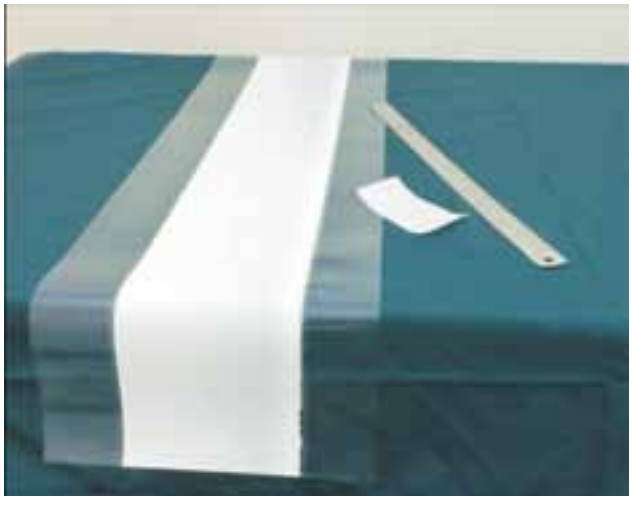
मुख्य विशेषताएं

- माइक्रोवेव सब्सट्रेट अनुप्रयोगों के लिए ग्लास मुक्त $LiMgPO_4$ आधारित एसटीसीसी टेप विकसित किया।
- विद्युत मैग्नेटिक परिरक्षण अनुप्रयोगों के लिए PVDF-$BaTiO_3$ आधारित पॉलिमर-सिरेमिक सम्मिश्र विकसित किया।
- वाष्प शीतल MgB_2 करन्ट लीड्स और Nd आधारित थोक अतिचालक विकसित किया
- विद्युत और इलेक्ट्रो-ऑप्टिकल अनुप्रयोगों के लिए $NaGdSnMO_7$:Eu आधारित नूतन अकार्बनिक ऑक्साइड फोस्फोरों की तैयारी की ।
- मैग्नेटिक प्रशीतन और स्पिनट्रॉनिक अनुप्रयोग के लिए $La_{2/3}Ca_{1/3}MnO_3$ आधारित सामग्री विकसित की ।
- उच्च ऊर्जा वैरिस्टर अनुप्रयोगों के लिए एक नया ZnO-La_2O_3-CeO_2 संयोजन विकसित किया
- बहुपरत कोटिंग के माध्यम से निम्न अल्ट्रा निस्पंदन के लिए SiO_2 डोप्ड TiO_2 सिरेमिक झिल्ली विकसित की ।
- सॉल-जेल समर्थित स्कंदन और सह - द्रवण अभिक्रिया द्वारा सतह संशोधित मध्यरंध्रीय ऐलुमिनो सिलोक्सेन तैयार किया।
- औद्योगिक रंजक- हटाव अनुप्रयोग के लिए अभिनव अदीप्त कटैलिसीस प्रक्रिया विकसित की।
- Al-Si-Cu (319) मिश्रधातु के साथ 0.4-0.45% मिलीग्राम मैग्नीशियम के संकलन द्वारा एक उच्च शक्ति एल्यूमीनियम मिश्र धातु संचक के यांत्रिक गुण का मूल्यांकन किया और उपर्युक्त मिश्रधातु के अप्रत्यक्ष निचोड़ कास्टिंग द्वारा एक दोपहिया कनेक्शन रॉड संविरचित किया।
- उच्च शक्तिऔर कठोरतायुक्तअपकेंद्री संचक LM13 एल्यूमीनियम मिश्रधातु प्रोटोटाइप सिलेंडर रैखिक संविरचित किया।
- इलेक्ट्रॉड फ्लक्स के वेल्डन के लिए टाइटेनियम फीडस्टॉक की तैयारी के लिए एक प्रक्रिया विकसित की।

ELECTROCERAMICS, ADVANCED SUPERCONDUCTORS, MAGNETIC MATERIALS AND IONIC CONDUCTORS

Glass-free LTCC tapes for microwave substrate applications

Glass free Low Temperature Co-fired Ceramic (LTCC) tape of $LiMgPO_4$ has been developed. The tape casting slurry was prepared by dispersing $LiMgPO_4$ powder in ethanol/xylene mixture followed by the addition of organic additives such as binder, plasticizer and homogenizer. $LiMgPO_4$ ceramic powder of average particle size 1.1 μm and BET surface area of 2.7 m^2g^{-1} was used for the slurry preparation. Tape casting slurry of $LiMgPO_4$ with typical pseudo-plastic behavior was cast into thin tapes of thickness 70 μm using the doctor blade technique. The green tape of $LiMgPO_4$ has a ε_r of 3.2 and tan δ of 0.0688 at 5 GHz. The thermo-laminated tape (4 layers) sintered at 950°C/2h showed good microwave dielectric properties: ε_r = 6.4 and tan δ = 0.0002. $LiMgPO_4$ ceramic showed a coefficient of thermal expansion of 10.5 ppm/°C and thermal conductivity of 7.1 $Wm^{-1}K^{-1}$. The glass-free nature and the good microwave dielectric properties obtained for the final tape makes the newly developed tape casting formulation attractive for LTCC applications.



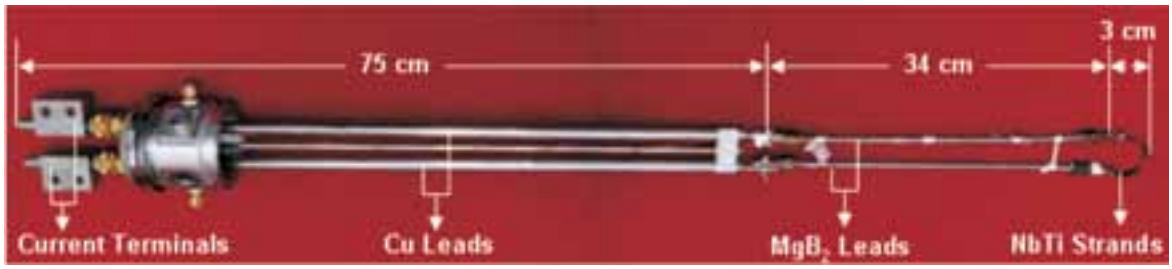
Cast LiMgPO4 ceramics Green tape

Polymer-ceramic composite for electromagnetic shielding materials

Composites of polyvinylidene fluoride (PVDF) with micron and nano sized $BaTiO_3$ powders were developed for electromagnetic interference (EMI) shielding applications in the X band. PVDF-nano $BaTiO_3$ composites showed better shielding properties compared to PVDF-micron sized $BaTiO_3$ composites and shielding effectiveness of about 9 dB was obtained. This composite shielded through both absorption and reflection. Addition of small amount of silver particles improved the shielding properties of these composites due to the increased conductivity and the shielding mechanism changed to absorption. An EMI shielding effectiveness of about 26 dB was obtained for the PVDF-20 vol% nano $BaTiO_3$-10 vol% Ag composite of thickness 1.2 mm in the X band. These composites can be engineered from partial absorption/reflection to absorption shielding applications by varying the amount and size of $BaTiO_3$ as well as Ag particles in the polymer matrix. Novel composite combining the advantages of metal, nano ceramic and polymer has the potential for effective EMI shielding applications.

Flexible electronics

Flexible electronics create a new era in the fast growing electronic industry and enable a wide range of applications. Recent years have witnessed an expanding interest in the application of flexible polymer materials as the substrates for electronic and display devices. Silicone rubber can be used for flexible electronic applications because of its good dielectric properties (ε_r = 3-3.5 and tanδ =10^{-3} at 1MHz) and can withstand to a relatively high temperature of about 200°C. Mechanically flexible silicone rubber composites filled with micro and nano alumina were prepared and the effect of filler content on the relative permittivity, dielectric loss, mechanical property, coefficient of thermal expansion and moisture absorption were investigated. The dielectric properties (ε_r = 5.89 and tanδ = 9 × 10^{-3} at 5GHz), coefficient of thermal expansion and mois-



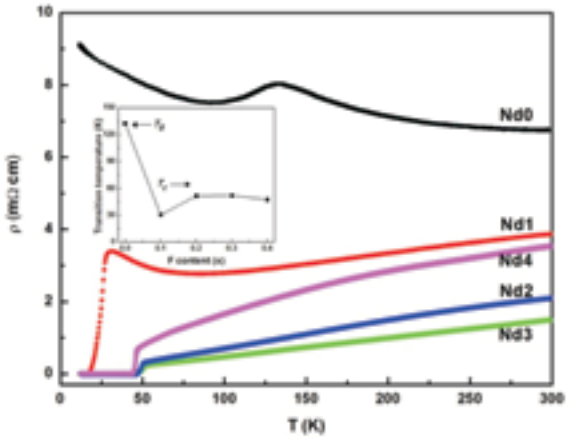
Vapor cooled superconducting current lead assembly

ture absorption were excellent for micro alumina composites. However, mechanical property was observed to be better for nano alumina composites. From the measured properties micro alumina filled silicone rubber composites it can be qualified as a good candidate for flexible microwave substrate applications.

Development of vapor cooled MgB_2 current leads and Nd based bulk superconductor

Vapour cooled current leads with a rating of 2500 A at 20 K suitable for application in fusion magnets were designed and developed. MgB_2/Fe superconducting strands were prepared by powder in tube technique and used to fabricate superconducting current leads. Effect of copper was investigated to maintain thermal stability at very high transport currents. The design, process and testing parameters of the leads such as wire geometry, rated current, thermal stability, heat leak, quench stability, thermal recycling stability and operational stability were optimized specifically for application in fusion magnets. A pair of leads was suitably anchored to vapour cooled Cu leads at one end and NbTi superconducting strands at the other end for direct use in fusion magnets.

The recently discovered $NdFeAsO_{1-x}F_x$ superconductor is found to be a potential candidate for magnet applications due to its very upper critical fields of about 300 T. The superconductor was synthesized at relatively low temperatures and ambient pressure. The highlight of the work is that even after opting a synthesis technique devoid of special precautions such as initial binary preparation, wrapping with expensive sheath materials or usage of high pressure capsules, the transition temperature and transport critical current density obtained are competitive or even better than the reported values.

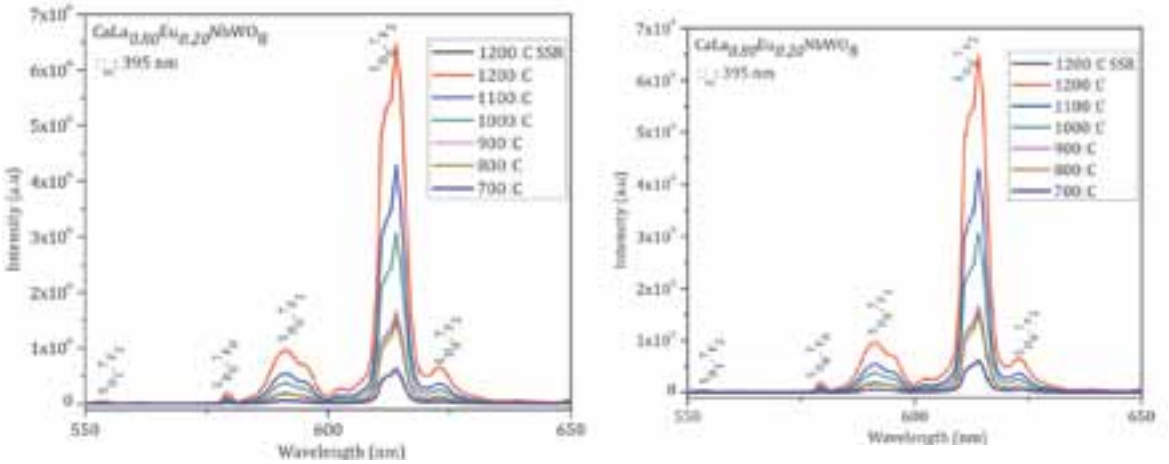


R-T plots of $NdFeAsO_{1-x}F_x$ (x=0, 0.1, 0.2, 0.3 and 0.4).

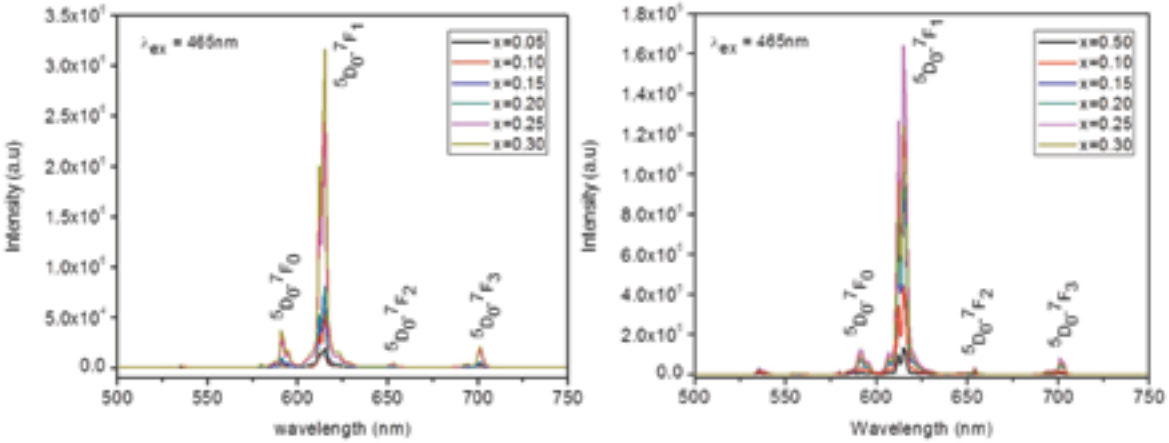
Development of novel inorganic oxide phosphors for electrical and electro-optical applications

Development of luminescent powellite/scheelite structured red phosphors, orange-red emitting $La_3NbO_7:Eu^{3+}$ phosphors, molybdenum based $KGd_{1-x}SnMoO_7$: x Eu^{3+} and $NaGd_{1-x}SnMoO_7$: x Eu^{3+} pyrochlore type red phosphors were investigated for achieving white light emitting diodes. Red phosphors such as $Ca(La/Gd)_{1-x}NbMoO_8$: xEu^{3+} and $Ca(La/Gd)_{1-x}NbWO_8$: xEu^{3+} were synthesized *via* citrate gel route and luminescence properties were studied. It was observed that morphological improvement enhance red emission by ~4 times. These phosphors are characterized by sharp red emission with longer life time and better color purity. Intense orange-red emitting host sensitized phosphors. $La_{3-x}NbO_7:xEu^{3+}$(x = 0.05, 0.10, 0.15, 0.20) were prepared by solid-state reaction route.

In these compounds intense orange red emissions were observed under near UV (394 nm) and blue (464 nm) excitations nicely matching with the output wavelengths of UV and blue LED chips. The emission intensity of the phosphor under blue excitation was nearly twice that of the phosphor under near UV irradiation. A new molybdenum based Pyrochlore type red phosphors $KGd_{1-x}SnMoO_7$: xEu^{3+} and $NaGd_{1-x}SnMoO_7$: x $Eu^{3+}x$ = (0.05, 0.10,0.15,0.20,0.25 and 0.30) were also attempted. Increased absorption strength of $^7F_0$-$^5L_6$ and $^7F_0$-$^5D_2$ transitions were observed in these materials. The intensity of 465nm excitation peak was more compared to that of 395nm excitation matching well with the excitation wavelength of blue LED chip.



Photoluminescence emission spectra of $Ca(La/Gd)_{1-x}NbMoO_8$: xEu^{3+} and $Ca(La/Gd)_{1-x}NbWO_8$: xEu^{3+} Phosphors

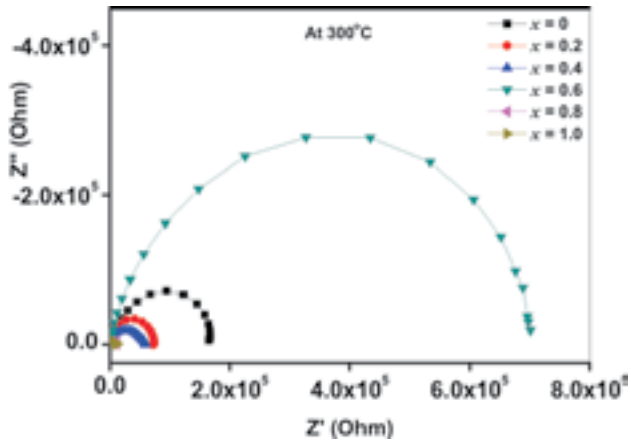


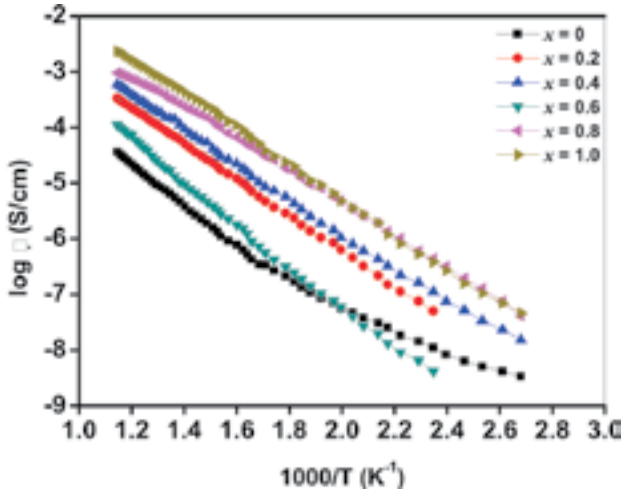
Photoluminescence emission spectra of($KGd_{1-x}SnMoO_7$& $NaGd_{1-x}SnMoO_7$): x Eu^{3+}

Development of oxide ion conductors and high temperature NTC thermistors

Quaternary pyrochlore-type solid solutions, $CaGdZrNb_{1-x}Ta_xO_7$ (x = 0, 0.2, 0.4, 0.6, 0.8, 1), and $CaZrO_3$-$Gd_2Zr_2O_7$ solid solutions with x mol% of $CaZrO_3$ in $Gd_2Zr_2O_7$ (x = 10, 20, 33.3, 40) were prepared by a high-temperature ceramic route. The isovalent substitution of Ta in place of Nb revealed the effect of chemical bonding on lattice thermal expansion and oxide ion conductivity. Role of chemical bonding in deciding the conductivity of pyrochlore oxides was evident and it confirmed dominance of the 48f-48f mechanism of oxide ion conduction. $CaZrO_3$ was found to dissolve in $Gd_2Zr_2O_7$ defect fluorite phase up to 33.3 mol% with gradual decrease in lattice parameter. The presence of additional Zr ions assisted in accommodating more divalent Ca ions to the lattice

without secondary phase formation. The increase in oxygen vacancy led to enhance the ionic conductivity which was found to show a maximum value of 3.59 x10^{-3} Scm^{-1}at 1023 K for x=33.3. These ionic conducting ceramic oxides can be used as electrolytes for SOFCs.





In addition to the ionic conductors, development of NTC thermistors based on new Mn substituted pyrochlore semiconducting oxides $CaCe_{1-x}Mn_xTiNbO_7$ (x = 0-1.0) was also studied. A new series of NTCR semiconducting oxides in $CaCe_{1-x}Mn_xTiNbO_7$ (x = 0, 0.2, 0.4, 0.6, 0.8 and 1.0) system was prepared. From the X-Ray diffraction study a phase transition from cubic to monoclinic was observed progressively with Mn substitution. The electrical conductivity measurements demonstrated the NTCR behaviour. The conductivity of the monoclinic structured compounds was observed to be higher than the cubic pyrochlore. The thermistor constant at 300°C and 600°C was found to lie in the range 5000 – 9000 K and the sensitivity values were in the range of 1-2%. Cubic pyrochlores provided high and efficient thermistor parameters in a wide range of temperatures promising to high-temperature thermistors device.

Materials for magnetic refrigeration and spintronics

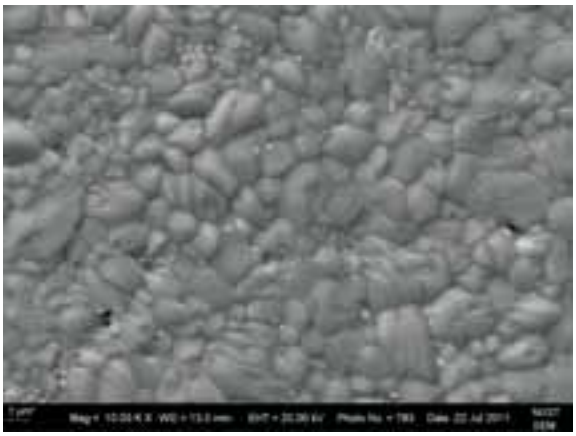
$La_{2/3}Ca_{1/3}MnO_3$ material doped with transition metals Co, Fe was developed and its magnetocaloric effect was investigated for possible applications as magnetic refrigerants. Similarly double perovskites Sr_2FeTiO_6 having room temperature relaxor ferroelectricity and spin glass behavior were prepared and properties were studied. The properties and magnetocaloric effect of perovskite manganite in $La_{0.67}Ca_{0.33}Mn_{1-x}Co_xO_3$ (x = 0.03, 0.1 and 0.15) series were studied. The Curie temperature as well as magnetic moment decreased with increasing cobalt doping concentrations and the sintered ceramics exhibited characteristics of spin/cluster glass state. The magneto caloric effect studies revealed a large magnetic entropy change of 4 J/ kg K at 3T magnetic field in Co doped $LCMCo_{0.03}$ compound. The relative cooling power was found to be ~184 J/kg in the case of $LCMCo_{0.03}$ and ~114 J/kg in the case of $LCMCo_{0.1}$ in a magnetic field change of 5T. An enhanced magneto resistance (MR) up to 87% and considerable magnetic entropy change make these cobalt doped compounds attractive for magnetic refrigeration application.

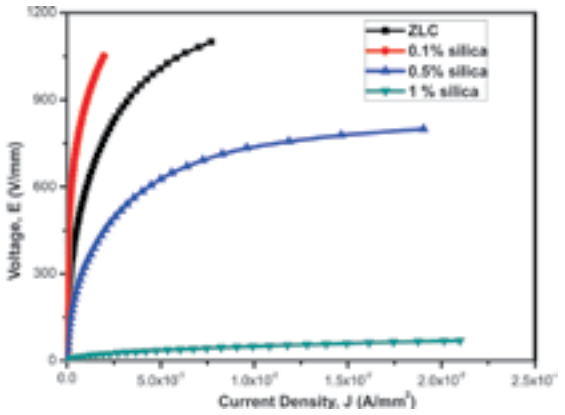
The compound Sr_2FeTiO_6 is a solid solution oxide mixture of ferroelectric $SrTiO_3$ and ferromagnetic $SrFeO_3$. Sr_2FeTiO_6 is a magnetic half metal with total magnetic moment ~2μ_B. The substitution of titanium for iron is of interest because of the stability and site preference of Ti^{4+}. Detailed characterizations of the structure, electrical and magnetic properties of Sr_2FeTiO_6 complex double perovskite were investigated. The temperature evolution of crystal structural studies indicated the absence of structural changes with temperature. The sintered ceramics exhibited heterogeneous grain distribution with average grain size of 1 -7.5 μm. Dielectric properties showed a broad dielectric anomaly

coupled with a shift in dielectric maxima towards higher temperature with frequency, exhibiting a typical relaxor ferroelectric behavior.

A new ZnO-La_2O_3-CeO_2 rare earth based high energy varistors

High energy ZnO varistors with La_2O_3-CeO_2 rare earth additions were successfully developed under a sponsored project. Fine-grained, dense ZnO varistors prepared with combined additions of La_2O_3 and CeO_2 at 1300°C.





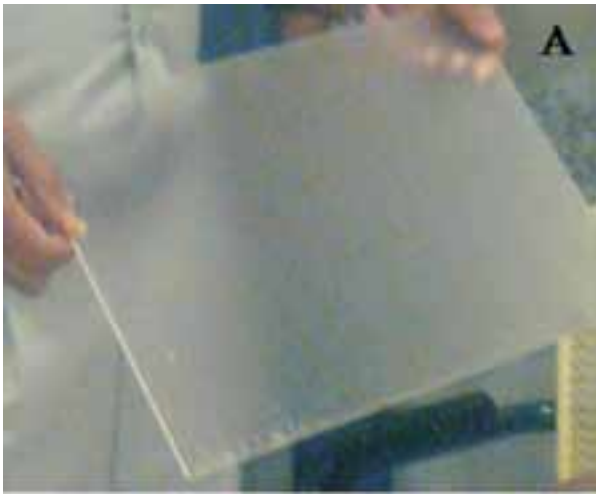
Microstructure and I-V characteristics of the ZnO-La_2O_3-CeO_2 varistors

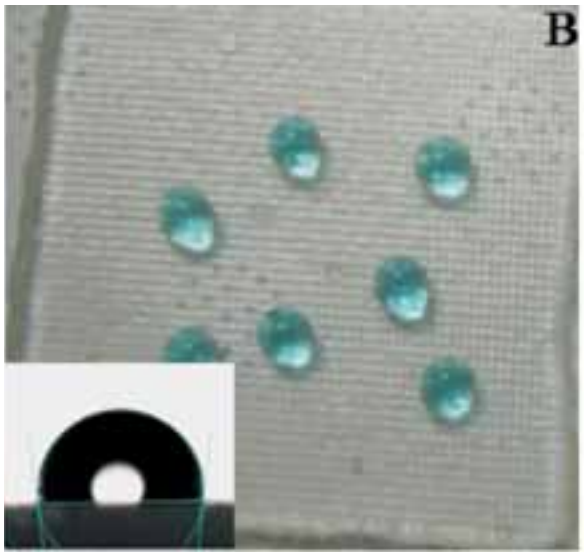
This composition was never attempted before. The use of Bi_2O_3 and Sb_2O_3 were also completely avoided. Sintered ZnO grain size of <4 μm was achieved. The effect of glass addition to engineer the grain boundary was examined. This new rare earth varistor composition has shown breakdown voltage as high as 600 V/cc.

Functional Nano Ceramics

Photo active nano titanium oxide coatings on solar panels

As continuation of the research activity in the area of sol gel titanium oxide, low temperature titanium oxide coatings were demonstrated on large area solar cell glass covers under a sponsored project. The dip coating process developed in laboratory level was switched over to spray coating for large area panels. Near transparent coatings having excellent photo activity and hydrophobicity were achieved. First layer consists of a UV curable monomer over which a functionally modified titania layer is deposited and then the glass is subjected to curing under UV radiation for a period of 5 minutes.



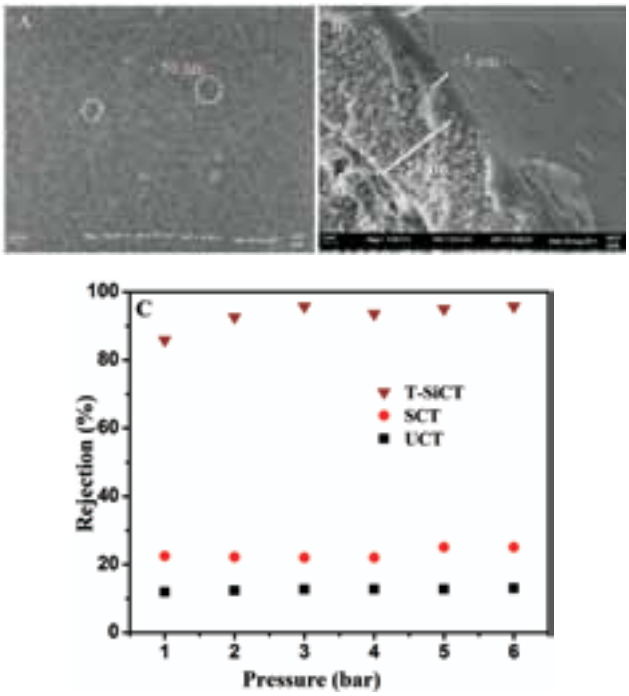


Solar cell cover with (A) Inorganic-organic hybrid coating (B) Hydrophobic nature of hybrid coating and (C) Photograph of NAL glass substrate coated with doped titania composition

The adherent coating is transparent (transmittance - 94%), hydrophobic (water contact angle - 96°) and self cleaning (dye degradation efficiency -94%). A new project was initiated to investigate novel applications of photoactive titania. Specific nano titania doped composition was also developed for coating on front glass of the visibility measuring system "Dristi" developed solely by National Aerospace Laboratories (NAL) Bangalore which is installed in the airports of New Delhi and Lucknow. Field studies showed that even under severe fog conditions, the visibility was excellent due to the self cleaning titania coatings provided on the front glass of the equipment, so that the sensors could perform well. A facile microwave treatment to crystallize the titania sol and was also developed in the laboratory. It showed enhanced photo activity compared to conventionally calcined titania. Particles are very small and elongated having size of ~7 nm with high surface area (~170 $m^2 g^{-1}$).

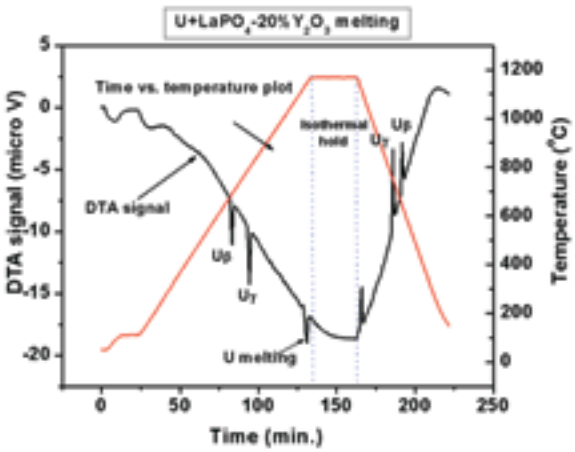
SiO_2 doped TiO_2 ceramic membranes

Multi functional silica doped TiO_2 ceramic membrane in the lower ultra-filtration range was achieved through coating on porous substrate (average pore size 1.3 µm) using multi layer coating technique having primary layer with alumina particles of size 0.3-0.35 µm followed by titania particulates of size < 20 nm. The effective pore size was about 11 nm, as determined by molecular weight cut off (MWCO). Water Flux was < 50 l/m^2h. The flux after the first layer coating was 400 l/m^2h. SEM images and efficiency of silica doped titania membrane are shown in the following figure (A, B, & C respectively). The photo active coating could decolorize 50 % methylene blue (MB) under UV-A (315-400 nm) irradiation for 2h.



SEM images (A) surface (B) Interface of coating on a porous substrate (C) Efficiency measurement (MWCO) of Silica doped Titania membrane. UCT-Uncoated, SCT- Primary layer T-SiCT-Silica doped Titania membrane.

High temperature non-reactive lanthanum phosphate

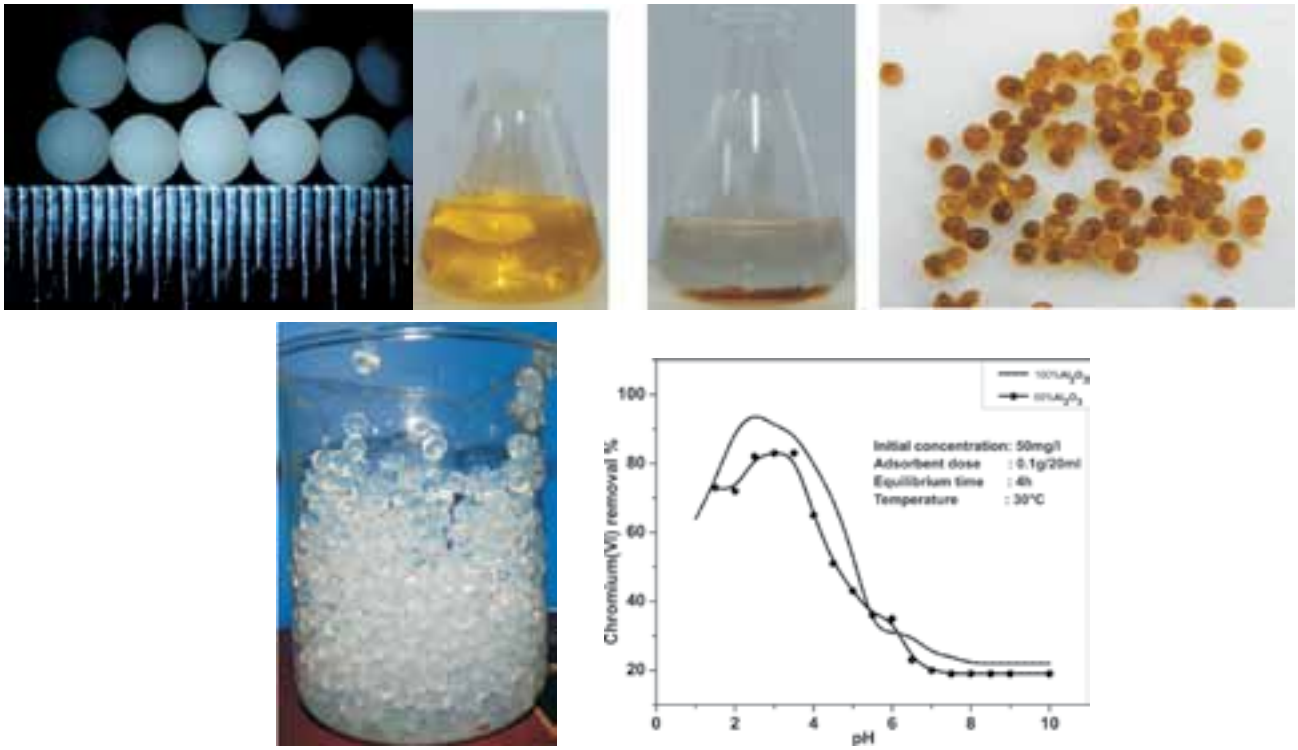


DTA graph showing non-wettability of the composite with uranium

An important property of lanthanum phosphate is its non-reactivity and non-wettability with molten metals. Synthesis of lanthanum phosphate-yttria nano composites and investigation on the interaction with molten uranium metal were carried out jointly with Indian Rare Earths Ltd and Bhabha Atomic Research Centre, Mumbai. Various compositions of the composite containing 5-20 wt% yttrium oxide were prepared by sol-gel process and tested at BARC under controlled atmosphere conditions. No reactivity was observed between the composite and molten uranium metal. Differential thermal analysis data indicated no reactivity between the two components.

Surface grafted mesoporous alumino-siloxane sol gel sorbents

Granular shape, amine grafted alumino-siloxane hybrid sorbent prepared by sol-gel assisted *in-situ* coagulation and co-condensation reaction. Adsorption application study of alumino-siloxane hybrid support was explored in polluted aqueous medium having high concentrations of Cr (VI) ions. Firstly, self assembly of aminated sol gel boehmite [A-HB] and behmite/silica [A-HBS] were prepared through nano casting technique. The granular hybrid sorbent was subjected to the Cr (VI) adsorption at acidic pH conditions with initial concentration of 100mgL^{-1}. This new inorganic, mesoporous hybrid sorptive support showed decontamination of chromium ions effectively from aqueous environment. The study revealed that the ion exchange and electrostatic interaction between protonated amino groups in the hybrid effectively controlled the adsorption process.



Sol gel derived amine grafted alumino-siloxane hybrid supports and its Cr(VI) adsorption efficiency

Innovative dark-catalysis process for the industrial dye-removal application

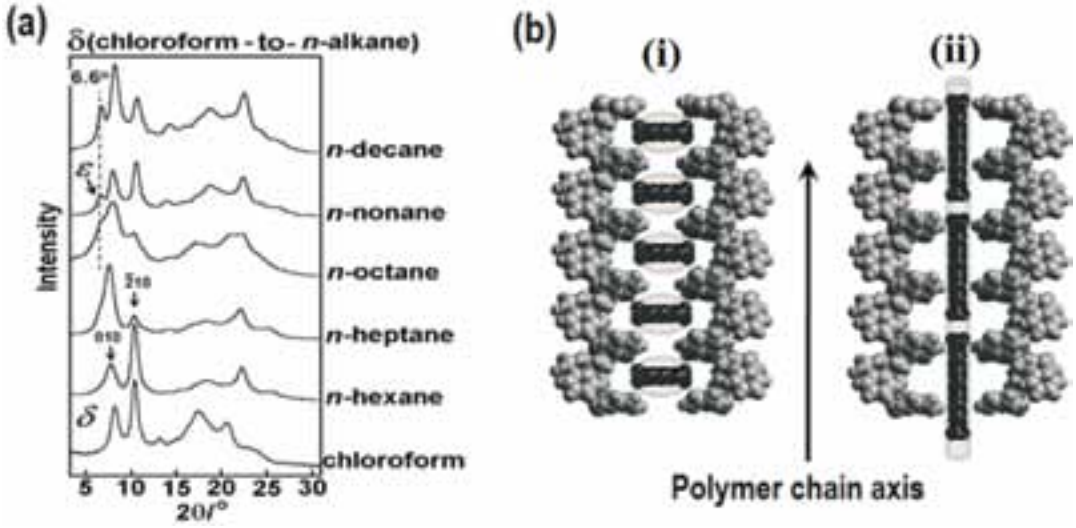
A new catalyst developed which can decompose the organic synthetic-dyes in the aqueous solutions under the dark-condition, that is, without the requirement of an exposure to the external-radiation such as the ultraviolet, visible, solar and fluorescent-light. The new technology has been demonstrated at the laboratory level using the methylene blue dye which is a basic dye and the industry effluent sample containing Direct Dye Blue 5GLL which is a reactive dye.

Dye-decomposition via innovative dark-catalysis process.

POLYMERS AND COMPOSITES

Structural changes in nanoporous crystalline phases of syndiotactic polystyrene during the guest exchange process with n-alkanes

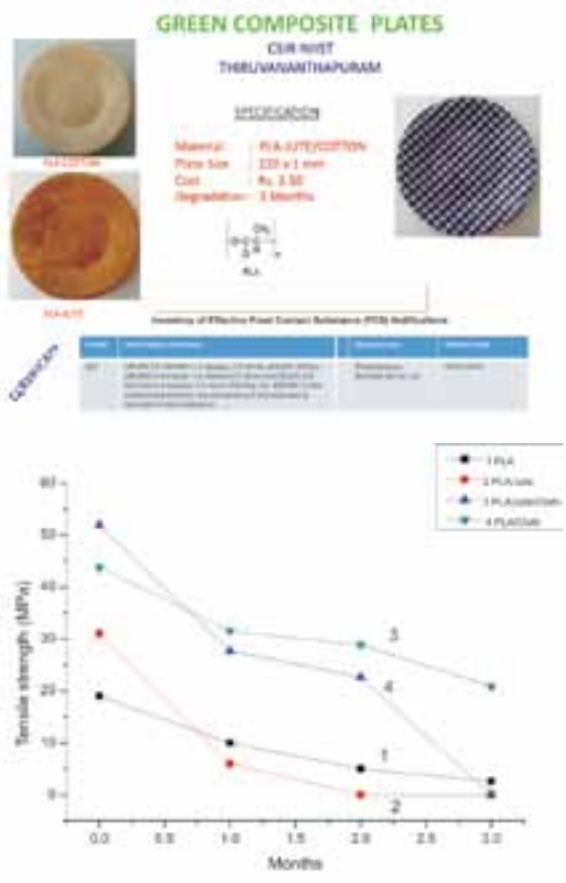
Syndiotactic polystyrene has a tendency to form polymer-solvent complexes (co-crystals) with a large number of guest molecules. Suitable extraction procedures of these guest molecules resulted in the formation of nanoporous crystalline phases. These nanoporous materials are used to understand the structural changes of syndiotactic polystyrene during the guest exchange process with a series of *n*-alkanes. The volume of the *n*-alkane played a crucial role in the choice of the polymer co-crystal that can be obtained after the guest exchange process. It was also observed that when the *n*-alkane molecular volume is above 160 Å^3, the guest molecules reside in the crystalline lattice with their main molecular axis parallel to the polymer chain axis. This research opens new possibilities to study the confinement of molecular guests in crystalline polymeric frameworks and development of molecule based materials and devices with enhanced properties.



X-ray patterns of the δ form samples containing n-alkanes after the solvent exchange from chloroform to n-alkanes. (b) Schematic illustration of possible packing arrangements of n-alkanes between one pair of polymer chains in sPS-n-alkane complex systems. (i) n-alkanes with molecular volume < 160 Å^3 (ii) n-alkanes with molecular volume > 160 Å^3.

Biodegrdation of polylactide-natural fiber composites

Petroleum based commodity plastics such as polyethylene, polypropylene, polystyrene and polyethyleneterephthalate are nondegradable in nature and cause serious environmental problems. Polylactic acid (PLA) based biodegradable polymers are the best alternative but use of which is limited due to high cost and brittle nature. Natural fiber/PLA composites are expected to reduce the brittle nature of the polymers induce toughness without affecting its degradability. Additionally these natural fibers which are widespread and available in plenty in different forms can reduce the cost of the final product. This is expected to generate income for the farmers as well as create job in the small scale sector leading to economic empowerment. Commercial



Polylactide (REVODE101) dichlomomethane solution was used for the preparation of non-woven jute mat prepregs and thermoformed at 150°C using hydro pneumatic thermoforming press. The effect of fiber content on mechanical properties was evaluated by tensile property measurements at various fiber contents. The PLA films were extruded using Haake Twin Screw Extruder and PLA/Cotton composites were also fabricated and studied for the thermoforming properties.

About 600 pieces of serving plates were produced and demonstrated for serving snacks as part of the CRSI National Symposium held in NIIST, Trivandrum during Feburary, 2012. Biodegradability studies were also carried out by soil burial test as per ASTM standard. The PLA/Jute samples degraded within 2 months compared to PLA alone which took more than 3 months.

Polymer and Rubber Composites

Phosphorylated cashew nut shell liquid prepolymer modified elastomeric contact adhesives have been developed and it finds applications in furniture upholstery and for bonding CRC floor/roof tiles.

Studies on Coir–Rubber Composite (CRC) products have been carried out under the National Coir Research and Management Institute sponsored Project. Molded CRC composites (1' x 1') were used successfully as roof tiles for house and as office flooring material.

CRC Floor tiles

Metals and Minerals

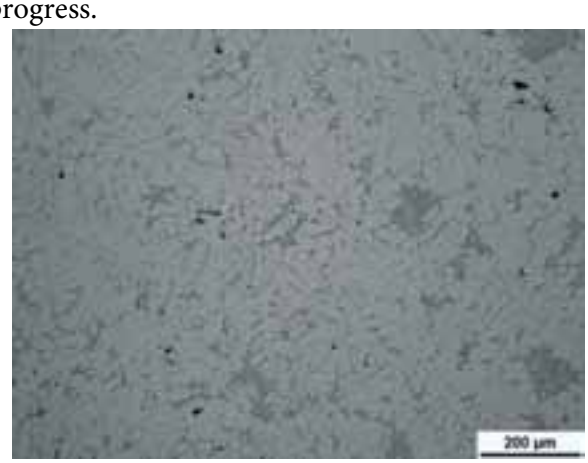
Development of high strength aluminium alloy and squeeze casting of two wheeler connecting rod

The development of a high strength cast Al alloy by the addition of 0.40-0.45% Mg to Al-Si-Cu alloy (319) was reported earlier. The mechanical properties obtained for this alloy was UTS: 423-425MPa and elongation: 3% compared to the targeted properties of UTS > 400 MPa and elongation: 8%. The elongation is proposed to be increased due to the micro structural refinement that can be obtained by squeeze casting. Squeeze casting combines permanent mould casting with die forging into a single operation where molten metal is solidified under high applied pressure. Generally, the squeeze cast engineering components are fine grained with excellent surface finish, have almost nil porosity, and have superior mechanical properties compared to conventional die casting.

