

वार्षिक | ANNUAL
प्रतिवेदन | REPORT
2017-2018



CSIR-NIIST

राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान

(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)

तिरुवनंतपुरम

National Institute for Interdisciplinary Science & Technology

(Council of Scientific & Industrial Research)

Thiruvananthapuram

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सी एस आई आर - राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान
CSIR-National Institute for Interdisciplinary Science & Technology (NIIST)

(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)
(Council of Scientific & Industrial Research)
तिरुवनंतपुरम / Thiruvananthapuram



वार्षिक प्रतिवेदन 2017-2018 ANNUAL REPORT

Published by : The Director
National Institute for
Interdisciplinary Science &
Technology, Thiruvananthapuram

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Design & Printing : Akshara Offset
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एनआईआईएसटी टेक्नोलॉजीज एंड प्रोडक्ट्स प्रोफाइल

NIIST Technologies & Products Profile



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Post harvest process for spices & agri crops



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Kitchen waste Biogas plant



लकड़ी विकल्प
Wood Substitute



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प्रस्तावना



टीम सीएसआईआर-एनआईआईएसटी की तरफ से आपको वर्ष 2017-18 की वार्षिक रिपोर्ट प्रस्तुत करने में मुझे बहुत खुशी और विशेषाधिकार है। पिछले कुछ वर्षों में सीएसआईआर-एनआईआईएसटी अपना ध्यान, प्रतिबद्धताओं, कामकाज और वैज्ञानिक गतिविधियों के निष्पादन को राष्ट्रीय तथा सीएसआईआर मिशन व जनादेश के साथ संरेखित कर रहा है। सीएसआईआर-एनआईआईएसटी ने इस गतिशील रूप से बदलते पर्यावरण को सफलतापूर्वक अनुकूलित किया और अनुमानित लक्ष्यों और परिणामों को पूरा किया। इस अवधि के दौरान उच्च प्रभाव अनुसंधान, आईपी उत्पादन, औद्योगिक गठबंधन, मानव संसाधन विकास तथा नए सहयोगी भागीदारों और हितधारकों को आकर्षित करते हुए संस्थान ने महत्वपूर्ण योगदान देना जारी रखा। हमारी टीम के वैज्ञानिकों, तकनीकी कर्मचारियों, प्रशासनिक कर्मचारियों और छात्रों के अथक और समर्पित प्रयासों की वजह से और सीएसआईआर-मुख्यालय से समय पर प्राप्त समर्थन से यह संभव हो पाया था। उद्देश्यों और लक्ष्यों को प्राप्त करने में कड़ी मेहनत और सहयोग दिये सभी सहयोगियों को मैं इस अवसर पर धन्यवाद देता हूँ।

संस्थान के जोरदार क्षेत्रों में रसायन, ऊर्जा (पारंपरिक और गैर परंपरागत), कार्यात्मक खाद्य पदार्थ, सुरक्षा अनुप्रयोगों के लिए फ्लोरोसेंट सामग्री, न्यूट्रास्यूटिकल्स, फसलोत्तर टेक्नोलॉजीज, डायग्नोस्टिक प्रोब, ड्रग इंटरमीडिएट्स, पॉलिमर कंपोजिट्स, हल्की मिश्र धातु और कम्प्यूटेशनल मॉडलिंग शामिल हैं। फास्ट ट्रेक ट्रांसलेशन और फास्ट ट्रेक व्यावसायीकरण (एफटीटी और एफटीसी) मोड के माध्यम से अच्छी तरह से निर्धारित लक्ष्यों और परिणामों के साथ इन डोमेन पर काम जारी रखने के लिए हम प्रयास करेंगे।

वर्ष 2017-18 हमारे लिए एक उत्तेजक वर्ष था, हमारे बाहरी नकदी प्रवाह, वर्ष 2016-17 के दौरान 27% था, अब रिपोर्टिंग अवधि में प्रयोगशाला रिजर्व में लगातार वृद्धि के साथ बाहरी नकदी प्रवाह 31% हो गया है। सरकार, निजी और शैक्षणिक क्षेत्रों में शामिल हमारे हितधारकों के समर्थन से ही यह संभव हो पाया। हमारे प्रकाशनों का औसत प्रभाव कारक सबसे उच्च स्तर 4.16 तक बढ़ गया।

खनन और बंदरगाह क्षेत्रों से संबंधित पर्यावरण प्रभाव आकलन (ईआईए) में सीएसआईआर-एनआईआईएसटी एक मजबूत स्थिति रखता है। हमारे ग्राहक की बैठक, जो ईआईए की अनिवार्य आवश्यकता है, को सुनिश्चित करते हुए

ईआईए अध्ययन के माध्यम से पर्यावरण संरक्षण और निगरानी की हमारी प्रतिबद्धता का पालन किया जाता है। यह उल्लेखनीय है कि सीएसआईआर-एनआईआईएसटी केरल में एकमात्र संगठन है, जिसे श्रेणी ए परियोजनाओं में एक ईआईए परामर्शदाता के रूप में एनएबीईटी / एमओईएफ मान्यता प्राप्त है। हमारी परिष्कृत परीक्षण और विश्लेषणात्मक सुविधाएं इन-हाउस आर एंड डी गतिविधियों को आगे बढ़ाने में सहायता प्रदान करने के साथ ही साथ बाहरी ग्राहकों के लिए परीक्षण और विश्लेषणात्मक सेवाओं की एक विस्तृत श्रृंखला प्रदान करती है। संस्थान में एक समर्पित डाइऑक्साइन परीक्षण सुविधा भी है। एसीएसआईआर के तहत पीएचडी कार्यक्रम, कौशल विकास कार्यक्रम, एमएससी और एम.टेक. परियोजना कार्य आदि के माध्यम से छात्रों, उद्यमियों, अकादमिक और उद्योगों को लाभान्वित करते हुए मानव संसाधन विकास हमारे संस्थान का ध्यान केंद्रित एक और प्रमुख क्षेत्र है।

वर्ष 2017-18 की अवधि के दौरान संस्थान द्वारा कई महत्वपूर्ण कार्यक्रम आयोजित किए गए। प्रौद्योगिकी हस्तांतरण / लाइसेंसिंग को सक्षम करते हुए उद्योगों, उद्यमियों, एमएसएमई और अन्य हितधारकों के लिए एक आम मंच प्रदान करने के लिए आर एंड डी- उद्योग बैठक, कार्यात्मक रंगों और उन्नत सामग्रियों पर 8 वीं पूर्व एशिया संगोष्ठी, विज्ञान तथा प्रौद्योगिकी मंत्रालय, पृथ्वी विज्ञान मंत्रालय और विज्ञान भारती द्वारा संयुक्त रूप से आयोजित आउटरीच कार्यक्रम "विभा", सीएसआईआर और केन्द्रीय विद्यालय के बीच की एक पहल "जिज्ञासा" ध्यान देने योग्य कार्यक्रम हैं। "विभा" और "जिज्ञासा" कार्यक्रमों का उद्देश्य युवा छात्रों के बीच वैज्ञानिक अनुसंधान और विकास की दिशा में जागरूकता और रुचि पैदा करना था।

रिपोर्टिंग अवधि के दौरान पुरस्कार और प्रशंसा जीत सीएसआईआर-एनआईआईएसटी के सभी को मैं बधाई देता हूँ और मुझे आशा है कि तीव्र शोध प्रयासों के माध्यम से वे अपनी रचनात्मकता को बनाए रखेंगे। सीएसआईआर मुख्यालय, अन्य वित्त पोषण एजेंसियों और उद्योगों से प्राप्त समर्थन के लिए मैं आभारी हूँ। समाज को प्रभावित करने वाले लक्ष्यों को प्राप्त करने में समान विचारधारा के वैज्ञानिक और औद्योगिक समुदाय के साथ सहयोग करने के लिए हम तत्पर हैं।

शुभकामना सहित,

ए अजयघोष
निदेशक



FOREWORD

On behalf of Team CSIR-NIIST, it gives me immense pleasure and privilege to present the Annual Report of 2017-18 to you. Over the past few years CSIR-NIIST has been aligning its focus, commitments, functioning and execution of scientific activities with National as well as CSIR Missions and Mandates. CSIR-NIIST had successfully adapted with this dynamically changing environment and accomplished the projected targets and outcomes. During this period the Institute continued to make significant contributions in high impact research, IP generation, forging industrial alliance, human resource development, attracting new collaborating partners and stake holders. This was possible due to the untiring and dedicated efforts of our team of scientists, technical staff, administrative staff, students and the timely support from CSIR-HQ. I take this opportunity to thank all my colleagues for their hard work and cooperation in achieving the objectives and the targets.

The thrust areas of the Institute comprise of chemicals, energy (conventional and non conventional), functional foods, fluorescent materials for security applications, nutraceuticals, post harvest technologies, diagnostic probes, drug intermediates, polymer composites, light metal alloys and computational modeling. It will be our endeavor in continuing to work on these domains with well laid out targets and outcomes through fast track translational and fast track commercialization modes (FTTs and FTCs). When we look back on the exciting year of 2017-18, our external cash flow rose from 27% during 2016-17 period to 31% for the reporting period along with a steady increase in lab reserve. This was possible by the support from our stake holders comprising of the Government, private and academic sectors. The average impact factor of our publications rose to an all-time high of 4.16.

CSIR-NIIST holds strong position in Environment Impact Assessment (EIA) pertaining to the Mining and Port Sectors. Through our EIA studies, our commitment towards environment

protection and monitoring is adhered to while ensuring our customer's meeting, the mandatory EIA requirement. It may be noteworthy that CSIR-NIIST is the only organization in Kerala with NABET/MOEF accreditation as an EIA consultant in category A projects. Our sophisticated testing and analytical facilities offers a wide range of testing and analytical services to the external clients while pursuing in house R&D activities. The Institute also has a dedicated dioxin testing facility. The human resource development is another major area of focus of our Institute through Ph.D. Programs under the aegis of AcSIR, skill development programs, M.Sc. and M.Tech. project works etc. benefiting students, entrepreneurs, academia and industries.

Several important programs were organized by the Institute during the period 2017-18. Noteworthy are the R&D industry meet for providing a common platform for industries, entrepreneurs, MSMEs and other stake holders enabling technology transfer/licensing, 8th East Asia Symposium on functional dyes and advanced materials, outreach program "VIBHA" jointly organized by Ministry of Science and Technology, Ministry of Earth Science and Vijnana Bharati, "Jigyasa" an initiative between CSIR and Kendriya Vidyalaya. "VIBHA" and "Jigyasa" programs were aimed at generating awareness and interest towards scientific research and development among young students.

I congratulate all at CSIR-NIIST who had won awards and accolades during the reporting period and I hope they will sustain their creativity through intensified research efforts. Let me also acknowledge the support received from CSIR Head Quarters, other funding agencies and industries. We look forward to having collaboration with like minded scientific and industrial community in achieving the targets that impacts the society.