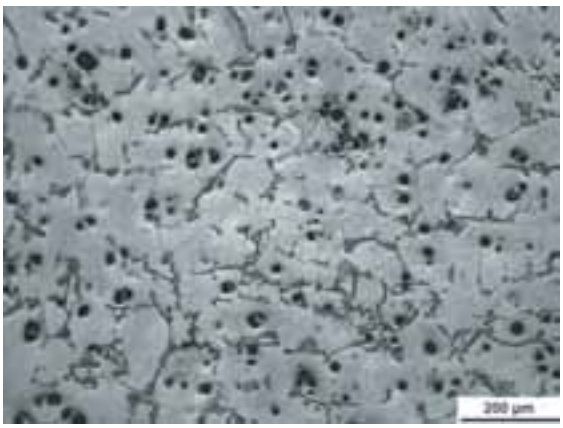
Connecting rods for a two wheeler were made by indirect squeeze casting. During indirect squeeze casting, the melt is poured into the shot sleeve of a squeeze casting machine. From there, it is injected into the die through relatively large ingates and at relatively slow velocity. The squeeze casting was carried out at the National Facility for Semisolid Forming, Dept. of Mechanical Engineering, Indian Institute of Science, Bangalore in a Buhler Vision N42 die casting machine. The connecting rods were made using 319 alloy to which 0.40/0.45% Mg was added. Two connecting rods were made in a single shot.

Two wheeler connecting rod

Microstructural analysis of the squeeze cast samples showed a finer microstructure compared to the gravity die cast samples. The finer microstructure should result in higher mechanical properties. Small amount of microporosity was observed in the squeeze cast samples. This may be due to the insufficient degassing of the melt prior to squeeze casting. The evaluation of the mechanical properties of the squeeze cast connecting rods is in progress.



(a)



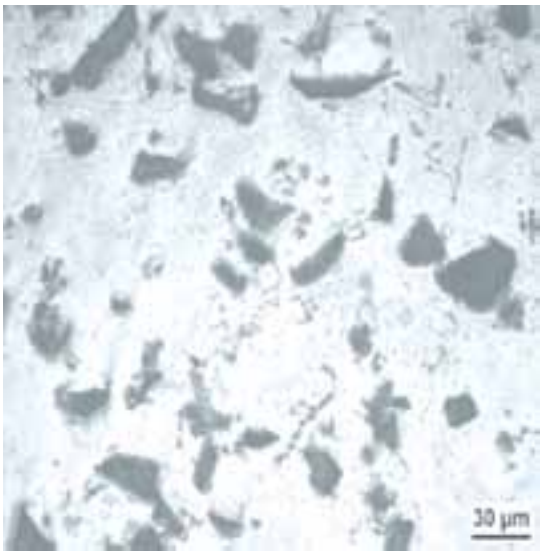
(b)

(a) Microstructure of squeeze cast connecting rod (as cast)
(b) Microstructure of gravity die casting from the same melt

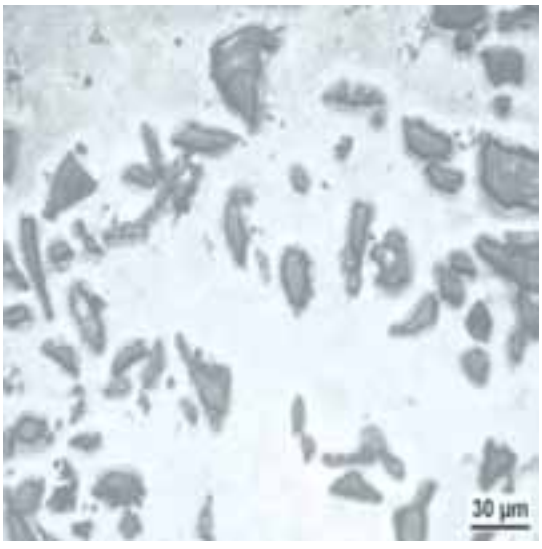
Processing and characterization of AZ91/SiC composites (Mg MMCs)

Synthesis of SiC particle reinforced AZ91 Mg MMC was carried out by liquid metal stir casting technique with optimized processing conditions. The role of different wt% of silicon carbide (SiC) particulates on mechanical properties and wear resistance of magnesium MMC as well as the structural characteristics such as particle distribution,

grain refinement and particle/matrix interfacial reactions were studied. The results revealed good particle distribution in the matrix, grain refinement and good interfacial bonding between the matrix and reinforcement. The co-efficient of thermal expansion (CTE), tensile properties, compressive properties, micro as well as macro hardness and fracture behavior of the composites were studied and compared with the base alloy AZ91.



(a)

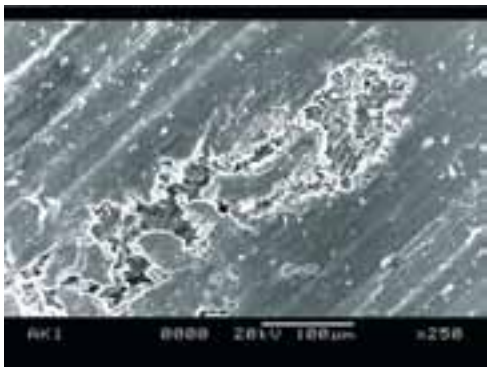


(b)

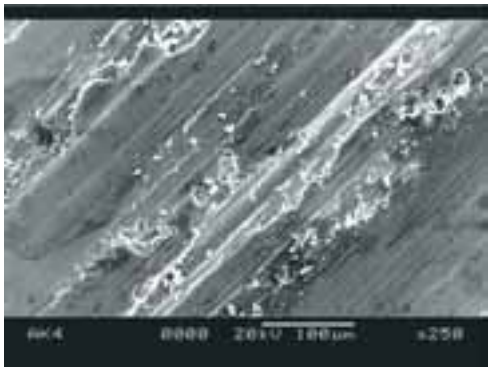
Microstructures of AZ91 Mg -SiC MMC (a) 10 wt% (b) 15wt%

Dry sliding wear behaviour of Mg-Si alloys

The wear behaviour of Mg-Si alloys during dry sliding condition has been evaluated. Different hypo [Mg-0.5, 0.7, 1.15 wt% Si] and hyper [2, 4, 6, 8 and10 wt% Si] eutectic Mg-Si alloys were prepared by gravity casting method. The microstructure morphology was studied along with the pure magnesium. Various parameters such as alloy compositions, normal loads with constant sliding speed and sliding distance were conducted using pin on disc configuration against a hardened chromium steel counter face. The high silicon magnesium alloys showed better wear resistance compared to hypoeutectic Mg-Si alloys because of coarse and hard primary Mg_2Si *in-situ* reinforcements. Scanning electron microscopy of worn surfaces and wear debris carried out to determine the grooving wear mechanisms in the alloys. The results indicated that the size of cracked Mg_2Si particles and debris play an important role in deciding the wear behaviour of composite.



(a)



(b)

Worn surface of Mg-Si alloy with 19.6 N normal load (a) 6 Si and (b) 10 Si

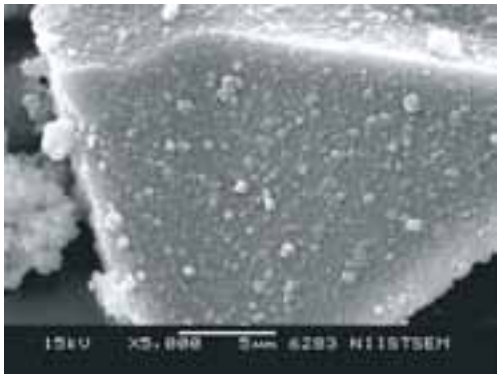
Centrifugally cast LM13 aluminium alloy cylinder liners

LM13 aluminum alloy cylinder liner was fabricated by vertical centrifugal casting method using water spray cooled mould. Water cooled mould gave higher properties and refined microstructure compared to atmospheric air and compressed air cooled moulds. Centrifugally cast cylinders provided high strength, hardness and 3 to 4% elongation compared to gravity cast alloys.

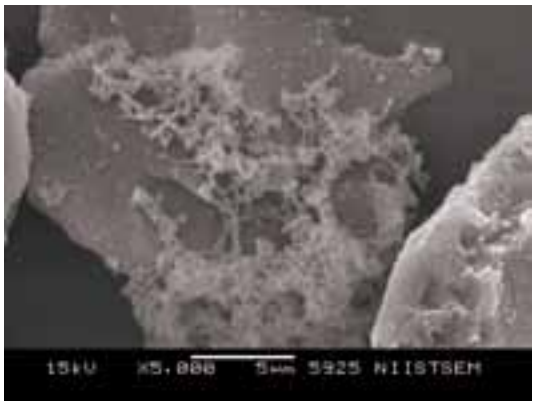
Centrifugally Cast LM13 Aluminium alloy Cylinder Liner

Formation of autocatalytic nickel boride alloy coating on boron carbide particles

Electroless/Autocatalytic Ni-B alloy coating on alkali treated B_4C particles under varying bath and drying conditions showed effective surface adsorption at pH=8 in 75°C bath reaction condition in presence of bath stabilizer. The co-deposition and agglomeration of Ni-B clusters deposits on B_4C particles increased with increase in bath reaction condition. The surface characteristics of coating on particle changed dramatically from mesh-like to platelet like with increase in bath alkalinity.



(a)

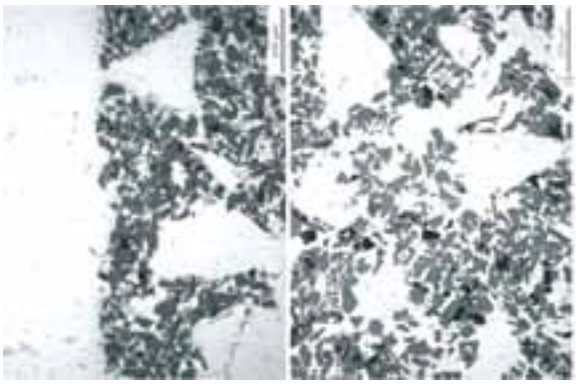


(b)

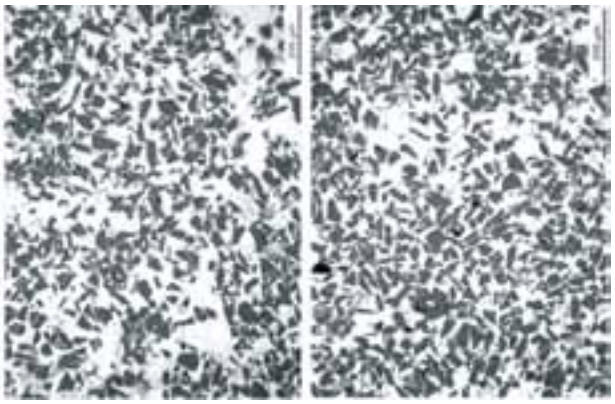
Autocatalytic Ni-B alloy coating on boron carbide surface (a) at pH8 shows uniform coating and (b) at pH10 shows clustering and co-precipitation.

Fabrication of functionally graded aluminium-SiC composite by infiltration technique

The functionally graded metal-ceramic composite are used for wide spectrum of applications in different areas such as aerospace, automotive, defense, electronics and communication, electrical, structural, biomedical and in general engineering applications. Squeeze infiltration of functionally graded porous ceramic preform is one of the potential techniques to obtain FGM with high volume of reinforcement having different layers. The graded SiC preform was synthesized by stacking of 3 layers containing different volume fraction of SiC particles, with less expensive inorganic salts as pore former. Direct squeeze infiltration of molten aluminium into porous SiC graded preform was successfully adopted for the formation functionally graded Al-SiC metal ceramic composites with gradient particle distribution.



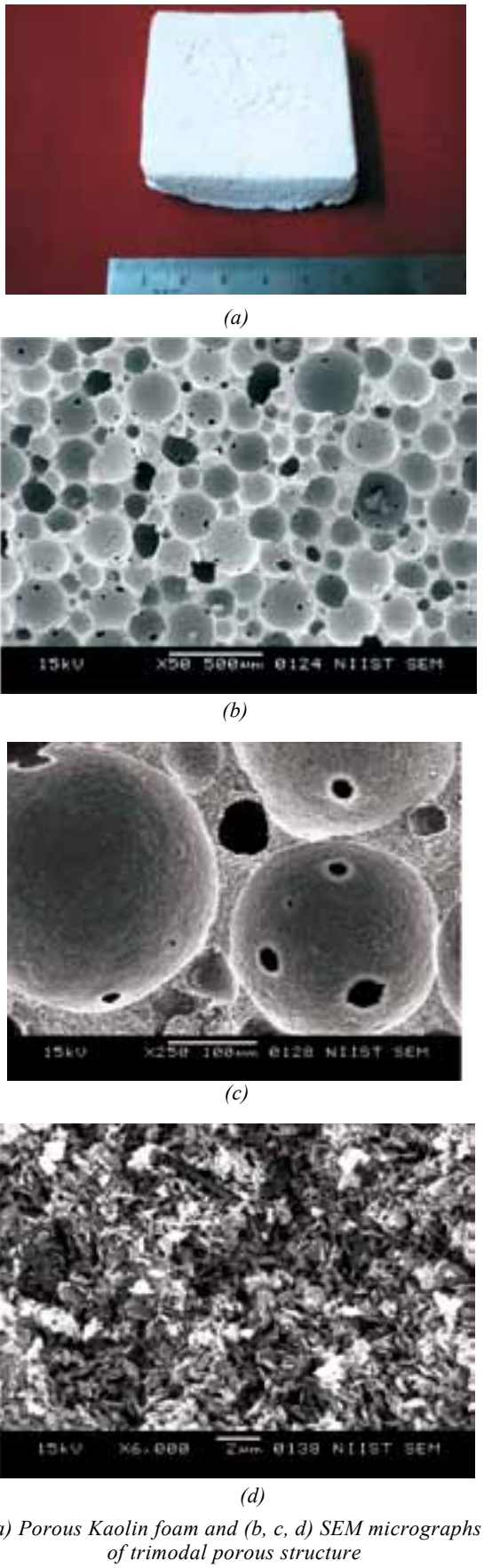
(a) *(b)*



(c) (d)
Micrograph of functionally graded Al(6061)-SiCp composite by infiltration processing

Trimodal porous structures by polymerization induced setting of surfactant stabilized clay foam

Porous and cellular materials are widely used for functional and structural applications, such as support for catalytic reaction, filtration of hot corrosive gases and molten metals in various industrial processes and as implant biomaterials. Macro porous kaolin materials with trimodal pore structure was processed successfully by direct foaming of premix clay slurry dispersed using sodium polyacrylate (SPA) with the aid of anionic surfactant sodium dodecyl sulphate (SDS). SDS will form micelle at air water interface and the clay particles are dragged towards the hydrophilic head of the SDS. The partially polymerized methylol urea added to the foam will get cross linked and set the foam by the formation of urea formaldehyde. The air bubbles in the aqueous foam get converted into a porous structure after controlled drying. Porosity and pore structure can be tuned by varying the surfactant concentration. Sintering at 1300°C provided enhanced strength to the porous structure. This facile method leads to a highly porous, low density structure with porosity $\geq$ 90%.



(a)

(b)

(c)

(d)

(a) Porous Kaolin foam and (b, c, d) SEM micrographs of trimodal porous structure

Process for preparation of titanium feedstock for the welding electrode flux

Titanium feedstocks such as natural rutile, synthetic rutile, titanium dioxide are used extensively in the preparation of welding rod flux materials. However, a sharp increase in the price of rutile feedstocks in the world market in recent years, had forced many in the welding electrode manufacturing sector to look for alternative and cheaper titanium feedstocks. Responding to a similar interest from a leading manufacturer of welding rods, NIIST had initiated a programme for the development of a process flow sheet for the preparation of suitable titanium feedstock for electrode flux from ilmenite.

Subsequent to a full scale physical and chemical characterization, the ilmenite supplied from Sri Lanka was subjected to reduction using coal supplied by the electrode manufacturer. The reduction experiments were carried out in a batch tubular reactor wherein over 85% of iron oxide was reduced to metallic iron. The metalized product after separating from excess coal and other non-magnetic particles by magnetic separation was subjected to aeration rusting for the removal of metallic iron and enrichment of the product thereon in terms of TiO_2 content. Beneficiated ilmenite thus produced was subsequently employed in various combinations in the preparation of electrode flux and welding rods. Parameters such as arc stability, ease of slag removal, electrode colour, slag coverage, weld bead, blow holes, weld shine etc., were evaluated. Preliminary trials showed the electrodes with flux material prepared with 50% beneficiated ilmenite after heating at 800°C and 50% rutile gave satisfactory results during welding. Discussions on the pilot plant trials based on ilmenite sourced from Sri Lanka and transfer of know how is under progress.

An Investigation on the potential beach placer deposits along Thiruchendur Coast, Tamil Nadu, India

The study was done on the Thiruchendur coast of Tamilnadu. Several samples were collected and analyzed to resolve the heavy mineral concentration. The collected samples underwent heavy mineral separation and were studied in detail to understand its concentration and to know about the nature of the source from which the sediments are derived. Based on the study, it is inferred that the total heavy mineral weight percentage varies from 74.33 to 88.90% and the area is dominated by Garnet>Silimanite>ilmenite.

PROCESS ENGINEERING & ENVIRONMENTAL TECHNOLOGY DIVISION

Process Engineering & Environmental Technology Division develops innovative technologies for managing the environment as well as for processing and adding value to natural resources. Knowledge-based services like environmental impact analysis and pollution monitoring are also provided. The Division has a vibrant computational group that uses computational methods for investigating natural phenomena and for designing engineering processes. Consisting of engineers, chemists, physicists, mathematicians, biologists and computer scientists, the division uses interdisciplinary skills to solve real problems on the ground. Some of the issues that are being addressed are:

- Municipal and household waste treatment
- Industrial effluent treatment
- Odour control
- Monitoring of dioxin release in the environment
- Environmental impact analysis
- Water quality analysis
- Extraction of natural fibre from plant materials
- Production of white pepper from black and green pepper
- Beneficiation of clay and other minerals
- Enhancing industrial profitability through affordable indigenous software

Along with the emphasis on problem solving, efforts are also made to enhance the skill base and deepen understanding of engineering processes and natural phenomena. In this connection projects with futuristic goals have also been undertaken. Examples of such projects are:

- Production of Biodiesel from algae
- Analysis and Remediation of Perchlorate in water
- Lake Remediation
- Development of Agent based simulations
- Computational Fluid Dynamics

Highlights

- Transfer of casting simulation technology to 3DFoundryTech, Mumbai
- Design and development of an outdoor raceway reactor that selects for auto-flocculating micro-algae with high lipid content for producing biodiesel
- Development of a family size bioreactor for treating kitchen wastes and producing biogas
- More licenses given for the technology for white pepper production

The activities of the Division are under four sections namely Chemical Process Engineering, Environmental Technology, Computational Modelling and Simulation and Dioxin Research.

प्रोसेस इंजीनियरिंग और पर्यावरण प्रौद्योगिकी प्रभाग

प्रोसेस इंजीनियरिंग और पर्यावरण प्रौद्योगिकी प्रभाग द्वारा पर्यावरण प्रबंधन तथा प्राकृतिक संसाधनों के प्रसंस्करण एवं मूल्यवर्धन के लिए अभिनव प्रौद्योगिकियों का विकास होता है । प्रभाग द्वारा पर्यावरण प्रभाव के विश्लेषण और प्रदूषण की निगरानी के लिए ज्ञान आधारित सेवा भी प्रदान की जाती हैं। प्रभाग में एक वाइब्रंट कम्प्यूटेशनल समूह हैं जो प्राकृतिक घटनाओं की जांच और इंजीनियरिंग प्रक्रियाओं के डिजाइन के लिए कम्प्यूटेशनल विधियों का उपयोग करता है। प्रभाग द्वारा इंजीनियरों, केमिस्टों, भौतिकविदों, गणितज्ञों, जीवविज्ञानियों और कंप्यूटर वैज्ञानिकों से मिलकर पृथ्वी की वास्तविक समस्याओं को हल करने के लिए अंतर्विषयी कौशल का उपयोग होता है। संबोधित किये जा रहे कुछ मुद्दे निम्न हैं:

- नगर और घरेलू अपशिष्ट उपचार
- औद्योगिक बहिः स्रावी उपचार
- गंध नियंत्रण
- वातावरण में डाइऑक्सीन रिलीज की निगरानी
- पर्यावरणीय प्रभाव का विश्लेषण
- जल गुणवत्ता विश्लेषण
- पादप सामग्रियों से प्राकृतिक फाइबर का निष्कर्षण
- काली और हरी मिर्च से सफेद मिर्च का उत्पादन
- मिट्टी और अन्य खनिजों का इष्टतमीकरण
- सस्ती स्वदेशी सॉफ्टवेयर के माध्यम से औद्योगिक लाभप्रदता का बढ़ाव

समस्या को हल करने पर जोर देने के साथ - साथ कौशल के आधार को बढ़ाने के लिए और इंजीनियरिंग प्रक्रियाओं और प्राकृतिक घटनाओं की समझ को सुदृढ़ करने के लिए भी प्रयास बने रहे हैं। इस संबंध में भविष्य के लक्ष्यों के साथ परियोजनाओं के कार्य भी किये गये हैं। ऐसी परियोजनाओं के उदाहरण हैं -

- शैवाल से बायोडीजल का उत्पादन
- पानी में पेरक्लोरेट का विश्लेषण और प्रतिविधि
- झील प्रतिविधि
- एजेंट आधारित सिमुलेशन का विकास
- कम्प्यूटेशनल फ्लुइड डायनैमिक्स

मुख्य विशेषताएं

1. 3डी फाउंडरी तक. मुंबई को कास्टिंग अनुकार प्रौद्योगिकी का हस्तांतरण ।
2. उच्च लिपिड सामग्री के साथ बायोडीजल के उत्पादन में स्वतः ऊर्णन सूक्ष्म शैवाल के चयन के लिए एक आउटडोर नाला रिएक्टर का डिजाइन और विकास ।
3. रसोई के कचरे का उपचार और बायोगैस के उत्पादन के लिए एक फैमिलि साइज बायोरिअक्टर का विकास ।
4. सफेद मिर्च के उत्पादन के लिए विकसित प्रौद्योगिकी के लिए अधिक लाइसेंस दिए गए ।

प्रभाग की गतिविधियॉ चार अनुभागों अर्थात् रासायनिक प्रक्रिया इंजीनियरिंग, पर्यावरण प्रौद्योगिकी, कम्प्यूटेशनल मॉडलिंग और सिमुलेशन और डाइऑक्सीन अनुसंधान के तहत हो रही हैं।

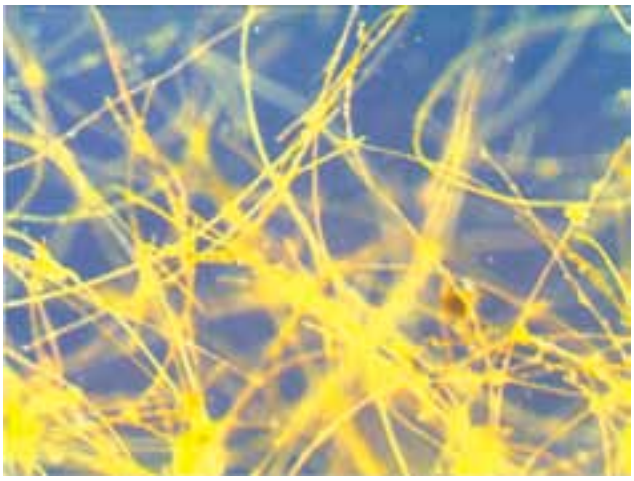
Environmental Technology

This year the main focus of the section has been on process design for producing micro algal biomass for extraction of biodiesel, treatment of municipal and household wastes, monitoring and remediation of pollution and environmental impact analysis.

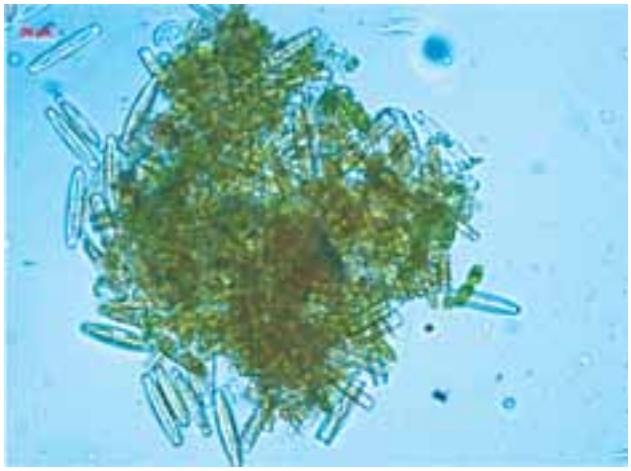
Biofuel from marine microalgae

Biodiesel is a substitute for the diesel currently obtained from fast dwindling fossil fuels. However diverting agricultural resources for production of vegetable oils for fuel puts unacceptable pressure on agricultural production. Hence there is a need to develop sources of biological oils that can be cultivated on non-agricultural land and without the consumption of fresh water. Microalgae is considered the only potential alternative to terrestrial plants for oil production. The technological challenge is to produce microalgae at oil yields in excess of agricultural crops. The main objectives of the present study are to develop auto-flocculating algae that are easily separated from water and to develop an algal raceway pond process to maximize the lipid yield. Both these objectives are to be achieved with perpetual cultures that require no seeding or re-seeding.

Auto-flocculating algal cultures (perpetual) have been developed by two methods. The first method is suited to continuous flow raceway ponds. It uses an innovative co-current tube settler. The second method uses a raceway pond process sequence of fill, react, settle and drain every day. This method was found to produce fast settling algae enabling complete recovery of biomass. A patent has been applied for a process to develop auto-flocculating algae. Detailed studies showed that auto-flocculating biomass develops as a result of natural selection for survival in the process condition applied to the raceway pond. Algae adopt several survival strategies that are manifested as auto-flocculation. These include growth in the form of filaments and growth in the form of mucilage bound dense flocks. The same organism can adopt various colony morphologies during various life cycle stages.

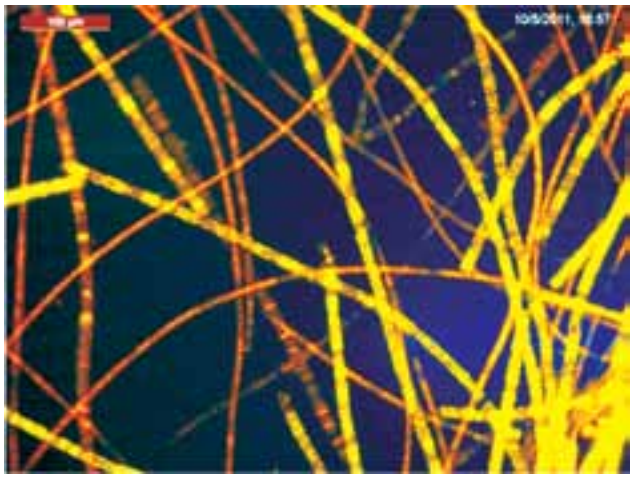


Algal growth as filaments that are easily harvested by settling and straining.



Algal flock with diatoms and green algae

The second objective of improving lipid content of algae was also achieved during the experiments last year. Here again the approach is to use natural selection as the driving force for lipid content increase. In this approach, the control reactor and process conditions to create a selection pressure in favour of algae that accumulate lipid. The increase in lipid content was achieved by temporal separation of cell division and energy storage phases. Control of nutrient loading characteristics allows nocturnal cell division and day time photosynthetic energy storage. A process patent has been applied for this method.



Photograph shows filaments of diatoms and green algae, bright field, stained with Nile Red. The same microscopic field is shown under fluorescence with green light excitation shows fluorescence from neutral lipids. The diatoms give yellow fluorescence, while the green algae give orange fluorescence. Even though the fluorescence from diatoms is much brighter, the total lipid content per unit mass for each organism is nearly the same. Diatoms appear brighter probably because of its transparent silica shell, whereas lipid fluorescence may partly be absorbed by chloroplasts in the green algae.

Fragilaria seen through scanning electron microscope showing silica frustules and pattern of pores. Fragilaria forming in the raceway reactor biomass has about 25% silica.

Anaerobic Leach Bed Reactor (ALBR) for treatment of solid wastes

The anaerobic leach bed reactor (ALBR) allows digestion of unsorted MSW containing non-degradable materials such as plastic. In the ALBR coarsely shredded MSW is contacted with leach liquor circulated through a UASB reactor. Volatile fatty acids (VFA) are formed during rapid decay of MSW is removed with the leach liquor and converted to biogas in a UASB reactor. The process design and basic engineering of a 5 TPD MSW leach bed pilot plant was carried out last year. The moisture content of around 85% in the treated MSW poses a problem for further treatment and complete stabilization of the material. This year studies were conducted extensively on the complete stabilization of the MSW after anaerobic pre-treatment. Moisture adjustment was attempted by mixing with low moisture garden soil. This mixing also supplies adequate microbial seeding for faster composting action. The soil content of the mixture was then re-

Photograph of compost produced from MSW through anaerobic leach bed treatment followed by aerobic composting

duced gradually by mixing with already composted material. This mixing of the garden soil and compost could achieve the overall moisture balancing to around 60% from 85% and produced stabilized organic compost.

Reverse Fluidized Loop Reactor treating china clay effluent

In continuation of the work started last year on removing contaminant iron mineral through microbial leaching and recycling the water, it was established that bio-oxidation of Fe (II) in industrial effluent employing Reverse Fluidized Loop Reactor (RFLR) is a feasible method. The study utilized RFLR for the treatment of an acidic Fe(II) rich effluent from clay-dithionite process which also contained phosphate, total dissolved solids, chloride, magnesium, and calcium. The effluent obtained after the china clay- dithionite treatment at pH around 3 was given to the reactor at a load rate of 3.5g Fe(II)/day, pH around 3.0 and oxygen supply of 9 L/min. Around 85% biooxidation of Fe(II) to Fe(III) was obtained at HRT of 5h. The XRD analysis of the precipitates formed within the reactor confirmed the formation of amorphous ferric hydroxide, which is the precursor of jarosite.

Reverse Fluidized Loop Reactor for Bio-oxidation of Iron (II)

Iron biooxidation could partially deplete the environment of soluble ferrous iron by oxidizing it to the ferric form that could co-precipitate with other components such as phosphate or sulfate to form insoluble complexes (e.g. jarosite) thus lowering the TDS of the treated effluent. Treated water when reused indicated that second cycle retained the biooxidation efficiency to the same extent at 85%. This accounted for the biooxidation of Fe(II) to Fe(III) at a load of 10.31g Fe(II)/ m^2 bed area. Suitability of the treated effluent for consecutive cycles of clay – dithionite treatment is under progress.

Family size compact anaerobic digester cum biogas plant

This is an improved anaerobic digestion system for managing household organic wastes. The anaerobic or biogas plants of small or medium sizes currently in use need large volumes of water and the solids are fed directly or after grinding. Such plants discharge large quantities of effluent containing partially and undigested organic matters including fats and fatty acids with less than 5% solids. Management of such digesters is extremely difficult due to the voluminous discharge of effluents with malodour, and regular requirement of precious water.

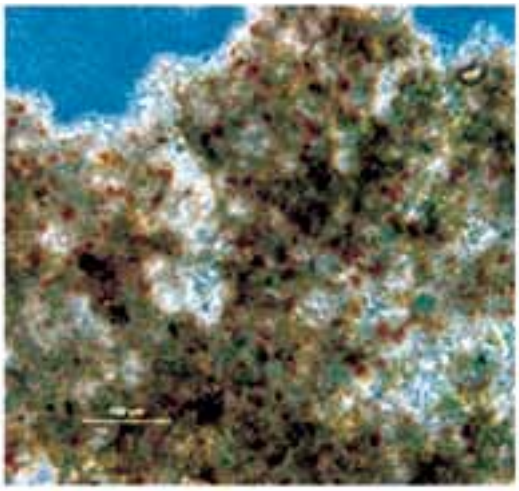
The newly developed anaerobic digester is a complete treatment system for the biodegradable household wastes. The digester of 350 litre volume is sufficient to treat around 3 kilograms wastes a day. It produces 250 to 600 litres of methane rich biogas daily by loading of 1 to 3 kg wastes as input. The biogas produced can be conveniently stored in biogas balloons, waste tubes or in the digester itself. There is no need of adding water or wastewater. Hard waste materials such as bones are fed through the attached crusher and its central axis rotated by hand for a few times to enable its thorough mixing with other biomass wastes. The wastes loaded through the inlet port travels more than 200 days in the digester before reaching the outlet. The horizontal design of the digester facilitates the slow

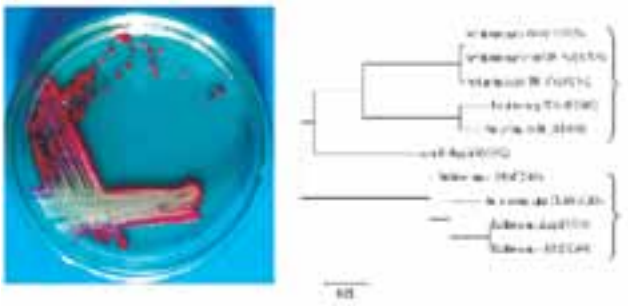
movement of wastes, thereby enabling decomposition of large sized wastes materials. The digested discharge from the outlet is thick slurry free from acidic foul smell unlike the discharge from widely used household biogas plants. The discharged slurry can be easily collected and stored conveniently for direct soil applications upon requirement.

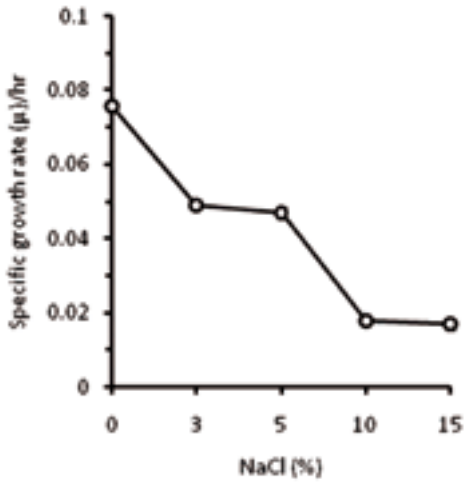
Household Wastes Digester cum Biogas plant

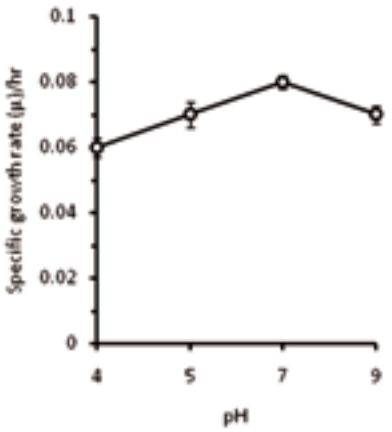
Bioremediation of perchlorate

In continuation of the work on bioremediation of perchlorate, an enrichment microbial consortium was developed for degrading perchlorate into innocuous chloride. The consortium was tested for degrading the compound present in discharge water from ammonium perchlorate manufacturing units and user industries. A number of perchlorate reducing bactetia (PRB) were isolated from the enrichment consortium and 16sDNA gene sequences were submitted to GenBank. A *Serratia* species was isolated from the reactor biofilm degraded perchlorate under extreme pH (4-9) and salinity (up to 15%). The salt/extreme pH tolerant PRB strains like *Serratia* sp. (GenBank No. JQ 807993) have good application potential in perchlorate remediation systems.



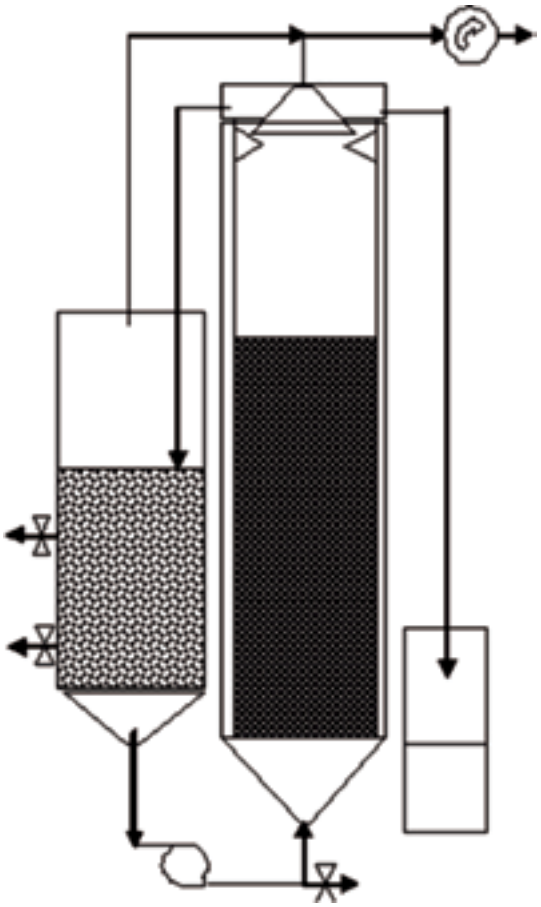




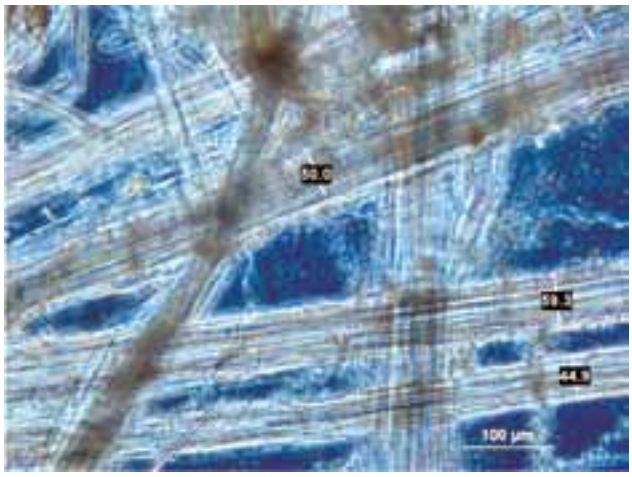


Anaerobic digestion of water hyacinth biomass for value added products

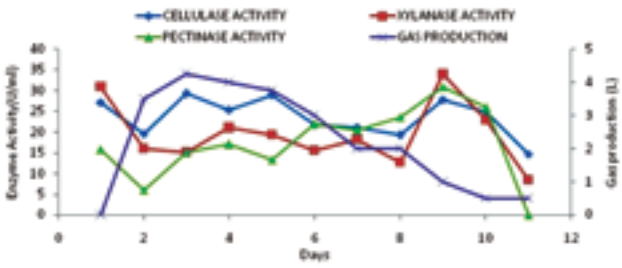
Remediation (nutrient removal) of eutrophic lakes through periodical harvesting of floating macrophytes is an environment friendly approach. The ongoing research focuses on harvesting water hyacinth (Eichornia) from polluted lakes and postharvest treatment of the biomass for recovering value added products like biogas, animal-digest-fibre and compost. The digestion studies were conducted in a two stage bioprocess, where a conventional leach-bed reactor for initial digestion of pretreated biomass was done. The hydrolyzed organics are converted into biogas in a subsequent UASB reactor. Profile of hydrolytic enzymes-cellulase, xylanase and pectinase during digestion process was more or less uniform and microbial diversity of the system included bacteria, archaea and higher trophic grazing fauna.



Schemetic representation of two stage process for water hyacinth digestion.



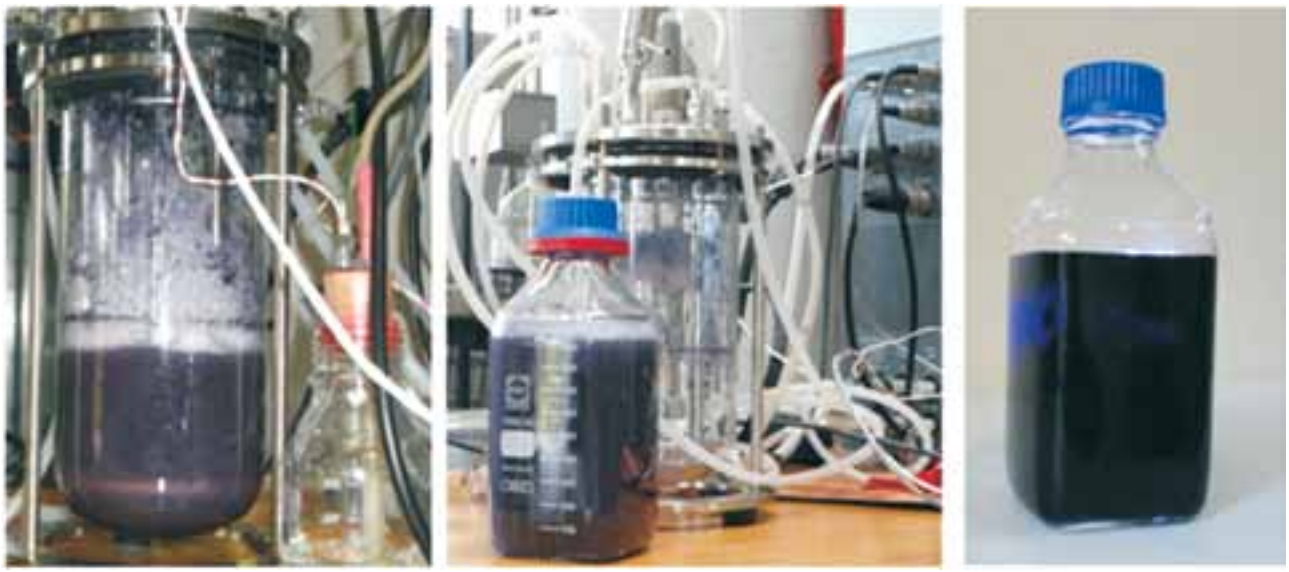
Fibres recovered from the water hyacinth after anaerobic digestion



Profile of hydorlytic enzymes and gas production in UASB during a typical batch operation.

Bioactive molecules from an isolated *Chromobacterium* sp.

Extraction and purification of high value bioactive compound Violacein from crude microbial pigment produced by *Chromobacterium* sp. NIIST CKK-01 isolate was reported last year. Violacein produced from the culture were found to have antioxidant, anti microbial (especially against gram positive), anti fungal and anti protozoal properties. Nearly five different (mostly coloured) compounds were also separated from the crude pigment. Characterization of the compounds and screening their bioactivities are in progress.



Production of violacein containing bioactive pigment in lab scale fermenter

Environmental Impact Assessment

Environmental impact assessment for the existing beach washing and mineral separation plant for Kerala Minerals & Metals Ltd, Kollam

The objective of the study is to identify the environmental impacts in the area due to the proposed mining activity and delineate environmental management plan. The final outcome of the study is to get environmental clearance for the proposed mining activity. The study includes mine site description, identification of key issues of each mine lease area, primary and secondary data collection, social impact assessment and suggestion of mitigation measures for minimizing the impacts. The project has been initiated starting from reconnaissance survey and other mandatory procedures.

EIA study for the proposed heavy mineral sand mining at Alappad, Panmana & Ayanivelikulangara, Kollam district

As an off-shoot of the EIA project carried out earlier, detailed R&D work was undertaken for the conversion of reject sand to construction sand. About 174550 tons are available as reject sand. Laboratory scale experiment for possible reuse as construction sand indicated its feasibility to replace the natural sand by 40%. The washed sand mixed with construction sand in the ratio 40:60 achieved a compressive strength of 58 N/m^2 which is comparable to natural sand.

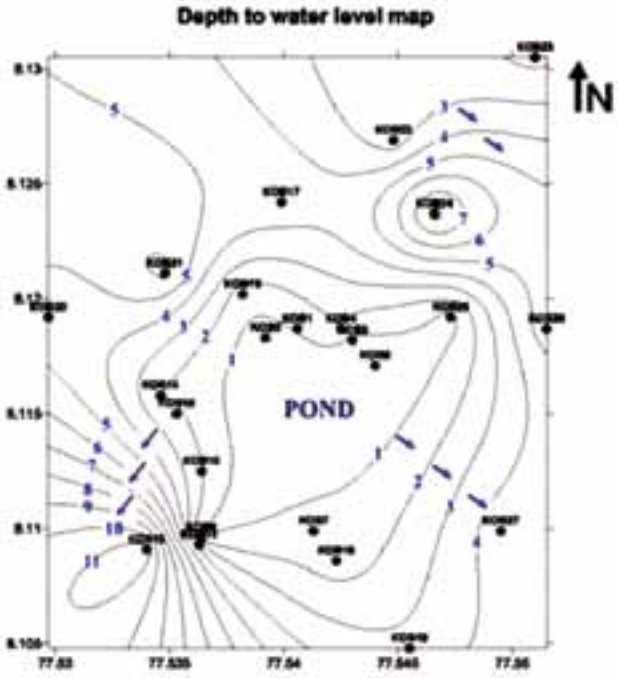
Marine ecological study for development of multi-user liquid terminal, Puthuvypeen SEZ, Kochi

Detailed marine ecological survey for proposed development of a multi-user liquid terminal (MULT) at Puthuvypeen SEZ, Kochi was undertaken for WAPCOS (I) Ltd to establish the existing status of the marine water in and around the proposed project site. The final report submitted to client. This study helped the client to identify the location for sitting of the terminal.

Impact assessment of road embankment construction on Narikulam water tank in Kanniyakumari District, Tamil Nadu

Environmental degradation, saline water intrusion, ground water depletion, loss of existing aquifers of the proposed project to construct a road across Narikulam water tank by National Highways

Authority of India were assessed. The field studies included hydrology, primary data generation on water quality, well inventory, ground waste flow pattern, primary and secondary data collection, evaluate mitigation measures etc. The report covered alternate management measures with costing. NIIST has finally recommended 10 bridges of ten metre length with alternate earthen embankments across the tank. These vent ways can facilitate steady and unobstructed movement of water. The embankment can be protected with stone pitching on both sides to avoid erosion.



Analytical and Engineering Services

The testing & analytical services activities of the Institute to external users is being coordinated by this section under the umbrella TASC (Testing & Analytical Services Cell). Clientele availing these services include Government departments, public and private sector agencies, and students.

The analysis of the water and sediment samples in and around the Periyar river carried out by the section was another challenging task taken up as per the interim order of the Hon'ble High Court of Kerala. Sampling was carried out by Kerala State Pollution Control Board. Around 120 water samples and 35 sediment samples were subjected to physicochemical analysis of general parameters, including heavy metals and pesticide residues. Compliance of the data obtained on these samples with Indian Standard Specifications for drinking water was checked. It was found that a large number of samples had α-BHC and β-BHC. Some samples were also contaminated with endosulfan and DDT. Heavy metals were also found in a few samples. The shrinking water table, inefficient industrial waste management practices and improper sanitation are mostly responsible for the deteriorating drinking water quality.

Dioxin Research

Dioxin monitoring in emissions from medical waste incinerators

No systematic dioxin monitoring work from medical waste incinerator emissions has been carried out or reported in India. In the present study, medical waste incinerators operating at various parts of the country were monitored for dioxin emission using EPA Methods 1-5 and 23A. The dioxins and furans analysis were carried out at the laboratory using EPA Method 8280A. Even though the international dioxin emission limit for medical waste incinerator flue gas is fixed at 0.1ngTEQ/Nm^3, most of these incinerator emissions cross the limit even at independent congener concentration levels which clearly shows the poor incineration practice and lack of advanced pollution control devices.

Chemical and Process Engineering

Beneficiation of Kaolin

This year, the project focused on the development of commercial flow sheets for the beneficiation of kaolin from various locations in the country. Kaolin ($Al_2O_3.2SiO_2.2H_2O$) or China clay is a versatile industrial mineral with wide industrial applications and is abundantly available in India. The most deleterious impurities in kaolin are the iron minerals, which imparts colour to the white kaolin. The identification and quantification of the impurity mineral phases plays a crucial role in the selection of beneficiation processes and the sequence in which the processes are to be carried out. The beneficiation work on the Guda clays of Rajasthan was continued. New projects for developing flowsheets for beneficiation of the clays of Kasargode and Kannur and for improving the brightness Kaolin by removal of colour imparting chemicals were initiated.

Colour imparting minerals separated from different kaolin samples

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

Laboratory studies showed that the major impurity mineral present in the Guda clay sample is magnetically susceptible, and they can be removed by magnetic separation. After optimizing the process parameters for the magnetic separation experiments, bulk quantity (10 Kg.) the non magnetic fraction of the size classified clay sample (< 2 micron) was produced using Wet High Intensity Magnetic Separator (WHIMS) and was sent to Rubber Research Institute, Kottayam to test its suitability as filler in Rubber industry.

Modern and eco-friendly process and flow sheet development for Kasargode and Kannur China clays

Kerala has got many promising kaolin deposits, spread over the districts of Trivandrum, Kollam, Kannur and Kasargode. Though extensive studies have been reported on the first two deposits, the deposits from Kannur and Kasargode are yet to be studied in detail. The objective of the present study was to develop a suitable processing flow sheet to value add the kaolin in these deposits. Initial characterization studies on the raw kaolin from Kannur (Madai Mine) indicated that oxides and hydroxides of iron are the major impurity phases present in the sample.

Brightness improvement studies on "EICL" China clays

The objective of the work was removal of the colour imparting phases present in the kaolin samples by various beneficiation techniques for their brightness improvement. Five clay samples (<53 micron fraction) were supplied by M/s. EICL and work on two samples are in progress. Oxide and hydroxides of iron are found to be the major impurity phase in the Pink clay, while oxy-hydroxides of iron are the major colouring phases present in Yellow clay. Clay samples were size classified using '2 inch' Standard and '1 inch' hydrocyclones to remove the coarser impurities and enrich the finer clay fraction. Wet High Intensity Magnetic Separation (WHIMS) tests on the size classified clay (Pink – 1 inch over flow solids) followed by reductive bleaching was found to improve the brightness of the clay by ~ 17 units (70 to 87 % ISO). Froth flotation work on the Pink clay and deferration studies on Yellow clay are in progress.

Colour of PINK clay sample (a) before and (b) after beneficiation

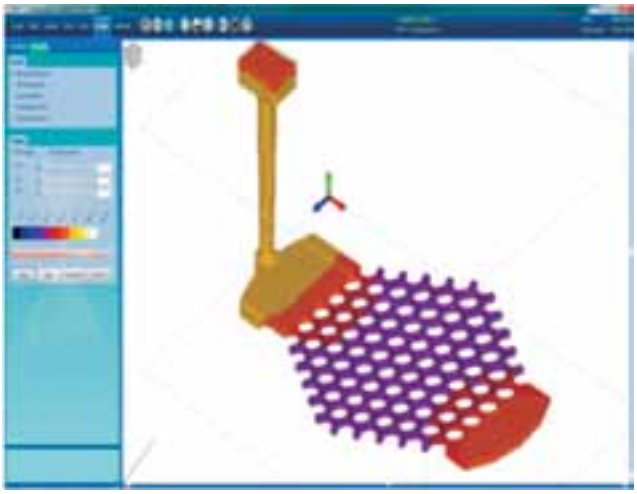
Computational Modelling and Simulation

The Virtual Casting Software developed by this section was successfully transferred. Computational fluid dynamics studies of mold filling and solidification in different casting processes like low pressure casting and centrifugal casting corroborated with experimental work by the metals processing group of the Institute. Computational chemistry research focused on understanding water splitting promoted by a Ruthenium(II) PNN Complex and Grubbs Olefin Metathesis

Virtual Casting Solver Acquired by 3DFoundry Tech Pvt. Ltd

Virtual Casting, a software for design of the casting process by simulation of mold filling and solidification in a casting, was developed in 2004. The Institute transferred 17 licenses so far by direct marketing with limited facilities for maintaining, supporting and marketing the software product. Therefore, this year the Virtual Casting Solver code was transferred to 3D Foundry Tech Pvt. Ltd., (3DFT) a company incubated in the Indian Institute of Technology Bombay as a better marketing strategy. 3DFT is an IIT-B start up company

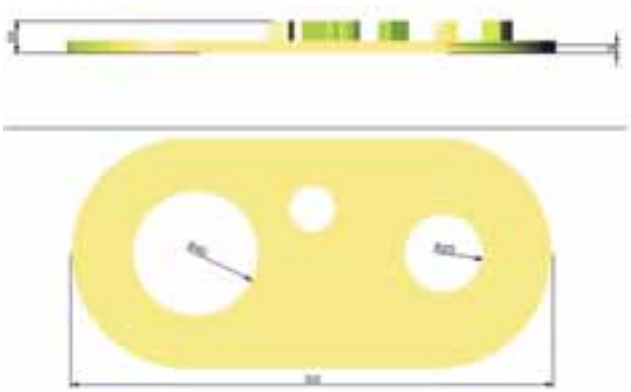
that maintains and markets AutoCAST-X which is based on a geometric reasoning engine developed at IIT Bombay, allowing semi-automatic design, 3D modelling and analysis of casting elements like cores, feeders, and gating channels. 3DFT has acquired the solver code of the NIIST software, Virtual Casting with the aim of enhancing the power and marketability of Autocast-X. Integration of the Virtual Casting, solver into Autocast-X would add important features like coupled simulation of metal flow and solidification, enabling visualization of mold filling sequence, changes in casting temperature and solidification rate. This helps in prediction of casting defects such as cold shut and shrinkage porosity without shop-floor trials, saving valuable time, energy and other costs. The new module is named FLOW+ and it is envisaged to be launched in August 2012.



Mold filling and casting simulation of complex shaped castings through LPC casting process

Crucial part of the low pressure casting process is the control of the pressure exerted in the crucible to ensure an even non-turbulent flow of molten metal through the riser tube to fill the cavity. If the filling is not appropriate, the casting will have filling related defects and the casting engineers depend on trial and error methods to get defect free castings.

In the present study, mold filling simulation of a particular thin walled casting component cast using low pressure casting technique was carried out using a commercial fluid flow software FLOW-3D to obtain an optimized pressure profile for defect free filling. A particular thin walled casting component was chosen and the dimensions in mm are shown below. The CAD file of this component was imported in FLOW-3D as a STL file and a finite difference mesh was then generated using the mesh building option in FLOW-3D. A356 aluminum alloy was used for the casting component.

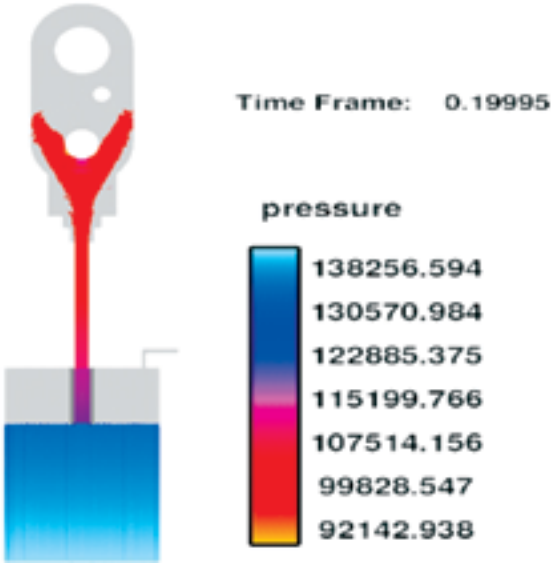


The numerical simulation of the transient fluid flow during the mold filling process in LPC process was carried out using the commercial FLOW-3D software. GMRES method was chosen for solving the discretized fluid flow equations. The convergence criteria chosen for the present simulation was mass convergence and the tolerance limit was set to 1.0e-04. The inlet boundary condition for fluid flow was specified pressure at the inlet and no-slip boundary condition was specified at the walls whereas for heat transfer, the heat transfer coefficient between the mold and the casting was calculated implicitly. The simulations were carried out for two different types of pressure boundary conditions *viz.*, (a) Constant pressure at the inlet, and (b) Time varying pressure at the inlet. Some typical results are shown below.

As a first case, the inlet pressure was set as a constant value equal to 1.12 atm. In this case the cavity was filled only partially and this inlet condition was not enough to fill the whole cavity even when the filling time was extended to 6s. For this simulation, the initial fluid pressure was set to 1 atm and the void fluid pressure above the fluid surface was set to 1.01 atm.

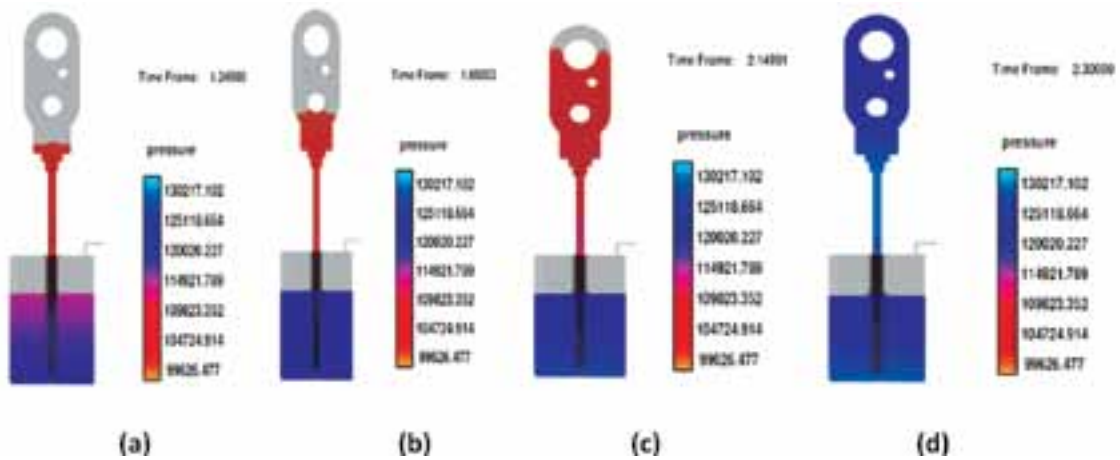
Simulated filling pattern of the cavity for a constant inlet pressure 1.12 atm.

When the inlet pressure was set to a constant value of 1.25 atm, the simulation results showed turbulent filling pattern.

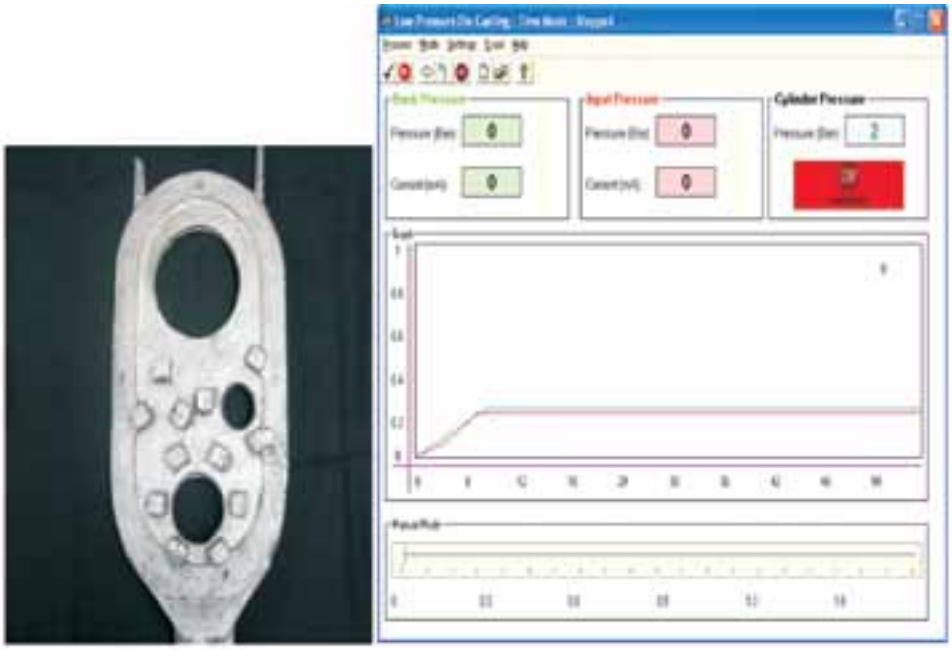


Simulated filling pattern of the cavity for a constant inlet pressure 1.25 atm.

From these simulation results it was clear that, by giving a constant inlet pressure value, a defect free casting will not be formed. This was verified through physical experiments. Hence type (2) boundary condition was adapted where a time varying pressure boundary condition was applied. The filling pattern of one such run where the inlet pressure condition was changed from 1.05 atm at t=0s to 1.25 atm. at t=4s is shown below.



Simulated filling pattern of the cavity for a time varying inlet pressure



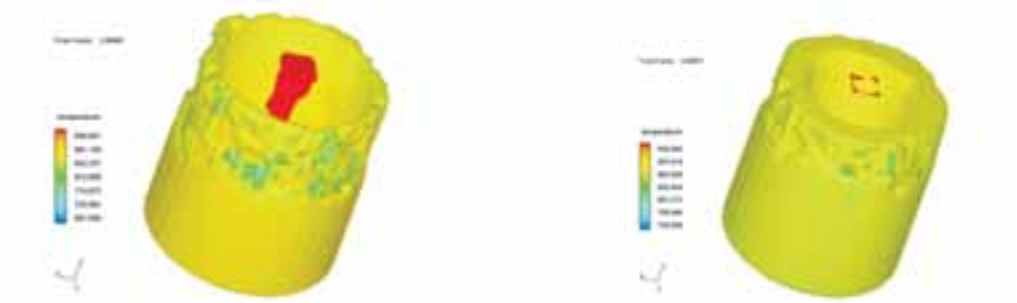
Experimentally obtained thin walled casting and the display of pressure sequence during mold filling

Centrifugal casting process: Mold filling and solidification simulation

The objective of this study is directed towards the numerical simulation of fluid flow in centrifugal casting process to estimate the optimum speed required to produce a defect free hollow cylinder and ring castings. The numerical simulation of fluid flow in a vertical rotating mold was carried out by employing the commercial fluid flow code FLOW 3D. The 3-D Navier Stokes equations which are used for fluid flow were modified to take care of the mold rotating about a fixed axis. This is done by including a source term for general non inertial accelerations. The dimensions for the cylinder mold are 100 mm in length and 70mm diameter and for the ring mold is 240 mm in diameter and 30mm height. Aluminium A356/LM 25 alloy was poured to the moulds and the corresponding components were made and characterization was done.

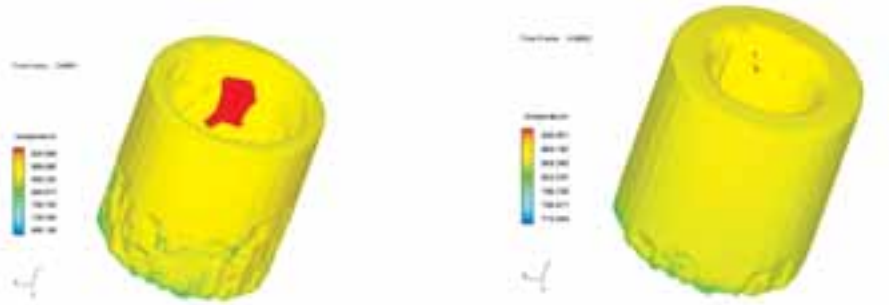
(a) Cylindrical mold *(b)Ring mold*

The models (cylinder, ring) were built using Flow-3D commercial CFD code. Mold filling and heat transfer simulations of these components were done using FLOW3D. To study the effect of rotational speed, simulations were carried out using FLOW 3D for different rotational speeds ranging from 1000 rpm to 1500 rpm. The volumetric flow rate was taken as 93.5cm^3/s for cylinder and 23.8 cm^3/s for ring casting. Fill time was chosen as 6s based on experimental observation. Initial mold temperature was 573k and the pouring temperature of the liquid metal was taken as 930k. 3D view of the volume fraction of fluid contour at the end of 3s and 6s for different rotational speeds (1000-1300 rpm) are given below. When the rotational speed was increased to 1400 rpm a uniform hollow cylinder was formed after 6s. This speed of rotation was found to be the optimum speed and is known as the critical angular velocity.



(a) 3s *(b) 6s*

Fluid fraction contours for hollow cylinder at 1000 rpm



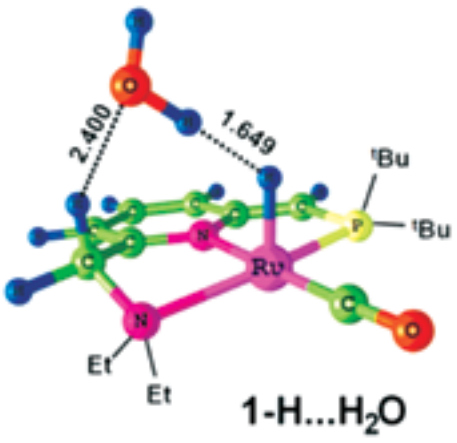
(c) 3s *(d) 6s*

Fluid fraction contours for hollow cylinder at 1300 rpm

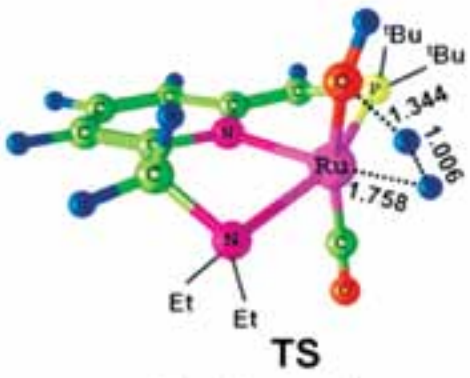
Cylinder casting fabricated by NIIST centrifugal casting machine

Water splitting promoted by a Ruthenium(II) PNN complex: An alternate pathway through a dihydrogen complex for hydrogen production

Using DFT calculations, a new mechanism for water splitting promoted by PNN Ru (II) pincer hydride complex (**1-H**) has been established. The reaction is facilitated by the formation of a dihydrogen intermediate (**1-H…H_2O**). The elimination of dihydrogen required an activation free energy, G_{act} of 10.48 kcal/mol. Unlike the previously reported mechanisms, the new mechanism operates without the co-operation of the aromatization-dearomatization processes of the pincer ligand and also bypasses a highly reversible step in the mechanism (*Organometallics*, 2011, ***30***, 3888–91).



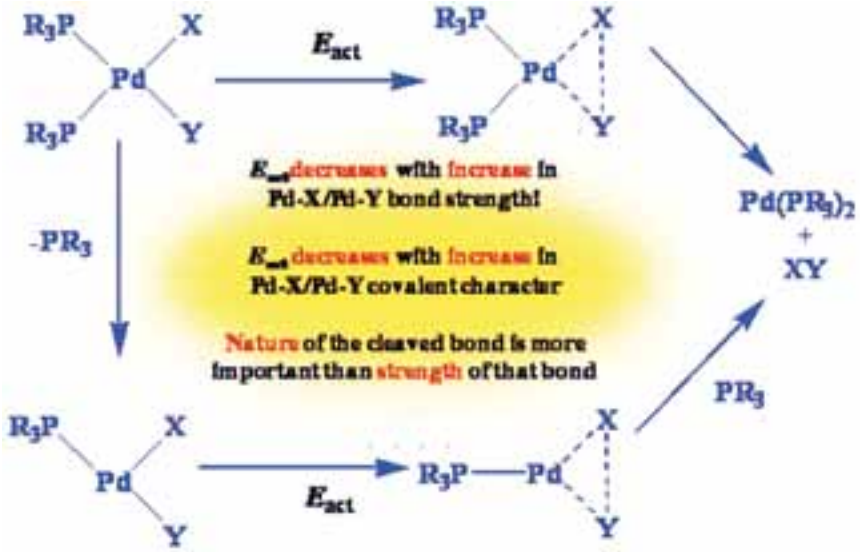
Catalyst showing dihydrogen bonding with water



Transition state for hydrogen evolution

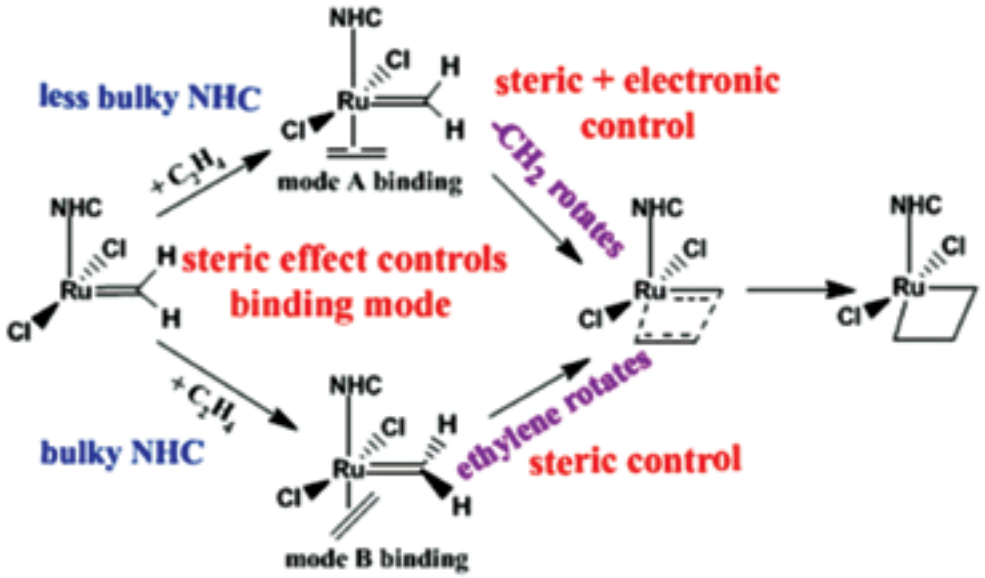
Mechanisms of reductive eliminations in Square Planar Pd(II) complexes: Nature of eliminated bonds and role of trans influence

The *trans* influence of various phosphine ligands (L) in direct as well as dissociative reductive elimination pathways yielding CH_3CH_3 from $Pd(CH_3)_2L_2$ and CH_3Cl from $Pd(CH_3)(Cl)L_2$ has been quantified in terms of isodesmic reaction energy, E_{trans} using DFT. In the absence of large steric effect, E_{trans} correlated linearly with the activation barrier (E_{act}) of both direct and dissociation pathways. The minimum of molecular electrostatic potential (V_{min}) at the lone pair region of phosphine ligands was used to assess their electron donating power. E_{trans} increased linearly with increase in the negative V_{min} values. Further, the nature of bonds which are eliminated during the reductive elimination have been analysed in terms of AIM parameters, *viz.* the electron density ($\rho(\mathbf{r})$), Laplacian of the electron density ($\nabla^2\rho(\mathbf{r})$), the total electron energy density ($H(\mathbf{r})$), and the ratio of potential and kinetic electron energy densities ($k(\mathbf{r})$). AIM details showed that the strength of the eliminated bond is not the deciding factor for the reductive elimination but the nature of the bond. Further, a unified picture showing the relationship between the nature of the eliminated chemical bond and the tendency of reductive elimination is obtained from the $k(\mathbf{r})$ values (*Inorg Chem*, 2011, ***50***, 8085-93).



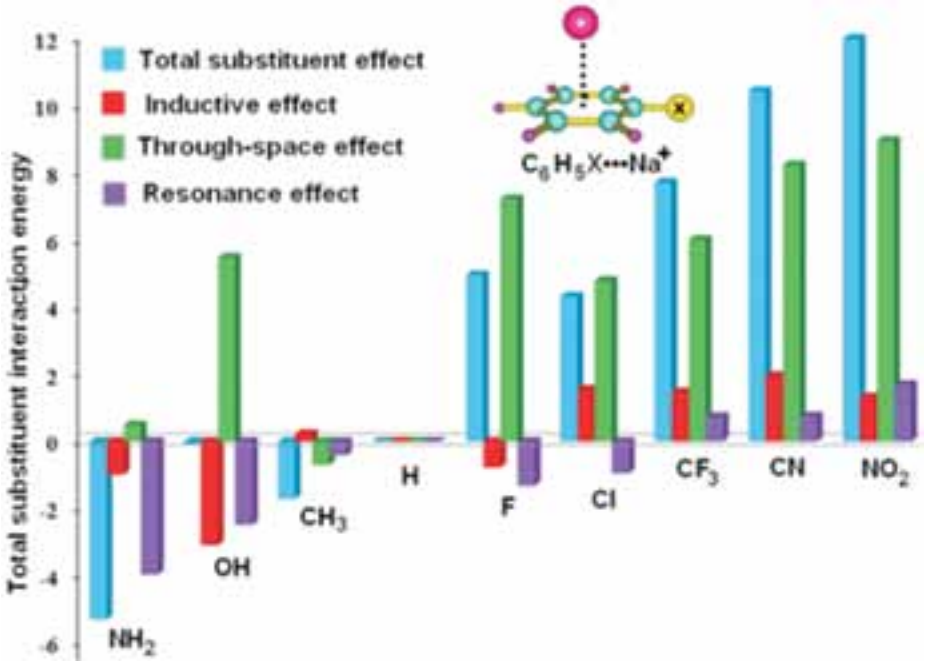
Assessment of steric and electronic effects of N-heterocyclic carbenes in Grubbs Olefin Metathesis using molecular electrostatic potential

The steric and electronic effects of N-heterocyclic carbenes (NHC) in the second-generation Grubbs olefin metathesis catalysts have been quantified on the basis of molecular electrostatic potential at the carbene carbon of both the NHC ligand (V_{C1}) and the alkylidene moiety (V_{C2}). This study also showed that if the NHC is bulky, the steric effect will dominate over the electronic effect and will control the metathesis whereas the electronic and steric effect will have almost equal importance in metathesis activity of catalyst with less bulky NHCs. Lone pair interactions of the type Ru...F have the ability to significantly alter the catalytic activity (*Organometallics*, 2011, ***30***, 3106–12).



Substituent effects in cation-π interactions: A unified view from inductive, resonance, and through-space effects

The quantification of inductive (I), resonance (R) and through-space (TS) effects of a variety of substituents (X) in cation-π interactions of the type $C_6H_5X\cdots Na^+$ were achieved by modeling C_6H_5-$(\Phi_1)_n$-X···Na^+ (**1**), C_6H_5-$(\Phi_2)_n$-X···Na^+ (**2**), C_6H_5-$(\Phi_{2\perp})_n$-X···Na^+ (**2'**) and $C_6H_6\cdots HX\cdots Na^+$ (**3**), where Φ_1 = -CH_2CH_2-, Φ_2 = -CHCH-, $\Phi_{2\perp}$ indicates that Φ_2 is perpendicular to the plane of C_6H_5, and n = 1-5. The cation-π interaction energies of **1**, **2**, **2'**, and **3**, relative to X = H and fitted to polynomial equations in n were used to extract the substituent effect $E_0^{\,1}$, $E_0^{\,2}$, $E_0^{\,2'}$ and $E_0^{\,3}$ for n = 0, the $C_6H_5X\cdots Na^+$ systems. $E_0^{\,1}$ is made up of inductive (E_I) and through-space (E_{TS}) effects while the difference ($E_0^{\,2}$-$E_0^{\,2'}$) is purely resonance (E_R) and $E_0^{\,3}$ is attributed to the TS contribution (E_{TS}) of the X. This study also showed that the total interaction energy of $C_6H_5X\cdots Na^+$ is equal to the sum of E_I, E_R and E_{TS} which brings out the unified view of cation-π interaction in terms of I, R and TS effects. (*J Phys Chem A*, 2011, ***115***, 5660-64).



S&T SERVICES SECTION

RESEARCH PLANNING AND BUSINESS DEVELOPMENT

TECHNOLOGY LICENSING & TRANSFER AGREEMENTS/MOUs SIGNED

Sl.No	Title	Name of the firm/agency
1	Confidentiality agreement for developing photo responsive materials	Unilever Industries Private Limited, 165/166, Backbay Reclamation, Mumbai 400 020
2	Confidentiality agreement for trying Virtual Casting Software	3D Foundry Tech Pvt. Ltd., CM-05, SINE, CSRE, IIT Bombay, Powai, Mumbai – 400 076
3	Brightness improvement studies on EICL China Clays	M/s English Indian Clays Ltd., TC 79/34, Veli, Trivandrum - 695 021
4	Transfer of know-how of white pepper production	Shri. Nagendran, Gnana Soundari Pepper Processing Unit, 27B, Chinthamani Road, Vaalai Thoppu, Madurai
5	Transfer of know-how of white pepper production	Shri.Prasanna Kumar G.N., Vasundara Sales Corporation, Golgar, Kesava Post, Koppa Taluk, Chikmangalore, Karnataka – 577 126
6	MoU for CIMAP's point of contact at NIIST	CIMAP, Kukrail Picnic Spot Road, Lucknow – 226 015
7	Licensing of Intellectual Property in respect of SOLVER module of Virtual Casting	*3D Foundry Tech Pvt. Ltd., CM-05, SINE, CSRE,* IIT Bombay, Powai, Mumbai – 400 007
8	Non-disclosure Agreement for evaluating the plasma process for synthetic rutile production	Satyavathi Titaslag Limited, Plot No 75, New MLA & MPs Colony, Road No. 10C, Jubilee Hills, Hyderabad – 500 033
9	Project MOU with Industry partner CSIR-NMITLI Project on Biofuels	Maps Enzymes Limited (Formerly Maps (India) Ltd.), 302, Shapath-3, Near GNFC Info Tower, S.G. Road, Ahmadabad 380 054
10	Project MOU with Industry partner CSIR-NMITLI Project on Biofuels	Maps Enzymes Limited (Formerly Maps (India) Ltd.), 302, Shapath-3, Near GNFC Info Tower, S.G. Road, Ahmadabad 380 054
11	Project MOU to revise IS 1908:1993 "Ginger, whole and ground (second revision)"	Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
12	Confidential information disclosure and Non-analysis agreement	The Goodyear Tire & Rubber Company, 1144 East Market Street, Akron, OH 44316-0001(USA)
13	Non-disclosure Agreement for evaluating the plasma process for synthetic rutile production	Eureka Systems and Electrodes Private Limited, 11/15-A, Selvarajapuram, Chinthamanipudur, Coimbatore – 641 103, Tamilnadu
14	Process know-how for making coir rubber composite (CRC) garden pots	'Sevashram', Mangattukara, Puliyanam P.O., Angamaly – 683572, Ernakulam District, Kerala
15	Non-disclosure Agreement for evaluating the process knowhow for making flux bonded fly ash bricks.	Reliance Cement Company Pvt. Ltd., 2nd Floor, E - block, Dhirubhai Ambani Knowledge City, Khopar Khairne, Navi Mumbai – 400 710
16	Agreement for setting up a demonstration plant (pineapple leaf fibre and banana fibre extraction) for Kottappuram Integrated Development Society (KIDS) as part of R&D project by DST	Kottappuram Integrated Development Scociety (KIDS), KIDS' campus, NH 17, Kottappuram, Kodungallur, Thrissur Dist., Kerala 680 667
17	Agreement for Licensing of Knowhow for the production of Banana fibre (Foreign Client)	SRANEXIM CORPORATION, House No. 368, Brgy 40, Cruzada, Legaspi City, Albay (4500), Philippines represented by Mr. Harjinder Singh Sran, an Indian national and GLOBE-ASIA NATURE INDUSTRIES, INC., Gernarine bldg. Annex, Alterate Road, Legaspi city, 4500 Philippines represented by Mr. Gerson Escaro
18	Agreement for setting up a demonstration plant (coir fibre) for Santhigiri Koottukudumba coir unit as prat of grant-in-aid R&D project by Kerala Biotechnology Commission, KSCSTE, Govt. of Kerala	Santhigiri Koottukudumba Coir Unit, Thavanakadavu, Cherthala, Alappuzha District, Kerala, a Unit of Santhigiri Ashram, a registered society

CONTRACT RESEARCH PROGRAMMES

SI No	Client	Project Title	Project Leader
		AGROPROCESSING AND NATURAL PRODUCTS DIVISION	
1	DST	Evaluation and control of acrylamide formation in traditional deep fried snack products	Dr. (Mrs). P. Nisha
2	Dir.Vanaspathi, Min.Con.Affairs	Evaluation of trans fatty acids in hydrogenated vegetables oil products and their health implication in the context of Indian food habits	Mrs. M.V. Reshma
3	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). P. Nisha
4	KSCSTE	Development of value added products from "Neera" of *Palmyrah*	Mrs. M.V. Reshma
5	DST	Synthesis of iminosugar variants of alphagalactosyl ceramide for tuning of selective cytikine release from natural killer T(NKT) cells	Dr. L. Ravi Shankar
6	ICMR	Phenolic compounds from *Centalla asiatica, Boerhavia diffusa & Desmodium gangeticum* as protectors against arsenic trioxide induced cardio toxicity	Dr. K. G. Raghu
7	KSCSTE	Development and standardization of value added products for "Jackfruit"	Dr. (Mrs).P. Nisha
8	Bureau of Indian Standards	Development of Indian Standards for North East Ginger and its value added products	Mr. V.V. Venugopal
		BIOTECHNOLOGY DIVISION	
9	CSIR	Bioethanol from lignocellulosic biomass	Dr. Ashok Pandey
10	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
11	DST	Centre for bio fuels	Dr. Ashok Pandey
12	DBT	Development of a bioprocess for the production of polyhydroxybutyrate(PHB) from biodiesel industry generated glycerol	Dr. Ashok Pandey
13	DBT	Cost effective production of lactic acid for polylactide synthesis and studies on PLA application and biodegradation.	Dr. K. Madhavan Nampoothiri
14	DBT	Exploiting western ghat biodiversity for antifungal metabolites for plant disease control	Dr. K. Madhavan Nampoothiri
		CHEMICAL SCIENCES & TECHNOLOGY DIVISION	
15	BRNS	Study of photo induced electron transfer in cyclodextrin based supramolecular systems	Dr. K.R. Gopidas
16	DST	Development of sensitizers based on NMR Dyes	Dr. D. Ramaiah
17	DAE	Molecular and supramolecular architecutres with optoelectronic functions	Dr. A. Ajayaghosh

18	DST	Development of novel cyclophanes as probes for bio-molecular recognition	Dr. D. Ramaiah
19	DST	The controlled carbopalladation of heterobicylic olefins: A novel stereo selective route to functionalized cyclo-pentanoids	Dr. K. V. Radhakrishnan
20	CSIR	Development of homogeneous catalysts for water splitting - A key technology for sustainable energy	Dr. C. H. Suresh
21	DST	Novel synthetic protocol for carbon-carbon and carbon-heteroatom bond forming reactions employing nucleophilic heterocyclic carbene catalysis	Dr. Vijay Nair
22	DST	Environmentally secure inorganic colorants	Dr. M.L.P. Reddy
23	IFCPAR	Development of fulvene based Zr(II) and Ti(II) chemistry: organometallics,reactivity and applications in organic synthesis	Dr. K. V. Radhakrishnan
24	DST	Organic and organic - inorganic hybrid solar cells: optimization of materials properties, bulk heterojunction morphology and device efficiencies (OISC/LARGE CELLS)	Dr. K. R. Gopidas
25	DST	Investigation of conformational sub-states and low frequency vibrational dynamics of native and non native heme proteins	Dr. Karunakaran Venugopal
26	DST	Green methods towards pharmaceutically important heterocycles and cyclopentanoids	Dr. K. V. Radhakrishnan
MATERIAL SCIENCES & TECHNOLOGY DIVISION			
27	M/s.IRELTDC, Kollam	Development of high field composite varistors based on rare earth oxides	Dr. S. Ananthakumar
28	Institute of Plasma Research	Development of long filamentary MgB_2 superconducting wires and tapes for fusion grade magnets and current leads	Dr. U. Syamprasad
29	DST	Optimization of aging parameters and alloy composition for improved age hardening response of AZ91 magnesium alloy	Dr. A. Sreenivasan
30	DRDO	Development of mono and hybrid discontinuously reinforced magnesium metal matrix composites for engineering applications	Dr. U .T .S .Pillai
31	DST	Silicate based dielectrics for electronic packaging applications	Dr. M. T. Sebastian
32	DST	Synthesis and characterisation of *in-situ* Magnesium matrix composites	Dr. (Mrs) Sreeja Kumari
33	DST	An investigation on the potential beach placer deposits along Tiruchendur coast, Tamilnadu	Dr. M. Sundararajan
34	DST	Development of novel powellite based red phosphor materials: $ARMMoO_8:Eu^{3+}$(A=Mg, Ca, Sr and Ba, R=Y, La and Gd: M=Nb and Ta) for white light emitting diodes (WLED's)	Dr. P. Prabhakar Rao
35	DRDO	Development of low loss low temperature co-fired ceramic glass composite (LTCC) tapes for future MIC device applications	Dr. M. T. Sebastian
36	DST	Supramolecular polymeric nanomaterials with hierarchical morphologies	Dr. Boje Gowd
37	DST	Preparation of M_3AX_2 phase ternary carbides and fabrication of its nanocomposites through novel methods	Dr. S. Ananthakumar