With best wishes

A Ajayaghosh
Director

महत्वपूर्ण उपलब्धियां 2017-2018

सीएसआईआर- राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान (एनआईआईएसटी) वर्ष 1975 में अपनी स्थापना से उच्च गुणवत्ता वाले विज्ञान तथा प्रौद्योगिकी अनुसंधान एवं विकास में अपनी स्थिति को बनाए रखने में हमेशा सफलतापूर्वक प्रयास किया है। वर्तमान में संस्थान का ध्यान, सामाजिक जरूरतों और राष्ट्रीय मिशन के साथ संरेखण में प्रौद्योगिकी संचालित और व्यापार अनुकूल पारिस्थितिक तंत्र के निर्माण में केंद्रित है। एक अंतर्विषयी अनुसंधान संस्थान होने के कारण, अनुसंधान में रसायन शास्त्र, सामग्री, कृषि प्रसंस्करण, माइक्रोबियल और पर्यावरण प्रौद्योगिकियों जैसे अनुसंधान विषयों का एक व्यापक स्पेक्ट्रम शामिल है। वर्तमान रिपोर्टिंग अवधि के दौरान, समुद्र तट खनिज प्रसंस्करण, रेयर एअर्थ पिगमेंट, कृषि प्रसंस्करण, आयुर्वेद के लिए फाइटोकेमिकल्स, अपशिष्ट उपचार, जैव ईंधन, सौर ऊर्जा, कोटिंग्स, सुरक्षा स्याही, नैदानिक जांच, दवा मध्यवर्ती जैसे आला क्षेत्रों की पहचान के साथ संस्थान ने अपने विज्ञान और रोड मैप को आगे सुधार किया।

बाहरी स्रोतों से राजस्व पैदा करने में काफी वृद्धि प्रदान करने वाली अत्याधुनिक अनुसंधान परियोजनाओं तथा औद्योगिक, निजी और सार्वजनिक क्षेत्रों शामिल नए सहयोग में वृद्धि के साथ सीएसआईआर-एनआईआईएसटी ने वर्ष 2017-2018 के दौरान अपने निष्पादन में उत्कृष्टता जारी रखी। रिपोर्टिंग अवधि के दौरान निम्नलिखित विषयों के तहत एनसीपी (आला निर्माण परियोजनाएं), एफबीआर (केंद्रित मूल शोध), एफटीटी (फास्ट ट्रेक ट्रांसलेशन) और एफटीसी (फास्ट ट्रेक व्यावसायीकरण) योजनाओं की पहचान पर अधिक जोर दिया गया था : खनन, खनिज, धातु और सामग्री 2. रसायन (चमड़े और पेट्रोकेमिकल्स सहित) 3. ऊर्जा (परंपरागत और गैर परंपरागत) और ऊर्जा उपकरणों 4. पारिस्थितिकी, पर्यावरण, पृथ्वी विज्ञान और जल 5. कृषि पोषण और जैव प्रौद्योगिकी 6. हेल्थकेयर।

सीएसआईआर-एनआईआईएसटी को सीएसआईआर से मिशन मोड कार्यक्रम के तहत स्वास्थ्य देखभाल के लिए नैनो-बायोसेंसर्स और माइक्रोफ्लुइडिक्स पर तथा सतत विकास के लिए कटैलिसिस पर दो प्रतिष्ठित परियोजनाएं मिलीं। रिपोर्ट अवधि के दौरान संस्थान ने अपनी कई महत्वपूर्ण प्रौद्योगिकियों को भी स्थानांतरित कर दिया। पिछले वर्षों के दौरान विकसित

व्यावसायिक रूप से महत्वपूर्ण कई कार्यात्मक सामग्री का बाहरी ग्राहकों द्वारा आगे मूल्यांकन किया गया और उनके फीडबैक के आधार पर प्रौद्योगिकी हस्तांतरण को सक्षम करने के लिए कई तकनीकी पहलुओं को परिष्कृत किया जा रहा है। हरे मार्ग के माध्यम से इल्मेनाइट के इष्टतमीकरण के लिए पायलट स्तर पर स्थानांतरित प्रक्रिया अब प्रौद्योगिकी हस्तांतरण के लिए पाइपलाइन में है। एनआईआईआर परावर्तक ब्लू पिगमेंट प्रौद्योगिकी का स्केल अप किया जा रहा है। बायोरफिनरियों के लिए बायोमास हाइड्रोलिसिस के लिए बड़े पैमाने पर β -ग्लूकोसिडेस एंजाइम के उत्पादन की प्रक्रिया जानकारी बाजार के लिए जल्द ही तैयार हो जाएगी। आयुर्वेदिक मुक्तशेष सामग्री का मूल्य वर्धन, आयुर्वेदिक उद्योग से कच्चे माल के योगों की मान्यता आदि उल्लेखनीय अन्य उपलब्धियों में से कुछ हैं। नगरपालिका ठोस अपशिष्ट को कम करने के लिए तथा नगरपालिका ठोस अपशिष्ट प्रबंधन के लिए संस्थान एक एकीकृत बायोड्राइंग प्रक्रिया के विकास में है। सुरक्षा अनुप्रयोगों के लिए नई फ्लोरोसेंट सामग्री और स्याही, रिपोर्टिंग अवधि के दौरान आला क्षेत्र विकास में की गयी महत्वपूर्ण गतिविधियों में से एक है।

खनन और बंदरगाह क्षेत्रों के लिए किए गए पर्यावरण प्रभाव आकलन के माध्यम से पारिस्थितिकी और पर्यावरण की निगरानी के लिए सीएसआईआर-एनआईआईएसटी प्रतिबद्ध है। सीएसआईआर-एनआईआईएसटी केरल में एनएबीईटी-मान्यता प्राप्त श्रेणी “ए” परामर्शदाता संगठन है। इसके अलावा, इलाके के स्कूलों में अपनी सिद्ध एनारोबिक डाइजेस्टर प्रौद्योगिकी पेश करते हुये संस्थान भारत सरकार की “स्वच्छ भारत पहल” को भी पूरा करता है। नव विकसित एनारोबिक डायजेस्टर कचरे को कंपोस्ट खाद के रूप में स्थायी करता है और उत्पत्ति के स्रोत पर बायोमास अपशिष्ट से मीथेन समृद्ध बायोगैस को उत्पन्न करता है। सीएसआईआर- एनआईआईएसटी ने केरल के कुछ स्थानों पर भूजल के परक्लोरेट संदूषण को एक गंभीर सार्वजनिक स्वास्थ्य समस्या के रूप में पहचान की है, जहां परक्लोरेट थोक मात्रा में निपटाया जाता है। इस पृष्ठभूमि में, सीमांत अनुसंधान के एक जोरदार चार्जिंग और चुनौतीपूर्ण अंतर्विषयी वातावरण में अपनी भविष्य की योजनाओं के साथ संरेखित करते हुए वर्ष 2017-2018 की वार्षिक रिपोर्ट सीएसआईआर- एनआईआईएसटी द्वारा किए गए नवाचार, उपलब्धियों, प्रगति और इंपैक्ट को निर्धारित करता है।

अनुसंधान एवं विकास कार्यक्रम में प्रगति और प्रदर्शन

अच्छी तरह से योजनाबद्ध और केंद्रित गतिविधियों के माध्यम से, सभी पांच प्रभागों ने इस रिपोर्ट की अवधि के दौरान उत्पाद विकास, प्रक्रिया फॉर्मूलेशन, अकादमिक उत्कृष्टता और अनुसंधान सहयोग में महत्वपूर्ण प्रगति हासिल की है। इस रिपोर्ट में रसायनों, सामग्रियों, माइक्रोबियल प्रक्रियाओं, कृषि प्रसंस्करण और पर्यावरण प्रौद्योगिकियों के क्षेत्रों की गतिविधियों और उपलब्धियों का संक्षेप क्रिया जाता है। कृषि प्रसंस्करण तथा प्रौद्योगिकी प्रभाग एक बहुआयामी केंद्र है जिसमें कृषि उपज और पादप संसाधनों पर जोर देते हुये, प्रक्रिया (शेल्फ लाइफ एन्हांसमेंट, स्टोरेज, वैल्यू एडिशन) और उत्पाद विकास (न्यूट्रास्यूटिकल्स, कार्यात्मक खाद्य पदार्थ, आहारीय पूरक, फाइटोफार्मास्यूटिकल्स, बायो-उर्वरक और बायो-कीटनाशकों) पर मुख्य ध्यान दिया जाता है। इस प्रभाग में कृषि प्रसंस्करण के क्षेत्र में प्रमुख पायलट संयंत्र सुविधाएं और एक प्रौद्योगिकी व्यवसाय ऊष्मायन केंद्र (टीबीआईसी) है। प्रभाग की गतिविधियों में समृद्ध जैव विविधता की खोज करके न्यूट्रास्यूटिकल्स और फाइटोफार्मास्यूटिकल्स का विकास और सत्यापन, एंडोफैटिक सूक्ष्म जीवों से जैव उर्वरकों और जैव कीटनाशकों का विकास, मसालों और फलों से सक्रिय सामग्री के अलगाव के लिए औद्योगिक रूप से महत्वपूर्ण एंजाइमों के उत्पादन करने में सक्षम नूतन स्वदेशी माइक्रोबियल उपभेदों का खनन आदि शामिल हैं। यौगिकों के इन विट्रो स्क्रीनिंग के लिए तथा मधुमेह, हृदय रोग, कैंसर और गैर-एल्कोहॉलिक फैटी यकृत रोगों के लिए मैकेनिज्म आधारित अध्ययन के लिए प्रभाग में सुविधाएं उपलब्ध हैं।

माइक्रोबियल प्रक्रिया तथा प्रौद्योगिकी प्रभाग (एमपीटीडी) माइक्रोबियल संसाधनों की खोज और दोहन करके जैव प्रक्रिया और उत्पाद विकास के केंद्रित क्षेत्रों के अनुसंधान में सक्रिय रूप से शामिल है। अनुसंधान के वर्तमान ध्यान केंद्रित क्षेत्रों में शामिल हैं- i) औद्योगिक एंजाइम और मूल्यवर्धित रसायनों ii) जैव ईंधन और बायोरिफाइनरी (iii) जैव सक्रिय अणु iv) स्वास्थ्य और जीनोमिक्स (v) पादप सूक्ष्मजीव इंटरैक्शन और (vi) प्रोबायोटिक और एल्गल न्यूट्रास्यूटिकल्स। दूसरी पीढ़ी बायोइथेनॉल पर विशेष अनुसंधान एवं विकास के लिए प्रभाग में एक समर्पित "जैव ईंधन केंद्र" है। लिम्नोसेल्युलॉसिक बायोइथेनॉल के उत्पादन का पायलट संयंत्र अब ओन-साइट ठोस-अवस्था किण्वन एंजाइम उत्पादन पायलट संयंत्र से समर्थित है, जो लागत प्रभावकता और हैंडलिंग के लिए बेहतर अवसर प्रदान करता है।

रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग संस्थान के निम्नलिखित तीन प्राथमिक क्षेत्रों पर ध्यान केंद्रित कर रहा है : 1. कार्बनिक और हाइब्रिड इलेक्ट्रॉनिक्स (ऊर्जा उत्पादन और भंडारण, ठोस अवस्था प्रकाश व्यवस्था, क्रोमोजेनिक कोटिंग्स और कम्प्यूटेशनल रसायन विज्ञान) 2. फ्लोरोसेंट सामग्री (सुरक्षा अनुप्रयोग, डायग्नोस्टिक्स, इमेजिंग प्रोब्स और अल्ट्राफास्ट