38	CSIR	Novel micro-nanointegrated composite particles as dye-adsorbent catalyst	Dr. S. K. Shukla
39	DST	Nanostructured double perovskites for spintronic applications,	Dr. Manoj Rama Varma
40	ICDD	Generation of experimental powder diffraction data of new ceramic complex oxides	Dr. P. Prabhakar Rao
41	DST	Development of nanostructured spinel oxide materials for spintronic applications	Dr. Savitha Pilla
42	BARC	Development of self lubricating AL_2O_3/ZrO_2 ceramic composites for journal bearing applications in acid/radiation environment	Dr. S. Ananthakumar
43	DST	Low temperature healing photo catalytic self cleaning coatings for solar cell covers and glass surfaces	Dr. K. G. K. Warrier
44	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
45	DRDO	Design and development of environmentally friendly rare earth based NIR reflecting camouflague pigments for defence applications	Dr. P. Prabhakar Rao
46	M/s. Schneider Electric DRC	Nano ceramic smart fillers for improving the thermal dissipation property of epoxy polymer dielectrics,	Dr. S. Ananthakumar
47	DST	Development of functionally graded porous ceramic preform and ceramic metal composites for engineering applications	Dr.T. P. D. Rajan
PROCESS ENGINEERING & ENVIRONMENTAL TECHNOLOGY DIVISION			
48	MNRE	Development of a household wastes & sanitation device with biogas recovery,	Dr. V. B. Manilal
49	MNRE	Anaerobic technology for biogas recovery and stabilization of unsorted municipal solid wastes	Dr. V. B. Manilal
50	NMITLI	Biofuel from marine microalgae	Mr. Ajith Haridas
51	Kerala State Pollution Control	Dust suppression: Field study in China clay mine	Dr. Rugmini Sukumaran
52	KSCSTE	Bioremediation of percholate containing waste water under high saline conditions using chemotropic mixed microbial system	Dr. B. Krishnakumar
53	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
54	KSCSTE	Development of modern and eco friendly beneficiation process and flow sheet for Kasargod and Kannur china clays	Dr. P. Raghavan
55	EICL	Brightness improvement studies on EICL china clays	Dr. P. Raghavan
56	KSIDC	Development of a suitable method to control fungal growth in screwpine leaf products	Dr. V. B. Manilal

CONSULTANCY PROGRAMMES

SI No	Client	Project Title	Project Leader
1	Ann Impex	Engineering consultancy for technology up gradation	Sri. M.M .Sreekumar
2	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
3	Environmental Resources Research Centre,TVM	Microstructural analysis of pollens of medicinal plants	Dr. P. Prabhakar Rao
4	M/s.TERI, Delhi	Evaluation of clay samples for suitability for extrusion & production of hollow blocks	Dr. K.G.K. Warrier
5	BHEL, Bangalore	Preparation of UV curable nano-TiO2 thin film on glass substrate to induce self cleaning properties	Dr. K.G.K. Warrier
6	VSSC	Structural and micro structural characterization of aerospace materials	Dr. P. Prabhakar Rao
7	WAPCO India Ltd	Fabrication of prototype aluminum alloy and composite cylinder liners for automotive air compressor applications.	Dr. T.P.D. Rajan
8	Nita Gelatin India Ltd. Koratty, Trichur	Ossein factory odour control	Mr. Ajith Haridas
9	KMML	EIA for KMML project	Mr. J. Ansari
10	WAPCOS	Marine ecological survey for the proposed multiuser liquid terminal, Kochi	Mr. J. Ansari
11	NEERI	Impact assessment due to construction of road embankment	Mr. J. Ansari
12	Miracle Polymers India Ltd, Coimbatore	Reclaim rubber factory odour control	Mr. Ajith Haridas

PATENTS

PATENTS FILED (FOREIGN)

NFNO	Title	Inventors	Filing Date	Application No.
0141NF2008/JP	A transparent chitam gel and a process for the preparation thereof	Tholath Emilia Abraham, Chandroth Kalyad Simi	10/06/2011	2011-540326
0141NF2008/US	A transparent chitam gel and a process for the preparation thereof	Tholath Emilia Abraham, Chandroth Kalyad Simi	14/06/2011	13/139679
0141NF2008/CN	A transparent chitam gel and a process for the preparation thereof	Tholath Emilia Abraham, Chandroth Kalyad Simi	14/06/2011	200980149968.8
0141NF2008/EP	A transparent chitam gel and a process for the preparation thereof	Tholath Emilia Abraham, Chandroth Kalyad Simi	15/06/2011	09787583.5
0141NF2008/CA	A transparent chitam gel and a process for the preparation thereof	Tholath Emilia Abraham, Chandroth Kalyad Simi	15/06/2011	---
0141NF2008/KR	A transparent chitam gel and a process for the preparation thereof	Tholath Emilia Abraham, Chandroth Kalyad Simi	11/07/2011	2011-7016069
0069NF2008/US	Preparation of green colorant from mixed rare earth and molybdenum compounds and process thereof as surface coatings	Mundlapudi Lakshmipathi Reddy	26/09/2011	13/260481
0069NF2008/AU	Preparation of green colorant from mixed rare earth and molybdenum compounds and process thereof as surface coatings	Mundlapudi Lakshmipathi Reddy	26/09/2011	2010228847
0197NF2008/US	A process for the preparation of novel non-toxic yellow inorganic colorant/pigment from samarium and molybdenum compounds	Mundlapudi Lakshmipathi Reddy	26/09/2011	13/260423
0197NF2008/BR	A process for the preparation of novel non-toxic yellow inorganic colorant/pigment from samarium and molybdenum compounds	Mundlapudi Lakshmipathi Reddy	27/09/2011	PI0924476-0

0197NF2008/AU	A process for the preparation of novel non-toxic yellow inorganic colorant/pigment from samarium and molybdenum compounds	Mundlapudi Lakshmipathi Reddy	27/09/2011	2009343120
0069NF2008/BR	Preparation of green colorant from mixed rare earth and molybdenum compounds and process thereof as surface coatings	Mundlapudi Lakshmipathi Reddy	27/09/2011	020110100281
0197NF2008/CN	A process for the preparation of novel non-toxic yellow inorganic colorant/pigment from samarium and molybdenum compounds	Mundlapudi Lakshmipathi Reddy	21/10/2011	200980158858.8
0069NF2008/CN	Preparation of green colorant from mixed rare earth and molybdenum compounds and process thereof as surface coatings	Mundlapudi Lakshmipathi Reddy	21/10/2011	201080017745.9
0069NF2008/EP	Preparation of green colorant from mixed rare earth and molybdenum compounds and process thereof as surface coatings	Mundlapudi Lakshmipathi Reddy	24/10/2011	10719793.1
0197NF2008/RU	A process for the preparation of novel non-toxic yellow inorganic colorant/pigment from samarium and molybdenum compounds	Mundlapudi Lakshmipathi Reddy	26/10/2011	2011143354
0169NF2010/WO	Metal oxide modified and unmodified molecularly imprinted conducting polymer film based aqueous aminoacid sensors	Varghese Saumya, Krishna Pillai Padmaja Kumari Prathish, Talasila Prasada Rao	31/01/2012	PCT/IN2012/000072
0170NF2010/WO	Molecular probes with high fluorescence for solid-state lighting, selective discrimination of counterions of zinc, two photon imaging	Ayyappanpillai Ajayaghosh, Kizhumuri P. Divya, Sampath Srinivasan	14/02/2012	PCT/IB2012/050656
0122NF2009/US	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	15/03/2012	13/421511

PATENTS FILED (INDIA)

NFNO	Title	Inventors	Filing Date	Application No.
0169NF2010/IN	Metal oxide modified and unmodified molecularly imprinted conducting polymer film based aqueous amino acid sensors	Varghese Saumya, Krishna Pillai Padmaja Kumari Prathish, Talasila Prasada Rao	17/01/2012	0264DEL2011
0170NF2010/IN	Molecular probes with high fluorescence for solid-state lighting, selective discrimination of counterions of zinc, two photon imaging	Ayyappanpillai Ajayaghosh, Kizhumuri P. Divya, Sampath Srinivasan	14/02/2012	0367DEL2011
0139NF2011/IN	Fluorescent material for self-erasable writing, authentic security labeling, currency counterfeit prevention and processes for the preparation thereof	Ayyappanpillai Ajayaghosh, Rajasekaran Thirumalai Kumaran	12/08/2011	2294DEL2011
0155NF2010/IN	An improved bioprocess for the production of L-methionine aminopeptidase (L-Map) from *Streptomyces gedanensis*	K Madhavan Nampoothiri, Raji Rahulan, Ashok Pandey	12/08/2011	2290DEL2011
0138NF2011/IN	Dye entrapped sol-gel film based test strip sensor for nitrite and a process thereof	Santhakumar Dhanya, Talasila Prasada Rao	26/08/2011	2419DEL2011
0188NF2011/IN	A novel method of developing nano-structured silver oxide film based aqueous voltammetric pesticide sensor	Panampillil Vijayammma Subha, Varghese Saumya, Talasila Prasada Rao	31/01/2012	0264DEL2012
0014NF2012/IN	Improved anaerobic digester for household organic wastes	Vattackatt Balakrishnan Manilal	19/03/2012	0799DEL2012

PATENTS GRANTED (FOREIGN)

Title	Inventors	Grant Date	Patent No.
Method for continuous production of MgB_2 based superconductors	Syamaprasad Upendran, Abhilash Kumar Raveendran Nair Girirajkumari Amma, Vinod Krishnan Kutty, Aloysius Rajappan Padmavathy, Sarun Pallian Murikoli, Thennavarajan Subramanian Guruswamy Perumal	15/06/2011	GB2446973

A novel low temperature process for the synthesis of ultra-fine rutile phase titanium dioxide particles through vapor phase hydrolysis of titanium tetrachloride	Gerald Devasagayam Surender, Ani Karimpanoor John, Kumara Pillai Rajendra Prasad, Sivaraman Savithri	12/08/2011	JP4800768
A method for the preparation of cross linked protein crystals	Tholath Emilia Abraham, Bindhu LVA	12/08/2011	JP4799422
Quinaldine based semisquaraines and squaraine dyes, process for preparation thereof and use thereof	Ramaiah, Danaboyina; Kuthanapillil, Jyothish; Arun, Kalliat Thazhathveetil	16/08/2011	US7998935
Development of yellow pigments comprising alkaline earth, praseodymium and transition metal oxides and process thereof	Padala Prabhakar Rao, Mundlapudi Lakshmipathi Reddy	02/09/2011	FR2915987B1
Process for synthesis of telechelic urethane acrylate UV curable pre-polymeric materials	Syamakumari, Asha; Pillai, Chennakkattu Krishna Sadasivan	01/11/2011	US048979
$Mg_2MM'O_{6+X}$,(M=Y, rare earth metal, and M'=Sn, OR Zr) dielectric ceramics and their preparation as nanoparticles	James J, Senthilkumar S, Nair KV	03/01/2012	CA2520555

PATENTS GRANTED (INDIAN)

Title	Inventors	Grant Date	Patent No.
A process for the production of micronutrients rich rice bran oil using supercritical carbon dioxide extraction	Chami Arumughan, Ponmalakunnel Nichlavose Mayamol, Thomas Samuel, Chandrasekharan Pillai Balachandran, Andikkannu Sundaresan	27/04/2011	247621
A process for the preparation of phytase from jackfruit seed powder using *Aspergillus ficcum*	Kesavan Madhavan Nampoothiri, Ashok Pandey	25/08/2011	248793
A process for the production of super degummed and dewaxed rice bran oil physical refining	Dasiah Retna Sobankumar, Leelavathy Rajam, Andikkannu Sundaresan, Chami Arumughan	08/09/2011	248905

KNOWLEDGE RESOURCE CENTRE

The Knowledge Resource Centre (KRC) helps NIIST's scientists to be in the forefront of their R&D area by bringing together information, knowledge and technology. KRC is housing a specialized collection of documents including books, periodicals, CD-ROM databases etc., and providing access to electronic journals and databases. KRC is providing the high speed network through dedicated leased lines on OFC link with Ethernet connectivity to all researchers. These 24X7 services with 100% throughput and >99% network uptime cater to the Bandwidth critical applications and internet browsing, data upload/download, emails, video conferencing etc.. The section made significant progress both in strengthening the infrastructure, resources and in rendering services.

Resources

Print collection: As on March 2012, the total print collection is 43,000 plus documents which include 12,967 Books, 10947 Standards and 10082 Bound Volumes of Periodicals. During 2011-12, 95 books were purchased. 83 foreign and 77 Indian Periodicals were subscribed for 2012 including 35 titles in online version. Nine periodicals were received as gratis.

e-Resources: Access to more than 4000 journals from 12 publishers were provided under the NKRC (National Knowledge Resource Consortia) Programme and under Lab Funds to all Network users through NIIST IP. Trial access followed by regular access to the e-resources under the NKRC (National Knowledge Resource Consortia) Programme was facilitated through the PCs 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
- American Society of Civil Engineers
- American Society of Mechanical Engineers
- American Institute of Physics
- Association for Computing Machinery
- Cambridge University Press
- Elsevier
- Emerald
- Institute of Electrical and Electronics Engineers
- Nature Publishing Group
- Oxford University Press
- Royal Society of Chemistry
- Science Magazine
- Springer
- Taylor & Francis
- Wiley – Blackwell
- Indian Journals.com of Divan Enterprises

Bibliographic & Citation Databases

- Web of Science - Science Citation Index Expanded
- SCOPUS

Patent Databases

- Derwent Innovations Index

- Delphion

Standards

- ASTM

This was in addition to the Trial access of REAXYS, a web-based system for searching Organic, Inorganic and Organometallic data, American Society of Microbiology journals and Theime journals.

The usage of e-resources has been overwhelming particularly those of ACS, Elsevier and SCOPUS. The regular monitoring of usage and various promotional programmes such as regular message broadcasting of new facilities/services initiated, hosting in the intranet with search links to each item have enhanced the level of usage.

IT Resources: NIIST is vitally connected to the global knowledge community with its state-of the art IT infrastructure and high speed network. The buildings in the campus are interconnected through gigabit OFC backbone. There are a large number of high end personal computers connected over LAN through CAT6 UTP cabling. KRC hosts latest high-end IBM, DELL and HP Servers with wide range of operating systems such as Windows 7, Windows XP professional, Windows Vista, Redhat, Ubuntu. The edge switches located in each building are connected through layer3 & layer2 switches at KRC. Wi-Fi is enabled through various access points of CISCO, DIGISOL and BELKIN. Data backup of servers is been done through IBM DS4200 and Fujitsu Storage devices. Printing and scanning facility are available on a wide variety of printers such as Heavy Duty Color Multi-Function Laser Printers and A3/A4 Scanners.

Services

Library services: During the period, the in-house databases of Books, Periodicals, PhD Theses, Publications of NIIST Scientists, etc were updated regularly and made available through NIIST website as well as through Intranet. Conducted regular and extensive CD-ROM and Online database searches including those of Standards and Patents for scientists, scholars and students. Our resource facilities and services were extended to external users, primarily from research, industrial and academic sectors. About 350 persons from institutes and universities in and around Kerala visited NIIST KRC and availed the services. Initiation of new members to services of KRC were done regularly.

Creation of Institutional Repository of Theses & Research papers produced from NIIST is in progress. During the period 134 records were added to the IR. 302 volumes of periodicals were bound during the period. Rendered Reprographic and Photographic services as a general Laboratory facility.

Scientometric service: 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 papers published by NIIST during 2011 is **201**. Of which **193** are SCI Papers with an average IF value of **2.649**. The total number of SCI papers include 8 papers published in SCI journals without IF.

IT services: Provided Wired and Wi-Fi high speed internet connectivity to scientists, staff and research scholars through NKN Gigabit connectivity and 9 mbps dedicated internet leased line connectivity through BSNL. Implemented Unified Threat Management (UTM) device for routing, load balancing, fail-over and secured data access. A new e-mail system Zimbra has been implemented replacing the old sendmail system to provide better institutional e-mail facility for NIIST staff which helped to overcome the virus and spam threats. NIIST website www.niist.res.in has been given a facelift with new features and more information. Design, development and maintenance of NIIST website in Hindi is in progress. Developed and maintained websites, bulletin board service for the following projects, groups and conferences

- www.niist.res.in/biobulletin/ - for the biotechnology group .
- www.niist.res.in/oisc - for the Organic and

Inorganic Solar Cells Group

- www.niist.res.in/oisc/bulletin - for the NIIST group.
- Websites for CRSI (Chemical Research Society of India) and
- NHBT (New Horizons in Biotechnology) conferences
- MIS intranet portal to access e-journals, Forms, Notices and Circulars, Events and Holidays, Project Status, Staff Directory, Publications, Thesis etc.,

During the year Renovation of IT Lab with a Data Centre was taken up and the work is in progress, KRC maintained the NIIST Video conferencing facility; provided Hardware/ software and network support to all desktops and laptops, Taken up the Implementation of CSIR-ERP project. KRC also managed many software solutions and databases such as Stores and Purchase software, Libsuite, DSpace, BIS, Kaspersky Antivirus, Chemdraw, Sigmaplot, Origin. Maintained the DHCP, DNS, Proxy, Web, e-Mail and FTP servers, Switches, WiFi access points etc., The NIIST data was secured through scheduled Backup of data from the servers. Assistance was given in ensuring Quality Assurance in the acquisition of IT products and Devices of the lab.

LIST OF PUBLICATIONS : 2011

1. **ABHILASH (PA), NISHA (P), PRATHAPAN (A), NAMPOOTHIRI (S V), CHERIAN (O L), SUNITHA (T K) and RAGHU (K G)**
Cardioprotective effects of aqueous extract of Oxalis corniculata in experimental myocardial infarction
Experimental and Toxicologic Pathology
63(6): 535-540; Sep 2011

2. **AFINISHA DEEPAM (L S), SUNDARESAN (A) and ARUMUGHAN (C)**
Stability of Rice Bran Oil in terms of oryzanol, tocopherols, tocotrienols and sterols
Journal of the American Oil Chemists Society
88(7):1001-1009; Jul 2011

3. **AJITHA (M J) and SURESH (C H)**
Role of stereoelectronic features of Imine and Enamine in (S)-proline catalyzed Mannich reaction of Acetaldehyde: An In silico study
Journal of Computational Chemistry
32(9): 1962-1970; 15 Jul 2011

4. **AJITHA (M J) and SURESH (C H)**
A higher energy conformer of (S)-proline is the active catalyst in intermolecular aldol reaction: evidence from DFT calculations
Journal of Molecular Catalysis A- Chemical
345(1-2): 37-43:05; Jul 2011

5. **AJITHA (M J) and SURESH (C H)**
NHC catalyzed CO_2 fixation with epoxides: Probable mechanisms reveal ter molecular pathway
Tetrahedron Letters
52(41):5403-5406; 12 Oct 2011

6. **AJITHABAI (M D), RAMESHKUMAR (B), JAYAKUMAR (G), LUXMI VARMA and MANGALAM S NAIR**
Molecular and crystal structure of 8-acetoxy goniofufurone from *Goniothalamus wyanaadensis,* Bedd.
I***ndian Journal of Chemistry Section B-Organic Chemistry Including Medicinal Chemistry***
50(12):1786-1793; Dec 2011

7. **ANISHA (G S), ROJAN P JOHN and PREMA (P)**
Substrate specificities and mechanism of action of multiple alpha-galactosidases from *Streptomyces griseoloalbus*
Food Chemistry
13(9):2498-2501; 01 Jan 2011

8. **ANJU (K S), RAMAKRISHNAN (S) and SRINIVASAN**
meso-Aryl Triphyrin(2.1.1)
Organic Letters
13(9):2498-2501; 06 May 2011

9. ANNAMMA JOHN, SHYLA JOSEPH, MANU (K M), THOMAS (J K) AND SAM SOLOMON

Structure, microwave dielectric and optical properties of Ln2/3Gd1/3TiNbO6 (Ln=Ce, Pr, Nd and Sm) ceramics

Journal of Materials Science: Materials in Electronics

22(7):776-780; Jul 2011

10. ANTONY (M J) and JAYAKANNAN (M)

Polyaniline Nanoscaffolds for Colorimetric Sensing of Biomolecules via Electron Transfer Process

Langmuir

27(10):6268-6278; 17 May 2011

11. ANTONY (M J) and JAYAKANNAN (M)

Role of anionic micellar template on the morphology, solid-state ordering, and unusual conductivity trend in Poly(aniline-co-pyrrole) nanomaterials.

Journal of Physical Chemistry B

115(20):6427-6436; 26 May 2011

12. ARUN (K T), DHANYA (T J), REKHA (R A) and RAMAIAH (D)

ß-Cyclodextrin as a photosensitizer carrier: Effect on photophysical properties and chemical reactivity of Squaraine dyes

Journal of Physical Chemistry B

115(21):7122-7128; 02 Jun 2011

13. ARUN BOBY, PILLAI (U T S) and PAI (B C)

Developments in Magnesium alloys for Transport applications – An Overview

Indian Foundry Journal

57(1):29-37; Jan 2011

14. ARYA NANDAN, GAURAV (A), PANDEY (A), and NAMPOOTHIRI (K M)

Arginine Specific Aminopeptidase from *Lactobacillus brevis*

Brazilian Archives of Biology and Technology

54(1):133-140; Jan-Feb 2011

15. ARYA NANDAN, PANDEY (A), and NAMPOOTHIRI (K M)

Proline-Specific Extracellular Aminopeptidase Purified from *Streptomyces lavendulae*

Applied Biochemistry and Biotechnology

163 (8): 994-1001; Apr 2011

16. BALAMURUGAN (A), REDDY (M L P) and JAYAKANNAN (M)

Amphiphilic π-conjugated Poly(m-phenylene) Photosensitizer for the Eu3+ Ion: The role of macromolecular chain aggregation on the color tunability of Lanthanides

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115(37):10789-10800; 22 Sep 2011

17. BASHEER (S M), SREEJA (C), BEENA (P S), RAJEEV K SUKUMARAN, ELYAS (K K) and CHANDRASEKARAN (M)

Lipase from marine *Aspergillus awamori* BTMFW032: Production, partial purification and application in oil effluent treatment

New Biotechnology

28(6) Special Issue: SI:627-638; Oct 2011

18. BHEEMESWAR (D)
Patent strategy and management for R & D organizations
Science India
43-45; May 2011

19. BHOJE (G E) and TASHIRO (K N)
Effect of chain-length of n-alkane on solvent-induced crystallization and solvent exchange phenomenon in syndiotactic polystyrene
Polymer
52(3):822-829; 03 Feb 2011

20. CHAKRABORTY (M), DASGUPTA (S), SOUNDRAPANDIAN, JUI CHAKRABORTY,GHOSH (S.K),MITRA (M. K),BASU (D)
Methotrexate intercalated ZnAl-layered double hydroxide
Journal of Solid State Chemistry
184 (9)(2011) 2439–2445; Sep 2011

21. CHANDINI (S S P), PRASAD (V S) and SUDARSANA (K K)
Rapid Synthesis of Pure and Pr-Doped Ticeo4 Nanopigments by Solution Combustion method
NANO
6(2):139-144; Apr 2011

22. CHIMILOVSKI (J S), HABU (S), TEIXEIRA (R F B), THOMAZ-SOCCOL (V), NOSEDA (M D), MEDEIROS (A B P), PANDEY (A) and SOCCOL (C R)
Antitumour activity of *Grifola frondosa* exopolysaccharides produced by submerged Fermentation using sugar cane and soy molasses as carbon sources.
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49(3):359-363 Special Issue SI; Jul-Sep 2011

23. DASGUPTA (D), SRINIVASAN (S), ROCHAS (C), THIERRY (A), SCHRODER (A), AJAYAGHOSH (A) and GUENET (J M)
Insight into the gelation habit of oligo(para-phenylene vinylene) derivatives: effect of end-groups
Soft Matter
7(6):2797-2804; 2011

24. DASGUPTA (D), SRINIVASAN (S), ROCHAS (C), AJAYAGHOSH (A), and GUENET (J M)
Solvent-mediated fiber growth in organogels
Soft Matter
7(19): 9311-9315; 2011

25. DASTAGER (S G), DEEPA (C K) and PANDEY (A)
Growth enhancement of black pepper (*Piper nigrum*) by a newly isolated *Bacillus tequilensis* NII-0943
Biologia
66(5): 801-806; Oct 2011

26. DASTAGER (S G), DEEPA (C K) and PANDEY (A)
Potential plant growth-promoting activity of *Serratia nematodiphila* NII-0928 on black pepper (*Piper nigrum* L.)
World Journal of Microbiology and Biotechnology
27(2): 259-265; Feb 2011

27. DASTAGER (S G), DEEPA (C K) and PANDEY (A)
Plant growth promoting potential of Pontibacter niistensis in cowpea (*Vigna unguiculata* (L.) Walp.)
Applied Soil Ecology
49:250-255; Sep 2011

28. DASTAGER (S G), DEEPA (C K), LI (W J), TANG (S K) and PANDEY (A)
Paracoccus niistensis sp nov., isolated from forest soil, India
Antonie Van Leeuwenhoek International Journal of General and Molecular Microbiology
99 (3): 501-506; Mar 2011

29. DEEPA (J P), RESMI (V G), RAJAN (T P D), PAVITHRAN (C) and PAI (B C)
Studies on the influence of surface pre-treatments on electroless copper coating of boron carbide particles
Applied Surface Science
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30. DEEPA (J P), RESMI (V G), RAJAN (T P D), PAVITHRAN (C) and PAI (B C)
Studies on the effect of processing parameters on electroless coating of copper on boron carbide particles
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31. DEEPA (M), PRABHAKAR RAO (P), SUMI (S), RADHAKRISHNAN (A N), CHANDRAN (M R)and PETER KOSHY
Structural and electrical properties of nonstoichiometric semiconducting pyrochlores in Ca-Ce-Ti-Nb-O system
Materials Chemistry and Physics
127(1-2):162-169; 16 May 2011

32. DEEPTHI (S K), BINOD (P), SINDHU (R) and PANDEY (A)
Media engineering for production of poly- ß -hydroxybutyrate by *Bacillus firmus* NII 0830
Journal of Scientific and Industrial Research
70(11):968-975; Nov 2011

33. DEVADAS (K M), RAHUL (S), THOMAS (S), VARGHESE (N), VINOD (K), SYAMAPR ASAD (U), PRADHAN (S), CHATTOPADHYAY (M K) and ROY (S B)
Transport properties of sealed MgB(2)/Fe/Ni multifilamentary wires heat treated in air.
Journal of Alloys and Compounds
509(31):8038-8041; 04 Aug 2011

34. DHANESH (T) and SEBASTIAN (M T)
Microwave dielectric properties of Ca_2+xLa_8-x(SiO4)$_6$-x(PO_4)xO_2 solid solution
Journal of the American Ceramic Society
94(8):2276-2278; Aug 2011

35. DHANYA (G) and NAMPOOTHIRI (K M)
Folate production using *Lactococcus lactis* ssp cremoris with implications for fortification of skim milk and fruit juices
Lwt-Food Science and Technology
44(9):1859-1864; Nov 2011

36. DHANYA (G), NAMPOOTHIRI (K M) and PANDEY (A)
α-Amylase production by *Bacillus amyloliquefaciens* using agro wastes as feed stock
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49(3):336-340 Special Issue SI; Jul-Sep2011

37. DIAS (A), LAGE (M M), ABDUL KHALAM (L), SEBASTIAN (M T) and IRA (R L)
Vibrational Spectroscopy of Ca(2)LnTaO(6) (Ln = lanthanides, Y, and In) and Ca_2InNbO_6 Double Perovskites
Chemistry of Materials
23(1):14-20,11; Jan 2011

38. DIVYA (L), WERNGREN (J), JOSE (L), SUJA (K P), MANGALAM S NAIR, LUXMI VARMA (R), SATHISH (M), HOFFNER (S) and KUMAR (R A)
Ethyl p-methoxycinnamate isolated from a traditional anti-tuberculosis medicinal herb inhibits drug resistant strains of Mycobacterium tuberculosis in vitro
Fitoterapia
82(5):757-761; Jul 2011

39. DIVYA (V), FREIRE (R O) and REDDY (M L P)
Tuning of the excitation wavelength from UV to visible region in Eu3+-beta-diketonate complexes Comparison of theoretical and experimental photophysical properties
Dalton Transactions
40(13):3257-3268; 2011

40. GEORGE (S C), SREEJA (T), ANAS (S), RADHAKRISHNAN (K V) and YAMAMOTO (Y)
Palladium catalyzed 1,8-Conjugate addition to Heptafulvene via Bis-π-allyl palladium complexes
Organic Letters
13(19): 4984-4987; 07 Oct 2011

41. GEORGE (S), SAJITH (V K), SEBASTIAN (M T), RAMAN (S) and MOHANAN (P)
Synthesis and microwave dielectric properties of Li_2MgSio_4 ceramics prepared using citrate gel route
Journal of Advanced Dielectrics (JAD)
1(2):209-213; Apr 2011

42. GIABLE GEORGE, VISHNU (V S) and REDDY (M L P)
The synthesis, characterization and optical properties of silicon and praseodymium doped Y6MoO12 compounds: Environmentally benign inorganic pigments with high NIR reflectance
Dyes and Pigments
88(1):109-115; Jan 2011

43. GISHA (E L) and PILLAI (C K S)
Biodegradable Polymers- A review on recent trends and emerging perspectives
Journal of Polymers and the Environment
19(3): 637-676; Sep 2011

44. GUPTA (S C), KANNAPPAN (R), KIM (J), RAHMAN (G M), FRANCIS (S K), RESHMA (R), MANGALAM S NAIR, DAS (J) and AGGARWAL (B B)
Bharangin, a Diterpenoid Quinonemethide, abolishes constitutive and inducible Nuclear Factor-kappa B (NF-kappa B) activation by modifying p65 on cysteine 38 residue and reducing inhibitor of nuclear factor-kappa B alpha kinase activation, leading to suppression of NF-kappa B-regulated gene expression and sensitization of Tumor cells to Chemotherapeutic agents
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80(5):769-781; Nov 2011

45. GUPTA (S C), REUTER (S), PHROMNOI (K), PARK (B), HEMA (P S), MANGALAM S NAIR and AGGARWAL (B B)
Nimbolide sensitizes human Colon Cancer cells to TRAIL through reactive Oxygen species- and ERK-dependent up-regulation of death receptors, p53, and Bax
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46. HARSHA (N), BABITHA (K B), SATYAJIT SHUKLA and WARRIER (K G K)
Comparing effects of Silver and Iron deposition on dye-adsorption in dark using Anatase-Titania Nanotubes Catalyst
Nanoscience and Nanotechnology Letters
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Journal of Nanoscience and Nanotechnology
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Effect of silver and palladium on Dye-removal characteristics of Anatase-Titania Nanotubes
Journal of Nanoscience and Nanotechnology
11(3):2440-2449; Mar 2011

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Effects of temperature and solvent on antioxidant properties of curry leaf (*Murraya koenigii L.*)
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147. SHERIN (T), SAYOOJYAM (B) and SEBASTIAN (M T)
Microwave dielectric properties of Novel rare earth based silicates: RE(2)Ti(2)SiO(9) [RE = La, Pr and Nd]
Journal of Materials Science-Materials in Electronics
22(9):1340-1345; Sep 2011

148. SHINTO VARGHESE and SURESH DAS
Role of molecular packing in determining solid-state optical properties of π –conjugated materials
Journal of Physical Chemistry Letters
2(8):863-873; 21 Apr 2011

149. SHUKLA D, SAXENA S, PURUSHOTHAMAN J, *et al.*
Hypoxic preconditioning with cobalt ameliorates hypobaric hypoxia induced pulmonary edema in rat
European Journal of Pharmacology
656 (1-3): 101-109; 10 Apr 2011

150. SHYAM KRISHNA, RAY (A), DUBEY (S K), LARROUY-MAUMUS (G), CHALUT (C), CASTANIER (R), NOGUERA (A), GILLERON (M), PUZO (G), VERCELLONE (A), NAMPOOTHIRI (K M) and NIGOU (J)
Lipoglycans Contribute to Innate Immune Detection of Mycobacteria
PLoS ONE
6(12):9pp;Article No e28476; 02 Dec 2011

151. SINDHU (R N), PRATHISH (K P), KARTHIK (G) and PRASADA RAO (T)
Hybrid gold atomic cluster-cobalt oxide scaffolds for dual tandem electrocatalytic sensing of cysteine
Biosensors and Bioelectronics
26(9):3920-3926; 15 May 2011

152. SINDHU (R), AMMU (B), BINOD (P), DEEPTHI (S K), RAMACHANDRAN (K B), SOCCOL (C R) and PANDEY (A)
Production and characterization of Poly-3-hydroxybutyrate from crude glycerol by *Bacillus sphaericus* NII 0838 and improving its thermal properties by blending with other polymers
Brazilian Archives of Biology and Technology
54(4): 783-794; Jul-Aug 2011

153. SINDHU (R), KUTTIRAJA (M), BINOD (P), JanU (K U), RAJEEV K SUKUMARAN and PANDEY (A)
Dilute acid pretreatment and enzymatic saccharification of sugarcane tops for bioethanol production
Bioresource Technology
102(23):10915-10921; Dec 2011

154. SINGHANIA (R R), RAJEEV K SUKUMARAN, RAJASREE (K P), MATHEW (A), LALITHADEVI (G) and PANDEY (A)
Properties of a major beta-glucosidase-BGL1 from *Aspergillus niger* NII-08121 expressed differentially in response to carbon sources
Process Biochemistry
46(7):1521-1524; Jul 2011

155. SMITHA (M), PARVATHY (R), SHALINI (V), HELEN (A) and JAYALEKSHMY (A)
Isolation, characterization and quantification of Tricin and Flavonolignans in the medicinal rice Njavara (*Oryza sativa* L.), as compared to staple varieties
Plant Foods for Human Nutrition
66(1):91-96; Mar 2011

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Investigations on the effect of experimental parameters on the porosity features of silica aerogels synthesized at ambient drying conditions
Materials Chemistry and Physics
131(1-2):507-511; 15 Dec 2011

157. SMITHA (S L), GOPCHANDRAN (K G), RAVINDRAN (T R) and PRASAD (V S)
Gold nanorods with finely tunable longitudinal surface plasmon resonance as SERS substrates
Nanotechnology
22(26):Article Number 265705; 01 Jul 2011

158. SMITHA (V S), MANJUMOL (K A), GHOSH (S K), BRAHMAKUMAR (M), PAVITHRAN (C), PERUMAL (P) and WARRIER (K G K)
Rhodamine 6G intercalated Montmorillonite Nanopigments-polyethylene composites: Facile synthesis and ultraviolet stability study
Journal of the American Ceramic Society
94(6):1731-1736; Jun 2011

159. SOCCOL (C R), PANDEY (A), LARROCHE (C) and THOMAZ-SOCCOL (V)
Selected papers presented at the International Congress on Bioprocesses in Food Industries (ICBF-2010), Curitiba, Brazil; October 5-8, 2010 - Preface
Food Technology and Biotechnology
49(3):275-275 Special Issue SI; Jul –Sep 2011

160. SOUMYA (M N), RANJITH (A) and ARUMUGHAN (C)
RP-HPLC-DAD method for the estimation of embelin as marker in *Embelia ribes* and its polyherbal formulations
Biomedical Chromatography
25(5):600-605; May 2011

161. SREEDEVI (K C G), THOMAS (A P), SALINI (P S), RAMAKRISHNAN (S), ANJU (K S), HOLADAY (M G D), REDDY (M L P), SURESH (C H) and SRINIVASAN (A)
5,5-Diaryldipyrromethanes: Syntheses and anion binding properties
Tetrahedron Letters
52(45):5995-5999; 09 Nov 2011

162. SREEJA (T), GANGA, (V B), PRAVEEN (L) and LUXMI VARMA (R)
Hybrid macrocyclic receptors based on lower rim functionalised thiacalix[4]arene and amino acids: Synthesis, structure and binding properties towards metal ions
Indian Journal of Chemistry Section B- Organic Chemistry including Medicinal Chemistry
50(5):704-714; May 2011

163. SREEJA KUMARI (S S), PILLAI (U T S) and PAI (B C)
Synthesis and characterization of in situ Al-AlN composite by nitrogen gas bubbling method
Journal of Alloys and Compounds
509(5): 2503-2509; 03 Feb 2011

164. SREEJITH (S), DIVYA (K P), MANOJKUMAR (T K) and AJAYAGHOSH (A)
Multiple Analyte Response and Molecular Logic Operations by Excited-State Charge-Transfer Modulation in a Bipyridine Integrated Fluorophore
Chemistry-An Asian Journal
6(2):430-437; 01 Feb 2011

165. SREENATH (K), THOMAS (T G) and GOPIDAS (K R)
Cu(II) Mediated generation and spectroscopic study of the Tris(4-anisyl)amine radical cation and dication. Unusually shielded chemical shifts in the Dication
Organic Letters
13(5):1134-1137; 04 Mar 2011

166. STEPHAN (A M), KUMAR (T P), ANGULAKSHMI (N), SALINI (P S), SABARINATHAN (R), SRINIVASAN (A) and THOMAS (S)
Influence of Calix[2]-p-benzo[4]pyrrole on the Electrochemical Properties of Poly(ethylene oxide)-Based Electrolytes for Lithium Batteries
Journal of Applied Polymer Science
120(4): 2215-2221; 15 May 2011

167. SUDHA (J D), PICH (A), REENA (V L), SIVAKALA (S) and ADLER (HANS-JUERGEN P)
Water-dispersible multifunctional polyaniline-laponite-keggin iron nanocomposites through a template approach
Journal of Materials Chemistry
21(41):16642-16650; 2011

168. SUMESH GEORGE and SEBASTIAN (M T)
Low-Temperature sintering and microwave dielectric properties of $Li_2ATi_3O_8$ (A=Mg, Zn) Ceramics
International Journal of Applied Ceramic Technology
8(6):1400-1407; Nov -Dec 2011

169. SUMESH GEORGE, SEBASTIAN (M T), SUJITH (R) and MOHANAN (P)
Novel Low Loss, Low Permittivity Glass-Ceramic Composites for LTCC Applications
International Journal of Applied Ceramic Technology
8(1):172-179; 2011

170. SUNDARARAJAN (M) and USHA (N)
Environmental geochemistry of core sediments from Serthalaikkadu creek, East coast of India
Environmental Earth Sciences
62(3):493-506; Feb 2011

171. SURESH (M), SRINIVASAN (A), PILLAI (U T S) and PAI (B C)
The effect of charcoal addition on the grain refinement and ageing response of magnesium alloy AZ91
Materials Science and Engineering: A Structural Materials Properties Microstructure and Processing
528(29-30):8573-8578; 15 Nov 2011

172. SURESH (M), SRINIVASAN (A), RAVI (K R), PILLAI (U T S) and PAI (B C)
Microstructural refinement and tensile properties enhancement of Mg-3Al alloy using charcoal additions
Materials Science and Engineering A-Structural Materials Properties Microstructure and Processing 528(6):2502-2508; 15 Mar 2011

173. SURESH KUMAR (S)
NIIST Nano activity: Progressing in tandem with trends
Nano Digest
3(4):24-27; Sep 2011

174. THOMAS (D), CHAMESWARY (J) and SEBASTIAN (M T)
Mechanically flexible Butyl Rubber-SrTiO(3) composite dielectrics for microwave applications
International Journal of Applied Ceramic Technology
8(5):1099-1107; Sep-Oct 2011

175. THOMAS (J K), PADMAKUMAR (H), PRASAD (V S) and SAM SOLOMON
Structure and properties of nanocrystalline BaHfO3 synthesized by an auto-igniting single step combustion technique
Ceramics International
37(2):567-571; Mar 2011

176. TORRES (S), PANDEY (A) and CASTRO (G R)
Organic solvent adaptation of Gram positive bacteria: Applications and biotechnological potentials
Biotechnology Advances
29(4):442-452; Jul –Aug 2011

177. USHASREE (M V), SALIM (S H B) and PANDEY (A)
A Comparative analysis of recombinant expression and solubility screening of two phytases in *E. coli*
Food Technology and Biotechnology
49(3):304-309 Special Issue SI; Jul –Sep 2011

178. USHASREE (M V), SUMAYYA (H B S) and PANDEY (A)
Adopting structural elements from intrinsically stable phytase- A promising strategy towards thermostable phytases
Indian Journal of Biotechnology
10(4):458-467; Oct 2011

179. VARGHESE (J), JOSEPH (T) and SEBASTIAN (M T)
ZrSiO4 ceramics for microwave integrated circuit applications
Materials Letters
65(7):1092-1094; 15 Apr 2011

180. VARGHESE (N), VINOD (K), RAHUL (S), ANEES (P), DEVADAS (K M), THOMAS (S), SHIPRA, SUNDARESAN (A), ROY (S B) and SYAMAPRASAD (U)
Effect of Carbon Substitution on the Superconducting Properties of Nanocarbon-, Nanodiamond- and Nano-SiC-Doped MgB2
Journal of the American Ceramic Society
94(4):1133-1137; Apr 2011

181. VIBIN (M), VINAYAKAN (R), ANNIE JOHN, RAJI (V), REJIYA (C S), and ANNIE ABRAHAM
Fluorescence imaging of stem cells, cancer cells and semi-thin sections of tissues using Silica-coated CdSe quantum dots
Journal of Fluorescence
21(4):1365-1370; Jul 2011

182. VIBIN (M), VINAYAKAN (R), ANNIE JOHN, RAJI (V), REJIYA (C S), VINESH (N S) and ANNIE ABRAHAM
Cytotoxicity and fluorescence studies of silica-coated CdSe quantum dots for bioimaging applications
Journal of Nanoparticle Research
13(6):2587-2596; Jun 2011

183. VIBIN (M), VINAYAKAN (R), ANNIE JOHN, RAJI (V), REJIYA (C S), VINESH (N S) and ANNIE ABRAHAM

Biokinetics and *in vivo* distribution behaviours of Silica-Coated Cadmium Selenide Quantum dots

Biological Trace Element Research

142(2):213-222; Aug 2011

184. VIBIN (M), VINAYAKAN (R), ANNIE JOHN, REJIYA (C S), RAJI (V) and ANNIE ABRAHAM

Cellular uptake and subcellular localization of highly luminescent silica-coated CdSe quantum dots- *in vitro* and in vivo

Journal of Colloid and Interface Science

357(2):366-371; 15 May 2011

185. VIDYA (J), SWETHA (S), SINGH (S K), DEEPTHY ALEX, RAJEEV K SUKUMARAN and PANDEY (A)

Isolation and characterization of a Novel α –amylase from a metagenomic library of Western Ghats of Kerala, India

Biologia 66(6)

939-944; Dec 2011

186. VIDYA,(J), USHASREE (M V), SOCCOL, (C R) and PANDEY (A)

Cloning, functional expression and characterization of L-Asparaginase II from *E. coli* MTCC 739

Food Technology and Biotechnology

49(3):286-290 Special Issue SI; Jul–Sep 2011

187. VIJAY NAIR (G), PAUL (R R), PADMAJA (D V M), AISWARYA (N), SINU (C R) and ANU JOSE

NHC-catalyzed annulation of enals and chalcones: Further explorations on the Novel synthesis of 1,3,4-trisubstituted cyclopentenes

Tetrahedron

67(51):9885-9889, 23 Dec 2011

188. VIJAY NAIR (G), RAJEEV S MENON, BIJU (A T), SINU (C R), PAUL (R R), ANU (J) and SREEKUMAR (V)

Employing homoenolates generated by NHC catalysis in carbon-carbon bond-forming reactions: state of the art

Chemical Society Reviews

40(11): 5336-5346; 2011

189. VIJAY NAIR (G), PAUL (R R), LAKSHMI (K C S), RAJEEV S MENON, ANU JOSE and SINU (C R)

N-Heterocyclic carbene (NHC) catalyzed annulation of enals and vinyl ketones: a Novel synthesis of [2H]-pyranones

Tetrahedron Letters

52(45) 5992-5994; 09 Nov 2011

190. VIJAY NAIR (G), SINU (C R), REJITHAMOL (R), LAKSHMI (K C S) and SURESH (E)

A Novel NHC-catalyzed transformation of 2H-chromene-3-carboxaldehydes to 3-methyl-2H-chromen-2-ones

Organic and Biomolecular Chemistry

9(15):5511-5514; 2011

191. VIJAYAKUMAR (C), PRAVEEN (V K), KARTHA (K K) and AJAYAGHOSH (A)
Excitation energy migration in oligo(p-phenylenevinylene) based organogels: structure-property relationship and FRET efficiency
Physical Chemistry Chemical Physics
13(11):4942-4949; 2011

192. VIJAYALAKSHMI (K P), NEETHA (M), AJITHA (M J) and SURESH (C H)
Mechanism of epoxide hydrolysis in microsolvated nucleotide bases adenine, guanine and cytosine: A DFT study
Organic and Biomolecular Chemistry
9(14):5115-5122; 2011

193. VIJI (V), HELEN (A) and LUXMI VARMA (R)
Betulinic acid inhibits endotoxin-stimulated phosphorylation cascade and pro-inflammatory prostaglandin E-$_2$ production in human peripheral blood mononuclear cells
British Journal of Pharmacology
162(6):1291-1303; Mar 2011

194. VINOTH BABU (K), JAPPES (J T W) and RAJAN (T P D)
Drilling studies on silicon carbide reinforced functionally graded aluminum matrix composites
Journal of Emerging Technology in Mechanical Science and Engineering
2:54-60; 2011

195. VINU (S), SARUN (P M), SHABNA (R) and SYAMAPRASAD (U)
Dissipative flux motion and flux flow resistivity analysis in La-Doped (Bi, Pb)-2212 superconducting ceramics
Journal of the American Ceramic Society
94(5):1634-1638; May 2011

196. VIPIN GOPINATH, MEISWINKEL (T M), WENDISCH (V F) and NAMPOOTHIRI (K M)
Amino acid production from rice straw and wheat bran hydrolysates by recombinant pentose-utilizing *Corynebacterium glutamicum*
Applied Microbiology and Biotechnology
92(5):985-996; Dec 2011

197. VISHNU (V S) and REDDY (M L P)
Near-infrared reflecting inorganic pigments based on molybdenum and praseodymium doped yttrium cerate: Synthesis, characterization and optical properties.
Solar Energy Materials and Solar Cells
95(9):2685-2692; Sep 2011

198. VISHNU (V S), JOSE (S) and REDDY (M L P)
Novel environmentally benign yellow inorganic pigments based on solid solutions of Samarium-Transition Metal Mixed Oxides
Journal of the American Ceramic Society
94(4):997-1001; Apr 2011

199. YAHAYA (L E), ADEBOWALE (K O), OLU-OWOLABI (B I) and MENON (A R R)
Compositional analysis of Tea (*Camellia sinensis*) seed oil and its application
International Journal of Research in Chemistry and Environment
1(2):153-158; Oct 2011

200. YESUDAS (J P), SAYYED (F B) and SURESH (C H)

Analysis of structural water and CH …π interactions in HIV-1 protease and PTP1B complexes using a hydrogen bond prediction tool, HBPredicT

Journal of Molecular Modeling

17(2):401-413; Feb 2011

201. YOTNOI (B), RUJIWATRA (A), REDDY (MLP), SARMA (D) and NATARAJAN (S)

Lanthanide Sulfate Frameworks: Synthesis, structure and optical properties

Crystal Growth and Design

11(4); 1347-1356; Apr 2011

GENERAL INFORMATION

VISITS ABROAD

Name	Country Visited	From	To	Purpose
Dr. Ashok Pandey	Greece	4.4.2011	4.4.2011	University of Patras - to deliver a lecture in the international seminar on "Biorefineries and food production"
	Hong Kong	5.5.2011	5.5.2011	Key note lecture in the international conference on solid waste managment
	Shangai , China	11.5.2011	14.5.2011	Lecture in the Asian congress on Biotechnology
	France	1.6.2011	30.6.2011	University Blaise Pascal Visiting Professor , Fellowship from University Blaise pascal (UBP), Clermony Ferrand, France
	Taiwan	25.9.11	30.9.11	Invited Lecture in the International conference CESE-2011
	Nottingham, UK	12.3.2012	13.3.2012	To attend International Conference on Functional biopolymers for tissue engineering application sponsored by Royal Society, Nottingham, UK
Dr. A. Ajayghosh	Seoul , Korea	25.4.2011	30.4.2011	To deliver a talk in Yonsei University
	Japan and Thailand	24.8.2011	8.9.2011	JSPS-DST collaborative programme at NIMS Tsukuba Japan and invited talk at the 14 th Asian chemical congress (ACC), Bangkok, Thailand
	Beijing, China	26.9.2011 13.10.2011	29.9.2011 17.10.11	Plenary speaker for the 5 th East Asia symposium and Invited talk in the 10 th International symposium on functional pi-Electron systems
Dr. Suresh Das	Denmark	4.5.2011	6.5.2011	Technical University of Denmark for attending the meeting of Joint EU India Research programme
Dr.M.T. Sebastian	Slovania	15.5.2011	29.5.2011	Bilateral visit under Indo-Slovanian project
Dr. C.H. Suresh	Germany	1.7.2011	30.9.2011	Marburg University, Germany (Humboldt fellowship)
Dr. T.P.D. Rajan	Germany	19.7.2011	22.7.2011	Oral Presentation in the 5th international light metals technology conference at Luneburg, Germany
Dr.D.Ramaiah	China and Hongkong	23.9.2011	29.9.2011	Key note lecture in 5 th East Asia Symposium (EASS) on functional dyes and advanced Materials
Dr. P.Prabhakar Rao	Niigata University, Japan	21.11.2011	23.11.2011	Oral presentation in the international conference on phosphor materials.
Dr. Rajeev K. Sukumaran	University of Nottingham, UK	12.3.2012	13.3.2012	To attend the International meeting on Functional biopolymers for tissue engineering

HONOURS AND AWARDS

Dr. Suresh Das	Member, Editorial Advisory Board, Langmuir
	Fellow, Indian National Science Academy, New Delhi
	Vice President, Material Research Society of India
Dr. D. Ramaiah	Council Member, Chemical Research Society of India, Bangalore
Dr. A. Ajayaghosh	Fellow, National Academy of Sciences India, Allahabad
	A. V. Rama Rao Foundation Award Lecture (JNCASR, Bangalore)
Dr. M. L. P. Reddy	Certificate of Appreciation- American Chemical Society, New York
Dr. Karunakaran Venugopal	Young Scientist Award 2012 (Indian Society of Chemist and Biologist (ISCB) in the Chemical Sciences)
Dr. Reena V. L	Best Thesis Award (Gold Medal) Instituted by the Society of Polymer Science of India
Mr. P. C. Nandajan	Best Poster Award, 14th Chemical Research Society of India Symposium - February, 2012
Mr. M. Shantil	Best Poster Award, 14th Chemical Research Society of India Symposium - February, 2012
Mr. K. Retheesh	Best Oral Presentation Award. 7th JNC Conference on Chemistry of Materials - October, 2011.
Dr. Giable George	Young Scientist Award- 2012, 24th Kerala Science Congress- January, 2012.
Dr. V. S. Vishnu	Best Poster Award, National Conference on Science, Technology and Application of Rare Earths - August, 2011.
Ms. Sheethu Jose	Best Poster Award, International Congress on Analytical Science2012 - January, 2012
Ms. Jisha Babu	Best Poster Award, National Conference on Organic Chemistry, RTCSFC - August, 2011
Mr. Praveen Prakash	Best Poster Award, National Conference on Organic Chemistry - RTCSFC August, 2011
Prof. Ashok Pandey	Visiting Professor, Universite Blaise Pascal, Clermont Ferrand, France
Dr. Reeta Rani Singhania	Post-doctoral Fellowship, Universite Blaise Pascal, Clermont Ferrand, France
Dr. Shyam Krishna	Post-doctoral Fellowship, INRS, Quebee, Canada
Ms. K. P. Rajasree	Best Paper Award, International Conference on New Horizons in Biotechnology, November, 2011
Ms. M.V. Ushasree	Best Paper Award, International Conference on New Horizons in Biotechnology, November, 2011

PH.D. DEGREE AWARDED

Student	Thesis title	Supervisor	University
Ms. Ambili Raj DB	Luminescence of fluorinated β-diketonate Complexes of Lanthanides	Dr. MLP Reddy	Kerala
Mr. Tony Joseph	Low Loss Silicate Based Dielectric Materials for Wireless Communication	Dr. MT Sebastian	Kerala
Mr. Praveen L	8-Hydroxyquinoline derived fluorescent probes for the detection of transition metal ions	Dr. R Luxmi Varma & Dr. MLP Reddy	Kerala
Mrs. Afinisha Deepam LS	Investigations on Unsaponifiable Phytochemicals of Rice Bran Oil	Dr. C. Arumughan & Dr. A Sundaresan	CUSAT
Mr. Ramakrishnan S	Ansa-Metallocene based normal and expanded Calixpyrroles and Calixphyrins: Syntheses, Spectral and Structural Characterization	Dr. MLP Reddy	Kerala
Ms. Dhanya James	Preconcentrative separation,removal and sensing of selected inorganic toxins	Dr. T Prasada Rao	Kerala
Mr. Prathish KP	Biomimetic and optoelectronic sensors for selected envirotoxic markers	Dr. T Prasada Rao	Kerala
Ms. Shabna R	Metal to insulator transition phenomenon in (bi,pb) - 2212 : an insight into the doping dependent evolution of a high temperature superconductor	Dr. U Shyama Prasad	Kerala
Mr. Anas S	Zinc oxide nano structures and Nano Composites for Functional and 'Smart' Varistor Applications	Dr. S Ananthakumar	Kerala
Ms. Anju KS	Meso-Aryl normal, expanded and contracted Porphyrinoids: Syntheses, Spectral and Structural Studies	Dr. MLP Reddy	Kerala
Mr. Vishnu VS	Synthesis, characterization, and optical properties of environmentally benign Rare Earth based inorganic pigments	Dr. MLP Reddy	Kerala
Mr. Vinu S	Studies on suppression of flux creep and scaling of vortex fluid resistivity in rare earth modified (bi,pb) - 2212 superconductors	Dr. U Shyama Prasad	Kerala
Ms. Nish VR	Microbial prodution of Polyhydroxybutyrate	Dr. Ashok Pandey	Kerala

MEMBERS OF THE RESEARCH COUNCIL

CHAIRMAN

Dr. Dipankar Banerjee
Department of Materials Engineering
Indian Institute of Science
Bengaluru-560 012

MEMBERS

Prof. S. Vasudevan
Professor
IPC Department, Indian Institute of Science
Bengaluru-560 012

Prof. M.K.Mathew
Laboratory of Membrane Biophysics
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
Ghotavde Phata, Urawde Road,
Pirangut Industrial Area, Gate No 1139/1
Mulshi, Pune- 412 108

Dr. M.R.Pillai
Director
Rajiv Gandhi entre 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 K Pillai
Acting Director
Central Electrochemical Research Institute
Karaikudi-630 006, Tamil Nadu

SISTER LABORATORY

Dr. Pushpito.K.Ghosh
Director
Central Salt & Marine Chemicals Research Institute
Gijubhai Badheka Marg, Bhavnagar-364 002

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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 Agroprocessing & 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

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Dr. A. Ajayaghosh, Scientist, NIIST
Dr. Elizabeth Jacob, Scientist, NIIST
Dr. K.V. Radhakrishnan, Scientist, NIIST
Dr. J.D. Sudha, TO Group lll (6)
Dr. Nagesh.R.Iyer, Director, SERC, Chennai
Head, RPBD, NIIST
COFA / F&AO, NIIST

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Dr. M.T. Sebastain, Scientist, NIIST
Dr. (Mrs). S.Savithri, Scientist, NIIST
Dr. T.P.D.Rajan, Scientist, NIIST
Dr. B.Krishnakumar, Scientist, NIIST
Sri. S.Veluswamy, NIIST
COFA, NIIST
Head, RPBD/PPD, NIIST

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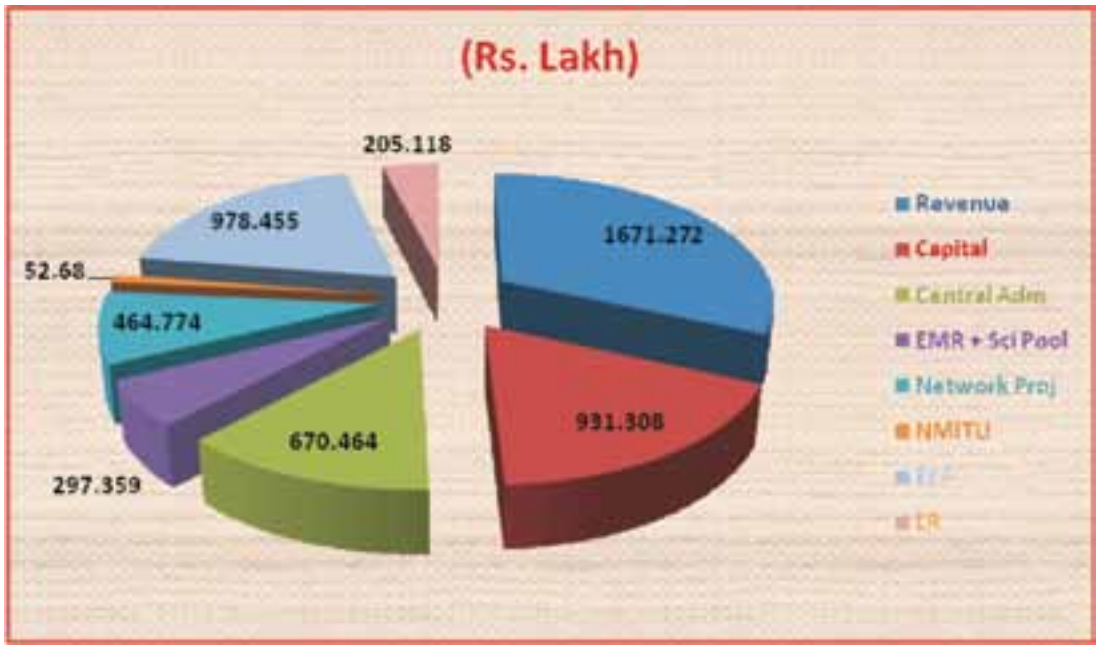
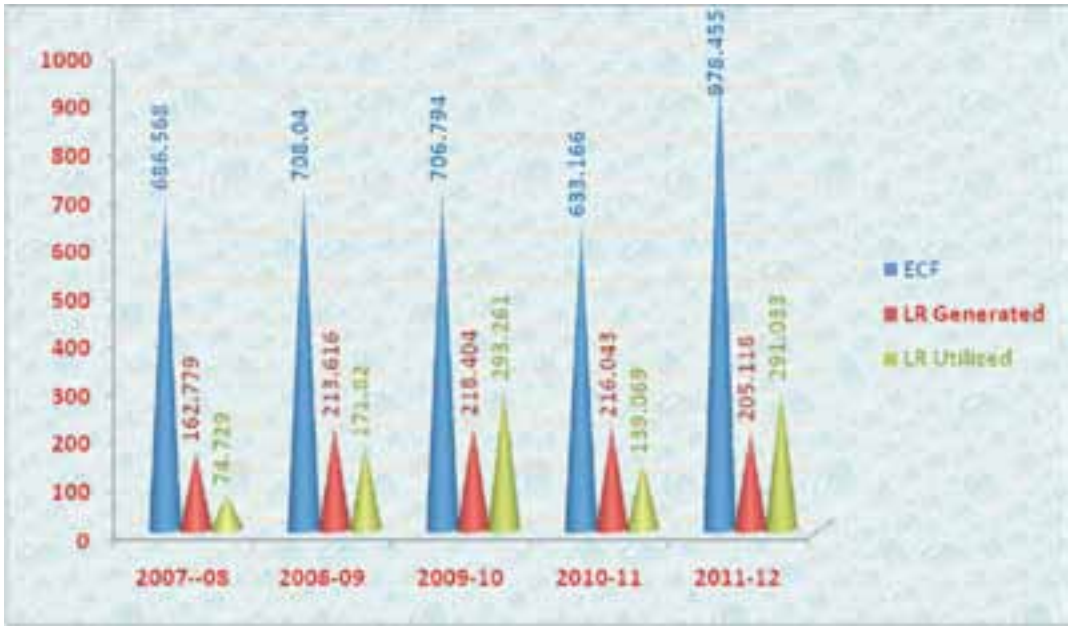
AO, NIIST

BUDGET 2011-2012



EXTERNAL CASH FLOW & LAB RESERVE (RS. LAKH)



STAFF - New Scientist Recruitments

Dr. BINOD PARAMESWARAN, Scientist, 19-Aug-2011

Dr. Binod Parameswaran obtained his Ph.D. from Kerala University. His research interests focuses on Biofuels, Biopolymers, Industrial Enzymes.

Mr. RIBIN JONES SB, Scientist, 19-Aug-2011

Mr. Ribin Jones holds a Master's degree (ME) in Network and Internet Engineering with a Cisco Certified Network Professional, Red Hat Certified Engineer. He is also a Certified Ethical Hacker. His areas of interest are IT and ITES services IT Administration Network Security and Open source environment.

Dr. RAMESHKUMAR NATARAJAN, Scientist, 12-Sep-2011

Dr. Rameshkumar Natarajan obtained his Ph.D. from M S Swaminathan Research Foundation, University of Madras in 2009. Microbial Ecology and Systematics are his areas of research interest.

Dr. U S HAREESH, Senior Scientist, 08-Nov-2011

U. S. Hareesh obtained PhD in Chemistry from Mahatma Gandhi University. He worked as a visiting scientist at Institute for New Materials, Saarbruecken, Germany during 2001-2004 and as a scientist at the Centre for Ceramic Processing, Advanced Research Centre International (ARCI), Hyderabad during 2004-2011. His current areas of research include materials processing for Dye sensitised and Quantum Dot sensitised Solar Cells, Methyl cellulose based thermal gelation for shape forming of ceramics and synthesis of advanced ceramic oxide powders by spray calcination technique for optical ceramics. He is a reviewer for many international Journals in the area of materials science & ceramics. He was awarded the Malaviya Award by the Indian Ceramic Society in 2011.

Dr. YOOSAF KARUVATH, Scientist, 22-Dec-2011

Dr. K. Yoosaf was born in Nilambur, Malappuram district, Kerala. He obtained his M.Sc. Degree in applied Chemistry and Ph.D. from Cochin University of Science and Technology, Kochi, Kerala for the work carried out under the supervision of Prof. K. George Thomas at CSIR-NIIST, Trivandrum. During his Ph.D. tenure he was a visiting fellow at CNR-ISOF, Bologna, Italy. Later he moved CNR-ISOF, Bologna, Italy to work with Dr. Nicola Armaroli and was awarded twice, in the year 2009 and 2010, prestigious Marie-Curie Post Doctoral Fellowship. Subsequently he was selected as a Researcher Level III at CNR-ISOF, Bologna, Italy. During this period he was also a visiting researcher at Dipartimento di Chimica "G. Ciamician", University of Bologna, Italy, Dipartimento di Scienze Farmaceutiche, Trieste, Italy FUNDP, Namur, Belgium. He also played a key role in setting up a Confocal Scanning Fluorescence Microscope at Dipartimento di Chimica "G. Ciamician", University of Bologna, Italy. His research interests are in the areas of metal/semiconducting/organic nanomaterials, organic inorganic nanohybrid systems, self-assembly, photophysics and various microscopies.

Dr. ERATHIMMANNA BHOJE GOWD, Senior Scientist, 22-DEC-2011

Dr. Bhoje Gowd is M.Sc. (Tech) in Polymer Science and Technology from Sri Krishnadevaraya University, Anantapur, Andhra Pradesh and Ph.D. from University of Pune. He worked as a post-doctoral fellow with Prof. Kohji Tashiro's group at Toyota Technological Institute, Nagoya, Japan and as an Alexander von Humboldt Fellow with Prof. Manfred Stamm's group at Leibniz Institute of Polymer Research, Dresden, Germany. He continued his research work at Indian Institute of Science, Bangalore as a Centenary post-doctoral fellow and at NIIST as a DST Ramanujan Fellow before joining the present post. His research interests are in the areas of polymer self-assembly, nanostructured materials, polymorphic phase transitions in semicrystalline polymers, polymer/inorganic hybrid nanocomposites, polymer-solvent complexes and molecular blending and biodegradable polymers.

Dr. RAVI SHANKAR LANKALAPALLI, Scientist, 22-DEC-2011

Dr. Ravi Shankar Lankalapalli obtained his M.Phil & Ph.D. (Chemistry) from the Graduate Center, City University of New York (CUNY). His fields of specialization are Synthesis of Glycoconjugates of biological significance, Synthesis of Natural Product like small molecule libraries, Structural Elucidation of Natural Products from plants, marine and microbial sources, Design and synthesis of Biosensors as Diagnostic Tools.

Dr. K P SURENDRAN, Scientist, 25-Jan-2012

Dr. K. P. Surendran received his PhD in Physics in 2005 on the topic "Investigations on Low Loss Dielectric Materials for Wireless Communication" based on the work done at NIIST, Trivandrum. In June 2005, he joined the Solid State and Structural Chemistry Unit, IISc Bangalore as a Research Associate. During 2006-2009 he was postdoc in University of Aveiro, Portugal and in 2009 he joined the University of Coimbra as an Auxiliary Researcher. In June 2010 he moved to the Leibnitz Institute for Solid State and Materials Research (IFW, Dresden), Germany as an Alexander von Humboldt Fellow. His research interests include Microwave Materials, Thin Film Epitaxy, Dielectric Inks for Printed Electronics, Templated Growth of Nanotubes

Dr. JOSHY JOSEPH, Scientist, 23-Feb-2012

Dr. Joshy Joseph completed his Masters Degree in Chemistry from School of Chemical Sciences, Mahatma Gandhi University, Kottayam, Kerala in 1998 and Ph. D. from University of Kerala (work carried out at CSIR-NIIST, Trivandrum under the guidance of Dr. D. Ramaiah) in 2004. Subsequently, he worked as a Postdoctoral Fellow (2004-2006) and as a Research Scientist II (2006-2011) in Professor Gary B. Schuster's group at School of Chemistry and Biochemistry, Georgia Institute of Technology, Atlanta, USA. In February 2012, he joined Chemical Science and Technology Division of CSIR-NIIST, Trivandrum as a Scientist. He is also a recipient of Ramanujan Fellowship (2012) from DST, India. His current research interests include biomolecular recognition, nucleic acid chemistry and design of functional organic materials.

Dr. SAJU PILLAI, Scientist, 28-Mar-2012

Dr. Saju Pillai obtained his Ph.D. in the area of Natural Sciences (Dr. rer. nat.) from Ulm University, GERMANY. He worked as a Post Doc at the Interdisciplinary Nanoscience Center (iNANO), Aarhus University, Aarhus, DENMARK and Department of Mechanical and Manufacturing Engineering (M-Tech), Aalborg University, Aalborg, DENMARK before joining CSIR-NIIST. His research focuses on fabricating functional organic-inorganic hybrid materials for smart coating and sustainable energy applications.

STAFF LIST as on 31/03/2012

DIRECTOR'S OFFICE

Dr Suresh Das	Director
Mr S Sureshkumar	Chief Scientist
Mrs Sarada Nair	Private Sec (Retired on 31/7/2011)
Mr A Krishnankutty	Tech Gr 1-4
Mr P B Vijayakumar	Tech Gr 1-4
Mr G K Nair	Senior Steno(ACP)

R& D DIVISIONS

AGROPROCESSING & NATURAL PRODUCTS DIVISION

Dr A Sundaresan	Chief Scientist (Head)
Mr M M Sreekumar	Chief Scientist
Dr C Balachandran	Senior Principal Scientist (Retired on 30/4/2011)
Mrs B Sankarikutty Amma	Senior Principal Scientist (Retired on 30/6/2011)
Mr Thomas Samuel	Senior Principal Scientist (Retired on 30/6/2011)
Mrs Omanakutty Amma	Principal Scientist
Mrs A Nirmala Menon	Principal Scientist
Dr Dileepkumar B S	Principal Scientist
Mr V V Venu gopal	Senior Scientist
Dr K G Raghu	Senior Scientist
Dr (Mrs) K P Padmakumari Amma	Senior Scientist
Dr (Mrs) P Nisha	Junior Scientist
Dr P Jayamurthy	Junior Scientist
Mrs M V Reshma	Scientist
Dr Ravi Shankar L	Scientist
Mr P J Varghese	Sr. Superintending Engineer
Mr G Chandra Babu	AEE (Civil)
Mr R Babu	Principal Technical Officer
Mr B Karthik	JE (Civil)
Dr (Mrs) Beena Joy	Senior Technical Officer-3
Mrs L Prasanna Kumari	Senior Technical Officer-2
Mr D R Soban Kumar	Technical Officer
Mr S Haridasan Pillai	Senior Technician (2)
Mr P V Thampy	Senior Technician (2)
Mr R Sukumaran	Tech Gr 1-4
Mrs Annamma Mathew	Senior Steno(ACP)

BIOTECHNOLOGY DIVISION

Dr Ashok Pandey	Chief Scientist (Head)
Dr K Madhavan Nampoothiri	Principal Scientist
Dr Rajeevkumar Sukumaran	Scientist
Dr N Ramesh Kumar	Scientist

Dr P Binod	Scientist
Mr K M Prakash	Senior Technician

CHEMICAL SCIENCES & TECHNOLOGY DIVISION

Dr A Ajayaghosh	Outstanding Scientist
Dr D Ramaiah	Chief Scientist (Head)
Dr T Prasada Rao	Chief Scientist
Dr M Lakshmipathy Reddy	Chief Scientist
Dr K R Gopidas	Chief Scientist
Dr (Mrs) Mangalam S Nair	Chief Scientist
Dr (Mrs) A Jayalakshmi	Senior Principal Scientist
Dr (Mrs) R Luxmi Varma	Senior Principal Scientist
Dr K George Thomas	Senior Principal Scientist (On Lien from 17/05/2010)
Dr K V Radhakrishnan	Senior Scientist
Dr C H Suresh	Senior Scientist
Mr Chandrakanth C K	Senior Scientist
Dr Biswapriya Deb	Senior Scientist
Dr Kaustabh Kumar Maiti	Senior Scientist
Dr Yoosaf Karuvath	Scientist
Dr Joshy Joseph	Scientist
Dr V S Prasad	Senior Technical Officer
Dr (Mrs) J D Sudha	Senior Technical Officer
Mrs S Viji	Technical Officer
Mrs Saumini Mathew	Technical Officer
Mr Robert Phillip	Technical Officer
Mr T R Suresh Kumar	Senior Technician
Mr T S Sasi Kumar	Private Secretary

MATERIAL SCIENCES AND TECHNOLOGY DIVISION

Dr K G K Warrier	Chief Scientist (Retired On 31/1/2012)
Dr M T Sebastian	Chief Scientist (Head)
Dr U Syamaprasad	Chief Scientist
Dr A R R Menon	Senior Principal Scientist
Mr M C Shaji	Senior Principal Scientist
Dr P Prabhakar Rao	Senior Principal Scientist
Mr K Harikrishna Bhat	Senior Principal Scientist
Dr Jose James	Senior Principal Scientist
Dr U T S Pillai	Senior Principal Scientist
Dr Swapan Kumar Ghosh	Principal Scientist
Dr Manoj Raama Varma	Principal Scientist
Dr M Ravi	Principal Scientist
Dr S Ananthakumar	Principal Scientist
Dr T P D Rajan	Senior Scientist
Dr Hareesh U S	Senior Scientist

Dr E Bhoje Gowd	Senior Scientist
Dr M Sundararajan	Scientist
Dr S V Shukla	Scientist
Dr A Srinivasan	Scientist
Dr K P Surendran	Scientist
Dr Saju Pillai	Scientist
Mr S Velusamy	Principal Technical Officer
Mrs Lucy Paul	Senior Technical Officer
Mr K K Ravikumar	Senior Technical Officer
Mr M Brahma Kumar	Senior Technical Officer
Mr P Perumal	Senior Technical Officer
Mr P Gurusami	Senior Technical Officer
Mr M R Chandran	Senior Technical Officer
Mr Peer Mohamed A	Technical Officer
Mr S Sasibhushanan	Senior Technician (2)
Mr T Soman	Senior Technician (2)
Mr P N Sivankutty Nair	Senior Technician (2)
Mr V Antony	Tech Gr 2-3
Mr V Sreekantan	Tech Gr 1-4

PROCESS ENGINEERING & ENVIRONMENTAL TECHNOLOGY DIVISION

Dr (Mrs) Roschen Sasikumar	Chief Scientist (Head)
Mr P Raghavan	Chief Scientist
Mr Ajit Haridas	Chief Scientist
Dr (Mrs) S Savithri	Senior Princi pal Scientist
Dr (Mrs) Elizabeth Jacob	Senior Principal Scientist
Dr (Mrs) Rugmini Sukumar	Principal Scientist
Dr V B Manilal	Principal Scientist
Mr J Ansari	Principal Scientist
Dr M Anbu	Senior Scientist
Dr B Krishnakumar	Scientist
Mr Abdul Haleem B	Scientist
Mrs Vijaya Prasad	Senior Technical Officer
Mr V K Shajikumar	Technical Officer
Dr S Ramaswamy	Technical Officer
Mr Karoona Shanker Roat	Technical Officer (Transferred On 2/9/2011)
Mr T P Paulose	Senior Technician (2)
Mrs Saharuba P M	JTA

S & T SERVICES DIVISIONS

CIVIL ENGINEERING & ESTATE MANAGEMENT DIVISION

Mr V P Thomas	Senior Principal Scientist, Head (Retired on 29/02/2012)
Mr R Rajeev	SE
Mr K V Oonnikrishnan	EE
Mr K Prasad	AE
Mr P Arumugam	JE (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	Principal Scientist (Head)
Mr V Moni	Junior Scientist
Mr Ribin Jones S B	Scientist
Mrs S Mini	Principal Technical Officer
Mr M Ramasamy Pillai	Senior Technical Officer(3)
Mr G Sudhakaran	Senior Technician (2)
Mr G Nagasrinivasu	Senior Technician (2)
Miss T S Latha	Asst(G)Gr II (MACP)
Mr Pushpakumar K R Nair	Gr D Non-Tech
Mrs P Savithri	Gr D Non-Tech (Retired On 31/05/2011)

MECHANICAL ENGINEERING SECTION

Mr N J Jacob	Senior Technician (2)
Mr N Sudhilal	Senior Technician (2)
Mr P M Raghavan	Senior Technician (2)
Mr P Soman	Tech Gr 1-4
Mr T T Rajappan Nair	Gr D Non-Tech (Retired On 31/01/2011)

R & D PLANNING & BUSINESS DEVELOPMENT DIVISION

Dr V G Mohanan Nair	Senior Principal Scientist (Head)
Dr C Chandrasekara Bhat	Senior Principal Scientist
Mr D Bheemeswar	Principal Scientist
Mr R S Praveen Raj	Scientist
Dr M Sankaranarayanan	Senior Technical Officer
Mrs V J Sarojakumari	Senior Steno(MACP)
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	Security Officer
Dr Rajesh Radhakrishnan	Medical Officer (Resigned On 27/5/2011)
Mr D Jayaprasad	Asst (G) Gr II(MACP)
Mrs Jyothi R Thampi	Asst (G) Gr II
Mr G Ramabhadran	Asst (G) Gr II
Mrs Mercy Joseph	Asst (G) Gr II
Mrs Susan Mathew	Asst (G) Gr II
Mrs K Saraswathy	Asst (G) Gr II(MACP)
Mr R K Ramesh Kumar	Asst (G) Gr II
Miss Parvathi Rajeevan	Assistant Gr I
Mr M K Sivadasan	Asst (G) Gr I (MACP)
Mrs Sisily Poulose	Asst (G) Gr I (MACP)
Mr V Mohanan Nair	Asst (G) Gr I (MACP)
Mrs Padmini P S	Senior Steno (ACP)
Mrs Elizabeth Thomas	Senior Steno(MACP)
Mrs Sreeletha Nair	Senior Steno(ACP)
Mr B Venugopal	Senior Technician (2)
Mr P Surendran	Senior Technician (2)
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 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 Krishna Kumar M	SO (F&A)
Mr A V Thomas	SO(F&A) (Retired On 31/5/2011)
Mr C Sivakumaran	Asst (G) Gr II (Retired On 31/1/2012)
Mrs Komala Soman	Asst(F&A)Gr II
Mr Sanjeev Sadananthan	Asst(G) Gr II

Mr K G Pillai	Asst(F&A)Gr I
Mrs Remani Devaraj	Asst(F&A)Gr I
Mrs G Geetha	Asst(F&A)Gr I
Mr S Raju	Senior 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	SO
Mr M Anilkumar	Asst(S&P)Gr II
Mr C M Krishnadas	Asst(S&P)Gr I
Mr V K Jithesh	Asst(S&P)Gr II (Resigned on 10/2/2012)
Mr K Satheesan Nair	Asst(S&P)Gr I
Mr K D Sasidharan	Asst (G) Gr I (Retired On 31/3/2012)
Mrs L Latha	Senior Technician (2)
Mr B Ajayakumar	Tech Gr 2-3
Mr T K Ghosh	Gr C Non-Tech
Mr T K Gopi	Gr D Non-Tech
Mr G Bhakthavalsalam	Gr D Non-Tech

14th NATIONAL SYMPOSIUM IN CHEMISTRY & 6th CRSI-RSC SYMPOSIUM IN CHEMISTRY

National Institute for Interdisciplinary Science and Technology (NIIST) and Indian Institute of Science Education and Research (IISER) Thiruvananthapuram had jointly organized the 14th National Symposium in Chemistry of The Chemical Research Society of India (CRSI) during 3-5 February 2012 at the NIIST campus. 6th Royal Society of Chemistry (RSC) symposium was also conducted along with the national symposium on 2nd February, 2012. The national symposium provided a forum for scientists, teachers and students in the country to participate and discuss recent developments in chemical sciences. It was also a platform to exchange ideas and create an environment for collaborative endeavours in emerging frontier interdisciplinary areas.

About 750 researchers from in and around the country participated in the symposium for which elaborate arrangements were made in CSIR-NIIST under the patronage of Prof. Samir Brahmachari, DG, CSIR, with Dr. Suresh Das, Director, NIIST as the chairman and Dr. D. Ramaiah, NIIST as the convener.

Prof. C.N.R. Rao (JNCASR, Bangalore), Scientific advisor to Prime Minister and founder president of CRSI delivered a special lecture on 'The birth and growth of Solid State and Materials Chemistry'. Prof. S. Chandrasekaran (IISc., Bangalore) President, CRSI delivered the inaugural lecture during the symposium. Prof. Robert Parker, CEO, RSC as well as a group of eminent scientists including Prof. Anna Peacock (UK), Prof. J. O. Midiwo (Kenya) and Prof. Bob Crawford (UK) presented their work during the RSC symposium.

During the symposium, the CRSI honoured the scientists who have made notable contributions in chemical sciences. As part of the promotion of chemical education, CRSI Best Researcher Awards were presented to selected teachers from various universities and colleges in India.

There were medal lectures, poster presentations apart from special lectures by internationally reputed scientists like Prof. R. Tenne (Israel), Prof. S. Kitegava (Japan), Prof. D. G. Nocera (MIT, USA), Prof. F. Mayer (Germany), Prof. M. A. Subramoniyam (USA), Prof. Kalyana Sundaram (Switzerland), Prof. A. Sen (USA), Prof. V. Krishnan (JNCASR, Bangalore), Prof. Uday Maitra (IISc Bangalore) and Dr. A. Ajayaghosh (NIIST, Thiruvananthapuram).


CRSI NATIONAL SYMPOSIUM IN CHEMISTRY &
CRSI-RSC SYMPOSIUM IN CHEMISTRY


NIIST


CRSI NATIONAL SYMPOSIUM
CRSI-RSC SYMPOSIUM IN CHEMISTRY
AstraZeneca

INDO-EUROPEAN UNION CONSORTIUM MEETING ON SOLAR ENERGY PROJECT (OISE/LARGE CELL)

The Photosciences and Photonics Section of the CSTD has been sanctioned a major Indo-European Union Collaborative research Project entitled: "Organic and Organic- Inorganic Hybrid Solar Cells: Optimization of Materials Properties, Bulk Heterojunction Morphology and Device Efficiencies". The Indian Collaborators of the project include Dr. Suresh Das (NIIST), Dr. K. R. Gopidas (NIIST), Prof. K. George Thomas (IISER, Trivandrum), Professor S. Sampath (IISc., Bangalore), Professor G. U. Kulkarni (JNCASR, Bangalore), and Professor P. Ramamurthy (Univ. of Madras). The European Union counterparts are Professor Mukundan Thelakkat (Univ. of Beyreuth, Germany), Prof. R.A.J. Rene Janssen (Eindhoven Univ. of Technology, The Netherlands), Dr. Eugene A. Katz (Ben-Gurion, Univ. of Negev, Israel), Mr. Markus Hosel (Technical Univ. of Denmark, Denmark), Mr. Chrostoph Hunger (Univ. of Bayreuth, Germany) and Mr. Karsten Ries (Mekoprint Graphics-Electronics, Denmark). In connection with this project, a three day workshop was organized on Solar cells during January 23-25, 2012 at Trivandrum. About 30 participants including the above scientists and students working in this project participated in the three day workshop. There were scientific lectures and fruitful discussions on the various aspects of the solar cells.

International Conference on New Horizons in Biotechnology & VIII Convention of the Biotech Research Society

The International Conference on New Horizons in Biotechnology & VIII Convention of the Biotech Research Society, India was organized by the National Institute for Interdisciplinary Science and Technology, CSIR, jointly with Society during 21st to 24th November 2011 at Trivandrum. NHBT-2011 offered a stage for all the researchers working in the various thrust areas of Biotechnology to come together and deliberate on various important issues. The conference was participated and supported by various organisations of international importance such as International Forum on Industrial Bioprocesses (IFIBiop), International Organization for Biotechnology and Bioengineering, Elsevier - UK, Thomson Reuters - USA, etc. and national organizations such as Council of Scientific and Industrial Research (CSIR), Department of Science and Technology (DST), Department of Biotechnology (DBT), Indian Council for Medical Research (ICMR), State Committee on Science, Technology and Environment, Govt of Kerala, State Bank of Travancore,

Dr Suresh Das, Director, NIIST with others lighting the lamp

The opening session was addressed by Prof CG Dussap, Chairman, International Forum on Industrial Bioprocesses, France; Prof Charles Tweisgye, Chairman, International Organization of Biotechnology and Bioengineering; Prof P Gunasekaran, President, The Biotech Research Society, India; Dr Suresh Das, Director, CSIR-NIIST and Prof Ashok Pandey, Chairman, Organizing Committee.

A glimpse of the Opening session

The Opening session witnessed the declaration of annual awards of the BRSI. These included Life Time Achievement Award to Prof Asis Datta, National Institute for Plant Genome Research, New Delhi, Industrial Medal Award to Dr RBN Prasad, Indian Institute of Chemical Technology, Hyderabad, Women Scientist Award to Dr Jyoti P Jadhav, Shivaji University, Kolhapur and AU-CBT Excellence Award (for research scholars) to Mr Srikanth Sandeepam of Indian Institute of Chemical Technology, Hyderabad. Sri Piyush Palkhiwala, CMD, MAPS Enzymes Ltd, Ahmedabad was conferred Honorary Fellowship of the Society and Prof Rekha S Singhal, Institute of Chemical Technology, Mumbai; Prof D Das, Indian Institute of Technology, Kharagpur; Dr AJ Varma, National Chemical Laboratory, Pune and Dr VK Garg, GJ University, Hisar were conferred as Fellow (FBRS)

"Women in Chemistry"

The Institute organized a one day seminar highlighting the role of "Women in Chemistry" on 13th October 2011 as part of the celebrations of the International year of Chemistry 2011 (IYC-2011) providing an opportunity to young college students, especially girl students of various colleges in Trivandrum to interact with some of the best woman chemists in the country. The seminar was inaugurated by Prof. H. IIa, Senior Scientist at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore and a specialist in synthetic organic chemistry. Dr. Suresh Das, Director, CSIR-NIIST presided over the function. Prof. Charusita Chakravarthy from the Indian Institute of Technology (IIT) - New Delhi, Dr. M.Lakshmi Kantam from the Indian Institute of Chemical Technology (IICT), Hyderabad and Dr. Aruna Dhathathreyan from the Central Leather Research Institute (CLRI), handled various technical sessions.

Prof H Ila, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, distributing the prizes to women college students who had excelled in their courses.

Prof Charusita Chakravarty Dept of Chemistry Indian Institute of Technology, New Delhi Delivering the Lecture

National Technology Day Celebrations

National Technology Day was celebrated at NIIST on May 11, 2011 to commemorate the triple success of indigenous technologies namely, Inaugural flight of Hansa, Successful flight of prithivi missile and sensational nuclear test at Pokhran. Shri. C. Balagopal, IAS, Managing Director, Terumo Penpol Ltd., Trvandrum was the chief guest during the occasion. Shri. Balagopal, while acknowledging the strong research foundation laid by illumanaries such as JC Bose, CV Raman, Saha etc., in the pre independence era, emphasized the need for the development of scientific temper among the people for the growth of science. He further added that Institutions of learning should focus more on inculcating scientific methods approach at community levels where in learning experience is associated with testability of scientific hypothesis. Shri.

Balagopal further emphasized the need of learning methods which encourage capacity to understand and find solutions to the problem and cautioned that many of the technical collaborations leads to dependency and hence should not be encouraged. Dr. Suresh Das in his presidential address, emphasized the importance of both applied research and basic science for the growth of any country and called upon for a right mix of basic and applied research which eventually bridges the gap between science and technology.

Vigilance Awareness Week (31st October to 4th November 2011)

The Vigilance Awareness Week- 2011 was observed in this institute from 31st October to 4th November 2011. The week started with administration of pledge in Hindi & English by the Director at 11am on 31st October 2011. Various competitions on Elocution, Cartoon Drawing and Slogan writing were conducted for staff members and students including of project students during 31st to 4th November, 2011. The valedictory function and prize distribution were held on 4th November, 2011. Dr. Suresh Das, Director presided over the function. Shri S. Gopinath, IPS, Inspector General of Police (Traffic) delivered the Valedictory Lecture and gave away the prizes to the winners of various competitions.