गतिकी) 3. फाइटो फार्मास्यूटिकल्स और ड्रग इंटरमीडिएट्स (औषधीय पौधों का जैव मूल्यांकन और उन्नत फार्मास्यूटिकल इंटरमीडिएट्स)। इसके अलावा, प्रभाग द्वारा इन क्षेत्रों में भविष्य विज्ञान और क्षमता निर्माण का कार्य भी करता है।

पदार्थ विज्ञान तथा प्रौद्योगिकी प्रभाग में अनुसंधान के फोकस क्षेत्र है- उन्नत कार्यात्मक सामग्रियों का विकास, खनिजों का इष्टतमीकरण और सामरिक, ऑटोमोबाइल, ऊर्जा और सामाजिक अनुप्रयोगों के लिए घटक। प्रभाग में, वर्ष 2017-18 के दौरान खनिज इष्टतमीकरण, ऊर्जा बचत के लिए बहुआयामी वर्णक, प्रकाश व्यवस्था अनुप्रयोगों के लिए लुमेनसेंट सामग्री, कार्बन डाइ ऑक्साइड अधिशोषण के लिए छिद्रपूर्ण सिरेमिक सामग्री, डार्ड निम्नीकरण के लिए नैनो फोटो उत्प्रेरक, मुद्रित इलेक्ट्रॉनिक्स के लिए सामग्री, चुंबकीय और चुंबक प्रशीतन सामग्री, बहुलक और बहुलक आधारित नैनो कंपोजिट, रणनीतिक और मोटर वाहन अनुप्रयोगों के लिए हल्की मिश्र धातु का विकास जैसे क्षेत्रों में अत्याधुनिक प्रौद्योगिकियों के विकास पर काम शुरू किया गया है।

पर्यावरण प्रौद्योगिकी प्रभाग, प्रदूषण नियंत्रण और क्षेत्र के प्राकृतिक संसाधनों के मूल्यवर्धन के लिए स्वदेशी प्रौद्योगिकियों के सृजन में सक्रिय रूप से लगे हुए है। प्रभागीय गतिविधियां तीन मुख्य क्षेत्रों में यानि अपशिष्ट प्रबंधन, जल उपचार और पर्यावरण प्रभाव आकलन (ईआईए)। ऐसे समय में, जब मौजूदा प्रणालियों और प्रक्रियाओं की वजह से हमारे नाजुक पर्यावरण में अपूर्णीय क्षति होती रहती है, इस ग्रुप ने शमन उपायों के लिए अपशिष्ट जल और प्रदूषण उपचार, फ्लू गैसों की सफाई, मिट्टी के उपचार और अपशिष्ट प्रबंधन समाधान में अपनी विशेषज्ञता के माध्यम से पहले से ही गठित दूषित पदार्थों को हटाने के लिए प्रौद्योगिकियों का एक आला बना दिया है।

डीएसआईआर-एनआईआईएसटी-सीआरटीडीएच: एमएसएमई में पर्यावरण हस्तक्षेप के लिए एनआईआईएसटी में (आम अनुसंधान व प्रौद्योगिकी विकास हब) स्थापित किया गया है। सुखाये हुये नारियल, मछली भोजन और चावल मिल उद्योग के लिए प्रौद्योगिकी तथा परामर्श सेवाएं प्रदान की गई हैं।

उद्योग और शैक्षिक संस्थानों से नमूनों के परीक्षण से राजस्व पैदा करने के अलावा सभी प्रमुख सुविधाओं के साथ पूरी क्षमता पर काम कर रही संस्थान की विश्लेषणात्मक सुविधा का इन-हाउस आर एंड डी कार्यक्रमों के लिए बड़े पैमाने पर उपयोग किया गया।

सीएसआईआर-एनआईआईएसटी की डाइऑक्साइन विश्लेषण अनुसंधान सुविधा, प्रभाग की महत्वपूर्ण गतिविधियों में से एक है। इस रिपोर्टिंग अवधि के दौरान बाहरी अनुदान में हुयी लगातार वृद्धि के साथ सीएसआईआर से प्राप्त निरंतर आर्थिक सहायता ने उच्च गुणवत्ता वाले प्रकाशनों के साथ

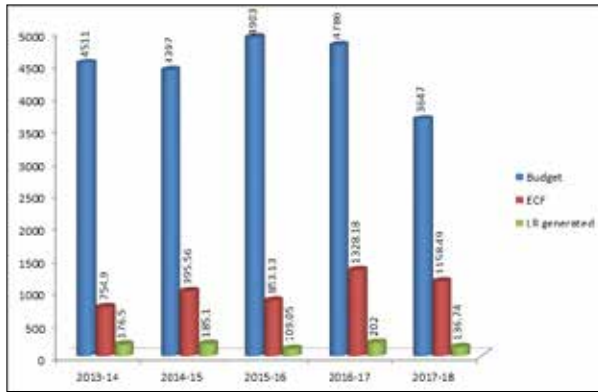
समझौता किए बिना स्थानांतरणीय अनुसंधान और प्रौद्योगिकी विकास पर ध्यान केंद्रित करने में हमारी मदद की है।

2017-2018 की अवधि के दौरान, सीएसआईआर-एनआईआईएसटी में कई महत्वपूर्ण घटनाओं का आयोजन हुआ। पारस्परिक हित के मुद्दों की पहचान करने के लिए और एमएसएमई सहित निजी, सार्वजनिक क्षेत्रों से उद्योगों के साथ गठबंधन बनाने के लिए संस्थान ने 23 फरवरी 2018 को एक दिवसीय आर एंड डी- उद्योग बैठक आयोजित की। श्री टी के जोस, आईएएस, अपर मुख्य सचिव (स्थानीय स्वशासन विभाग), केरल सरकार ने, डॉ एम बीना, आईएएस, प्रबंध निदेशक, केएसआईडीसी, पद्मश्री हरीद्रन नायर, संस्थापक एवं प्रबंध निदेशक, पंकजकस्तूरी और डॉ राम चंद, मुख्य कार्यकारी अधिकारी, सैक्सिन लाइफ साइंसेज प्रा. लिमिटेड की प्रतिष्ठित उपस्थिति में आर एंड डी उद्योग बैठक का उद्घाटन किया। कई उद्योग प्रतिनिधियों ने बैठक में भाग लिया और कई एमओयू निष्पादित किए गए। रिपोर्ट की अवधि के दौरान कई महत्वपूर्ण राष्ट्रीय और अंतर्राष्ट्रीय कार्यक्रम भी आयोजित किए गए। कार्यात्मक रंजकों और उन्नत सामग्रियों (ईएस 8) पर 8 वीं पूर्व एशिया संगोष्ठी, डाइऑक्साइन विश्लेषण में उन्नत विश्लेषणात्मक समाधान, लुमेनसेंस और इसके अनुप्रयोगों पर राष्ट्रीय

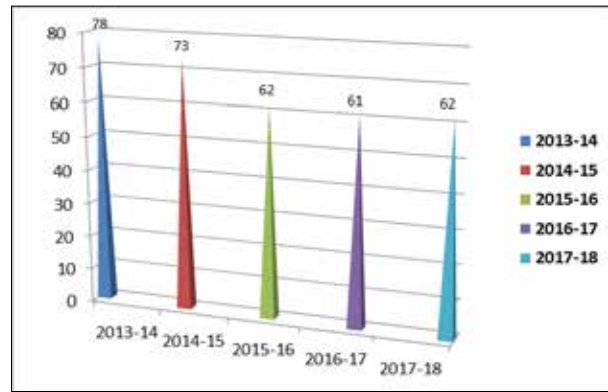
सम्मेलन (एनसीएलए-2018) आदि इनमें से कुछ हैं। संस्थान में राष्ट्रीय विज्ञान दिवस, राष्ट्रीय प्रौद्योगिकी दिवस और सीएसआईआर स्थापना दिवस भी मनाया गया। इन अवसरों पर प्रयोगशाला द्वारा खुला दिन मनाया गया और बड़ी संख्या में छात्रों और संकायों ने संस्थान का दौरा किया। वैज्ञानिकों के साथ विचार-विमर्श किया। प्रयोगशाला में हिंदी सप्ताह और सतर्कता जागरूकता सप्ताह आयोजित किया गया था। संस्थान में स्वच्छ भारत मिशन से संबंधित गतिविधियां शुरू हुईं। प्रयोगशाला और उसके आसपास के क्षेत्रों को कर्मचारियों और छात्रों की भागीदारी के साथ साफ कर दिया गया था।

वैज्ञानिकों और शोध छात्रों ने कई प्रतिष्ठित पुरस्कार, सम्मान और मान्यता के माध्यम से संस्थान के लिए ख्याति लायी। प्रयोगशाला में हिंदी सप्ताह और सतर्कता जागरूकता सप्ताह का आयोजन किया गया। संस्थान में स्वच्छ भारत मिशन से संबंधित गतिविधियां शुरू की गयीं और कर्मचारियों और छात्रों की भागीदारी में प्रयोगशाला और इसके आसपास के क्षेत्रों को साफ किया गया। वैज्ञानिकों और शोध छात्रों ने कई प्रतिष्ठित पुरस्कार, सम्मान और मान्यता के माध्यम से संस्थान के लिए ख्याति अर्जित की। शोध छात्रों ने प्रतिष्ठित सेमिनार और संगोष्ठी में सर्वश्रेष्ठ पोस्टर, सर्वश्रेष्ठ मौखिक प्रस्तुति और शोध पत्र पुरस्कार प्राप्त करते हुए अपनी जीत का दौरा जारी रखा।

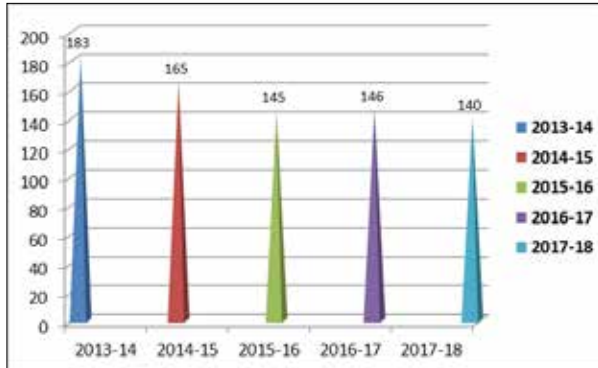
बजट / ईसीएफ / एलआर (लाखों में)
BUDGET/ECF/LR (in lakhs)



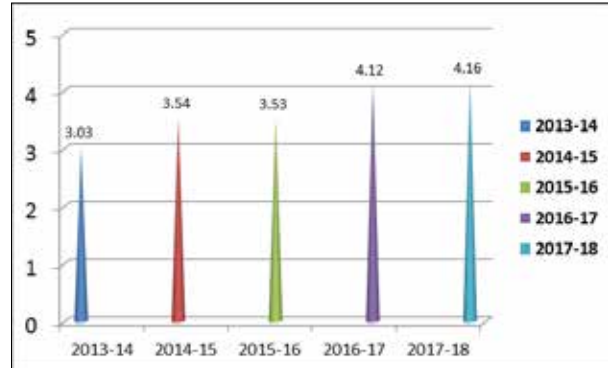
वैज्ञानिकों की स्थिति
SCIENTIST POSITION



कर्मचारियों की संख्या
STAFF STRENGTH



औसत प्रभाव कारक
AVERAGE IMPACT FACTOR



SIGNIFICANT ACHIEVEMENTS 2017-2018

CSIR- National Institute for Interdisciplinary Science & Technology (NIIST) since its inception in the year 1975 has always endeavored successfully in upholding its position in high-quality science and technology research and development. The Institute is currently focused on creating technology driven and business-friendly ecosystem aligning with the societal needs and national mission. Being an interdisciplinary research Institute the broad spectrum of research topics encompassing chemistry, materials, agro processing, microbial and environmental technologies. During the current reporting period, the vision and road map were further fine-tuned identifying niche areas in the field of beach mineral processing, rare earth pigments, agro processing, phytochemicals for Ayurveda, waste treatment, biofuels, solar energy, coatings, security inks, diagnostic probes and drug intermediates.