Shri S. Gopinath, IPS, Inspector General of Police (traffic) delivering the valedictory address.

Observance of Hindi Day /Hindi week during 14- 20 September

The Institute observed 14th September, 2011 as the Hindi Day and the week succeeding it as the Hindi week. Formal inauguration of the Hindi Day started at 10.30 am on 14th Sep. with the welcome address of Dr.Ashok Pandey, Chairman,organizing committee. Dr. Suresh Das, Director inaugurated the function with the lighting of the lamp, and later he delivered the Hindi Day Lecture. In his speech, he told that Official Language Hindi has marked its presence at International level. He appealed to everyone that Official Language Hindi has to be used not only for official purpose but for day to day communication by which the development and popularization Hindi can be made.

Dr. Suresh Das, Director inaugurating the function with the lighting of the lamp

After the inaugural function, two power point presentations were arranged. Dr. P. Jayamurthy, Scientist and member, Organizing Committee made a presentation in Hindi on "Diabetes: In the present scenario. The motto of such a presentation was to make the participants aware of the disease. India has become the capital country of diabetics and in India, Kerala has the maximum number of diabetes affected people. In his presentation he explained the different types of diabetes and risk factors.

Dr. P. Jayamurthy, Scientist and member, Organizing Committee giving presentation on "Diabetes: In the present scenario"

The second Power point presentation was given by Shri.Sanjay Suman, SO(S&P). He explained the development of Hindi and its popularization in India & abroad. He pointed out the challenges being faced in Official Language Implementation and using simple, easily available Hindi vocabulary, he explained the initiations required for its progressive development. During the entire week various competitions in Hindi were held among staff members research students and their school going children.

Shri.Sanjay Suman, SO(S&P) giving the presentation.

Valedictory function and prize distribution were arranged on 20.09.2011 at 4.30 p.m. Shri.P.K.Phathak, IFS, Managing Director, MILMA, Trivandrum was the chief guest. In his valedictory address, he informed the importance of Official Language Implementation in Central Govt. Offices and at the same time, he opined that along with official Language, use of all regional languages are to be encouraged. Chief guest distributed prizes to the winners of various competitions.

A scene of Prize distribution by Shri.P.K.Phathak, Chief Guest

हिंदी रूपांतर

एस एंड टी सेवा प्रभाग

अनुसंधान योजना और व्यवसाय विकास

प्रौद्योगिकी लाइसेंसिंग और हस्तांतरण समझौते / हस्ताक्षर किए समझौता ज्ञापन

क्रम सं	शीर्षक	फर्म / एजेंसी का नाम
1	प्रकाश अनुक्रिय सामग्री के विकास के लिए गोपनीयता करार	यूनिलीवर इंडस्ट्रीज प्राइवेट लिमिटेड, 165 / 166, बैकबे रिक्लेमेशन, मुंबई 400 020
2	वर्चुअल कास्टिंग सॉफ्टवेयर की कोशिश के लिए गोपनीयता समझौता	3 डी फाउंड्री टेक. प्रा. लिमिटेड, सीएम-05, साइन, सीएसआरई, आईआईटी मुम्बई, पवई, मुंबई - 400 076
3	ईआईसीएल चीन क्लेज पर चमक सुधार का अध्ययन	मेसेर्स इंग्लीश इंडियन क्लेज लिमिटेड, टीसी 79/34, वेली, तिरुवनंतपुरम - 21
4	सफेद मिर्च उत्पादन की तकनीकी जानकारी का हस्तांतरण	श्री नागेन्द्रन, ज्ञान सुन्दरी काली मिर्च प्रोसेसिंग यूनिट, 27बी, चिन्तामणी रोड, वालै तोप्पु, मदुरै
5	सफेद मिर्च उत्पादन की तकनीकी जानकारी का हस्तांतरण	श्री प्रसन्नकुमार जी.एन, वसुन्दरा सेल्स निगम, गोलगर, केशवा डाक, कोप्पा तलूक, चिकमंगलोर, कर्नाटक - 577 126
6	एनआईआईएसटी में सिमैप के संपर्क बिंदु के लिए समझौता ज्ञापन	सिमैप, कुक्रैल पिकनिक स्पॉट रोड, लखनउ - 226 015
7	वर्चुअल कास्टिंग के सोल्वर मॉड्यूल के संबंध में बौद्धिक संपदा का लाइसेंसिंग	3 डी फाउंड्री टेक. प्रा. लिमिटेड, सीएम-05, साइन, सीएसआरई, आईआईटी मुम्बई, पवई, मुंबई - 400 076
8	सिंथेटिक रूटाइल उत्पादन के लिए प्लाज्मा प्रक्रिया के मूल्यांकन करने के लिए गैर डिस्क्लोशर समझौता	सत्यवती टिटास्लैग लिमिटेड, प्लॉट नं. 75, न्यू एमएलए और एमपीस् कॉलोनी, रोड नं 10सी, जुबली हिल्स, हैदराबाद - 500 033
9	उद्योग पार्टनर के साथ परियोजना समझौता ज्ञापन जैव ईंधन पर सीएसआईआर - एनएमआईटीएलआई परियोजना	मैप्स एंजाइम्स लिमिटेड (पूर्व मैप्स लिमिटेड (भारत), 302, शपथ-3 जीएनएफसी इन्फो टॉवर के सामने, एसजी रोड, अहमदाबाद 380 054
10	उद्योग पार्टनर के साथ परियोजना समझौता ज्ञापन जैव ईंधन पर सीएसआईआर - एनएमआईटीएलआई परियोजना	मैप्स एंजाइम्स लिमिटेड (पूर्व मैप्स लिमिटेड (भारत)), 302, शपथ-3 जीएनएफसी इन्फो टॉवर के सामने, एसजी रोड, अहमदाबाद 380 054
11	आईएस 1908:1993 का संशोधन के लिए परियोजना समझौता ज्ञापन "अदरक पूरी, और जमीन (दूसरा संशोधन)"	भारतीय मानक ब्यूरो, मानक भवन, 9, बहादुर शाह जफर मार्ग, नई दिल्ली 110 002
12	गोपनीय जानकारी डिस्क्लोशर और गैर - विश्लेषण समझौता	दि गुडइयर टायर एंड रबड़ कंपनी, 1144 ईस्ट मर्केट स्ट्रीट, एक्रोण, ओएच 44316-0001 (यूएसए)
13	सिंथेटिक रूटाइल उत्पादन के लिए प्लाज्मा प्रक्रिया के मूल्यांकन करने के लिए गैर डिस्क्लोशर समझौता	यूरेका सिस्टम्स एंड इलेक्ट्रोड प्राइवेट लिमिटेड, 11/15-ए, शेलवाराजपुरम, चिन्तामणिपुदुर, कोयंबटूर - 641 103, तमिलनाडु
14	कॉयर रबड़ (सीआरसी) कंपोजिट उद्यान बर्तन बनाने के लिए प्रक्रिया जानकारी	'सेवाश्रम', मंगाट्टुकरा, पुलियनम पीओ, अंगमाली - 683572, एरनाकुलम जिला, केरल
15	फ्लक्स बंधित फ्लाई ऐश के निर्माण की प्रक्रिया की तकनीकी जानकारी के मूल्यांकन के लिए गैर डिस्क्लोशर समझौता	रिलायंस सिमेंट कंपनी प्रा. लिमिटेड, द्वितीय मंजिल, ई ब्लॉक, धीरूभाई अंबानी नॉलिज सिटी, खोपार खरैन, नवी मुंबई - 400 710

16	डीएसटी द्वारा अनुसंधान एवं विकास परियोजना के भाग के रूप में कोट्टप्पुरम इंटीग्रेटेड डेवलपमेंट सोसाइटी (केआईडीएस) के लिए एक डिमोंस्ट्रेशन संयंत्र (अनानास पत्ती फाइबर और केला फाइबर निष्कर्षण) की संस्थापना के लिए समझौता	कोट्टप्पुरम इंटीग्रेटेड डेवलपमेंट सोसाइटी (केआईडीएस) "केआईडीएस" परिसर, एनएच 17, कोट्टप्पुरम , कोडुंगल्लुर, त्रिशूर जिला, केरल 667 680
17	केले फाइबर के उत्पादन के लिए तकनीकी जानकारी के लाइसेंस के लिए करार (विदेशी ग्राहक)	श्रानिक्सिम निगम, हाउस नं 368, 40 बरगी ,क्रज़दा ज़दा लेगास्पी शहर, अलबी (4500), फिलीपींस। श्री हरजिंदर सिंह सरन , एक भारतीय नागरिक और ग्लोब ऐशिया नेच्चर इंडस्ट्रीज, इंक, जेर्नारिन बिल्डिंग्स द्वारा प्रतिनिधित्व, ऐनेक्स अल्टरेट रोड, लेगास्पी शहर, 4500 फिलीपींस श्री गेरसन एस्कारो द्वारा प्रतिनिधित्व
18	केरल जैव प्रौद्योगिकी आयोग, केएससीएसटीई, केरल सरकार द्वारा सहायता अनुदान अनुसंधान एवं विकास परियोजना के भाग के रूप में शांतिगिरी कूट्टुकुडुंबम कॉयर इकाई के लिए एक डिमोंस्ट्रेशन संयंत्र (कॉयर फाइबर) की संस्थापना के लिए करार	शांतिगिरी कूट्टुकुडुंबम कॉयर यूनिट, थवनक्काड, चेर्तला, अलाप्पुझ़ा जिला, केरल, शांतिगिरी आश्रम, एक पंजीकृत सोसायटी का एक यूनिट

संविदात्मक अनुसंधान कार्यक्रम

क्रम सं.	ग्राहक	परियोजना शीर्षक	परियोजना प्रधान
कृषि प्रसंस्करण प्रभाग			
1	डीएसटी	इवाल्युवेशन एंड कण्ट्रोल ऑफ़ एक्रिलामाइड फ़ोर्मेशन इन ट्रडीशनल डीप फ्राइड स्नैक प्रोडक्ट्स	डॉ. (श्रीमती) पी. निशा
2	वनस्पति निदेशालय उपभोक्ता कार्य मंत्रालय	इवाल्युवेशन ओफ ट्रांस फैट्टी एसिड्स इन हाइड्रोजनेटड वेजिटबिल्स ऑयल प्रोडक्ट्स एंड देयर हेल्थ इम्प्लिकेशन्स इन दि कांटेक्स्ट ऑफ़ इंडियन फ़ूड हबिट्स	श्रीमती एम.वी.रेश्मा
3	वनस्पति निदेशालय उपभोक्ता कार्य मंत्रालय	स्टडीस ऑण इम्प्रूविंग स्टोरज स्टेबिलिटी ऑफ़ रिफैन्ड् एंड अनरिफैन्ड् वेजिटबिल ऑयल्स बाई दि अडिशन ऑफ माइक्रोन्यूट्रियन्ट्स एंड एंटीऑक्सिडेन्ट फाइटोकेमिकैल्स एंड दि डिवेलप्मैंट ऑफ़ ए आँयल फंग्शनल वेजिटबिल	डॉ. (श्रीमती) पी. निशा
4	केएससीएसटीई	डिवलप्मेंट ऑफ़ वाल्यु आडड् प्रोडक्ट्स फ्रॉम "नीरा" ऑफ़ पल्मथ्ह	श्रीमती एम.वी.रेश्मा
5	डीएसटी	सिंथेसिस ऑफ़ इमिनोशुगर वारिएट्स ऑफ़ ऐल्फागालेक्टोसिल सिरामिड फॉर टुनिंग ऑफ़ सेलेक्टिव साइटीकिन रिलीज़ फ्रॉम नाचुरल किल्लर टी (एनकेटी) सेल्स	डॉ. एल.रविशंकर
6	आईसीएमआर	फेनोलिक कॉम्पाउड्स फ्रॉम सेन्ताल्ला असेटिका, बोर्हाविया डिफ्फुसा : डेस्मोडियम गन्गेटिकम आस प्रोटक्टेर्स एगेंस्ट आर्सेनिक ट्रायोक्साइड इन्ड्सूस्ड कार्डियोटोक्सिसिटि	डॉ. के.आर.रघु
7	केएससीएसटीई	डिवलप्मेंट एंड स्टैन्डेडाइसेशन ऑफ़ वाल्यु आडड् प्रोडक्ट्स फ्रम "जैकफ्रूट"	डॉ. (श्रीमती) पी. निशा
8	भारतीय मानक ब्यूरो	डिवलप्मेंट ऑफ़ इंडियन स्टैन्डेर्डस् फॉर नोर्थ ईस्ट जिंजर एंड इट्स वाल्यु आडड् प्रोडक्ट्स	श्री वी.वी.वेणुगोपाल
जैवप्रौद्योगिकी प्रभाग			
9	सीएसआईआर	बायोएथानॉल फ्रॉम लिग्नोसल्लुलोसिक बायोमास	डॉ. अशोक पाण्डेय
10	डीएसटी	आईसोलेशन एंड क्लोनिंग ऑफ़ ग्लुकोस टोलेरन्ट बीटाग्लुकोसिडेस फ्रम फंगल आईसोलेट बीटीसीएफ-5 एंड दि सीबीएच1 कण्ट्रोल एलेमेंट्स फ्रम ट्राइकोडेर्मा रीसी एंड स्टडीस ऑण दि प्रोपर्टीस ऑफ़ दि एनजाइम	डॉ. राजीव.के.सुकुमारन
11	डीएसटी	सेंटर फोर बायोफ्यूवल्स	डॉ. अशोक पाण्डेय
12	डीबीटी	डिवेलप्मेंट ऑफ़ ए बायोप्रोसस फॉर दि प्रोडक्शन ऑफ़ पॉलीहाइड्रोक्सी ब्यूटिरेट (पीएचबी) फ्रम बायोडीजल इन्डस्ट्री जनरेटड ग्लिसरॉल	डॉ. अशोक पाण्डेय
13	डीबीटी	कोस्ट एफेक्टिव प्रोडक्शन ऑफ़ लैक्टिक एसिड फ़ोर पॉलीलैक्टाइड सिंथेसिस एंड स्टडीस ऑण पीएलए अप्लिकेशन एंड बायोडीग्रेडेशन	डॉ. के.माधवन नंपूतिरि
14	डीबीटी	एक्सप्लोइटिंग वेस्टर्न घाट बायोडाइवेर्सिटि फॉर एंटीफंगल मेटाबोलैट्स फॉर प्लांट डिसीस कंट्रोल	डॉ. के.माधवन नंपूतिरि
रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग			
15	बीआरएनएस	स्टडी ऑफ़ फोटो इन्ड्यूस्ड इलेक्ट्रॉन ट्रान्सफर इन साइक्लोडेक्स्ट्रिन बेस्ड सुप्रामोलिकुलर सिस्टम्स	डॉ. के.आर.गापिदास
16	डीएसटी	डिवलप्मेंट ऑफ़ सेंसिटेर्स बेस्ड ऑण एनएमआर डाइस	डॉ. डी.रामय्या
17	डीएई	मोलिकुलर एंड सुप्रामोलिकुलर अर्किटक्चेर्स विथ ओप्टोइलेक्ट्रॉनिक फंग्शन्स	डॉ. ए.अजयघोष

18	डीएसटी	डिवलप्मेंट ऑफ़ नोवेल साइक्लोफेन्स आस प्रोब्स फॉर बायोमोलिकुलर रकेग्निशन	डॉ. डी.रामय्या
19	डीएसटी	दि कंट्रॉल्ड कार्बोपल्लाडेशन ऑफ़ हेटरोबाइसैक्लिक ओलिफिंस : ए नोवल स्टिरिओ सिलेक्टिव रूट टु फंग्शनलैस्ड साइक्लोपेन्टानोइड्स	डॉ. के.वी.राधाकृष्णन
20	सीएसआईआर	डिवलप्मेंट ऑफ़ होमोजीनस कैटलिस्ट्स फॉर वाटर स्प्लिटिंग - ए की तकनोलॉजी फॉर सस्टैनबिल एनेर्जी	डॉ. सी.एच.सुरेश
21	डीएसटी	नोवल सिंथेटिक प्रोटोकॉल फॉर कार्बन -कार्बन एंड कार्बन – हेटेरोअटम बोंड फोर्मिंग रिअक्शन्स एम्प्लोयिंग नुक्लिओफिलिक हेटरोसैक्लिक कार्बीन कैटालिसिस	डॉ. विजयन नायर
22	डीएसटी	एनवयोर्मेंटली सेक्युअर इनोर्गानिक कोलोरंट्स	डॉ. एम.एल.पी.रड्डि
23	आईएफसीपीएआर	डिवलप्मेंट ऑफ़ फुल्वेन बेसड Zr(II) and Ti(II) केमिस्ट्री :ओर्गानोमेटाल्लिक्स, रिअक्टिविटी एंड अप्लिकेशन्स इन ओर्गानिक सिंथेसिस	डॉ. के.वी.राधाकृष्णन
24	डीएसटी	ओर्गानिक एंड ओर्गानिक - इनोर्गानिक हाइब्रिड सोलार सेल्स : ओप्टिमाइसेशन ऑफ़ मेटिरिअल्स, प्रोपर्टीस, बल्क हेटरोजंक्शन मोर्फोलॉजी एंड डिवाइस एफीशियन्सीस (ओआईएससी/लार्ज सेल्स)	डॉ. के.आर.गोपिदास
25	डीएसटी	इन्वेस्टिगेशन ऑफ़ कन्फ़ोर्मेशनल सब -स्टेट्स एंड लो फ्रिक्युवन्सी वाइब्रेशनल डाइनामिक्स ऑफ़ नेटिव एंड नॉन नेटिव हेमे प्रोटीन्स	डॉ. करुणाकरन वेणुगोपाल
26	डीएसटी	ग्रीन मेथेड्स टुवेर्ड्स फार्मास्यूटिकली इम्पोर्टन्ट हेटरोसाइकिल्स एंड साइक्लोपेन्टानोइड्स	डॉ. के.वी.राधाकृष्णन
		पदार्थ विज्ञान तथा प्रौद्योगिकी प्रभाग	
27	मेसेर्स आईआरईएल टीडीसी, कोल्लम	डिवलप्मेंट ऑफ़ हाई फील्ड कोम्पोसिट वरिस्टेर्स बेस्ड ऑण रेअर अर्थ्स ऑक्साईड्स	डॉ. एस.अनंतकुमार
28	भारतीय प्लाज्मा अनुसंधान संस्थान	डिवलप्मेंट ऑफ़ लोंग फिलमेंटरी MgB_2 सुपरकंडक्टिंग वर्येस एंड टेप्स फॉर फ्यूशन ग्रेड मैग्नेट्स एंड करेंट लीड्स	डॉ. यू.श्यामप्रसाद
29	डीएसटी	ओप्टिमैसेशन ऑफ़ एजिंग परामीटेर्स एंड अल्लोय कोम्पोसिशन फॉर इंप्रूव्ड एज हार्डेनिंग रेस्पोंस ऑफ़ AZ91 मैग्नीशियम अल्लोय	डॉ. ए.श्रीनिवासन
30	डीआरडीओ	डिवलप्मेंट ऑफ़ मोनो एंड हैब्रिड डिस्कंटिन्युवस्लि रीइंफोर्सड मैग्नीशियम मेटल मैट्रिक्स कॉम्पोसिट्स फॉर इंजीनियरिंग अप्लिकेशन्स	डॉ. यू.टी.एस.पिल्लै
31	डीएसटी	सिलिकेट बेस्ड डाइइलेक्ट्रिक्स फॉर इलेक्ट्रोनिक पैकेजिंग अप्लिकेशन्स	डॉ एम.टी.सेबास्टियन
32	डीएसटी	सिंथेसिस एंड कैरक्टरैसेशन ऑफ़ इन –सिट्यू मैग्नीशियम मैट्रिक्स कॉम्पोसिट्स	डॉ. (श्रीमती) श्रीजा कुमारी
33	डीएसटी	आन् इन्वेस्टिगेशन ऑण दि पोटेंशियल बीच प्लेसर डेपोसिट्स एलोंग तिरुचेंदुर कॉस्ट, तमिलनाडु	डॉ. एम.सुन्दरराजन
34	डीएसटी	डिवलप्मेंट ऑफ़ नोवेल पोवेल्लैट बेस्ड रेड फोस्फोर मेटीरिएलस :$ARMMoO_8:Eu^{3+}$(A=Mg,Ca,SrandBa,R=Y,LaandGd:M=NbandTa) फॉर वैट लाइट एमिट्टिंग डयोड्स (WLED's)	डॉ. पी. प्रभाकर राव
35	डीआरडीओ	डिवलप्मेंट ऑफ़ लो लोस लो टेंपरेचर को –फायेर्ड सिरेमिक ग्लास कोम्पोसिट (एलटीसीसी) टेप्स फॉर फ यूचर एमआईसी डिवाइस अप्लिकेशन्स	डॉ एम.टी.सेबास्टियन

36	डीएसटी	सुप्रामोलिकुलर पोलिमेरिक नैनोमेटीरियल्स विथ हैरार्किकल मोर्फोलोजीस	डॉ. ई.भोजे गौड
37	डीएसटी	प्रिपरेशन ऑफ़ M3AX2 फेस टेर्नारी कार्बाइड्स एंड फ़ैब्रिकेशन ऑफ़ इट्स नैनोकोम्पोसिट्स थ्रूनोवल मेथेड्स	डॉ. एस.अनन्तकुमार
38	सीएसआईआर	नोवल माइक्रो -नैनोइन्टग्रेटड कोम्पोसिट्स पार्टिकिल्स आस डाइ – अब्सोर्बन्ट कैटलिस्ट	डॉ. एस.के.शुक्ला
39	डीएसटी	नैनोस्ट्रक्चेर्ड डबल पेरोव्स्केट्स फॉर स्पिन्ट्रॉनिक अप्लिकेशन्स	डॉ. मनोज राम वर्मा
40	आईसीडीडी	जनरेशन ऑफ़ एक्सपिरिमेंटल पाउडर डिफ्राक्शन डाटा ऑफ़ न्यू सिरेमिक कॉम्प्लेक्स ऑक्साइड्स	डॉ. प्रभाकर राव
41	डीएसटी	डिवलप्मेंट ऑफ़ नैनोस्ट्रक्चेर्ड स्पिनेल ऑक्साइड मेटीरियल्स फॉर स्पिन्ट्रॉनिक अप्लिकेशन्स	डॉ. सविता पिल्लै
42	बीएआरसी	डिवलप्मेंट ऑफ़ सेल्फ लुब्रिकेटिंग AL_2O_3/ZrO_2 सिरेमिक कॉम्पोसिट्स फॉर जर्नल बेअरिंग अप्लिकेशन्स इन एसिड /रेडियेशन एन्विरोन्मेंट	डॉ. एस.अनन्तकुमार
43	डीएसटी	लो टेंपरेचर हीलिंग फोटो कैटलिटिक सेल्फ क्लिनिंग कोटिंग्स फॉर सोलार सेल कवेर्स एंड ग्लास सर्फसस	डॉ. के.जी.के.वार्यर
44	एमएचआरडी	दि विल्लेज कम्युनिटि नेटवर्क : तकनोलॉजी डिवलप्मेंट एंड पाइलट रोल्लौट प्लान फॉर लो कोस्ट ओप्पर्ट्यूनिस्टिक कम्मयूनिकेशन नेटवर्क्स फॉर रूरल एरियास ऑफ़ इंडिया	डॉ एम.टी.सेबास्टियन
45	डीआरडीओ	डिजाइन एंड डिवलप्मेंट ऑफ़ एन्विरोर्नमेटली फ्रण्डली रेअर अर्थ बस्ड एनआईआर रिफ लक्टिंग कामौफ लाग पिगमेंट्स फॉर डिफेन्स अप्लिकेशन्स	डॉ. प्रभाकर राव
46	मेसर्स शिनिडेर इलेक्ट्रिक डीआरसी	नैनो सिरेमिक स्मार्ट फिल्लेर्स फॉर इंप्रूविंग दि थर्मल डिस्सिपेशन प्रोपर्टी ऑफ एपोक्सी पॉलिमर डाइइलेक्ट्रिक्स	डॉ. एस.अनंतकुमार
47	डीएसटी	डिवलप्मेंट ऑफ़ फ़ंग्शनली ग्रेडड पोरस सिरेमिक प्रिफोर्म एंड सिरेमिक मेटल कॉम्पोसिट्स फॉर इंजीनियरिंग अप्लिकेशन्स	डॉ. टी.पी.डी.राजन
		प्रक्रिया इंजीनियरिंग और पर्यावरण प्रभाग	
48	एमएनआरई	डिवलप्मेंट ऑफ़ ए हाउसहोल्ड वेस्ट्स एंड सानिटेशन डिवाइज विथ बायोगैस रिकवरी	डॉ. वी.बी.मणिलाल
49	एमएनआरई	एनरोबिक तकनोलॉजी फॉर बायोगैस रिकवरी एंड स्टेबिलासेज़न ऑफ़ अन्सोर्टड् मुनिसिपल सोलिड वेस्ट्स	डॉ. वी.बी.मणिलाल
50	एनएमआईटीएलआई	बायोफ यूवल फ्रम मराईन माइक्रोअल्गे	श्री अजित हरिदास
51	केरल राज्य प्रदूषण नियंत्रण	डस्ट सप्रेशन : फील्ड स्टडी इन चीना क्ले	डॉ. रु ग्मिणी सुकुमारन
52	केएससीएसटीई	बायोरेमडियेशन ऑफ़ पेर्कोलेट कंटैनिंग वेस्ट वाटर अंडर हाई सलैन कंडीशन्स यूसिंग केमोट्रोफिक मिक्सड मिक्रोबियल सिस्टम	डॉ. बी. कृष्णकुमार
53	मेसेर्स एसोशियेटड सोपस्टॉण डिस्ट्रिब्यूटेर्स	बेनिफीसियेशन प्रोसेस डिवलप्मेंट फ लो शीट डिजाईन फॉर चीना क्ले ऑफ़ गुडा माइन्स ऑफ़ मेसेर्स. एसोशियेटड सोप्सस्टोन डिस्टिलेशन कं. प्राई. लिमिटेड	डॉ. पी.राघवन
54	केएससीएसटीई	डिवलप्मेंट ऑफ़ मोडेर्ण एंड इको फ्रण्ड्ली बेनिफ़िसिएशन प्रोसेस एंड फ लो शीट फ़ोर कासरगोड एंड कन्नूर चीना क्लेस्	डॉ. पी.राघवन
55	ईआईसीएल	ब्राईट्नस्स इंप्रूव्मेंट स्टडीस ऑण चीना क्लेस्	डॉ. पी.राघवन
56	केएसआईडीसी	डिवलप्मेंट ऑफ़ ए स्यूटबिल मेथेर्ड टु कण्ट्रोल फंगल ग्रोथ इन स्कूपाइन लीफ प्रोडक्ट्स	डॉ. वी.बी.मणिलाल

कंसल्टेंसी कार्यक्रम

क्रम सं.	ग्राहक	परियोजना शीर्षक	परियोजना प्रधान
कृषि प्रसंस्करण प्रभाग			
1	आन इम्पेक्स	इंजीनियरिंग कंसल्टेंसी फॉर तकनॉलजी अपग्रेडेशन	श्री एम.एम.श्रीकुमार
पदार्थ विज्ञान तथा प्रौद्योगिकी प्रभाग			
2	वीएसएससी	सर्फस अनालिसिस टेस्ट सैंपिल्स ऑफ़ कोप्पर क्रोमैट, फेरिक ऑक्साइड, अलुमिना, बीएन, एआईएन एंड इन्डियम पेल्लेट्स बाय 3 पॉइंट बीट मेथेड़	श्री के.एच.भट
3	पर्यावरण रिसोर्स अनुसंधान केन्द्र, तिरुवनन्तपुरम	माइक्रोस्ट्रक्चरल अनालिसिस ऑफ़ पोल्लेंस ऑफ़ मेडिसिनल प्लांट्स	डॉ. पी. प्रभाकर राव
4	मेसेर्स टीईआरआई, दिल्ली	इवालुवेशन ऑफ़ क्ले सैंपिल्स फॉर स्यूटबिलिटी फॉर एक्सट्रूशन एंड प्रोडक्शन ऑफ़ होलो ब्लोक्स	डॉ. के.जी.के.वार्यर
5	बीएचईएल, बैंगलोर	प्रिपरेशन ऑफ़ यूवी क्यूरबिल नैनो-TiO2 थिन फिल्म ओण ग्लास सबस्ट्रेट टु इन्टूस सेल्फ क्लीनिंग प्रोर्पेटीस	डॉ. के.जी.के.वार्यर
6	वीएसएससी	स्ट्रक्चरल एंड माइक्रोस्ट्रक्चरल कैरक्टराइसेशन ऑफ एरोस्पेस मेटीरियल्स	डॉ. पी. प्रभाकर राव
7	वापको इंडिया लिमिटेड	फैब्रिकेशन ऑफ़ प्रोटोटाइप एलुमिनियम अल्लोय एंड कॉपोसिट सिलिंडर लाइनेर्स फॉर ओटोमोटीव एयर कंप्रेसर अप्लिक्केशन्स .	डॉ. टी.पी.डी.राजन
प्रोसेस इंजीनियरिंग और पर्यावरण प्रभाग			
8	निता जेलाटिन इंडिया लिमिटेड, कोरट्टी, त्रिचूर	ओस्सीन फैक्टरी ऑडर कन्ट्रोल	श्री अजित हरिदास
9	केएमएमएल	ईआईए फॉर केएमएमएल प्रोजेक्ट	श्री जे.अंसारी
10	वैपकोस	मरैन इकोलोजिकल सर्वे फॉर थि प्रोपोस्ड मल्टियूसर लिक्युड टेर्मिनल, कोच्ची	श्री जे.अंसारी
11	नीरी	इंपाक्ट असेसमेंट ड्यू टु कॉणस्ट्रक्शन ऑफ़ रोड एम्बांक्मेंट	श्री जे.अंसारी
12	मिराक्किल पॉलिमेर्स इंडिया लिमिटेड, कोयंबटूर	रीक्लेइम रब्बर फाक्टरी ऑडर कन्ट्रोल	श्री अजित हरिदास

पेटेंट

फाइल किए गए पेटेंटों (विदेशी)

एनएफएनओ	शीर्षक	आविष्कारकों	मंजूरी की तारीख	आवेदन सं.
0141एनएफ2008/ जेपी	ए ट्रांसपरेंट कैटम जेल एंड ए प्रोसेस फॉर दि प्रिपरेशन देयरऑफ	थोलत एमिलिया अब्रहाम, चन्द्रोत कल्याड सिमि	10/06/2011	2011-540326
0141 एनएफ 2008/ यूएस	ए ट्रांसपरेंट कैटम जेल एंड ए प्रोसेस फॉर दि प्रिपरेशन देयरऑफ	थोलत एमिलिया अब्रहाम, चन्द्रोत कल्याड सिमि	14/06/2011	13/139679
0141 एनएफ 2008/सीएन	ए ट्रांसपरेंट कैटम जेल एंड ए प्रोसेस फॉर दि प्रिपरेशन देयरऑफ	थोलत एमिलिया अब्रहाम, चन्द्रोत कल्याड सिमि	14/06/2011	200980149968.8
0141 एनएफ 2008/ईपी	ए ट्रांसपरेंट कैटम जेल एंड ए प्रोसेस फॉर दि प्रिपरेशन देयरऑफ	थोलत एमिलिया अब्रहाम, चन्द्रोत कल्याड सिमि	15/06/2011	09787583.5
0141 एनएफ 2008/सीए	ए ट्रांसपरेंट कैटम जेल एंड ए प्रोसेस फॉर दि प्रिपरेशन देयरऑफ	थोलत एमिलिया अब्रहाम, चन्द्रोत कल्याड सिमि	15/06/2011	—
0141 एनएफ 2008/केआर	ए ट्रांसपरेंट कैटम जेल एंड ए प्रोसेस फॉर दि प्रिपरेशन देयरऑफ	थोलत एमिलिया अब्रहाम, चन्द्रोत कल्याड सिमि	11/07/2011	2011-7016069
0069 एनएफ 2008/ यूएस	प्रिपरेशन ऑफ़ ग्रीन कलरेंट फ्रम मिक्सड रेअर अर्थ एंड मॉलिब्डिनम कोम्पौंड्स एंड प्रोसेस देयरऑफ आस सर्फस कोटिंग्स	मुण्डलापुडी लक्ष्मीपति रेड्डि	26/09/2011	13/260481
0069 एनएफ 2008/एयु	प्रिपरेशन ऑफ़ ग्रीन कलरेंट फ्रम मिक्सड रेअर अर्थ एंड मॉलिब्डिनम कोम्पौंड्स एंड प्रोसेस देयरऑफ आस सर्फस कोटिंग्स	मुण्डलापुडी लक्ष्मीपति रेड्डि	26/09/2011	2010228847
0197 एनएफ 2008/ यूएस	ए प्रोसेस फॉर दि प्रिपरेशन ऑफ़ नोवल नॉन-टोक्सिक येल्लो इन्ओर्गानिक कलरेंट/पिगमेंन्ट फ्रम समरियम एंड मॉलिब्डिनम कॉम्पौंड्स	मुण्डलापुडी लक्ष्मीपति रेड्डि	26/09/2011	13/260423
0197 एनएफ 2008/बीआर	ए प्रोसेस फॉर दि प्रिपरेशन ऑफ़ नोवल नॉन-टोक्सिक येल्लो इन्ओर्गानिक कलरेंट/पिगमेंन्ट फ्रम समरियम एंड मॉलिब्डिनम कॉम्पौंड्स	मुण्डलापुडी लक्ष्मीपति रेड्डि	27/09/2011	पीआई 0924476-0

0197 एनएफ 2008/एयू	ए प्रोसेस फॉर दि प्रिपरेशन ऑफ़ नोवल नॉन-टोक्सिक येल्लो इन्ओर्गानिक कलरेंट/पिगमेंन्ट फ्रम समरियम एंड मॉलिब्डिनम कॉम्पौंड्स	मुण्डलापुडी लक्ष्मीपति रेड्डि	27/09/2011	2009343120
0069 एनएफ 2008/ बीआर	प्रिपरेशन ऑफ़ ग्रीन कलरेंट फ्रम मिक्सड रेअर अर्थ एंड मॉलिब्डिनम कोम्पौंड्स एंड प्रोसेस देयरऑफ आस सर्फस कोटिंग्स	मुण्डलापुडी लक्ष्मीपति रेड्डि	27/09/2011	020110100281
0197 एनएफ 2008/सीएन	ए प्रोसेस फॉर दि प्रिपरेशन ऑफ़ नोवल नॉन-टोक्सिक येल्लो इन्ओर्गानिक कलरेंट/पिगमेंन्ट फ्रम समरियम एंड मॉलिब्डिनम कॉम्पौंड्स	मुण्डलापुडी लक्ष्मीपति रेड्डि	21/10/2011	200980158858.8
0069 एनएफ 2008/सीएन	प्रिपरेशन ऑफ़ ग्रीन कलरेंट फ्रम मिक्सड रेअर अर्थ एंड मॉलिब्डिनम कोम्पौंड्स एंड प्रोसेस देयरऑफ आस सर्फस कोटिंग्स	मुण्डलापुडी लक्ष्मीपति रेड्डि	21/10/2011	201080017745.9
0069 एनएफ 2008/ईपी	प्रिपरेशन ऑफ़ ग्रीन कलरेंट फ्रम मिक्सड रेअर अर्थ एंड मॉलिब्डिनम कोम्पौंड्स एंड प्रोसेस देयरऑफ आस सर्फस कोटिंग्स	मुण्डलापुडी लक्ष्मीपति रेड्डि	24/10/2011	10719793.1
0197 एनएफ 2008/आरयू	ए प्रोसेस फॉर दि प्रिपरेशन ऑफ़ नोवल नॉन-टोक्सिक येल्लो इन्ओर्गानिक कलरेंट/पिगमेंन्ट फ्रम समरियम एंड मॉलिब्डिनम कॉम्पौंड्स	मुण्डलापुडी लक्ष्मीपति रेड्डि	26/10/2011	2011143354
0169 एनएफ 2010/डब्ल्यूओ	मेटल ऑक्साइड मोडिफाइड एंड अन्मोडिफाइड मोलिकुलारलि इंप्रिंटड कण्डक्टिंग पॉलिमर फिल्म बेस्ड अक्युवस ऐमिनो ऐसिड सेंसेर्स	वर्गीस सौम्या, कृष्ण पिल्लै, पद्मजा कुमारी प्रतीश, तलशीला प्रसादा राव	31/01/2012	पीसीटी/आईएन 2012/000072
0170 एनएफ 2010/ डब्ल्यूओ	मोलिकुलार प्रोब्स विथ हाई फ्लूरासेन्स फॉर सोलिड स्टेट लाइटिंग, सेलक्टीव डिस्क्रिमिनेशन ऑफ काउंटर- आयन्स ऑफ जिंक, टु फोटोन इमेजिंग	अय्यप्पनपिल्लै अजयघोष, किषुमुरि पी. दिव्या, संपत्त श्रीनिवासन	14/02/2012	पीसीटी/आईबी 2012/050656
0122 एनएफ 2009/ यूएस	ए रीयूसबिल थायोफिन एंड-केप्पड बाईपिरिडीन फ्लूरासेंट अस्से फॉर सेलेक्टीव डिटेक्शन ऑफ साइनाइड इन आन्अयन्स एंड बायोरेलवेंट सांपिल्स एंड प्रोसेस देयरऑफ	अय्यप्पनपिल्लै अजयघोष, शिवरामपणिक्कर श्रीजित्त, किषुमुरि पी. दिव्या, पुरुषोत्तमन जयमूर्ति	15/03/2012	13/421511

फाइल किए गए पेटेंटों (भारतीय)

एनएफएनओ	शीर्षक	आविष्कारकों	मंजूरी की तारीख	आवेदन सं.
0169 एनएफ 2010/आईएन	मेटल ऑक्साइड मोडिफाइड एंड अन्मोडिफाइड मोलिकुलारलि इंप्रिंटड कण्डक्टिंग पॉलिमर फिल्म बेस्ड अक्युवस ऐमिनो ऐसिड सेंसेर्स	वर्गीस सौम्या, कृष्ण पिल्लै, पद्मजा कुमारी प्रतीश, तलशीला प्रसादा राव	17/01/2012	0264डीईएल2011
0170 एनएफ 2010/ आईएन	मोलिकुलार प्रोब्स विथ हाई फ्लूरासेन्स फॉर सोलिड स्टेट लाइटिंग, सेलक्टीव डिस्क्रिमिनेशन ऑफ काउंटरआयन्स ऑफ जिंक, टु फोटोन इमेजिंग	अय्यप्पनपिल्लै अजयघोष, किषुमुरि पी.दिव्या, संपत्त श्रीनिवासन	14/02/2012	0367 डीईएल 2011
0139 एनएफ 2011/ आईएन	फ्लूरासेंट मेटीरियल फॉर सेल्फ-इरेसिबिल रैट्टिंग, ओथेंटिक सेक्यूरिटि लैबलिंग, करेंसी काउंटरफीट प्रिवेंशन एंड प्रोसेसस फॉर दि प्रिपरेशन देयरऑफ	अय्यप्पनपिल्लै अजयघोष, राजशेखरन तिरु मलै कुमारन	12/08/2011	2294 डीईएल 2011
0155 एनएफ 2010/ आईएन	आन इंप्रूव्ड बायोप्रोसेस फॉर दि प्रोडक्शन ऑफ एल-मीथियोनिन ऐमिनोपेप्टिडेस (एल-मैप) फ्रम स्ट्रेप्टोमाइसीज़ गेडेनसिस	के.माधवन नंपूतिरि, राजी राहुलन, अशोक पाण्डेय	12/08/2011	2290 डीईएल 2011
0138 एनएफ 2011/ आईएन	डाई एन्ट्राप्पड सॉल-जेल फिल्म बेस्ड टेस्ट स्ट्रिप सेंसर फॉर नाइट्राइट एंड ए प्रोसेस देयरऑफ	शान्तकुमार धन्या, तलशीला प्रसादा राव	26/08/2011	2419 डीईएल 2011
0188 एनएफ 2011/ आईएन	ए नोवल मेथेड ऑफ डिवलप्पिंग नैनो-स्ट्रक्चेर्ड सिलवर ऑक्साइड फिल्म बेस्ड अक्यूवस वोल्टामेट्रिक पेस्टिसाइड सेंसर	पनंपिल्लिल विजयम्मा शुभा, वर्गीस सौम्या, तलशीला प्रसादा राव	31/01/2012	0264 डीईएल 2012
0014 एनएफ 2012/ आईएन	इंप्रूव्ड ऐनयरोबिक हाइजेस्टर फॉर हाउसहोल्ड ऑर्गानिक वेस्ट्स	वट्टाक्काट्टु बालकृष्णन मणिलाल	19/03/2012	0799 डीईएल 2012

फाइल किए गए पेटेंटों (विदेशी)

शीर्षक	आविष्कारकों	मंजूरी की तारीख	पेटेंट संख्या
मेथेड फॉर कण्डिन्यूवस प्रोडक्शन ऑफ MgB_2 बेस्ड सूपरकण्डक्टेर्स	श्यामाप्रसाद उपेन्द्रन, अभिलाश कुमार रवीन्द्रन नायर गिरिजाकुमारि अम्मा, विनोद कृष्णन कुट्टि, अलोशियस राजप्पन पत्मावति, सरूण पल्लियन मुरिकोली, तेन्नवराजन सुब्रमणियन गुरुसामी पेरुमाल	15/06/2011	जीबी 2446973

ए नोवल लो टेंपरेचर प्रोसस फॉर दि सिंतेसिस ऑफ अल्ट्रा-फाइन रूटाइल फेस टाइटेनियम डाइऑक्साइड पार्टिकिल्स थ्रूवेपर फेस हाइड्रोलिसिस ऑफ टाइटेनियम टेट्राक्लोराइड	जेराल्ड देवसगायम सुरेन्दर, अनि करिमपानूर जोन, कुमारा पिल्लै राजेन्द्रा प्रसाद, शिवरामन सावित्री	12/08/2011	जेपी 4800768
ए मेथेड फॉर दि प्रिपरेशन ऑफ क्रोस लिंग्ड प्रोटीन क्रिस्टल्स	थोलत एमिलिया अब्रहाम, बिन्दु एलवीए	12/08/2011	जेपी 4799422
क्विनैल्डीन बेस्ड सेमिस्कुरैन्स एंड स्कुरैन डाइस, प्रोसस फॉर प्रिपेरेशन देयरऑफ एंड यूस देयरऑफ	डानबोयिना रामय्या, कुतनापिल्लिल ज्योतिश, अरुण कल्लियाट ताष़तुवीट्टील	16/08/2011	यूएस 7998935
डिवलप्मेंट ऑफ येल्लो पिगमेंट्स कॉप्रैसिंग ऐल्केलाइन एर्थ, प्रैजियोडिमियम एंड ट्रांसीशन मेटल ऑक्साइड्स एंड प्रोसस देयरऑफ	पडला प्रभाकर राव, मुण्डलापुडी लक्ष्मीपति रेड्डि	02/09/2011	एफआर 2915987बी1
प्रोसेस फॉर सिंथेसिस ऑफ टेलिचिलिक यूरिथेन ऐक्रिलेट यूवी क्युरबिल प्री-पॉलिमेरिक मेटीरियल्स	श्यामकुमारी, आशा पिल्लै, चेन्नाक्काट्टु कृष्ण सदाशिवन	01/11/2011	यूएस 048979
$Mg_2MM'O_{6+X}$,(M=Y, रेअर अर्थ मेटल एंड M'=Sn, OR Zr) डाइइलेक्ट्रिक सिरेमिक्स एंड देयर प्रिपरेशन आस नैनोपार्टिकिल्स	जेइम्स जे, सेन्तिलकुमार.एस, नायर.के.वी.वी	03/01/2012	सीए 2520555

फाइल किए गए पेटेंटों (भारतीय)

शीर्षक	आविष्कारकों	मंजूरी की तारीख	पेटेंट संख्या
ए प्रोसेस फॉर दि प्रोडक्शन ऑफ़ मैक्रोन्यूट्रियेंट्स रिच राइस ब्रान ऑयल यूसिंग सूपरक्रिटिकल कार्बन डाइ ऑक्साइड एक्सट्राक्शन	चामी अरु मुखन, पोंमलाकुन्नेल निक्लावोस मायामोल , थोमस सामुअल, चंद्रशेखरन पिल्लै बालचंद्रन, अन्दिक्कान्नु सुन्दरेशन	27/04/2011	247621
ए प्रोसेस फॉर थ प्रिपरेशन ऑफ़ फाइटेस फ्रम जैकफ्रूट सीड पाउडर यूसिंग ऐस्परजिलस फिक्कम	केशवन माधवन नंपूतिरि, अशोक पाण्डेय	25/08/2011	248793
ए प्रोसेस फॉर दि प्रोडक्शन ऑफ़ सूपर डिगूम्मड एंड डीवाक्सड राइस ब्रान ऑयल फिसिकल रिफाइनिंग	दासिया रत्ना शोभनकुमार लीलावती राजम, अन्दिक्कान्नु सुन्दरेशन, चामी अरु मुखन	08/09/2011	248905

ज्ञान संसाधन केंद्र

ज्ञान, सूचना और प्रौद्योगिकी को एक साथ लाकर एनआईआईएसटी के वैज्ञानिकों को अपने अनुसंधान एवं विकास क्षेत्र में अग्रणी रहने में ज्ञान संसाधन केन्द्र (केआरसी) मदद करता है। पुस्तकों, पत्रिकाओं, सीडी रॉम डेटाबेसस आदि सहित दस्तावेजों का एक विशेष संग्रह उपलब्ध कराने के साथ ही साथ केआरसी द्वारा इलेक्ट्रॉनिक पत्रिकाओं और डेटाबेस के लिए भी पहुँच प्रदान करती है। केआरसी द्वारा ऑप्टिकल फाइबर केबल लिंक पर ईथरनेट कनेक्टिविटी के साथ समर्पित पट्टे लाइनों के माध्यम से सभी शोधकर्ताओं को उच्च गति नेटवर्क प्रदान करता है। 100 प्रतिशत प्रवाह क्षमता और 99 प्रतिशत से उपर उपरिकाल के साथ इस तरह की 24X7 सेवा बैंडविड्थ महत्वपूर्ण अनुप्रयोगों और इंटरनेट ब्राउजिंग, डेटा अपलोड/डाउनलोड, ई-मेल, वीडियो कॉन्फ्रेंसिंग आदि की आवश्यकताओं की पूर्ति करती हैं। अनुभाग ने बुनियादी ढांचे, संसाधनों, सेवाओं आदि के प्रतिपादन और सीएसआईआर ईआरपी परियोजना के कार्यान्वयन को मजबूत बनाने में महत्वपूर्ण प्रगति की है।

संसाधन

प्रिंट संग्रहः मार्च 2012 तक को कुल प्रिंट संग्रह 43,000 से अधिक दस्तावेज हैं, जिनमें 12,967 पुस्तकों, 10,947 मानकों और पत्रिकाओं की 10,082 जिल्दवाली शामिल हैं । वर्ष 2011-12 के दौरान 95 पुस्तक खरीदी गयीं । वर्ष 2012 के लिए 35 ऑनलाइन ख़िताब सहित 83 विदेशी और 77 भारतीय पत्रिकाओं के लिए सदस्यता ली गयी । नौ पत्रिका मुफ्त प्राप्त हुई थीं।

ई–संसाधनों : एनकेआरसी कार्यक्रम (राष्ट्रीय ज्ञान संसाधन भागीदारी) और प्रयोगशाला फंड के तहत एनआईआईएसटी आईपी के माध्यम से सभी नेटवर्क उपयोगकर्ताओं को 12 प्रकाशकों के 4000 से अधिक पत्रिकाओं के लिए पहुंच प्रदान की गयी। एनकेआरसी कार्यक्रम के तहत ई - संसाधनों के लिए सभी वैज्ञानिकों, शोध छात्रों और अन्य कार्यकर्ताओं की पीसी के माध्यम से आईपी सक्षम मोड में प्रयोगशाला भर में परीक्षण अभिगम्यता और बाद में नियमित रूप से उपयोग के लिए मदद की थी। अभिगम्यता की सुविधाओं / प्रकाशकों, जिनकी ई- पत्रिकाओं / पूर्ण पाठ डेटाबेस सुलभ हैं, की सूची नीचे प्रस्तुत की जाती हैः

- अमेरिकन केमिकल सोसायटी
- वार्षिक समीक्षा
- अमेरिकन सोसायटी ऑफ सिविल इंजीनियर्स
- अमेरिकन सोसायटी ऑफ मैकेनिकल इंजीनियर्स
- अमेरिकी भौतिकी संस्थान
- एसोसिएशन फॉर कम्प्यूटिंग मशीनरी
- कैम्ब्रिज यूनिवर्सिटी प्रेस
- एल्सेवियर
- एमराल्ड
- इलेक्ट्रिकल और इलेक्ट्रॉनिक्स इंजीनियर्स संस्थान
- प्रकृति प्रकाशन समूह
- ऑक्सफोर्ड यूनिवर्सिटी प्रेस
- रसायन विज्ञान की रॉयल सोसाइटी
- विज्ञान पत्रिका
- स्प्रिंगर
- टेलर और फ्रांसिस
- विले – ब्लैकवेल
- दीवान उद्यम के भारतीय जर्नल्स.कोम

ग्रन्थसूची और प्रशस्ति पत्र डेटाबेस

- विज्ञान के वेब - विज्ञान प्रशस्ति पत्र विस्तारित सूचकांक
- स्कोपस

पेटेंट डेटाबेस

- डरवेन्ट नवाचार सूचकांक
- डेल्फियोन

मानक

- एएसटीएम

यह, जैविक, अकार्बनिक और कार्ब-धात्विक डेटा, अमेरिकन

सूक्ष्म जीव विज्ञान सोसायटी की पत्रिकाओं और थेइमे पत्रिकाओं की खोज के लिए एक वेब आधारित प्रणाली रेअक्सिस की परीक्षण पहुँच के अलावा था। ई - संसाधनों का, विशेष रूप से एसीएस, एल्सेवियर और स्कोपस का उपयोग अत्यधिक था। उपयोग की नियमित निगरानी और नई सुविधाओं / सेवाओं का नियमित संदेश प्रसारण जैसे विभिन्न प्रचार कार्यक्रम प्रारंभ किए गए, प्रत्येक आइटम के लिए इंट्रानेट में खोज लिंक का होस्टिंग, उपयोगिता स्तर को बढ़ावा दिया है ।

आईटी संसाधनों: अत्याधुनिक आईटी अवसंरचना और उच्च गति नेटवर्क के साथ एनआईआईएसटी महत्वपूर्ण रूप से वैश्विक ज्ञान समुदाय से जुड़ा है । मुख्य सहारे जिगाबाइट ओएफसी के माध्यम से कैम्पस में इमारतें जुड़े रहते हैं। यहाँ बड़ी संख्या में उपलब्ध उच्च अंत पर्सनल कंप्यूटर CAT6 UTP केबल के माध्यम से लैन पर जुड़े हैं। विंडोज 7, विंडोज एक्स पी प्रोफेशनल, विंडोज विस्टा रेड्हत, उबुन्तू जैसे ऑपरेटिंग सिस्टम की एक विस्तृत श्रृंखला के साथ केआरसी नवीनतम उच्च अंत आईबीएम, डेल, और एचपी सर्वर को होस्ट करता है। प्रत्येक इमारत में स्थित सीमा स्विच, लायेर 3 और लायेर 2 स्विच के माध्यम से केआरसी के साथ जुड़ा हुआ है। सिस्को, डिजीसॉल और बेलकिन के विभिन्न अभिगम्यता पॉइंट के माध्यम से वाई - फाई सक्षम किया गया है। सर्वर के डेटा बैकअप आईबीएम डीएस 4200 और फुजित्सु भंडारण उपकरणों के माध्यम से किया जा रहा है। प्रिंटर की एक विस्तृत विविधता पर मुद्रण और स्कैनिंग सुविधा उपलब्ध हैं, जैसे अत्यधिक टिकाउ बहु प्रकार्यात्मक रंग लेजर प्रिंटर और ए 3 /ए 4 स्कैनर ।

सेवाएं

पुस्तकालय सेवाएं: इस अवधि के दौरान पुस्तकों, पत्रिकाओं, पीएचडी थीसिस, एनआईआईएसटी के वैज्ञानिकों के प्रकाशनों आदि के इन-हाउस डेटाबेस का नियमित रूप से अद्यतन किया गया और एनआईआईएसटी की वेबसाइट और इंट्रानेट के माध्यम से इन्हें उपलब्ध कराया गया । वैज्ञानिकों और शोध छात्रों के लिए मानकों और पेटेंटों सहित नियमित और व्यापक सीडी रॉम और ऑनलाइन डेटाबेस खोजों का संचालन किया। संसाधन सुविधाओं और सेवाओं को मुख्य रूप से अनुसंधान, औद्योगिक और शैक्षिक क्षेत्रों के बाहरी उपयोगकर्ताओं के लिए बढ़ाया गया। केरल और उसके आसपास के संस्थानों और विश्वाविद्यालयों से करीब 350 व्यक्तियों ने एनआईआईएसटी - केआरसी का दौरा किया और उसकी सेवाओं का लाभ उठाया। केआरसी की सेवाओं के लिए नए सदस्यों की शुरूआत नियमित रूप से किया गया था।

एनआईआईएसटी से उत्पन्न शोध और अनुसंधान कागजात की संस्थागत रिपोजिटरी का निर्माण प्रगति पर है। इस अवधि के दौरान 134 रिकॉर्ड आईआर में जोड़ा गये थे। इस अवधि के दौरान पत्रिकाओं की 302 वॉल्यूम्स बाउंड किये गये। एक सामान्य प्रयोगशाला सुविधा के रूप में रिप्रोग्रफिक और फ़ोटोग्राफी सेवाओं का विस्तार किया गया ।

साइन्टोमीट्रिक सेवा: जर्नल प्रशस्ति पत्र की रिपोर्ट और विज्ञान की वेब- विज्ञान प्रशस्ति पत्र सूचकांक विस्तारित और स्कोपस का उपयोग करके एनआईआईएसटी प्रकाशनों के इंपैक्ट फैक्टरों का ग्रंथमापीय / साइन्टोमीट्रिक विश्लेषण जारी किया । वर्ष 2011 के दौरान एनआईआईएसटी द्वारा प्रकाशित शोधपत्रों की कुल संख्या 201 हैं, जिनमें से 193 कागजात 2.649 के औसत आईएफ मूल्य के साथ एससीआई कागजात हैं। एससीआई कागजात की कुल संख्या में, एससीआई पत्रिकाओं में बिना इंपैक्ट फैक्टर से प्रकाशित 8 कागजात शामिल हैं।

आईटी सेवा: वैज्ञानिकों, कर्मचारियों और अनुसंधान छात्रों को एन के एन जिगाबाइट कनेक्टिविटी और बीएसएनएल के माध्यम से 9 एमबीपीएस समर्पित इंटरनेट लीज्ड लाइन कनेक्टिविटी के माध्यम से वायर्ड और वाई - फाई उच्च गति इंटरनेट कनेक्टिविटी प्रदान की अनुमार्गण, भार संतुलन, फेल-ओवर और सुरक्षित डेटा अभिगमन के लिए एकीकृत ख़तरा प्रबंधन उपकरण (यूटीएम) कार्यान्वित किया। एनआईआईएसटी के कर्मचारियों के लिए बेहतर संस्थागत ई - मेल सुविधा प्रदान करने के लिए पुरानी सेंटमेल प्रणाली की जगह पर एक नयी ई - मेल प्रणाली ज़िब्रा लागू की गयी है, जो वायरस और स्पैम के खतरों पर काबू पाने में मदद कर सकती है। एनआईआईएसटी वेबसाइट www.niist.res.in को नई सुविधाओं और अधिक जानकारी के साथ एक नया रूप दिया गया। एनआईआईएसटी की हिंदी वेबसाइट का डिजाइन, विकास और अनुरक्षण का कार्य प्रगति पर है। निम्नलिखित परियोजनाओं, समूहों और सम्मेलनों के लिए वेबसाइटों और बुलेटिन बोर्ड सेवाओं का विकास और रखरखाव किया।

- www.niist.res.in/biobulletin/ -जैवप्रौद्योगिकी समूह के लिए

- www.niist.res.in/oisc - कार्बनिक और अकार्बनिक सौर कोशिका समूह के लिए
- www.niist.res.in/oisc/bulletin एनआईआईएसटी समूह के लिए
- सीआरएसआई (भारतीय केमिकल रिसर्च सोसाइटी) और
- एनएचबीटी (जैव प्रौद्योगिकी में नए क्षितिज) सम्मेलन के लिए वेबसाइटों
- ई - पत्रिकाओं, फार्म्स, सूचना ,परिपत्र, घटनाक्रम, छुट्टियों, परियोजना स्थिति, कर्मचारी निर्देशिका, प्रकाशनों, थीसिस आदि की पहुँच के लिए एमआईएस इंट्रानेट पोर्टल

वर्ष के दौरान एक डाटा सेंटर के साथ आईटी लैब का नवीकरण का कार्य लिया गया था और यह कार्य प्रगति पर है । केआरसी ने एनआईआईएसटी वीडियो कॉन्फ्रेंसिंग की सुविधा को बनाया रखा है और सभी डेस्कटॉप और लैपटॉप के लिए हार्डवेयर / सॉफ्टवेयर और नेटवर्क समर्थन प्रदान किया । केआरसी ने भंडार व क्रय सॉफ्टवेयर, लिब्स्यूट, डीस्पेस, बीआईएस, कास्पर्स्की एंटीवायरस, केमड्रो, सिग्मास्पॉट, ओर्जिन जैसे कई सॉफ्टवेयर समाधान और डेटाबेस के लिए प्रबंधन किया । डीएचसीपी, डीएनएस, प्रॉक्सी, वेब, ई - मेल और एफ्टीपी सर्वर, स्विच, वाई-फ़ाई अभिगमन पांइट आदि बनाए रखे । आईटी उत्पादों और प्रयोगशाला के उपकरणों की खरीद में गुणवत्ता आश्वासन सुनिश्चित करने में सहायता प्रदान की गयी ।

सामान्य सूचना

विदेशी यात्रा (1.4.2011 से 31.3.2012 तक)

नाम	दौरा किया गया देश	से	तक	उद्देश्य
डॉ.अशोक पाण्डेय, मुख्य वैज्ञानिक	ग्रीस	4.4.2011	4.4.2011	जैव रिफाइनरियों और खाद्य उत्पादों पर पट्रास विश्वविद्यालय में आयोजित अन्तर्राष्ट्रीय संगोष्ठी में व्याख्यान देने के लिए
	होंगकॉग	5.5.2011	5.5.2011	ठोस अपशिष्ट प्रबंधन पर अंतर्राष्ट्रीय सम्मेलन में मूल व्याख्यान देने के लिए।
	शंघाई , चीन	11.5.2011	14.5.2011	जैव प्रौद्योगिकी पर एशियाई कांग्रेस में भाग लेने केलिए
	फ्रांस	1.6.2011	30.6.2011	ब्लेस पास्कल विश्वाविद्यालय, विजिटिंग प्रोफेसर, यूनिवर्सिटि ब्लेस पास्कल (यूबीपी) से फेलोशिप, क्लेर्मोनी फेर्रैंड, फ्रांस
	ताइवान	25.9.2011	30.9.2011	अंतर्राष्ट्रीय सम्मेलन- सीईएसई - 2011 में आमंत्रित व्याख्यान देने के लिए ।
	नोट्टिंगहाम, यूके	12.3.2012	13.3.2012	'ऊतक इंजीनियरिंग अनुप्रयोग के लिए कार्यात्मक बायोपॉलिमरों' पर रॉयल सोसाइटी, नॉटिंघम, ब्रिटेन द्वारा प्रायोजित अंतर्राष्ट्रीय सम्मेलन में भाग लेने केलिए
डॉ. ए.अजयघोष वैज्ञानिक एच	सियोल, कोरिया	25.4.2011	30.4.2011	योंसे विश्वविद्यालय में व्याख्यान देने के लिए
	जापान तथा थाईलैंड	24.8.2011	8.9.2011	एनआईएमएस, सुबाका, जापान में जेएसपीएस-डीएसटी सहकारिता कार्यक्रम में भाग लेने के लिए तथा बैंकॉक, थाईलैंड में आयोजित 14वीं एशियाई रासायनिक कांग्रेस (एसीसी) में आमंत्रित व्याख्यान के लिए ।
	बीजिंग, चीन	26.9.2011 13.10.2011	29.9.2011 17.10.2011	5वीं पूर्व एशिया संगोष्ठी में पूर्ण वक्ता तथा बीजिंग, चीन में कार्यात्मक पीआई इलेक्ट्रॉन सिस्टम पर आयोजित 10वीं अन्तर्राष्ट्रीय संगोष्ठी में आमंत्रित व्याख्यान देने के लिए
डॉ. टी.पी. डी.राजन, वैज्ञानिक सी	जर्मनी	19.7.2011	22.7.2011	लूनबर्ग, जर्मनी में 5वीं अंतर्राष्ट्रीय हल्की धातु प्रौद्योगिकी सम्मेलन में भाग लेने और शोधपत्र की मौखिक प्रस्तुति के लिए ।
डॉ. एम.टी. सेबास्टियन, वैज्ञानिक जी	स्लोवानिया	15.5.2011	29.5.2011	इंडो - स्लोवेनियन परियोजना के तहत द्विपक्षीय दौरा

डॉ. सुरेशदास, निदेशक	डेनमार्क	4.5.2011	6.5.2011	डेनमार्क तकनीकी विश्वविद्यालय में संयुक्त ईयू - भारत अनुसंधान परियोजना की बैठक में भाग लेने के लिए
डॉ. सी.एच. सुरेश, वैज्ञानिक सी	जर्मनी	1.7.2011	30.9.2011	मारबर्ग विश्वाविद्यालय, जर्मनी (हमबॉल्ट फेलोशिप)
डॉ. डी. रामय्या, वैज्ञानिक जी	चीन तथा होंगकॉग	23.9.2011	29.9.2011	कार्यात्मक रंजकों और अग्रवर्ती पदार्थों पर 5वीं पूर्व एशिया संगोष्ठी (ईएएसएस) में मूल व्याख्यान देने के लिए
डॉ. पी.प्रभाकर राव, वरिष्ठ प्रिंसिपल वैज्ञानिक	निगिटा विश्वविद्यालय, जापान	21.11.2011	23.11.2011	फ़ासफ़ोरस सामग्रियों पर आयोजित अंतर्राष्ट्रीय सम्मेलन में मौखिक प्रस्तुतीकरण के लिए ।
डॉ. राजीव.के. सुकुमारन	नोट्टिंगहाम विश्वविद्यालय, यूके	12.3.2012	13.3.2012	'ऊतक इंजीनियरिंग अनुप्रयोग के लिए कार्यात्मक बायोपॉलिमरों' पर आयोजित अंतर्राष्ट्रीय बैठक में भाग लेने के लिए ।

सम्मान और पुरस्कार

डॉ. सुरेश दास	सदस्य, संपादकीय सलाहकार बोर्ड, लांगम्यूर
	फेलो, भारतीय राष्ट्रीय विज्ञान अकादमी, नई दिल्ली
	उपाध्यक्ष, भारतीय पदार्थ अनुसंधान सोसायटी
डॉ. डी.रामय्या	परिषद सदस्य, भारतीय रासायनिक अनुसंधान सोसायटी, बेंगलूर
डॉ. ए.अजयघोष	फेलो, राष्ट्रीय विज्ञान अकादमी, भारत, इलाहाबाद
	ए वी राम राव फाउंडेशन पुरस्कार व्याख्यान (जेएनसीएएसआर, बेंगलूर)
डॉ. एम.एल.पी.रेड्डी	प्रशंसा प्रमाणपत्र- अमेरिकन केमिकल सोसायटी, न्यूयॉर्क
प्रो. अशोक पाण्डेय	विजिटिंग प्रोफेसर, यूनिवर्सिटि ब्लेस पास्कल, क्लेरमोंट फेरेन्ड, फ्रांस
डॉ. करु णाकरन वेणुगोपाल	युवा वैज्ञानिक पुरस्कार 2012 (भारतीय रसायनज्ञ और बायोलॉजिस्ट सोसाइटी (आईएससीबी) (रसायन विज्ञान में)
डॉ. रीना.वी.एल	सर्वश्रेष्ठ थीसिस पुरस्कार (स्वर्ण पदक) भारतीय पॉलिमर साइंस सोसायटी द्वारा संस्थापित
श्री पी.सी.नन्दजन	सर्वश्रेष्ठ पोस्टर पुरस्कार,14वीं भारतीय केमिकल रिसर्च सोसायटी संगोष्ठी- फरवरी, 2012
श्री एम.शान्टिल	सर्वश्रेष्ठ पोस्टर पुरस्कार,14वीं भारतीय केमिकल रिसर्च सोसायटी संगोष्ठी- फरवरी, 2012
श्री के.रतीश	सर्वश्रेष्ठ मौखिक प्रस्तुति पुरस्कार - सामग्रियों के रसायन विज्ञान पर आयोजित 7वें जेएनसी सम्मेलन -अक्टूबर, 2011.
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डॉ. वी.एस.विष्णु	सर्वश्रेष्ठ पोस्टर पुरस्कार - विज्ञान, प्रौद्योगिकी और रेअर अर्थ्स के अनुप्रयोगों पर राष्ट्रीय सम्मेलन - अगस्त 2011
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सुश्री जिशा बाबु	सर्वश्रेष्ठ पोस्टर पुरस्कार, कार्बनिक रसायन विज्ञान पर राष्ट्रीय सम्मेलन, आरटीसीएसएफसी - अगस्त, 2011
श्री प्रवीण प्रकाश	सर्वश्रेष्ठ पोस्टर पुरस्कार, कार्बनिक रसायन विज्ञान पर राष्ट्रीय सम्मेलन, आरटीसीएसएफसी - अगस्त, 2011
डॉ. रीता रानी सिंघानिया	पोस्ट डॉक्टरेट फैलोशिप, यूनिवर्सिटि ब्लेस पास्कल, क्लेरमोंट फेरेन्ड, फ्रांस
डॉ. श्याम कृष्णा	पोस्ट डॉक्टरेट फैलोशिप, आएनआरएस, क्यूबी, कनाडा
सुश्री के.पी.राजश्री	सर्वश्रेष्ठ शोध पत्र पुरस्कार, जैव प्रौद्योगिकी में नए क्षितिज पर अंतर्राष्ट्रीय सम्मेलन, नवम्बर 2011
सुश्री एम.वी.उषश्री	सर्वश्रेष्ठ शोध पत्र पुरस्कार, जैव प्रौद्योगिकी में नए क्षितिज पर अंतर्राष्ट्रीय सम्मेलन, नवम्बर 2011

पीएच.डी डिग्री से सम्मानित

छात्र	थीसिस का शीर्षक	पर्यवेक्षक	विश्वविद्यालय
सुश्री अम्बिली राज.डी.बी	ल्यूम्निसेंस ऑफ़ फ्लूरिनेटड β -डाइकीटोनेट कॉप्लेक्सस ऑफ़ लंथानैड्स	डॉ. एम.एल.पी.रेड्डि	केरल
श्री टोनी जोसफ	लो लोस सिलिकेट बेस्ड डाइइलेक्ट्रिक मेटीरियल्स फॉर वयरलस कम्मूनिकेशन	डॉ. एम.टी.सेबास्टियन	केरल
श्री प्रवीण.एल	8-हाईड्रोक्सिक्युनोलिन डिराइव्ड फ्लूरसेन्ट प्रोब्स फॉर दि डिटेक्शन ऑफ ट्रांसीशन मेटल ऑयन्स	डॉ. आर.लक्ष्मी वर्मा तथा डॉ. एम.एल.पी.रेड्डि	केरल
सुश्री अफि नशा दीपम.एल. एस	इन्वेस्टिगेशन्स ऑण अनसापोनिफियबिल फैटोकेमिकल्स ऑफ राइस ब्रान ऑयल	डॉ. सी.अरुमुखन तथा डॉ. ए.सुन्दरेशन	कुसाट
श्री रामकृष्णन.एस	अन्सा-मेटलोसीन बेस्ड नोर्मल एंड एक्सपांडेड कैलिक्सपैरोल्स एंड कैलिक्सफ्रीन्सः सिंथेसिस, स्पेक्ट्रल एंड स्ट्रक्चरल कैरक्टरैसेशन	डॉ. एम.एल.पी.रेड्डि	केरल
सुश्री धन्या जेइम्स	प्री-कॉसेट्रेटीव सेपरेशन, रिमुवल एंड सेंसिग ऑफ सिलेक्टड इनओर्गानिक टोक्सीन्स	डॉ. टी.प्रसादाराव	केरल
श्री के.पी.प्रदीश	बायोमेमिटिक एंड ऑप्टोइलेक्ट्रॉनिक सेंसेर्स फॉर सिलेक्टड एन्वायरोटॉक्सिक मार्केर्स	डॉ. टी.प्रसादाराव	केरल
सुश्री आर.शब्ना	मेटल टु इन्सुलेटर ट्रांसीशन फिनोमिनन इन(बिआई,पीबि)-2212 आन् इन्साइट इन टुद डोपिंग डिपेंडन्ट एवलूशन ऑफ ए हाइ टेंपरेचर सूपरकण्डक्टर	डॉ. यू.श्यामप्रसाद	केरल
श्री अनस.एस	जिंक ऑक्साइड नैनो स्ट्रक्चेर्स एंड नैनो कॉपोसिट्स फॉर फंगशनल एंड स्मार्ट वारिस्टर अप्लिकेशन्स	डॉ. एस.अनन्तकुमार	केरल
सुश्री अंजु.के.एस	मीसो-ऐरिल नोर्मल, एक्सपांडेड एंड कॉट्राक्टड पोफ्रिनोईड्सः सिंथेसिस, स्पेक्टरल एंड स्ट्रक्चरल स्टडीस	डॉ. एम.एल.पी.रेड्डि	केरल
श्री विष्णु.वी.एस	सिंथेसिस, कैरक्टरैसेशन, एंड ओप्टिकल प्रोपेर्टीस ऑफ एन्वयोर्मेन्टली बिनाइन रेअर अर्थ बेस्ड इनओर्गानिक पिग्मेंट्स	डॉ. एम.एल.पी.रेड्डि	केरल
श्री विनु.एस	स्टडीस ऑन सप्रशन ऑफ फ्लक्स क्रीप एंड स्केलिंग ऑफ वोर्टेक्स फ्लूयिड रेसिस्टिविटि इन रेअर अर्थ मोडिफाइड (बिआई,पीबि)-2212 सूपर कण्डक्टेर्स	डॉ. यू.श्यामप्रसाद	केरल
सुश्री निशा.वी.आर	माइक्रोबियल प्रोडक्शन ऑफ पॉलिहाइड्रोक्सिब्यूटिरेट	डॉ. अशोक पाण्डेय	केरल

अनुसंधान परिषद के सदस्य

अध्यक्ष

डॉ.दिपंकर बनर्जी
पदार्थ इंजिनीयरिंग प्रभाग
इंडियन इंस्टिट्यूट ऑफ साइंस
बंगलुरु - 560 012

सदस्य

श्री एस. वासुदेवन
प्रोफेसर
आईपीसी विभाग, इंडियन इंस्टिट्यूट ऑफ साइंस
बंगलुरु - 560 012

प्रोफ. एम.के.माथ्यू
झिल्ली बयोभौतिकी प्रयोगशाला
राष्ट्रीय जीव विज्ञान केन्द्र
टाटा मूलभूत अनुसंधान संस्थान
जीकेवीके, बेल्लारी रोड, बंगलूरु - 560 065

प्रोफ. वै.एन.मोहपत्रा
भौतिकी विभाग
भारतीय प्रौद्योगिकी संस्थान, कानपुर
कानपुर - 208 016

डॉ. एल.एस.शशिधरा
भारतीय विज्ञान शिक्षा और अनुसंधान संस्थान
प्रोफेसर एवं समन्वयक - जीवविज्ञान
प्रथम तल, केन्द्रीय टॉवर, साई ट्रिनिटी बिल्डिंग
गरवारे सर्किल, सुलटरवाडी, पाषान
पुणे-411 021

प्रोफ. ए.भट्टाचार्या
प्रोफेसर, जीवन विज्ञान स्कूल
जवाहरलाल नेहरू विश्वविद्यालय
नई दिल्ली - 110 067

डॉ. एम.शास्त्री
मुख्य वैज्ञानिक अधिकारी
टाटा केमिकल्स अभिनव केन्द्र
गोट्वदे फाटा, उरवदे रोड
पिरंगट औद्योगिक क्षेत्र, गेट 1139/1
मुलशी, पुणे - 412 108

डॉ. एम.आर.पिल्लै, निदेशक
राजीव गांधी जैव प्रौद्योगिकी केंद्र
जगति, तिरु वनन्तपुरम - 695 014

एजेंसी के प्रतिनिधि

डॉ. अरविन्द दुग्गल
सलाहकार
जैव प्रौद्योगिकी विभाग, ब्लॉक नं.2, 7वॉ तल
सीजीओ कॉम्प्लेक्स, लोदी रोड
नई दिल्ली - 110 003

महानिदेशक नामांकित

डॉ. विजयमोहनन के.पिल्लै
कार्यकारी निदेशक
केंद्रीय विद्युतरासायन अनुसंधान संस्थान
कारैक्कुडी - 630 006, तमिलनाडु

सहोदर प्रयोगशाला

डॉ. पुष्पितो.के.घोष
निदेशक
केंद्रीय नमक एवं समुद्री रसायन -
अनुसंधान संस्थान
जीजुभाई बधेका मार्ग, भावनगर - 364 002

क्लस्टर निदेशक

डॉ. एम.ओ.गार्ग
निदेशक
भारतीय पेट्रोलियम संस्थान (आईआईपी)
पी. ओ. आईआईपी, मोहकमपूर
देहरादून -248 005

निदेशक

डॉ. सुरेश दास
निदेशक
राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान
तिरुवनंतपुरम-695 019

स्थायी आमंत्रित

प्रधान या उनके नामित
योजना एवं निष्पादन प्रभाग(पीपीडी)
वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्
अनुसंधान भवन, 2, रफी मार्ग
नई दिल्ली -110 001

सचिव

डॉ. ए.सुन्दरेशन
प्रधान
कृषि प्रसंस्करण तथा प्राकृतिक उत्पाद प्रभाग
राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान
तिरुवनंतपुरम - 695 019

प्रबंधन परिषद के सदस्य

(1/1/2010 से 31/12/2011 तक की अवधि)

अध्यक्ष

निदेशक, एनआईआईएसटी

सदस्य

डॉ. के.आर.गोपिदास, वैज्ञानिक, एनआईआईएसटी
डॉ. अजयघोष, वैज्ञानिक, एनआईआईएसटी
डॉ. एलिज़बेत जेकब, वैज्ञानिक, एनआईआईएसटी
डॉ. के.वी.राधाकृष्णन, वैज्ञानिक, एनआईआईएसटी
डॉ. जे.डी.सुधा, तकनीकी अधिकारी III (6)
डॉ. नागेश आर.अय्यर, निदेशक, एसईआरसी, चेन्नई
प्रधान, आरपीबीडी, एनआईआईएसटी
सीएफए / एफएओ, एनआईआईएसटी

सदस्य सचिव

सीओए /एओ, एनआईआईएसटी

(1/1/2012 से 31/12/2013 तक की अवधि)

अध्यक्ष

निदेशक, एनआईआईएसटी

सदस्य

डॉ. विजयमोहनन के.पिल्लै, निदेशक, सीईसीआरआई,कारैकुडी
डॉ. अजयघोष, वैज्ञानिक, एनआईआईएसटी
डॉ. एम.टी.सेबास्टिन, वैज्ञानिक, एनआईआईएसटी
डॉ. (श्रीमती) एस.सावित्री, वैज्ञानिक, एनआईआईएसटी
डॉ. टी.पी.डी.राजन, वैज्ञानिक, एनआईआईएसटी
डॉ. बी.कृष्णकुमार, वैज्ञानिक, एनआईआईएसटी
श्री एस.वेलुस्वामी, एनआईआईएसटी
सीओएफए, एनआईआईएसटी
प्रधान, आरपीबीडी/पीपीडी, एनआईआईएसटी

सदस्य सचिव

एओ, एनआईआईएसटी

कर्मचारियों की सूची

नए वैज्ञानिकों की भर्ती

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डॉ. बिनोद परमेश्वारन ने केरल विश्वाविद्यालय से अपनी पीएच.डी. की उपाधि प्राप्त की । आपके शोध के हित जैव ईंधन, बायोपॉलिमर और औद्योगिक एंजाइमों पर केंद्रित है ।

श्री रिबिन जोन्स एस.बी., वैज्ञानिक, 19 अगस्त 2011

श्री रिबिन जोन्स को नेटवर्क और इंटरनेट इंजीनियरिंग में मास्टर डिग्री (एम.ई) प्राप्त है। आप सिस्को प्रमाणित नेटवर्क प्रोफेशनल, रेड हैट प्रमाणित इंजीनियर है, और एक प्रमाणित एथिकल हैकर भी है । आईटी और आईटीईएस सेवाएं, आईटी प्रशासन नेटवर्क सुरक्षा और ओपन सोर्स पर्यावरण आपके हित के क्षेत्र हैं।

डॉ. रमेशकुमार नटराजन, वैज्ञानिक, 12 सितंबर 2011

डॉ. रमेशकुमार नटराजन ने एम एस स्वामिनाथन रिसर्च फाउंडेशन, मद्रास विश्वाविद्यालय से वर्ष 2009 में अपनी पीएच.डी.की उपाधि प्राप्त की। माइक्रोबियल पारिस्थितिकीय और सिस्टमैटि - क्स आपके अनुसंधान हित के क्षेत्र हैं।

डॉ. यू एस हरीश, वरिष्ठ वैज्ञानिक, 08 नवंबर -2011

डॉ. यू.एस. हरीश ने महात्मा गांधी विश्वाविद्यालय से रसायन विज्ञान में अपनी पीएच.डी. की उपाधि प्राप्त की। आपने वर्ष 2001-2004 के दौरान नई सामग्री संस्थान, सारब्रूकेन, जर्मनी में विजिटिंग वैज्ञानिक के रूप में और वर्ष 2004-2011 के दौरान सिरेमिक प्रसंस्करण केन्द्र, एडवांस्ड रिसर्च सेंटर (एआरसीआई) इंटरनेशनल, हैदराबाद में वैज्ञानिक के रूप में काम किये। वर्तमान में, आपकी अनुसंधान अभिरुचि इन क्षेत्र में केंद्रित हैं -डाई सुग्राहीकृत और क्वांटम डॉट सुग्राहीकृत सौर सेल के लिए सामग्री प्रसंस्करण, चीनी मिट्टी की चीज़ों को आकृति बनाने के लिए मिथाइल सेलूलोज़ आधारित थर्मल जलेशन और ऑप्टिकल सिरेमिक्स के लिए स्प्रे निस्तापन तकनीक द्वारा उन्नत सिरेमिक ऑक्साइड पाउडर का संश्लेषण। आप पदार्थ विज्ञान और सिरेमिक्स के क्षेत्रों में कई अंतरराष्ट्रीय पत्रिकाओं के समीक्षक हैं। वर्ष 2011 में भारतीय सिरेमिक सोसायटी द्वारा आपको मालवीय पुरस्कार से सम्मानित किया गया।

डॉ. यूसफ करुवाथ, वैज्ञानिक - 22 दिसंबर 2011

डॉ. के. यूसफ का जन्म केरल के मलप्पुरम जिले के निलंबूर में हुआ था। आपने एप्लाइड कैमिस्ट्री में एमएससी और प्रो के. जॉर्ज थॉमस, सीएसआईआर - एनआईआईएसटी, तिरुवनंतपुरम के पर्यवेक्षण के अंतर्गत किए गए कार्यों के लिए कोच्चीन विज्ञान तथा प्रौद्योगिकी विश्वाविद्यालय, कोच्चि, केरल से अपनी पीएच.डी. डिग्री प्राप्त की। अपनी पीएच.डी के कार्यकाल के दौरान आप सीएनआर-आईएसओएफ, बोलोग्ना, इटली में एक विजिटिंग फेलो थे। बाद में डॉ. निकॉला आर्मरॉली के साथ काम करने के लिए आपने सीएनआर-आईएसओएफ, बोलोग्ना, इटली छोड दिया। दो बार, वर्ष 2009 और वर्ष 2010 में, आप को प्रतिष्ठित मैरी-क्यूरी पोस्ट डॉक्टरल फैलोशिप से सम्मानित किया गया था। इसके बाद सीएनआर-आईएसओएफ, बोलोग्ना, इटली में तृतीय स्तर के एक शोधकर्ता के रूप में चुने गये। इस अवधि के दौरान भी आप डिपार्टिमेन्टो डि केमिका 'जी सियामिकन, बोलोग्ना विश्वाविद्यालय, इटली, डिपार्टिमेन्टो डि साइन्स फार्मस्यूटिके, ट्राइस्टे, इटली एफयूएनडीपी, नमूर, बेल्जियम में एक विजिटिंग शोधकर्ता थे। डिपार्टिमेन्टो डि केमिका 'जी सियामिकन, बोलोग्ना विश्वाविद्यालय, इटली में एक कॉनफोकल स्कैनिंग प्रतिदीप्ति सूक्ष्मदर्शी स्थापित करने में आपने एक महत्वपूर्ण भूमिका निभाई है। आप के शोध के हितों में धातु /अर्धचालक / कार्बनिक नैनोमेटीरियल्स कार्बनिक -अकार्बनिक नैनोहाइब्रिड प्रणालियों, स्वतः समुच्चयन, फोटोफिसिक्स और विभिन्न माइक्रोस्कॉपीस के क्षेत्र शामिल हैं।

डॉ. एराथिम्मन्ना भोजे गौड, वरिष्ठ वैज्ञानिक 22 दिसंबर 2011

डॉ. एराथिम्मन्ना भोजे गौड ने श्री कृष्णादेवायार युनिवर्सिटी, अनंतपुर, आंध्र प्रदेश से पॉलिमर विज्ञान में एमएससी (तक.) और पुणे विश्वाविद्यालय से पीएच.डी. की उपाधि प्राप्त की। आपने टोयोटा प्रौद्योगिकी संस्थान, नागोया, जापान में प्रोफेसर कोहजि तशिरो समूह के साथ पोस्ट डॉक्टरल फेलो के रूप में और लाइबनिट्स पॉलिमर रिसर्च संस्थान, ड्रेसडेन, जर्मनी में प्रोफेसर मैनफ्रेड स्ताम्म समूह के साथ अलेक्जेंडर वॉन हम्बोल्ट फेलो के रूप में काम किये। वर्तमान पद में शामिल होने से पहले आपने भारतीय विज्ञान संस्थान, बंगलौर में सन्टिनरी पोस्ट डॉक्टरल फेलो के रूप में और एनआईआईएसटी में रामानुजन फैलो के रूप में अपने शोध कार्य को जारी रखा। अपने शोध के हितों में बहुलक स्वतः समुच्चय, नैनोसंरचित सामग्री,अर्धक्रिस्टलाइन बहुलकों में बहुरूपी चरण संक्रमण, पॉलिमर/अकार्बनिक संकर नैनोकंपोजिटों, बहुलक -विलायक कोम्प्लेक्सेस और आणविक सम्मिश्रण और जैवनिम्नीकरणीय बहुलक शामिल हैं।

डॉ.रविशंकर लंकलापल्ली, वैज्ञानिक , 22 दिसंबर, 2011

डॉ.रविशंकर लंकलापल्ली ने ग्रेजुएट सेंटर, न्यूयॉर्क सिटी विश्वाविद्यालय (सीयूएनवाई) से एम. फिल और पीएच.डी. (कैमिस्ट्री) की उपाधि प्राप्त की। आपके विशेषज्ञता के क्षेत्र ये हैं- जैविक महत्व के ग्लैकोकांजुगेट्स का संश्लेषण, छोटे अणुओं के संग्रह की तरह प्राकृतिक उत्पादों का संश्लेषण, पौधों से प्राकृतिक उत्पाद के संरचनात्मक स्पष्टीकरण, समुद्री और सूक्ष्म स्रोतों और नैदानिक उपकरण के रूप में बायोसेंसरों का डिजाइन और संश्लेषण।

डॉ. के.पी. सुरेंद्रन, वैज्ञानिक, 25 जनवरी 2012

एनआईआईएसटी तिरुवनंतपुरम में "बेतार संचार के लिए कम हानि डाईइलेक्ट्रिक सामग्री" पर की गयी अपनी जांच के आधार पर डॉ. के.पी. सुरेन्द्रन ने वर्ष 2005 में भौतिकी में अपनी पीएच. डी. प्राप्त की। वर्ष 2005 जून में, सोलिड स्टेट एंड स्ट्रक्चरल रसायन विज्ञान यूनिट, आईआईएससी बंगलौर में एक रिसर्च एसोसिएट के रूप में आप शामिल हो गए। 2006-2009 के दौरान आप अवेइरो, विश्वाविद्यालय, पुर्तगाल में पोस्ट डॉक्टर थे और वर्ष 2009 में आप एक सहायक शोधकर्ता के रूप में कोइम्ब्रा विश्वाविद्यालय में शामिल हुए। जून 2010 में आपने अलेक्जेंडर वॉन हम्बोल्ट फैलो के रूप में लीबिन्ट्स इंस्टिट्यूट फॉर सोलिड स्टेट एंड मेटीरिअल्स रिसेर्च (आईएफडब्ल्यु , ड्रेस्डेन), जर्मनी में काम किया। अपने शोध के हितों में माइक्रोवेव सामग्री, थिन फिल्मी एपीडैक्सी, मुद्रित इलेक्ट्रॉनिक्स के लिए डाइइलेक्ट्रिक स्याही, और नैनोट्यूब के टेंपलेट विकास शामिल हैं।