CSIR-NIIST continued to excel in its performance during the year 2017-2018 securing cutting edge research projects, upsurge in new collaborations involving industrial, private and public sectors which lead to a substantial increase in generating revenue from external sources. During the reporting period, greater emphasis was laid on identifying NCP (Niche creating projects), FBR (Focused Basic Research), FTT (Fast Track Translational) and FTC (Fast Track Commercialization) schemes under the following themes: 1. Mining, Minerals, Metals and Materials 2. Chemicals (including leather and Petrochemicals) 3. Energy (Conventional and non-conventional) and Energy devices 4. Ecology, Environment, Earth Sciences and Water 5. Agri. Nutrition and Biotechnology 6. Healthcare

CSIR-NIIST received two prestigious projects under the mission mode program from CSIR on Nano-Biosensors and Microfluidics for Health Care and on Catalysis for sustainable development. The Institute also transferred several of its important technologies during the period under report. Commercially important functional materials developed over the past few years have been

further evaluated by external clients and based on the feedback several technical aspects are being fine-tuned for enabling technology transfer. A process for the beneficiation of Ilmenite through green route is transferred at pilot level and is now in pipeline for technology transfer. The NIR reflecting blue pigment technology is being scaled up. Process know-how for large-scale production of β -glucosidase enzyme for biomass hydrolysis for bio refineries will also be market-ready soon. Value addition of ayurvedic spent materials, validation of raw material formulations from ayurvedic industry are some of the other achievements worth mentioning. To mitigate municipal solid waste, the Institute is in the process of developing integrated biodrying process for municipal solid waste management. New florescent materials and inks for security applications is also one of the important niche area development activity carried out during the reporting period.

CSIR-NIIST is committed to the monitoring of ecology and environment through Environment Impact Assessment carried out for the mining and port sectors. CSIR-NIIST is a NABET- Accredited Category A consultant organization in Kerala. In addition, the Institute also caters to Swachh Bharat initiative of Govt. of India by introducing its proven anaerobic digester technology to schools in the locality. The newly developed anaerobic digester stabilizes wastes as compost manure and generates methane rich biogas from biomass wastes at the source of generation. CSIR-NIIST has identified perchlorate contamination of ground water as a serious public health issue at few places in Kerala where perchlorate is handled in bulk.

Against this backdrop, the Annual Report for the period 2017-2018 sets out the innovation, achievements, progress and impact made by CSIR-NIIST aligning with its future plans in a vigorously charging and challenging interdisciplinary environment of frontier research.

Progress and Performance in R&D Programs

Through well planned and focused activities, all

the five divisions have made significant progress in product development, process formulations, academic excellence and research collaborations during the period of this report. Activities and achievements in the areas of chemicals, materials, microbial processes, agro-processing and environmental technologies are summarized in this report.

Agro Processing and Technology Division is a multidisciplinary centre with main focus on process (shelf life enhancement, storage, value addition) and product development (nutraceuticals, functional foods, dietary supplements, phytopharmaceuticals, bio-fertilizers & bio-pesticides) emphasizing on agri produce & plant resources. This division has major pilot plant facilities and a Technology Business Incubation centre (TBIC) in the area of agro processing. They are also involved in the development and validation of nutraceuticals and phytopharmaceuticals exploring rich biodiversity, development of bio-fertilizers & bio-pesticides from endophytic microbes, mining of novel indigenous microbial strains capable of producing industrially important multiple enzymes for the active ingredients isolation from spices and fruits. The division is also equipped with facilities for in vitro screening of compounds and mechanism based studies for diabetes, cardiovascular, cancer and non-alcoholic fatty liver diseases.

Microbial Processes and Technology Division (MPTD) is actively involved in research in the focussed areas for bioprocesses and products development by exploring and exploiting the microbial resources. The current focus of research are in the areas of i) Industrial enzymes and value added chemicals ii) Biofuels and biorefinery (iii) bioactive molecules iv) Health and genomics (v) plant microbe interactions and (vi) probiotic and algal nutraceuticals. The Division has a dedicated "Centre for Biofuels" for exclusive R&D on 2nd generation bioethanol. The pilot plant for the production of lignocellulosic bioethanol is now supported by on-site solid-state fermentation enzymes production, bringing better cost-effective and handling opportunities.

The Chemical Sciences and Technology Division has been focusing on three priority areas of the Institute:

1. Organic and Hybrid Electronics (Energy generation and storage, solid state lighting, chromogenic coatings and computational chemistry)
2. Fluorescent materials (Security applications, diagnostics, imaging probes and ultrafast kinetics)
3. Phyto-pharmaceuticals and Drug Intermediates (Bio-evaluation of medicinal plants and advanced pharmaceutical intermediates).

In addition, the team also focus on futuristic sciences and capacity building in such areas carving out a niche.

Development of advanced functional materials, mineral beneficiation and components for strategic, automobile, energy and societal applications has been the focus areas of research in the Materials Science and Technology Division. In the year 2017-18, the division has embarked on the development of cutting edge technologies in the areas of mineral beneficiation, multifunctional pigments for energy savings, luminescent materials for lighting applications porous ceramic materials for CO₂ adsorption, nano photo catalysts for dye degradation, materials for printed electronics, magnetic and magneto refrigeration materials, polymers and polymer based nano composites and light alloys development for strategic and automotive applications.

The Environment Technology Division is actively engaged in creating indigenous technologies for pollution control and value addition to the region's natural resources. The divisional activities converge into three main areas of waste management, water treatment and Environment Impact Assessment (EIA). At a time, when existing systems and processes are causing irreparable damage to our fragile environment, the group has made a niche in "end of the pipe" technologies for mitigation measures, through its expertise in waste water and effluent treatment, cleanup of flue gases, soil remediation and waste management solutions.

The DSIR-NIIST-CRTDH (Common Research and Technology Development Hub) for environmental interventions in MSMEs has been set up at NIIST. Technology and consulting services have been offered to desiccated coconut, fishmeal and rice mill industries.

The analytical facility of the Institute was extensively utilized for the in-house R&D Programs with all major facilities working to the full capacity, besides generating

revenue from testing of samples and tailor-made analytical services for industry and academia. Dioxin analysis research facility of CSIR-NIIST is one of the important activity of the division. The sustained funding from CSIR during this reporting period along with a steady rise in external funding, have helped in focused translational research and technology development without compromising on high quality publications.

During the period 2017-2018, several important events were organized in CSIR-NIIST. The Institute organized a one-day R&D Industry meet on 23rd February 2018 to identify the issues of mutual interest and to forge alliances with industries from private, public sectors including MSMEs. The R&D Industry meet was inaugurated by Shri T.K. Jose, IAS Additional Chief Secretary (Local Self Government Department), Govt. of Kerala in the esteemed presence of Dr. M. Beena, IAS Managing Director, KSIDC, Padmashree Hareendran Nair, Founder & MD, Pankajakasthuri, Dr. Ram Chand Chief Executive Officer, Saksin Lifesciences Pvt. Ltd. Many industries attended the meet and several MoUs were executed.

Many important national and international events also were organized during the period of this report. The 8th East Asia Symposium on functional dyes and advanced materials (EAS8), Advanced Analytical Solutions in Dioxin Analysis, national conference on Luminescence and its applications (NCLA-2018) etc. to name a few. The Institute also celebrated the National Science Day, National Technology Day, and CSIR Foundation Day and one-day science outreach programme. Open day was observed by the Laboratory on these occasions and large number of students and faculty visited the Institute, interacted with the scientists. Hindi Week and Vigilance Awareness Week were conducted in the Laboratory. Activities related to the Swacchh Bharat Mission started in the Institute. The laboratory and its neighboring areas were cleaned with the involvement of staff and students.

The scientists and research fellows brought many laurels to the institute through several prestigious awards, honours and recognitions. The research scholars continued their winning streak by achieving best poster, best oral presentation and paper awards in prestigious seminars and symposia.

कृषि प्रसंस्करण तथा प्रौद्योगिकी प्रभाग

कृषि प्रसंस्करण तथा प्रौद्योगिकी प्रभाग एक बहु-विषयक केंद्र है, जो कृषि उपज और पादप संसाधनों पर जोर देते हुए प्रक्रिया (शेल्फ लाइफ एन्हांसमेंट, भंडारण, मूल्यवर्धन) तथा उत्पाद विकास (न्यूट्रास्यूटिकल्स, कार्यात्मक खाद्य पदार्थ, आहारीय पूरक, फाइटोफार्मास्यूटिकल्स, बायो-उर्वरक और बायो-कीटनाशक) पर मुख्य ध्यान देता है। प्रभाग के मुख्य उद्देश्यों में से एक है- वैज्ञानिक तथा तकनीकी नवाचार के माध्यम से अपने उपज के लिए उच्च लाभ प्रदान कराते हुए किसानों के सामान्य कल्याण में सुधार। प्रभाग में कृषि प्रसंस्करण के क्षेत्र में प्रमुख पायलट संयंत्र सुविधाएं और एक तकनीकी व्यापार उभयान केंद्र (टीबीआईसी) वर्तमान है।

प्रभाग की गतिविधियों में समृद्ध जैव विविधता की खोज तथा इस क्षेत्र में प्रचुर मात्रा में उपलब्ध पारंपरिक ज्ञान और प्रभाग की विशेषज्ञता का उपयोग करते हुए न्यूट्रास्यूटिकल्स और फाइटो फार्मास्यूटिकल्स के विकास और सत्यापन शामिल हैं। एंडोफिटिक सूक्ष्म जीवों से जैव उर्वरक और जैव कीटनाशकों का विकास तथा मसालों और फलों से सक्रिय तत्व के अलगाव के लिए औद्योगिक रूप से महत्वपूर्ण एंजाइमों के उत्पादन में सक्षम नूतन स्वदेशी माइक्रोबियल उपभेदों के खनन पर प्रभाग सक्रिय है। यौगिकों के इन विट्रो स्क्रीनिंग के लिए तथा मधुमेह, हृदय रोग, कैंसर और गैर-एल्कोहॉलिक फैटी यकृत रोगों के लिए मैकेनिजम आधारित अध्ययन के लिए प्रभाग में सुविधाएं उपलब्ध हैं। प्रभाग में मानव संसाधन विकास के लिए अकादमिक कार्यक्रम है (पीएचडी) और उद्योगों और अकादमिक संस्थानों की आवश्यकता के लिए खाद्य विज्ञान और जैव चिकित्सा विज्ञान के तहत भी कार्यक्रम है।

हाइलाइट

- उत्पाद और प्रक्रिया विकास, प्रौद्योगिकी उन्नयन और स्वास्थ्य लाभ के वैज्ञानिक सत्यापन के लिए आर एंड डी, उद्योग इंटरफेस कार्यक्रम (प्रायोजित और परामर्श)
- विटामिन ए की कमी के लिए रेड पामओलेन (आरपीओ) आधारित कार्यात्मक खाद्य उत्पाद (कार्यात्मक वनस्पति तेल और मुलायम जेल)
- चयापचय विकारों और कैंसर के लिए पौधों से बायोएक्टिव यौगिकों का फार्माकोलॉजिकल मूल्यांकन
- देशी सूक्ष्मजीव से औद्योगिक रूप से महत्वपूर्ण एंजाइमों के माध्यम से सक्रिय घटकों के निष्कर्षण के लिए वानस्पतिकों का जैव प्रसंस्करण
- एंडोफाइटिक जीवों पर विशेष जोर देने के साथ सूक्ष्मजीव से जैव उर्वरक और जैव कीटनाशक
- प्राकृतिक उत्पादों के साथ ट्राइफिनाइल फॉस्फोनियम के संयोग के माध्यम से माइटोकॉन्ड्रियल एंटीऑक्सीडेंट का विकास
- चयापचय वर्धक के रूप में कृषि / खाद्य प्रसंस्करण अवशेष सामग्री से आहार फाइबर
- खाद्य पदार्थों में एंक्रिलमाइड और शमन रणनीतियों
- पोषण और बायोएक्टिव घटकों के लिए गैर-डेयरी पेय पदार्थ और वितरण प्रणाली

AGROPROCESSING AND TECHNOLOGY DIVISION

Agro Processing and Technology Division is a multidisciplinary centre with main focus on process (shelf life enhancement, storage, value addition) and product development (nutraceuticals, functional foods, dietary supplements, phytopharmaceuticals, bio-fertilizers & bio-pesticides) emphasizing agri produce & plant resources. One of the main objectives of division is improvement of general welfare of farmers through high returns of their produces via scientific and technological innovation. This division has major pilot plant facilities and a Technology Business Incubation centre (TBIC) in the area of agro-processing. We are also involved in the development and validation of nutraceuticals and phytopharmaceuticals exploring rich biodiversity, availability of abundant traditional knowledge in this region and available expertise in the division. We are also working on development of bio-fertilizers & bio-pesticides from endophytic microbes, mining of novel indigenous microbial strains capable of producing industrially important multiple enzymes for the active ingredients isolation from spices and fruits. This division is also equipped with facilities for in vitro screening of compounds and mechanism based studies for diabetes, cardiovascular, cancer and non-alcoholic fatty liver diseases. We have academic programmes (Phd) for human resource development in the field of food science and biomedical sciences for meeting the needs of industries and academic institutes.

Highlights

- R & D, Industry interface programmes (sponsored & consultancy) for product and process development, technology up-gradation and scientific validation of health benefits
- Red Palm Olein (RPO) based functional food products (functional vegetable oil & soft gel) for vitamin A deficiency
- Pharmacological evaluation of bioactive compounds from plants for metabolic disorders and cancer
- Bio-processing of botanicals for active ingredient extraction through industrially important enzymes from native microbes
- Bio-fertilizers and Bio-pesticides from microbes with special emphasis on endophytic organisms.
- Development of mitochondrial antioxidant through conjugation of triphenyl phosphonium with natural products
- Dietary fibre from agri/food processing spent materials as metabolic enhancers
- Acrylamide in foods and mitigation strategies
- Nondairy beverages and delivery systems for nutritional and bioactives components

Post harvest operations for value addition of indigenous fruits and vegetables

Post-harvest management of agro produce is very significant for the sustainable development of the agriculture and related sectors. Shelf life enhancement using various food processing technologies offers tremendous scope for value addition of indigenous fruits and vegetables which are otherwise underutilized. The focus is to process maximum quantity of the raw material during the peak harvest period and keep available stock in a safe processed condition for the whole year. Cost effective dehydration through appropriate mechanism for the selected crops is one of the simple & direct approach for preserving in a stable and safe condition and provides extended shelf life. Most of the cash crops such as fruits, vegetables, flowers, spices, mushrooms etc can be thus processed through this route by selecting the tailor made drying mechanisms standardized for the selected crop. The available technologies for dehydration are either not cost effective or the quality of the final product is of inferior quality. CSIR-NIIST has designed and developed an innovative drying model, Refrigeration Adsorption Dehumidified Drier (RADD), for the low temperature drying of agri crops for further value addition. This dryer can be used for the shelf life enhancement of fruits, vegetables, spices, flowers etc. of the state during peak harvest season when there is a surplus production of the crop. Other models for driers such as freeze drier, spray drier, Fluid Bed Drier, Tray Drier, Vacuum Drier etc are also available in the institute for the research on selection of the drying models for different crops. The unit operations for the dehydration process for ginger, nutmeg, cardamom, raw banana and raw jackfruit have already been optimized in pilot scale level.

In this context, a sponsored project has been initiated with Govt. of Kerala, with an objective to undertake process development studies for the value addition for indigenous fruits (ripe banana, ripe jack fruit and any other seasonal fruits available) and vegetables (leafy vegetables, Cucurbitaceae family vegetables, bitter gourd, ridge gourd, *Coccinia grandis*, long beans etc) that are important for the agricultural economy of the state, using above mentioned post-harvest operations. The project also envisages establish their nutritional & health benefits

(antidiabetic, cardiovascular protection etc properties) for scientific validation.

The ultimate target of the programme will be to support MSME's engaged in agri produce sector through development & transfer of customized technologies.

FSSAI sponsored programme on food safety & security

Actively contributing in the ongoing programme sponsored by FSSAI on "Occurrence of acrylamide, a heat induced food toxicant, in processed food products of India: mitigation strategies and health risks". The main objectives of which are:

- Study, survey & generate a data base on acrylamide content in Indian foods
- Mitigation strategy: Solutions for reducing acrylamide content in foods (changes in formulation, processing, other practices)
- Increase the public awareness on the toxicity & dietary exposure of acrylamide
- Inputs for policy decisions to FSSAI to identify any specific recommended level or action level for acrylamide.
- Input for growers, product manufacturers & service operators on how to reduce the acrylamide content in processed foods

Need based research with industry linkages

A large number of sponsored industrial projects were recently undertaken under the functional food & nutraceuticals programme of the division. The major projects include:

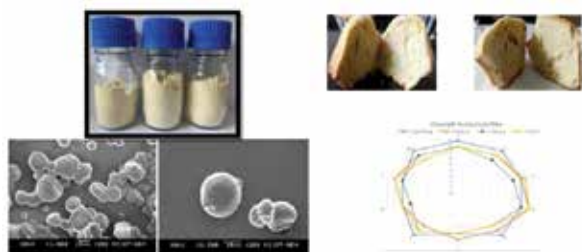
- (a) Sponsored programme initiated with M/s Tata Chemicals Mumbai, for pre-biotic efficacy and health benefits of identified products.
- (b) Development of speciality emollient from marine resources is shark liver oil in collaboration with leading fish product manufacturers M/s Arbee Bio Marine Extracts Ltd, Mysore. The work envisages the product development & optimization in the pilot scale level and quality evaluation.
- (c) Product development for formulated functional foods

(Collaborator: M/s Sreedhareeyam Speciality Eye Hospital).

- (d) Technology up-gradation for the existing breakfast mixing unit for leading foods product manufacturer M/s Brahmins Food Products Pvt. Ltd.
- (e) Scientific validation of antidiabetic products developed by leading nutraceutical company M/s Arjuna Natural Extracts Limited, Cochin.

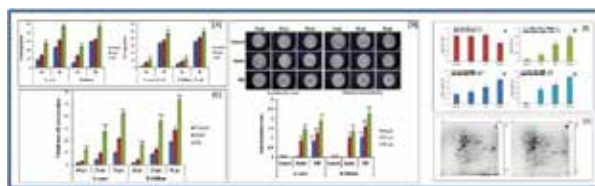
Micro encapsulation of Red Palm Olein (RPO) and flax seed oil blends for food enrichment applications: Optimization studies

Health benefits associated with the consumption of red palm oil has been previously established and reported earlier. In order to deliver optimum composition of fatty acids, blends of RPO (rich in carotenoids and tocotrienols) and flax seed oil (rich in polyunsaturated fatty acids) were blended and microencapsulated for fortification and food enrichment applications. The encapsulation efficiency was tuned by varying the wall material compositions and inlet air temperatures of spray drying conditions. Trials were carried out in order to find out the best wall material combination with maximum encapsulation efficiency at the same time offering the best bioactive stability. The oil powders were characterized for moisture content, water activity, bulk density, particle morphology (SEM), and encapsulation efficiency. A combination of whey protein and gum arabic as core materials yielded 40% oil encapsulation efficiency. Baked products were prepared using the encapsulated blends by replacing 15% of the fat and 50g of the final product supplemented 50% RDA for vitamin A. Fortified products were similar in appearance to control and had similar organoleptic properties as evaluated by sensory analysis. The Further studies are under way to improve the efficiency >50% by various technological interventions.



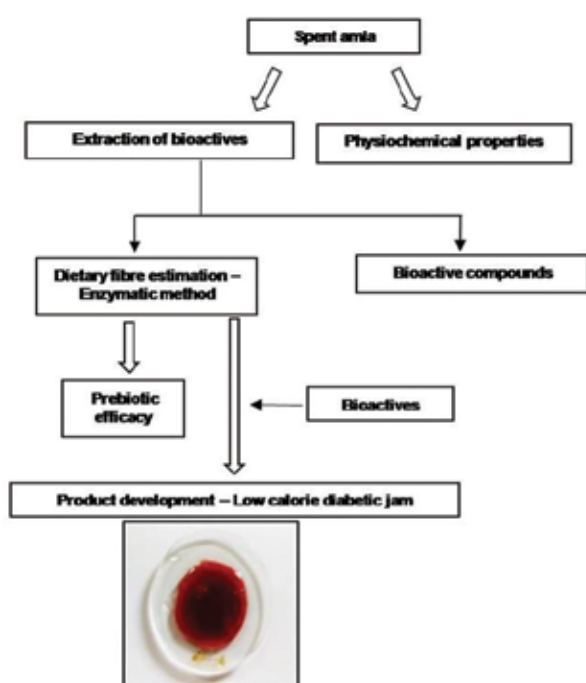
Short chain fatty acids produced during fermentation of dietary fibre from Musa paradisiaca inflorescence promotes free radical induced apoptosis in HT29 colon cancer cells

It was reported earlier that the plantain inflorescence is a rich source of dietary fibre with prebiotic properties. The prebiotics are associated with lowering the risk of colorectal cancer (CRC) owing to the production of short chain fatty acids. In order to establish the efficacy of plantain inflorescence dietary fibre (PIF) in prevention and management of CRC, we have carried out anticancer studies using HT29 colon cancer cells. The fermentation supernatant enriched with short chain fatty acids (SCFA) obtained by the fermentation of soluble dietary fibre from Musa paradisiaca inflorescence (PIF) using Lactobacillus casei and Bifidobacterium bifidum, LS and BS respectively. The studies using LS and BS were found to be inducing DNA damage and ROS production in HT29 cells leading to apoptosis. The apoptosis was facilitated by the reduction in the mitochondrial membrane potential and ATP production; enhanced cytochrome c release and interference with the expression of pro/anti-apoptotic proteins. BS, which exhibited better activity, was analyzed further to elucidate the total profile of HT29 proteins by performing 2D-PAGE and peptide mass fingerprinting for identification of differentially expressed proteins and was found the exposure upregulated the expression of apoptosis inducing factor-AIFM1 leading to apoptosis of HT29 cells.