डॉ. जोशी जोसफ, वैज्ञानिक, 23 फरवरी 2012

डॉ. जोशी जोसफ ने वर्ष 1998 में महात्मा गांधी विश्वाविद्यालय, कोट्टयम, केरल से रसायन विज्ञान में मास्टर्स डिग्री पूरा की और केरल विश्वाविद्यालय से वर्ष 2004 में (सीएसआईआर - एनआईआईएसटी तिरूवनंतपुरम, में डॉ. रामैय्या के मार्गदर्शन किए गए काम के तहत) पीएच.डी. प्राप्त की। बाद में, आपने स्कूल ऑफ केमिस्ट्री और बायोकेमिस्ट्री, जॉर्जिया प्रौद्योगिकी संस्थान, अटलांटा, संयुक्त राज्य अमेरिका में प्रोफेसर गैरी बी शूस्टर समूह में एक पोस्ट डॉक्टरल फेलो के रूप में (वर्ष 2004-2006) और एक रिसर्च साइंटिस्ट II (वर्ष 2006-2011) के रूप में काम किये। फ़रवरी 2012 में सीएसआईआर - एनआईआईएसटी , त्रिवेंद्रम के रसायन विज्ञान और प्रौद्योगिकी विभाग में वैज्ञानिक के रूप में आप शामिल हो गए। आप डीएसटी, भारत से रामानुजन फैलोशिप (2012) के प्राप्तकर्ता हैं। आपके वर्तमान अनुसंधान हितों में बायोमोलिकुलार रिकग्निशन, न्यूक्लिक एसिड रसायन और कार्यात्मक कार्बनिक सामग्री के डिजाइन शामिल हैं।

डॉ. सजु पिल्लै, वैज्ञानिक, 28 मार्च 2012

डॉ. सजु पिल्लै ने उल्म विश्वाविद्यालय, जर्मनी से प्राकृतिक विज्ञान के क्षेत्र में अपनी पीएच.डी. प्राप्त की। आपने सीएसआईआर - एनआईआईएसटी में शामिल होने से पहले अंतर्विषयी नैनौसाइंस (आईएनएएनओ) केंद्र, आरहूस विश्वाविद्यालय, आरहूस, डेनमार्क और मैकेनिकल और विनिर्माण इंजीनियरिंग विभाग (एम. टेक), अलबोर्ग विश्वाविद्यालय, अलबोर्ग, डेनमार्क में एक पोस्ट डॉक्टर के रूप में काम किये। आपके शोध स्मार्ट कोटिंग और स्थायी ऊर्जा अनुप्रयोगों के लिए कार्यात्मक कार्बनिक-अकार्बनिक संकर सामग्री की विरचना पर केंद्रित है।

31/03/2012 को कर्मचारियों की सूची

निदेशक का कार्यालय

डॉ. सुरेश दास	निदेशक
श्री एस.सुरेशकुमार	मुख्य वैज्ञानिक
श्रीमती शारदा नायर	निजी सचिव (31/7/2011 को सेवानिवृत्त)
श्री ए.कृष्णनकुट्टी	तकनीकी ग्रेड 1 -4
श्री पी.बी.विजयकुमार	तकनीकी ग्रेड 1 -4
श्री जी.के.नायर	वरिष्ठ आशुलिपिक (एसीपी)

आर एण्ड डी प्रभाग

कृषि प्रसंस्करण एवं प्राकृतिक उत्पादन प्रभाग

डॉ. ए.सुन्दरेशन	मुख्य वैज्ञानिक (प्रधान)
श्री एम.एम.श्रीकुमार	मुख्य वैज्ञानिक
डॉ. सी.बालचन्द्रन	वरिष्ठ प्रिंसिपल वैज्ञानिक (30/4/2011 को सेवानिवृत्त)
श्रीमती बी.शंकरिकुट्टि अम्मा	वरिष्ठ प्रिंसिपल वैज्ञानिक (30/6/2011 को सेवानिवृत्त)
श्री थॉमस सामुअल	वरिष्ठ प्रिंसिपल वैज्ञानिक (30/6/2011 को सेवानिवृत्त)
श्रीमती ओमनाकुट्टि अम्मा	प्रिंसिपल वैज्ञानिक
श्रीमती ए.निर्मला मेनोन	प्रिंसिपल वैज्ञानिक
डॉ. दिलीपकुमार.बी.एस	प्रिंसिपल वैज्ञानिक
श्री वी.वी.वेणुगोपाल	वरिष्ठ वैज्ञानिक
डॉ. के.जी.रघु	वरिष्ठ वैज्ञानिक
डॉ. (श्रीमती) के.पी.पद्मकुमारी अम्मा	वरिष्ठ वैज्ञानिक
डॉ. (श्रीमती) पी.निशा	कनिष्ठ वैज्ञानिक
डॉ. पी.जयमूर्ती	कनिष्ठ वैज्ञानिक
श्रीमती एम.वी.रेश्मा	वैज्ञानिक
डॉ. रविशंकर.एल	वैज्ञानिक
श्री पी.जे.वर्गीस	वरिष्ठ अधीक्षक अभियंत्रा
श्री जी.चन्द्रबाबु	सहायक कार्यपालक इंजिनीयर(सिविल)
श्री आर.बाबु	प्रिंसिपल तकनीकी अधिकारी
श्री बी.कार्तिक	कनिष्ठ इंजिनीयर(सिविल)
डॉ.(श्रीमती) बीना जोय	वरिष्ठ तकनीकी अधिकारी - 3
श्रीमती एल.प्रसन्नाकुमारी	वरिष्ठ तकनीकी अधिकारी - 2
श्री डी.आर.शोभन कुमार	तकनीकी अधिकारी
श्री एस.हरिदासन पिल्लै	वरिष्ठ तकनीशन (2)
श्री पी.वी.तम्पी	वरिष्ठ तकनीशन (2)
श्री आर.सुकुमारन	तकनीकी ग्रेड 1-4
श्रीमती अन्नम्मा माथ्यू	वरिष्ठ आशुलिपिक(एसीपी)

जैवप्रौद्योगिकी प्रभाग

डॉ. अशोक पाण्डेय	मुख्य वैज्ञानिक (प्रधान)
डॉ. के.माधवन नंपूतिरि	प्रिंसिपल वैज्ञानिक
डॉ. राजीवकुमार सुकुमारन	वैज्ञानिक
डॉ. एन.रमेश कुमार	वैज्ञानिक
डॉ. पी.बिनोद	वैज्ञानिक
श्री के.एम.प्रकाश	वरिष्ठ तकनीशन

रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग

डॉ. ए.अजयघोष	उत्कृष्ट वैज्ञानिक
डॉ. डी.रामय्या	मुख्य वैज्ञानिक (प्रधान)
डॉ. टी.प्रसादाराव	मुख्य वैज्ञानिक
डॉ. एम.लक्ष्मीपति रेड्डी	मुख्य वैज्ञानिक
डॉ. के.आर.गोपिदास	मुख्य वैज्ञानिक
डॉ. (श्रीमती) मंगलम एस.नायर	मुख्य वैज्ञानिक
डॉ. (श्रीमती) ए.जयलक्ष्मी	वरिष्ठ प्रिंसिपल वैज्ञानिक
डॉ. (श्रीमती) आर.लक्ष्मी वर्मा	वरिष्ठ प्रिंसिपल वैज्ञानिक
डॉ. के.जोर्ज थॉमस	वरिष्ठ प्रिंसिपल वैज्ञानिक (17/05/2010 से लियन पर)
डॉ. के.वी.राधाकृष्णन	वरिष्ठ वैज्ञानिक
डॉ. सी.एच.सुरेश	वरिष्ठ वैज्ञानिक
श्री चन्द्राकान्त.सी.के	वरिष्ठ वैज्ञानिक
डॉ. यूसफ करुवात	वैज्ञानिक
डॉ. जोशी जोसफ	वैज्ञानिक
डॉ. वी.एस.प्रसाद	वरिष्ठ तकनीकी अधिकारी
डॉ. (श्रीमती) जे.डी.सुधा	वरिष्ठ तकनीकी अधिकारी
श्रीमती एस.विजी	तकनीकी अधिकारी
श्रीमती सौमिनी मैथ्यू	तकनीकी अधिकारी
श्री रोबर्ड फिलिप	तकनीकी अधिकारी
श्री टी.आर.सुरेश कुमार	वरिष्ठ तकनीशन
श्री टी.एस.शशिकुमार	निजी सचिव

पदार्थ विज्ञान तथा प्रौद्योगिकी प्रभाग

डॉ. के.जी.के.वार्यर	मुख्य वैज्ञानिक (31/1/2012 को सेवानिवृत्त)
डॉ. एम.टी.सेबास्टियन	मुख्य वैज्ञानिक (प्रधान)
डॉ. यु.श्यामप्रसाद	मुख्य वैज्ञानिक
डॉ. ए.आर.आर.मेनोन	वरिष्ठ प्रिंसिपल वैज्ञानिक
श्री एम.सी.षाजी	वरिष्ठ प्रिंसिपल वैज्ञानिक
डॉ. पी.प्रभाकर राव	वरिष्ठ प्रिंसिपल वैज्ञानिक
श्री के.हरिकृष्ण भट्	वरिष्ठ प्रिंसिपल वैज्ञानिक
डॉ. जोस जेइम्स	वरिष्ठ प्रिंसिपल वैज्ञानिक

डॉ. यु.टी.एस.पिल्लै	वरिष्ठ प्रिंसिपल वैज्ञानिक
डॉ. सपनकुमार घोष	प्रिंसिपल वैज्ञानिक
डॉ. मनोज रामवर्मा	प्रिंसिपल वैज्ञानिक
डॉ. एम.रवी	प्रिंसिपल वैज्ञानिक
डॉ. एस.अनन्तकुमार	प्रिंसिपल वैज्ञानिक
डॉ. टी.पी.डी.राजन	वरिष्ठ वैज्ञानिक
डॉ. हरीश.यु.एस	वरिष्ठ वैज्ञानिक
डॉ. ई.भोजे गौड	वरिष्ठ वैज्ञानिक
श्री एम.सुन्दराराजन	वैज्ञानिक
डॉ. एस.वी.शुक्ला	वैज्ञानिक
डॉ. ए.श्रीनिवासन	वैज्ञानिक
डॉ. के.पी.सुरेन्द्रन	वैज्ञानिक
डॉ. सजु पिल्लै	वैज्ञानिक
श्री एस.वेलुसामी	प्रिंसिपल तकनीकी अधिकारी
श्रीमती लूसी पॉल	वरिष्ठ तकनीकी अधिकारी
श्री के.के.रविकुमार	वरिष्ठ तकनीकी अधिकारी
श्री एम.ब्रह्मकुमार	वरिष्ठ तकनीकी अधिकारी
श्री पी.पेरुमाल	वरिष्ठ तकनीकी अधिकारी
श्री पी.गरुसामी	वरिष्ठ तकनीकी अधिकारी
श्री एम.आर.चन्द्रन	वरिष्ठ तकनीकी अधिकारी
श्री पीर मोहम्मद.ए	तकनीकी अधिकारी
श्री एस.शशिभूषणन	वरिष्ठ तकनीशन (2)
श्री टी.सोमन	वरिष्ठ तकनीशन (2)
श्री पी.एन.शिवनकुट्टि नायर	वरिष्ठ तकनीशन (2)
श्री वी.आन्टणी	तकनीकी ग्रेड 2-3
श्री वी.श्रीकण्डन	तकनीकी ग्रेड 1-4

प्रक्रिया इंजिनीयरिंग तथा पर्यावरण प्रौद्योगिकी प्रभाग

डॉ. (श्रीमती) रोशन शशिकुमार	मुख्य वैज्ञानिक (प्रधान)
श्री पी.राघवन	मुख्य वैज्ञानिक
श्री अजित हरिदास	मुख्य वैज्ञानिक
डॉ. (श्रीमती) एस.सावित्री	वरिष्ठ प्रिंसिपल वैज्ञानिक
डॉ. (श्रीमती) एलिज़बत जेकब	वरिष्ठ प्रिंसिपल वैज्ञानिक
डॉ. (श्रीमती) रुग्मिणी सुकुमार	प्रिंसिपल वैज्ञानिक
डॉ. वी.बी.मणिलाल	प्रिंसिपल वैज्ञानिक
श्री जे.अंसारी	प्रिंसिपल वैज्ञानिक
डॉ. एम.अंबू	वरिष्ठ वैज्ञानिक
डॉ. बी.कृष्णकुमार	वैज्ञानिक
श्री अब्दुल हलीम.बी	वैज्ञानिक
श्रीमती विजयाप्रसाद	वरिष्ठ तकनीकी अधिकारी

श्री वी.के.षाजिकुमार	तकनीकी अधिकारी
डॉ. एस.रामस्वामी	तकनीकी अधिकारी
श्री करुणा शंकर रावत	तकनीकी अधिकारी (02/09/2011 को स्थानांतरित)
श्री टी.पी.पौलोस	वरिष्ठ तकनीशन (2)
श्रीमती सहरूबा.पी.एम	कनिष्ठ तकनीकी सहायक

एस एंड टी सेवा प्रभाग

सिविल इंजीनियरिंग एवं एस्टेट प्रबंधन प्रभाग

श्री वी.पी.थॉमस	वरिष्ठ प्रिंसिपल वैज्ञानिक, प्रधान(29/02/2012 को सेवानिवृत्त)
श्री आर.राजीव	अधीक्षक इंजिनीयर
श्री के.वी.उण्णिकृष्णन	कार्यपालक इंजीनियर
श्री के.प्रसाद	सहायक इंजीनियर
श्री पी.अरुमुखम	कनिष्ठ इंजीनियर(सिविल)
श्री एम.जयदीप	तकनीकी ग्रेड 2-2
श्री के.एस.प्रमोद	तकनीकी ग्रेड 2-1
श्री के.सुरेश कण्णन	तकनीकी ग्रेड 2-1
श्री यु.धरणीपति	तकनीकी ग्रेड 2-1
श्री बी.विक्रमन	तकनीकी ग्रेड 1-4
श्री सी.पी.नारायणन	तकनीकी ग्रेड 1-4
श्री टी.वी.सतीश	ग्रूप सी गैर तकनीकी

नॉलिज रिसोर्स सेंटर

श्रीमती संतोश बाबु	प्रिंसिपल वैज्ञानिक(प्रधान)
श्री वी.मणी	कनिष्ठ वैज्ञानिक
श्री रिबिन जोन्स.एस.बी	वैज्ञानिक
श्रीमती एस.मिनि	प्रिंसिपल तकनीकी अधिकारी
श्री एम.रामसामि पिल्लै	वरिष्ठ तकनीकी अधिकारी(3)
श्री जी.सुधाकरन	वरिष्ठ तकनीशन(2)
श्री जी.नागश्रीनिवासु	वरिष्ठ तकनीशन(2)
सुश्री टी.एस.लता	सहायक(सा)ग्रेड ।। (एमएसीपी)
श्री पुष्पकुमार.के.आर.नायर	ग्रूप डी गैर तकनीकी
श्रीमती पी.सावित्री	ग्रूप डी गैर तकनीकी (31/5/2011 को सेवानिवृत्त)

यांत्रिकी इंजिनीयरिंग अनुभाग

श्री एन.जे.जेकब	वरिष्ठ तकनीशन (2)
श्री एन.सुधिलाल	वरिष्ठ तकनीशन (2)
श्री पी.एम.राघवन	वरिष्ठ तकनीशन (2)
श्री पी.सोमन	तकनीकी ग्रेड 1-4
श्री टी.टी.राजप्पन नायर	ग्रूप डी गैर तकनीकी (31/1/2011 को सेवानिवृत्त)

आर एंड डी योजना तथा व्यवसाय विकास प्रभाग

डॉ. वी.जी.मोहनन नायर	वरिष्ठ प्रिंसिपल वैज्ञानिक (प्रधान)
डॉ. सी.चन्द्रशेखरा भट्ट	वरिष्ठ प्रिंसिपल वैज्ञानिक
श्री डी.भीमेश्वार	प्रिंसिपल वैज्ञानिक
श्री आर.एस.प्रवीण राज	वैज्ञानिक
डॉ. एम.शंकरानारायणन	वरिष्ठ तकनीकी अधिकारी
श्रीमती वी.जे.सरोजाकुमारी	वरिष्ठ आशुलिपिक(एमएसीपी)
श्री के.सी.चाक्को	ग्रूप डी गैर तकनीकी

प्रशासन

श्री एन.एस.राजु	प्रशासन अधिकारी
श्रीमती एस.शोभना	अनुभाग अधिकारी
श्री के.एफ.जोसफ	अनुभाग अधिकारी(सा)
श्रीमती के.एस.लतीदेवी	हिन्दी अधिकारी
श्री टी.जे.बाबु	सुरक्षा अधिकारी
डॉ. राजेश राधाकृष्णन	चिकित्सा अधिकारी (27/5/2011 से इस्तीफा दे दिया)
श्री डी.जयप्रसाद	सहायक(सा) ग्रेड।।(एमएसीपी)
श्रीमती ज्योति आर.तम्पी	सहायक(सा) ग्रेड।।
श्री जी.रामभद्रन	सहायक(सा) ग्रेड।।
श्रीमती मेर्सी जोसफ	सहायक(सा) ग्रेड।।
श्रीमती सूसन मैथ्यू	सहायक(सा) ग्रेड।।
श्रीमती के.सरस्वति	सहायक(सा) ग्रेड।।(एमएसीपी)
श्री आर. के. रमेशकुमार	सहायक(सा) ग्रेड।।
श्रीमती पार्वती राजीवन	सहायक ग्रेड।
श्री एम.के.शिवदासन	सहायक(सा) ग्रेड।(एमएसीपी)
श्रीमती सिसिली पौलोस	सहायक(सा) ग्रेड।(एमएसीपी)
श्री वी मोहनन नायर	सहायक(सा) ग्रेड।(एमएसीपी)
श्रीमती पद्मिनी.पी.एस	वरिष्ठ आशुलिपिक(एसीपी)
श्रीमती एलिज़बेत थॉमस	वरिष्ठ आशुलिपिक (एमएसीपी)
श्रीमती श्रीलता नायर	वरिष्ठ आशुलिपिक(एसीपी)
श्री बी.वेणुगोपाल	वरिष्ठ तकनीशन (2)
श्री पी.सुरेन्द्रन	वरिष्ठ तकनीशन (2)
श्री प्रवीण कण्णाल	तकनीकी ग्रेड 2-2
श्री बी.राधाकृष्णन	तकनीकी ग्रेड 2-1
श्री एम.पी.वर्की	तकनीकी ग्रेड 1-4
श्रीमती एम.गीता	तकनीकी ग्रेड 1-3
श्री के.मधु	बेयरर(एसीपी)
श्री ए.श्रीकुमारन	सफाईवाला(एसीपी)
श्रीमती एस.लीलादेवी अम्मा	ग्रूप डी गैर तकनीकी
श्री के.उण्णिकृष्णन	ग्रूप डी गैर तकनीकी
श्री बी.सतीशकुमार	ग्रूप डी गैर तकनीकी

वित्त एवं लेखा विभाग

श्री टी.वी.शंकरन	वित्त एवं लेखा नियंत्रक
श्रीमती पी.वी.विजि	अनुभाग अधिकारी(वित्त एवं लेखा)
श्री कृष्णकुमार.एम	अनुभाग अधिकारी(वित्त एवं लेखा)
श्री ए.वी.थॉमस	अनुभाग अधिकारी(वित्त एवं लेखा) (31/5/2011 को सेवानिवृत्त)
श्री सी.शिवकुमारन	सहायक(सा) ग्रेड।। (31/1/2012 को सेवानिवृत्त)
श्रीमती कोमला सोमन	सहायक(वित्त एवं लेखा) ग्रेड।।
श्री संजीव सदानन्दन	सहायक (सा)ग्रेड।।
श्री के.जी.पिल्लै	सहायक(वित्त एवं लेखा) ग्रेड।
श्रीमती रमणी देवराज	सहायक(वित्त एवं लेखा) ग्रेड।
श्रीमती जी.गीता	सहायक(वित्त एवं लेखा) ग्रेड।
श्री एस.राजु	वरिष्ठ आशुलिपिक(एसीपी)
श्री पी.परमेश्वरन पिल्लै	ग्रूप सी गैर तकनीकी
श्रीमती आर.रमादेवी	रेकोर्ड कीपर

भण्डार एवं क्रय

श्री एम.आर.देवासीस	भण्डार एवं क्रय अधिकारी
श्री संजय सुमन	अनुभाग अधिकारी
श्री एम.अनिलकुमार	सहायक(भण्डार एवं क्रय) ग्रेड।।
श्री सी.एम.कृष्णदास	सहायक(भण्डार एवं क्रय) ग्रेड।
श्री वी.के.जितेश	सहायक(भण्डार एवं क्रय) ग्रेड।। (10/2/2012 से इस्तीफा दे दिया)
श्री के.सतीशन नायर	सहायक(भण्डार एवं क्रय) ग्रेड।
श्री के.डी.शशिधरन	सहायक(सा) ग्रेड।(31/3/2012 को सेवानिवृत्त)
श्रीमती एल.लता	वरिष्ठ तकनीशन (2)
श्री बी.अजयकुमार	तकनीकी ग्रेड 2-3
श्री टी.के.घोष	ग्रूप सी गैर तकनीकी
श्री टी.के.गोपि	ग्रूप डी गैर तकनीकी
श्री जी.भक्तवत्सलम	ग्रूप डी गैर तकनीकी

रसायन विज्ञान में 14वीं राष्ट्रीय संगोष्ठी और 6वीं सीआरएसआई-आरएससी संगोष्ठी

राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान, तिरुवनंतपुरम तथा भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान (आईआईएसईआर) के संयुक्त तत्वावधान में फरवरी 3-5 2012 के दौरान भारतीय केमिकल रिसर्च सोसायटी (सीआरएसआई) की 14वीं रसायन विज्ञान राष्ट्रीय संगोष्ठी का आयोजन किया गया। इसके साथ 2 फरवरी 2012 को रसायन विज्ञान रॉयल सोसाइटी की 6वीं राष्ट्रीय संगोष्ठी का आयोजन भी हुआ। राष्ट्रीय संगोष्ठी ने देश के वैज्ञानिकों, शिक्षकों और छात्रों के लिए संगोष्ठी में भाग लेकर रसायन विज्ञान में हाल के घटनाक्रम पर चर्चा करने के लिए एक मंच प्रदान किया। यह भी, विचारों के आदान प्रदान और उभरते सीमांत अंतर्विषयी क्षेत्रों में सहयोगात्मक प्रयासों के लिए एक माहौल बनाने में एक मंच प्रदान किया गया।

देश भर से करीब 750 शोधार्थियों ने संगोष्ठी में भाग लिया, जिसके लिए प्रो. समीर ब्रह्मचारी, महानिदेशक, सीएसआईआर के संरक्षण के तहत सीएसआईआर - एनआईआईएसटी में व्यापक व्यवस्था की गयी थी। डॉ. सुरेश दास, निदेशक, एनआईआईएसटी और डॉ. डी. रामय्या क्रमशः संगोष्ठी के अध्यक्ष एवं संयोजक थें।

प्रधानमंत्री के वैज्ञानिक सलाहकार और सीआरएसआई के संस्थापक अध्यक्ष प्रो. सीएनआर राव (जेएनसीएएसआर, बंगलौर) ने 3 फरवरी को राष्ट्रीय संगोष्ठी के दौरान ठोस अवस्था सामग्री रसायन विज्ञान की उत्पत्ति और विकास पर एक विशेष व्याख्यान दिया। प्रो. एस चंद्रशेखरन (आईआईएससी, बंगलौर) अध्यक्ष, सीआरएसआई ने संगोष्ठी के दौरान उद्घाटन भाषण दिया। आरएससी संगोष्ठी के दौरान प्रो रॉबर्ट पार्कर, सीईओ, आरएससी तथा प्रो. अन्ना पीकोक (यूके), प्रो. जे. ओ. मिडिओ (केनिया) और प्रो.बॉब क्रॉफर्ड (यूके) जैसे प्रख्यात वैज्ञानिकों ने अपने काम के ब्यौरे प्रस्तुत किए।

संगोष्ठी के दौरान, सीआरएसआई ने रसायन विज्ञान में महत्वपूर्ण योगदान दिये वैज्ञानिकों को सम्मानित किया। रासायनिक शिक्षा को बढ़ावा देने के भाग के रूप में, भारत के विभिन्न विश्वाविद्यालयों और कॉलेजों से चयनित शिक्षकों को सीआरएसआई उत्तम शोधक पुरस्कार प्रदान किया गया।

प्रो.आर.तेंने (इजराइल), प्रो.एस.कितेगावा (जापान), प्रो. डी.जी.नोसर (एमआईटी,यूएसए), प्रो.एफ.मेयर (जर्मनी), प्रो.एम.ए सुब्रमोनियम (यूएसए), प्रो.कल्याणा सुंदरम (स्विट्जरलैंड), प्रो.ए.सेन (यूएसए), प्रो.वी.कृष्णन (जेएनसीएएसआर, बंगलौर), प्रो.उदय मैत्रा (आईआईएससी, बंगलौर) और डॉ.ए.अजयघोष (एनआईआईएसटी, तिरुवनंतपुरम) जैसे अंतर्राष्ट्रीय स्तर पर प्रतिष्ठित वैज्ञानिकों के विशेष व्याख्यानों के अलावा पदक व्याख्यान और पोस्टर प्रस्तुतियाँ भी थें।


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रसायनविज्ञान तथा प्रौद्योगिकी प्रभाग के फोटोसाइन्सेस और फोटोनिक्स अनुभाग को 'ओरगानिक एंड ओरगानिक-इनओरगानिक हाइब्रिड सोलार सेल्स-ओप्टिमाइसेशन ऑफ मेटीरियल्स प्रोपर्टीस, बल्क हेटरोजंक्शन मोर्फोलजी एंड डिवाइज़ एफीशियन्सीस' नामक एक प्रमुख भारत - यूरोपीय संघ सहयोगात्मक अनुसंधान परियोजना मंजूर की गयी है। परियोजना के भारतीय सहयोगियों में डॉ.सुरेश दास (एनआईआईएसटी), डॉ.के.आर.गोपिदास (एनआईआईएसी), प्रो. के.जोर्ज थॉमस (आईआईएसईआर, त्रिवेंद्रम), प्रो.एस.संपत्त (आईआईएशसी बंगलोर), प्रो.जी.यु.कुलकर्णी (जेएनसी एएसआर, बंगलोर) और प्रो. पी.राममूर्ति (मद्रास विश्व विद्यालय) शामिल हैं। यूरोपीय संघ के पक्ष में प्रो.मुकुंदन थेलाकाट (जर्मनी), प्रो.आर.ए.जे.रेने जानसेन (आइंटहॉवन तकनोलजी विश्वविद्यालय, नीदरलैंड), डॉ.युजीन ए.काट्स (बेन-गुरिओन, नेगेव विश्वविद्यालय, इजराइल), श्री मरकुस होसल (तकनीकी विश्वविद्यालय, डेनमर्क), श्री क्रोस्टेफ हंगर (बेय्रयूथ विश्विविद्यालय, जर्मनी), और श्री कार्स्टन रिएस (मेकोप्रिंट ग्राफिक्स -इलेक्ट्रॉनिक्स, डेनमार्क) । इस परियोजना के संबंध में, संस्थान में 23-25 जनवरी, 2012 के दौरान त्रिवेंद्रम में सौर कोशिकाओं पर तीन दिवसीय कार्यशाला का आयोजन किया। इस परियोजना में काम कर रहे उपर्युक्त वैज्ञानिकों और छात्रों के 30 प्रतिभागियों ने इन तीन दिवसीय कार्यशाला में भाग लिया। सौर कोशिकाओं के विभिन्न पहलूओं पर वैज्ञानिक व्याख्यान और उपयोगी विचार विमर्श शामिल थे ।

जैव प्रौद्योगिकी में नए क्षितिज पर अंतर्राष्ट्रीय सम्मेलन तथा बायोटेक रिसर्च सोसायटी के आठवीं कन्वेंशन

राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान, सीएसआईआर और भारतीय बायोटेक रिसर्च सोसायटी के तत्वावधान में 21 -24 नवम्बर 2011 के दौरान त्रिवेंद्रम में जैव प्रौद्योगिकी में नए क्षितिज पर अंतर्राष्ट्रीय सम्मेलन तथा बायोटेक रिसर्च सोसायटी, भारत, के आठवीं सम्मेलन (www.brsi.in) आयोजित किया गया। जैव प्रौद्योगिकी के विभिन्न प्रबल क्षेत्रों में कार्य कर रहे सभी शोधकर्ताओं को एक साथ लाने में और विभिन्न महत्वपूर्ण मुद्दों पर विचार - विमर्श करने में एनएचबीटी - 2011 में मंच प्रदान किया गया। अंतर्राष्ट्रीय औद्योगिक जैवप्रक्रिया फोरम (आईएफआईबायो.), अंतर्राष्ट्रीय जैव प्रौद्योगिकी और जैवइंजीनियरिंग संगठन, एल्सेवियर, ब्रिटेन, थॉमसन रायटर- संयुक्त राज्य अमेरिका जैसे अंतरराष्ट्रीय महत्व के विभिन्न संगठनों तथा वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद् (सीएसआईआर), विज्ञान तथा प्रौद्योगिकी विभाग (डीएसटी), जैव प्रौद्योगिकी विभाग (डीबीटी), इंडियन काउंसिल फॉर मेडिकल रिसर्च (आईसीएमआर), राज्य विज्ञान, प्रौद्योगिकी और पर्यावरण समिति, केरल सरकार, स्टेट बैंक ऑफ त्रावणकोर, जैसे राष्ट्रीय संगठनों ने सम्मेलन का समर्थन किया और उसमें भागीदारी की।

एनआईआईएसटी के निदेशक डॉ. सुरेश दास मंच पर दूसरों के साथ दीप जलाते हुए

प्रोफेसर सी जी दुस्साप, अध्यक्ष, अंर्ताष्ट्रीय औद्योगिक जैवप्रक्रिया फोरम, फ्रांस, प्रोफेसर चार्ल्स ट्वेइस्ग्ये, अध्यक्ष, अंतर्राष्ट्रीय जैव प्रौद्योगिकी और बायोइन्जिनियरिंग संगठन, प्रोफेसर पी गुणशेखरन, अध्यक्ष, बायोटेक रिसर्च सोसायटी, भारत, डॉ. सुरेश दास, निदेशक, सीएसआईआर-एनआईआईएसटी, प्रोफेसर अशोक पाण्डेय, अध्यक्ष, आयोजन समिति ने उद्घाटन सत्र का संबोधन किया।

उद्घाटन सत्र झलक

उद्घाटन सत्र में बीआरएसआई के वार्षिक पुरस्कारों की घोषणा की गई। इसमें प्रो. असीस दत्ता, राष्ट्रीय पादप जीनोम अनुसंधान संस्थान, नई दिल्ली को लाइफ टाइम अचीवमेंट पुरस्कार, डॉ.आर.बी.एन. प्रसाद, भारतीय रासायनिक प्रौद्योगिकी संस्थान, हैदराबाद को औद्योगिक पदक पुरस्कार, डॉ. ज्योति पी जाधव, शिवाजी विश्वविद्यालय, कोल्हापुर को महिला वैज्ञानिक पुरस्कार, भारतीय रासायनिक प्रौद्योगिकी संस्थान, हैदराबाद के श्री श्रीकांत संदीपम को ए.यू.- सीबीटी उत्कृष्टता पुरस्कार (अनुसंधान छात्रों के लिए) और एमएपीएस एंजाइम लिमिटेड, अहमदाबाद के सीएमडी श्री पीयूष पालखीवाला को सोसायटी के मानद फैलोशिप शामिल थे। प्रो. रेखा एस सिंघल, रासायनिक प्रौद्योगिकी संस्थान, मुंबई, प्रोफेसर डी दास, इंडियन इंस्टीट्यूट ऑफ टेक्नोलॉजी, खड़गपुर, डॉ. ए.जे. वर्मा, राष्ट्रीय रासायनिक प्रयोगशाला, पुणे और डॉ. वी.के. गर्ग, जीजे हिसार विश्वविद्यालय को सोसायटी के फैलो के रूप में सम्मानित किया गया (एफबीआरए)

"रसायन विज्ञान में महिलाओं"

वर्ष 2011 को रसायन विज्ञान के अंतर्राष्ट्रीय वर्ष मनाने के भाग के रूप में 13 अक्टूबर 2011 को 'रसायन विज्ञान में महिलाओं की भूमिका" पर प्रकाश डालते हुए संस्थान में एक दिवसीय संगोष्ठी का आयोजन किया गया, जिसमें कॉलेज के युवा छात्रों, विशेष रूप से त्रिवेंद्रम के विभिन्न कॉलेजों की छात्राओं को देश के कुछ सर्वश्रेष्ठ महिला केमिस्टों के साथ बातचीत के लिए अवसर प्रदान किया गया । सिंथेटिक कार्बनिक रसायन विज्ञान में एक विशेषज्ञ तथा जवाहर लाल नेहरू एडवांस्ड साइंटिफिक रिसर्च सेंटर (जेएनसीएएसआर, बंगलौर) के वरिष्ठ वैज्ञानिक प्रो एच. इला ने संगोष्ठी का उद्घाटन किया । डॉ. सुरेश दास, निदेशक, सीएसआईआर – एनआईआईएसटी ने समारोह की अध्यक्षता की। प्रो. एस. चारु सीता चक्रवर्ती, भारतीय प्रौद्योगिकी संस्थान (आईआईटी) - नई दिल्ली, डॉ. एम. लक्ष्मी कांतम, भारतीय रासायनिक प्रौद्योगिकी संस्थान, (आईआईसीटी) हैदराबाद और डॉ. अरु णा दथात्रेयन, केन्द्रीय चर्म अनुसंधान संस्थान (सीएलआरआई) ने विभिन्न तकनीकी सत्रों को संभाला ।

प्रोफेसर एच. इला, जवाहरलाल नेहरू सेंटर फॉर एडवांस्ड साइंटिफिक रिसर्च, बंगलौर, अपने पाठ्यक्रमों में उत्कृष्ट निष्पादन प्रदर्शित महिला कॉलेज छात्रों को पुरस्कार वितरित करती हुई।

प्रो. एस. चारु सीता चक्रवर्ती, भारतीय प्रौद्योगिकी संस्थान (आईआईटी) - नई दिल्ली समारोह में भाषण देती हुई

राष्ट्रीय प्रौद्योगिकी दिवस समारोह

स्वदेशी प्रौद्योगिकियों की ट्रिपल सफलता, अर्थात् हंसा का पहला उड़ान, पृथ्वी मिसाइल का सफल उड़ान और पोखरन में सनसनी परमाणु परीक्षण की स्मृति में एनआईआईएसटी में मई11, 2011 को राष्ट्रीय प्रौद्योगिकी दिवस मनाया गया। श्री सी. बालगोपाल, आईएएस, प्रबंध निदेशक, टेरु मो पेनपोल लिमिटेड, तिरुवनंतपुरम समारोह में मुख्य अतिथि थे। श्री बालगोपाल ने स्वतंत्रता पूर्व युग में जे. सी. बोस, सी.वी. रमन, साहा जैसे बुद्धिजीवियों द्वारा रखी मजबूत अनुसंधान नींव के लिए आभार व्यक्तकरते हुए विज्ञान के विकास के लिए लोगों के बीच वैज्ञानिक सोच के विकास की आवश्यकता पर ज़ोर दिया। उन्होंने आगे कहा कि शिक्षा संस्थानों को समुदाय स्तर पर वैज्ञानिक विधियों की पहुंच के अंतर्निवेशन पर अधिक ध्यान देना चाहिए, जहां सीखने का अनुभव वैज्ञानिक परिकल्पना की परख के साथ जुड़ा हुआ है। श्री बालगोपाल ने आगे शिक्षा के तरीकों की जरूरत पर

बल दिया, जो समझने और समस्या के समाधान खोजने की क्षमता को प्रोत्साहित करता है और आगाह किया है कि कई तकनीकी सहयोग निर्भरता की ओर ले जाता है और इसलिए उन्हों प्रोत्साहित नहीं किया जाना चाहिए । अपने अध्यक्षीय भाषण में डॉ. सुरेश दास ने किसी भी देश के विकास के लिए अनुप्रयुक्त अनुसंधान और बुनियादी विज्ञान, दोनों के महत्व पर बल दिया और बुनियादी और अनुप्रयुक्त अनुसंधान के एक सही मिश्रण के लिए आह्वान किया,जो अंत में विज्ञान और प्रौद्योगिकी के बीच की खाई को पाट करता है।

सतर्कता जागरूकता सप्ताह-2011 का आयोजन (31 अक्तूबर से 4 नवंबर 2011)

संस्थान में 31 अक्तूबर से 4 नवंबर 2011 तक की अवधि के दौरान सतर्कता जागरूकता सप्ताह - 2011 मनाया गया। सतर्कता जागरू कता सप्ताह का प्रारंभ 31 अक्तूबर 2011 के पूर्वाह्न 11.00 बजे निदेशक के द्वारा स्टाफ सदस्यों को हिंदी और अंग्रेजी दोनों भाषाओं में सतर्कता जागरूकता प्रतिज्ञा दिलाने के साथ हुआ। 31 अक्तूबर से 4 नवंबर 2011 तक स्टाफ सदस्यों, अनुसंधान छात्रों, परियोजना स्टाफ आदि के लिए निबंध लेखन, वक्तृत्ता, कार्टून चित्रण तथा नारा लेखन पर प्रतियोगितायें चलाई गयीं । 4 नवंबर 2011 को समापन समारोह तथा पुरस्कार वितरण संपन्न हुआ। डॉ. सुरेश दास, निदेशक ने समारोह की अध्यक्षता की। श्री एस.गोपिनाथ, आई पी एस, पुलिस महानिरीक्षक (यातायात) समापन समारोह में मुख्य अतिथि थे और उन्होंने समापन भाषण दिया और उनके द्वारा प्रतियोगिताओं के विजेताओं को पुरस्कार वितरित किये गए।

श्री एस.गोपिनाथ, आई पी एस, पुलिस महानिरीक्षक (यातायात) समापन समारोह में भाषण देते हुए

हिंदी दिवस एवं हिंदी सप्ताह-2011 का आयोजन

संस्थान में 14 सितंबर 2011 को हिंदी दिवस के रूप में तथा बाद के एक सप्ताह को हिंदी सप्ताह के रूप में समुचित ढंग से मनाया गया। हिंदी दिवस का औपचारिक उद्घाटन 14 सितंबर के सुबह 10.30 बजे आयोजन समिति के अध्यक्ष डॉ. अशोक पाण्डेय के स्वागत भाषण के साथ प्रारंभ हुआ।

संस्थान के निदेशक डॉ. सुरेश दास ने दीप प्रज्वलित करके समारोह का औपचारिक उद्घाटन किया और हिंदी दिवस व्याख्यान दिया। उन्होंने अपने भाषण में बताया कि हमारी राजभाषा हिंदी अंतरराष्ट्रीय स्तर पर भी बहुत पसंद की जाती है और उन्होंने सभी प्रतिभागियों से यह अपील किया कि सरकारी काम-काज में ही नहीं, बल्कि दैनिक जीवन में बोलचाल की भाषा के रूप में भी हिंदी का प्रयोग करते हुए इसे आगे बढ़ायें ।

हिंदी दिवस का औपचारिक उद्घाटन करते हुए संस्थान के निदेशक डॉ. सुरेश दास

उद्घाटन समारोह के बाद हिंदी में दो प्रस्तुतीकरण आयोजित किए गए। डॉ. पी. जयमूर्ति, वैज्ञानिक व सदस्य, हिंदी सप्ताह आयोजन समिति द्वारा "मधुमेह (डयाबिटीस): वर्तमान परिदृश्य" शीर्षक पर व्याख्यान प्रस्तुत किया गया।

प्रस्तुतीकरण करते हुए डॉ. पी. जयमूर्ति, वैज्ञानिक, कृषि प्रसंस्करण तथा प्राकृतिक उत्पाद प्रभाग

इस व्याख्यान का उद्देश्य श्रोतागण को इस बीमारी के प्रति जागरूक बनाना था। पूरी दुनियां में भारत मधुमेह की राजधानी बन चुकी है और साथ ही भारत में मधुमेह पीड़ितों की संख्या सबसे ज्यादा केरल राज्य में ही है। इस व्याख्यान द्वारा लोगों को मधुमेह के प्रकार, जोखिम कारकों एवं संभव निधनों की भी जानकारी दी गयी।

इसके बाद श्री संजय सुमन, अनुभाग अधिकारी (भंडार व क्रय) ने राजभाषा हिन्दी के विकास और भारत तथा विश्व में इसके प्रचार संबंधी प्रस्तुतीकरण दिया। राजभाषा कार्यान्वयन में आनेवाली चुनौतियों को रेखांकित करके उन्होंने भविष्य में राजभाषा के उत्तरोत्तर वृद्धि के उपायों की विवेचना की और सरल और सुलभ भाषा का प्रयोग करते हुए इस संबंध में उपस्थित लोगों की जानकारी का दायरा बढ़ाने में मदद की।

प्रस्तुतीकरण करते हुए श्री संजय सुमन,अनुभाग अधिकारी (भंडार व क्रय)

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 गई। समापन समारोह व पुरस्कार वितरण दिनांक 20.9.2011 को शाम 4.30 बजे आयोजित किया गया। श्री. पी.के.पाठक, आईएफएस, प्रबंध निदेशक, मिल्मा, तिरुवनंतपुरम समारोह में मुख्य अतिथि थे। श्री पी.के. पाठक ने अपने भाषण में केंद्रीय सरकार कार्यालयों में राजभाषा कार्यान्वयन की आवश्यकता पर बताया और यह आग्रह प्रकट किया कि राजभाषा के साथ ही साथ सभी क्षेत्रीय भाषाओं को भी प्रोत्साहन देना है। मुख्य अतिथि द्वारा विभिन्न प्रतियोगिताओं के विजेताओं को नकद पुरस्कार एवं प्रमाणपत्र से सम्मानित किया गया।

श्री पी.के. पाठक, मुख्य अतिथि, द्वारा पुरस्कार वितरण का दृश्य

CSIR - NIIST