Process development studies for valorisation of spent Turmeric and Amla

Studies were carried out to valorise spent turmeric and amla generated from industries and were found to be rich source of dietary fibre and bioactive phytochemicals. Preliminary studies to establish the prebiotic properties indicated excellent prebiotic potential of the dietary fibre



extracted from these spent materials. The antioxidant, antidiabetic and cardiovascular protection properties of the extracts was also evaluated using in vitro biochemical analysis. We have also done preliminary studies to develop functional foods by incorporating dietary fibre extracted from amla. However, the process needs to be further fine-tuned for scale up operations as well as for economic viability. In order to utilize the dietary fibre and bioactive extracts for functional food and nutraceutical application, further detailed investigation using in vitro cell lines and in vivo studies needs to be done to establish its health benefits. Studies in this direction are progressing.

Isolation of Phytoconstituents in Palmyrah Palm Sap Using Chromatographic Techniques and Identification by ¹H, ¹³C NMR, And HR-ESI-MS

Borassus flabellifer Linn. (Palmyra palm) belonging to Arecaceae family grows ubiquitously throughout India and widely distributed in tropical Asian countries. Its inflorescence (spathes) produces a sweet oyster colored sap called Neera which is a popular beverage. The male and female inflorescence are carried on separate trees. The sap is collected from both male and female inflorescence. The chemical composition of sap depends on various

factors like place, the variety of palm, mode and season of its collection. The study of phytoconstituents other than macronutrients is a great challenge from this matrix as they are present in minor quantities and isolating them from a sugar matrix is extremely difficult. In the present study we explored isolation of phytoconstituents from a sugar rich matrix; palm sap of *Borassus flabellifer*. HPLC-Diode Array Detector (DAD) analysis was performed for both organic acids profiling and amino acids profiling. Isolation of other phytoconstituents was performed by adopting 3 different protocols in which lyophilized palm sap was subjected to solvent extractions followed by purification using different stationary phases viz., Amberlite XAD7 HP, Sephadex LH 20 columns and silica gel. The isolated compounds were then characterized and identified by ¹H, ¹³C NMR, and HR-ESI-MS techniques. The chromatogram for organic acids showed the presence of tartaric acid, ascorbic acid, lactic acid, citric acid, succinic acid. Amino acid profiling showed the presence of aspartic acid, serine, glutamic acid, and alanine. Protocol 1 yielded L-tryptophan and phenylalanine. While protocol 2 yielded fructose, tyrosine, isoleucine, and phenylalanine, tryptophan and 4-hydroxy benzaldehyde. Aliphatic hydrocarbon, triacylglyceride, fatty acids, and a diacylglyceride were isolated following protocol 3. We have successfully isolated 26 compounds for the first time from Palmyra palm sap by adopting different chromatographic techniques.

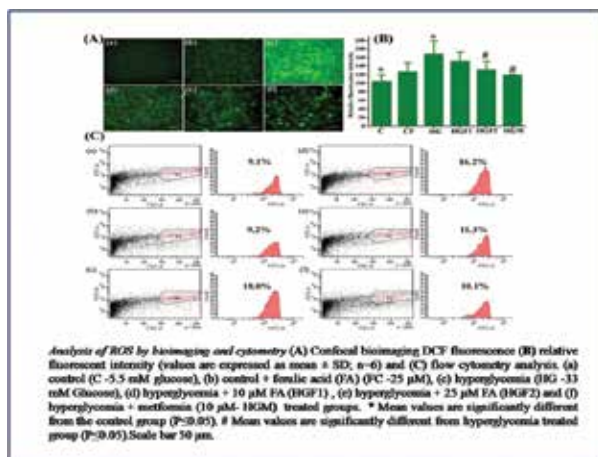
Optimization of Palm Syrup Development from Palm Sap of *Borassus flabellifer* (Linn.) Using Response Surface Methodology

In the present study, we have optimized the combination of process parameters for the production of shelf stable syrup from the sap of *Borassus flabellifer* Linn. The process optimization trials were done using response surface methodology in terms of Brix value and liquid glucose. The quadratic model was used to explain the variability in color, appearance, aroma, taste and overall acceptability in terms of process parameters. Kruskal-Wallis one-way Analysis of Variance (ANOVA) was carried to see the effect of storage days on sensory attributes of the product and also on non-sensory attributes (color, water activity (aw) and non enzymatic browning) of the product. The product was also observed for its microbial stability and

crystallization behavior. The optimized syrup developed was found to retain overall stability as indicated by color values, aw, non enzymatic browning, microbial study and absence of crystals. It was also observed that the quality of syrup stored under refrigeration to simulate consumer use was comparable to that of syrup stored at room temperature. However, since the syrup prepared is without preservative storage under refrigeration is recommended to overcome the abuse at the consumer level which can cause spoilage of the product.

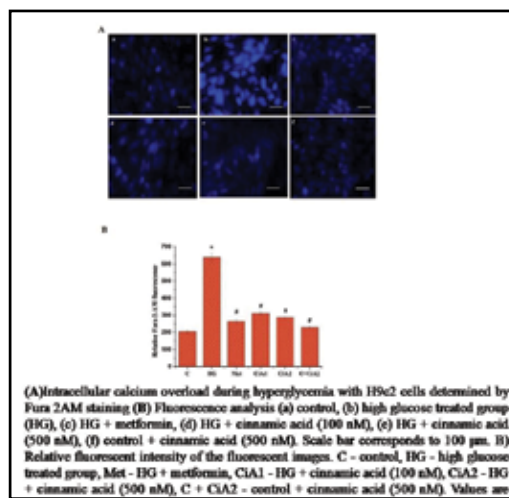
Ferulic acid protects H9c2 cells from hyperglycemia mediated injury through its antioxidant potential

One of the early markers of diabetic cardiomyopathy is the hyperglycemia induced oxidative stress through multiple pathways, and our present study is to elucidate the role of oxidative stress in evoking cardiac injury during hyperglycemia and evaluate the efficacy of ferulic acid (FA). For induction of hyperglycemic condition, H9c2 cells were treated with high glucose (33Mm) for 48 hrs. Then we evaluated the alteration in cell morphology, oxidative stress and the downstream markers like ANP, BNP, lipid peroxidation, protein carbonylation, intracellular calcium overload and superoxide dismutase with hyperglycemia. Hyperglycemia caused an increase in overall cell size, surplus ROS generation, depletion of SOD, significant release of injury markers BNP and ANP and simultaneous treatment with FA significantly reversed these effects. Overall results revealed that alteration in the redox status of cells via hyperglycemia leads to cell injury and FA could be an attractive bioactive for further exploration for cardiac protection during diabetes.



Cinnamic acid ameliorates glucotoxicity in H9c2 cells via maintaining redox status, mitochondrial dynamics and preventing sorbitol accumulation

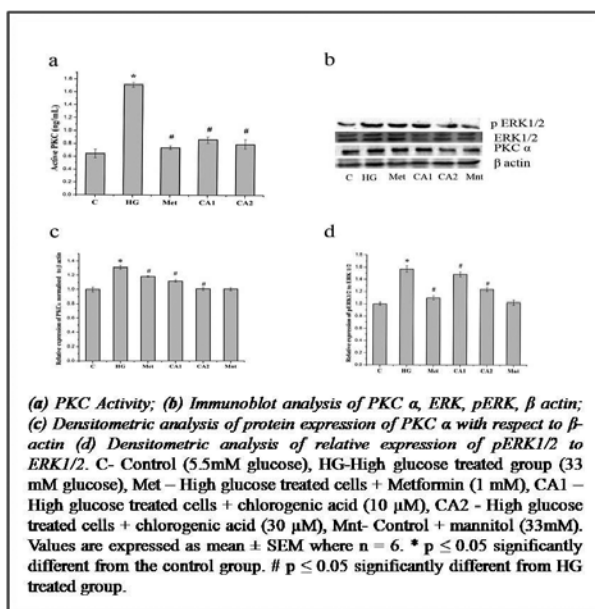
Alterations in various pathways like the innate antioxidant system, polyol pathway, mitochondrial integrity, dynamics, calcium homeostasis and apoptosis were investigated during hyperglycemia. Hyperglycemic insult



significantly depleted the antioxidant activity, enhanced reactive oxygen species (ROS) generation, and caused alterations in mitochondrial functions, finally leading to apoptosis. Cinnamic acid was beneficial to prevent the genesis of the adverse effect of hyperglycemia most probably through its antioxidant properties. The overall study reveals for the first time the sequence of alterations in various pathways and cross talk between them during hyperglycemia. These novel findings will be useful for planning future strategies for therapeutic intervention of hyperglycemic cardiomyopathy.

Chlorogenic acid protects H9c2 cells from glucotoxicity via inhibition of glycation and PKC α upregulation and safeguarding innate antioxidant status

Various parameters like free radical generation, alteration in innate antioxidant system, lipid peroxidation, AGE production and PKC α - ERK axis were investigated during hyperglycemia and with chlorogenic acid. Hyperglycemia has significantly enhanced reactive oxygen species (ROS - 4 fold) generation, depleted SOD activity (1.3 fold) and

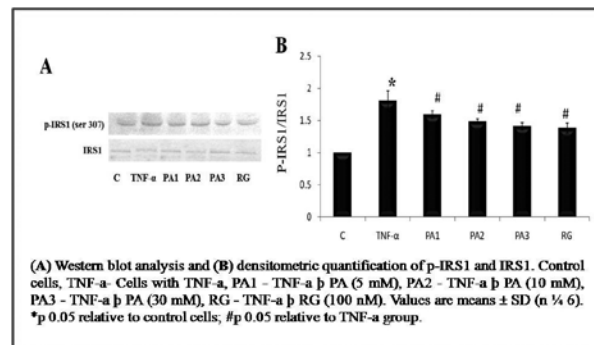


expression of enzymes particularly CuZnSOD (SOD1) and MnSOD (SOD2), increased production of AGE (2.18 fold). Besides, PKC α dependent ERK signaling pathway was found activated (1.43 fold) leading to cardiac dysfunction during hyperglycemia. Chlorogenic acid (CA) was found beneficial against hyperglycemia most probably through its antioxidant mediated activity. The outcome of this preliminary study reveals the importance of integrated approach emphasizing redox status, glycation and signaling pathways like PKC α - ERK axis for control and management of diabetic cardiomyopathy (DCM) and potential of bioactives like CA.

Punicic acid is a potent insulin sensitizer in 3T3-L1 adipocytes acts through upregulation of insulin signalling pathway and endocrine function, and downregulation of proinflammatory cytokines

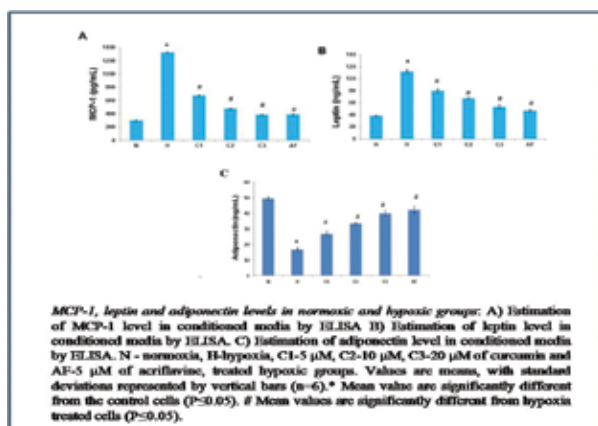
Insulin resistance (IR) has become a major threat to public health due to its role in metabolic syndrome. Inflammation associated IR is an interesting area of biomedical research in recent years and is expected to affect insulin signalling pathway via downregulating glucose transporters. In the present study, we evaluate the potential of punicic acid (PA), a nutraceutical found in pomegranate seed oil, against TNF- α induced alteration in 3T3-L1 adipocytes on glucose metabolism, endocrine function and inflammation. IR was induced in 3T3-

L1 adipocytes by treating with TNF- α (10 ng/mL) and various concentrations of PA (5, 10, 30 μ M) were incubated simultaneously. After 24 h, we found that TNF- α treatment increased mRNA expression of SOCS3, PTP1B and a decrease in IRS1 causing diminished glucose uptake. Further, it showed significantly increased transcriptional activity of NF κ B and leptin secretion while PA maintained leptin levels normal. Additionally, PA prevented the over-expression of phosphorylated JNK in a dose dependent manner during IR. PA also ameliorated significantly the upregulation of proinflammatory cytokines. From the results, we conclude that PA is effective to ameliorate TNF- α induced IR and also we recommend the intake of PA for control and management of IR and its associated complications.



Insulin resistance through inflammatory markers during hypoxia in 3T3-L1 adipocytes is ameliorated with curcumin

The role of phytochemicals in general well-being has been recognized. Curcumin is an ideal example. Hypoxia in adipose tissue is a major cause of inflammation and insulin resistance in obesity. Herein we mainly explored inflammation, insulin resistance and angiogenesis in 3T3-L1 adipocytes and possible reversal with the curcumin during hypoxia. Hypoxia for 24 h significantly increased (P \leq 0.05) the secretion of monocyte chemotactic protein-1 (4.59 fold), leptin (2.96 fold) and reduced adiponectin (2.93 fold). mRNA level of resistin (6.8 fold) and toll-like receptor-4 (TLR-4) (8.8 fold) was upregulated. Increased serine phosphorylation of insulin receptor substrate 1 (IRS-1) (1.9 fold) and decreased expression of insulin receptor substrate 2 (IRS-2) (0.53 fold) in hypoxic group were observed. Hypoxia significantly increased (P \leq 0.05) basal glucose uptake (3.3 fold), GLUT-1 expression and angiogenic factors but down regulated GLUT-4.

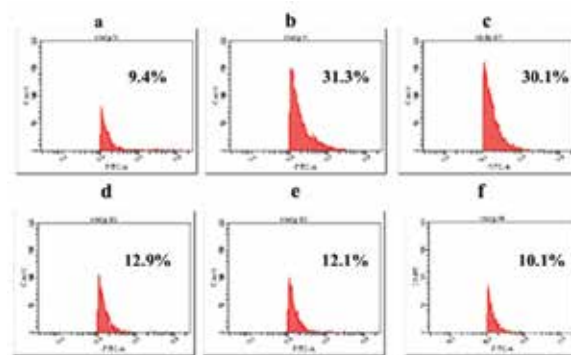


Curcumin protected adipocytes from hypoxia induced inflammation and insulin resistance via reducing inflammatory adipokine, nuclear factor- κ B (NF- κ B)/c-jun N-terminal kinase (JNK) and serine phosphorylation of IRS-1 receptors and improving adiponectin secretion.

Bilobalide abates inflammation, insulin resistance and secretion of angiogenic factors induced by hypoxia in 3T3-L1 adipocytes by controlling NF- κ B and JNK activation

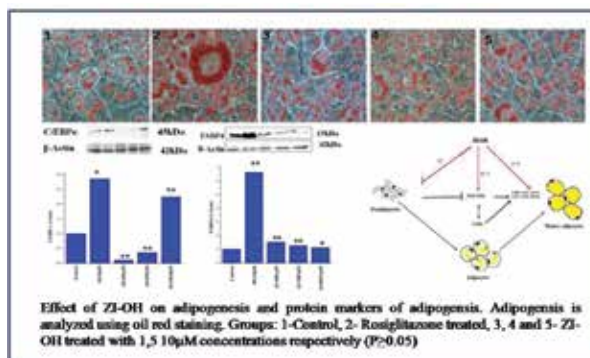
Obesity leads to inflammation and insulin resistance in adipose tissue. Hypoxia, observed in obese adipose tissue is suggested as a major cause of inflammation and insulin resistance in obesity. However, the role of hypoxia in adipose tissue during obesity and insulin resistance was not well established. Here we mainly explored the crosstalk between hypoxia induced inflammation, and insulin resistance and also secretion of angiogenic factors in 3T3-L1 adipocytes and possible reversal with bilobalide. Hypoxia for 24 h significantly ($P \leq 0.05$) increased the secretion of MCP-1 (4.59 fold), leptin (2.96 fold) and reduced adiponectin secretion (2.93 fold). In addition, the mRNA level of resistin (6.8 fold) and TLR4 receptors (8.8 fold) was upregulated in hypoxic adipocytes. The release of inflammatory cytokines and expression of TLR4 receptors led to activation of JNK and NF- κ B signalling. We further investigated the effects of JNK and NF- κ B activation on insulin signalling receptors. The present study showed increased ($P \leq 0.05$) serine 307 phosphorylation of IRS-1 (1.9 fold) and decreased expression of IRS-2 (0.53 fold) in hypoxic group showing hypoxia induced impairment in insulin signalling. Hypoxia

significantly ($P \leq 0.05$) increased basal glucose uptake (3.3 fold) as well as GLUT-1 expression in adipocytes indicating GLUT-1 mediated glucose uptake. Hypoxia for 24 h significantly increased ($P \leq 0.05$) the expression of angiogenic factors. Bilobalide protected adipocytes from hypoxia induced inflammation and insulin resistance mainly by reducing inflammatory adipokine secretion, improving adiponectin secretion, reducing NF- κ B/JNK activation, and inhibiting serine phosphorylation of IRS-1 receptors of insulin signalling pathway.



ZI-OH, a Peroxisome Proliferator-Activated Receptor γ (PPAR γ) modulator with strong insulin sensitizing property

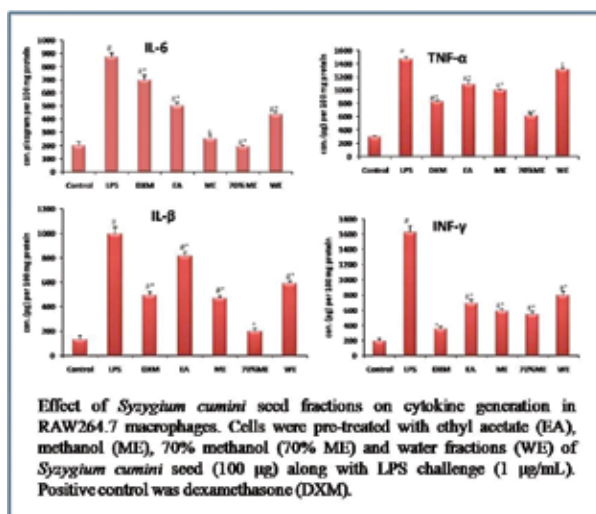
Adipocyte differentiation plays a pivotal role in maintaining the production of small-size adipocytes with insulin sensitivity, and impaired adipogenesis is implicated in insulin resistance. Indole functionalized zerumbone (ZI-OH), a phytochemical component of Zingiber zerumbet possesses diverse biological properties such as anti-inflammatory, antidiabetic, and antitumor. In the present study, we investigated the effects of ZI-OH on adipocyte differentiation. ZI-OH promoted lipid accumulation in 3T3-L1 cells, upregulated both peroxisome proliferator-activated receptor (PPAR)- γ



protein expression, and acted as a ligand for PPAR γ in competitive binding and fluorescent polarization assay. Moreover, Zi-OH increased the mRNA and protein expression levels of adiponectin. Additionally, it promoted insulin-dependent glucose uptake into 3T3-L1 adipocytes and increased Akt phosphorylation and glucose transporter (GLUT) 4 protein expression. In summary, these findings suggest that Zi-OH, which promoted adipogenesis and insulin sensitivity in 3T3-L1 cells, might be a phytochemical with potent anti-diabetic effects.

Syzygium cumini seed attenuates LPS induced inflammatory response in murine macrophage cell line RAW264.7 through NF- κ B translocation

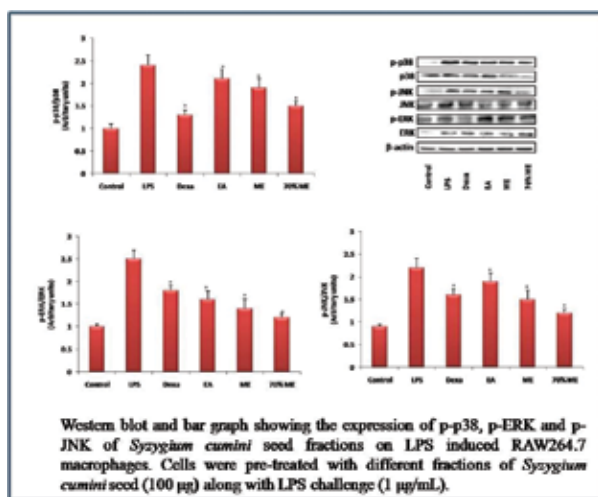
The anti-inflammatory activity of *Syzygium cumini* seeds using lipopolysaccharide (LPS) stimulated RAW264.7 cells was investigated. Our study focused on anti-inflammatory effects of *Syzygium cumini* seeds through the modulation of key inflammatory mediators, such as, expression of pro-inflammatory molecules like cyclooxygenase (COX), lipoxygenase (LOX), inducible nitric oxide synthase (iNOS), tumor necrosis factor- α (TNF- α), interleukin-1 β (IL-1 β), interleukin-10 (IL-10), interleukin-6 (IL-6) and interferon- γ (INF- γ). Moreover, we also monitored the signaling pathways including nuclear factor- κ B (NF- κ B), mitogen-activated protein kinases (MAPKs), extra cellular signal-regulated kinase (ERK), Jun N-terminus kinase (JNK), p38, to explicate the mechanism of action of *Syzygium cumini* seeds in LPS induced macrophages.



Syzygium cumini seeds effectively reduced the production of nitric oxide (NO) and pro-inflammatory cytokines (IL-6, IL-10, INF- γ , IL- β , TNF- α). *Syzygium cumini* fractions also inhibited LPS-activated LOX and reduced the levels of iNOS and COX-2 mRNA expression in murine macrophages. These effects were mediated by impaired translocation of nuclear factor (NF)- κ B and inhibition of the phosphorylation of JNK, ERK and p38 in LPS-stimulated RAW264.7 cells. This study gives scientific evidence that *Syzygium cumini* seeds inhibits the LPS-induced expression of inflammatory mediators via suppression of JNK, ERK and p38 mediated NF- κ B pathway as well as down regulation of iNOS and COX-2.

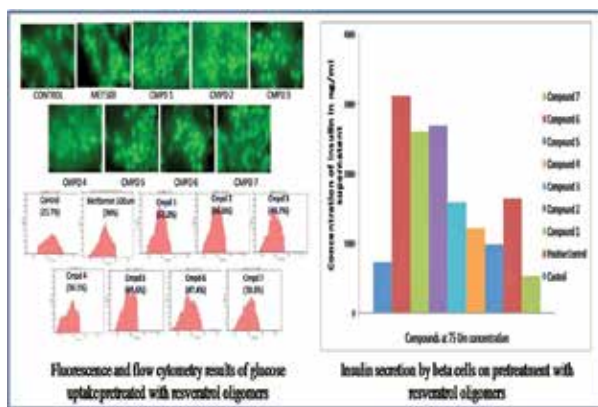
Evaluation of hypoglycemic potential of resveratrol based compounds from Dipterocarpaceae family for stimulated glucose uptake in skeletal muscle cell lines and ER stress induced generation of beta cells

Diabetes mellitus is characterized by chronic hyperglycemia due to insulin resistance and defect in insulin secretion and/or insulin action caused by Langerhans islets' β -cell failure. This disease is one of the most important worldwide health problems that show an increasing prevalence. According to the International Diabetes Federation's (IDF) report there are approximately 381 million diabetic patients worldwide, a figure that expects to rise to 592 million by 2035. The current therapies for type 2 diabetes include mainly oral antidiabetic drugs, which are used as monotherapy or in combination. However, these oral agents have many undesirable side effects and ultimately cannot control the glycemic level. Therefore, safer and more effective antidiabetic drugs are still urgently needed. Traditional medicines derived from medicinal plants are used by about 60% of the world's population. There are various approaches to reduce the ill effects of diabetes and its secondary complications. Dependence on natural products for managing diabetes mellitus is increasing due to its easy availability and low cost with often wrongly perceived reduced toxicity. Polyphenols, constituting oligomers of resveratrol ranging from dimer to octamer are found abundantly in plants belonging to Vitaceae, Dipterocarpaceae, Leguminosae and Cyperaceae families. The biological activities such



as anti-bacterial, anti-HIV, anti-inflammatory, anti-proliferative property makes resveratrol a potential drug candidate. The evaluation of the mechanism underlying the biological activities of resveratrol oligomers would provide a substantial clue in the development of new drug leads. It is evident from the literature that resveratrols are also accountable for antidiabetic activity and the recent works by Sharma et al. proved the efficacy of resveratrol as an effective therapeutic adjuvant for diabetes mellitus.

Herein, we had screened about seven resveratrol oligomers isolated from different plants belonging to the Dipterocarpaceae family for its antidiabetic efficiency. The present study explored the antidiabetic activity of these resveratrol oligomers in rat skeletal L6 cell lines and a mouse beta insulinoma cell line (βTC6). The results found that these oligomers can act as potent antidiabetic agents in skeletal cell lines as well as in beta cell lines. Further, molecular studies to elucidate the mechanistic role of these compounds are in progress.

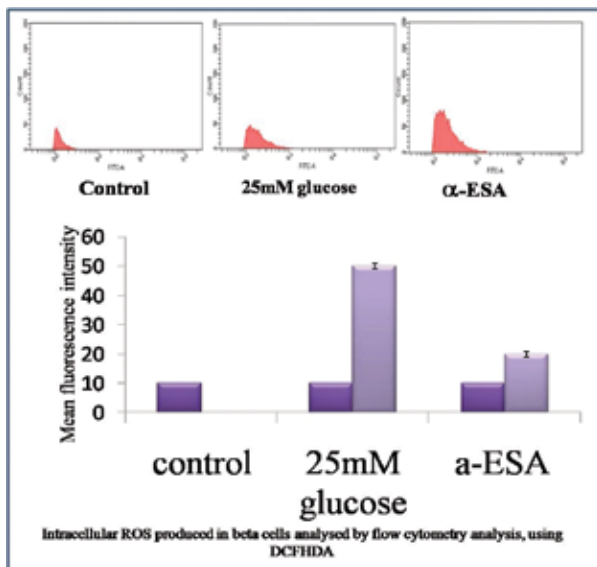


Investigation of the modulatory effect of active compounds in *Momordica charantia* Linn on pancreatic beta cell autophagy and its associated implications in the management of Type 2 diabetes mellitus

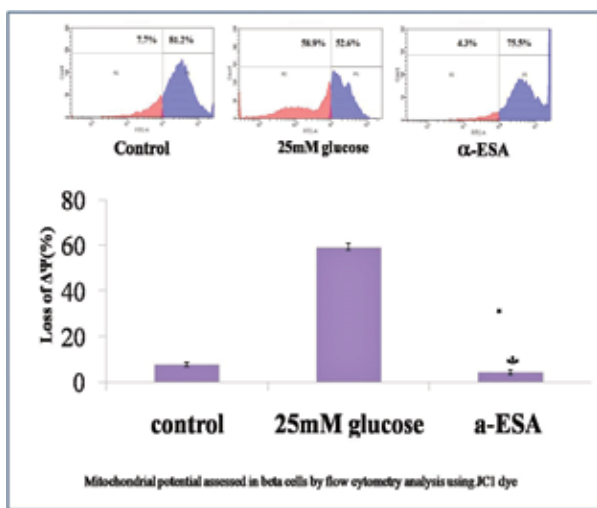
Type 2 diabetes mellitus is characterized by insulin resistance and failure of pancreatic β-cells producing insulin. Recent findings suggest that ER stress act as a pathological component of both type 1 and type 2 diabetes and results in β cell apoptosis/ loss. One form of physiological stress, which leads to ER stress, occurs when these cells are exposed to high glucose. Under high glucose conditions, increased insulin biosynthesis can overwhelm the ER folding capacity, causing an imbalance in homeostasis and leading to ER stress. Chronically elevated ER stress, therefore, may also play a role in glucose toxicity which contributes to potentially irreversible β cell damage/apoptosis leading to diabetes.

Pancreatic autophagy plays an important role in the pathogenesis of insulin resistance and maintaining pancreatic beta cell function can be considered as a strategical approach for the prevention and treatment of diabetes. *Momordica charantia* is a popular fruit used as an agent to treat DM. Experimental studies suggested that the vegetable has a role in glycaemic control. However, the exact mechanism of *M. charantia* is unknown. Phytochemical analysis had shown that fruit contains certain active compounds like momordin, charantin, polypeptide -P and seed fat contains eleostearic acid (αESA) which have an industrial value. The active components of *M. charantia* are reported to have antidiabetic effect and have a potency to induce autophagy. However to date there is no reports showing the efficacy of these bioactives in inducing autophagy in β-cells. The present study analyzed the role of active compounds of *M. charantia* in the amelioration of β cell ER stress and associated autophagy process in the management of diabetes. MTT assay was carried out to check the toxicity of αESA in beta TC6 cells. Flow cytometry analysis was carried out to examine the oxidative stress, mitochondrial potential and apoptotic profile of the cells. Western blot analysis was carried out to confirm the involvement of autophagy markers, LC3-I & II.

By examining the efficacy of α ESA in inducing autophagy in beta cells, it was found that it can ameliorate oxidative stress in beta cells induced by hyperglycemic stress.

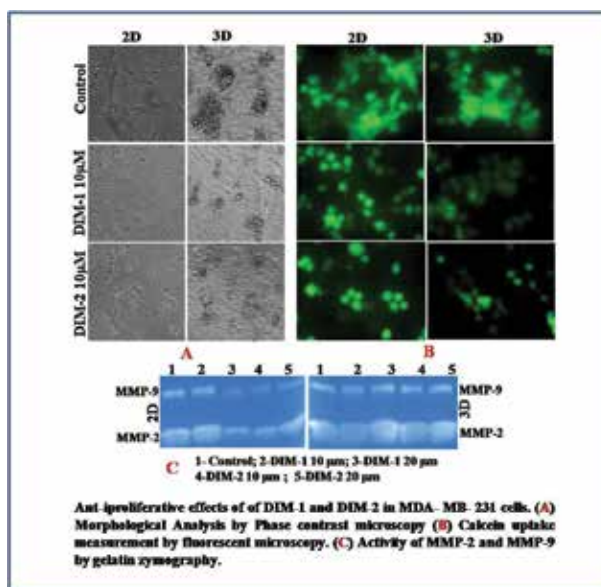


The bioactive is found to have a potential in maintaining the mitochondrial membrane potential in cells and also have the capacity to inhibit apoptosis induced by hyperglycemia in beta cells. Moreover it was found that α ESA can activate autophagy markers expression in beta cells. This study confirms the potential of α ESA in inhibiting apoptosis and its associated events in beta cells thus to protect the cells from hyperglycemic stimuli. This study unravels the protective effect of aESA from hyperglycemia induced apoptotic effects in pancreatic beta cells, showing its efficacy for therapeutic approaches.



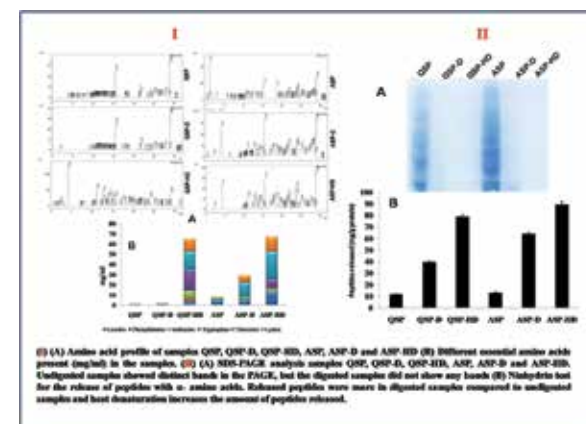
Biaryl derivatives of diindolyl methane induced apoptosis in triple negative metastatic breast cancer cells in 2D and 3D culture condition

Three dimensional culture systems are widely used in drug discovery due to their ability to provide physiologically relevant data which can be translated to in vivo conditions. Three dimensional cancer cell culture models are used for preclinical studies to validate the drug molecule and studying the physiological response. Diindolyl methanes are the degradation products of indole 3 carbinols, the main pharmacological scaffold present in cruciferous vegetables. The cellular response of the biological effects of cruciferous vegetables is attributed to the diindolyl methanes. Here we have studied two DIM derivatives (DIM-1 and DIM-2) for the anticancer potential in triple negative breast cancer cells (MDA-MB-231). From the studies we have observed that the compounds exerted cytotoxicity, significant alteration in cell morphology and reduced uptake of calcein in 2D as well as 3D culture conditions. The activity of caspase 3, expression of Bax and cleaved PARP are increased in 2D and 3D models on treatment with DIM-1 and 2. But the production of MMP-2 and 9 decreased in 2D models on treatment with DIM-1 and DIM-2, but did not change in 3D model. This may be due to the effective interactions of cells with the extracellular matrix in 3D condition compared to 2D condition.



Quinoa and Amaranth seed protein upon simulated digestion after heat denaturation released more essential amino acids and bioactive peptides with antioxidant and anti-inflammatory properties

Pseudocereals are the seeds produced by non-grass family plants which are consumed as grains. They are gluten free and contain a high amount of proteins, making them forefront among cereals in the food industry. Dietary proteins are the source of essential amino acids and the protein denaturation and digestibility are the main determinants of protein quality. In the present study, we have isolated the proteins from the pseudocereals quinoa and amaranth seeds. Simulated digestion was done in raw and heat denatured proteins and compared the digestibility, essential amino acid release, antioxidant and anti-inflammatory activities in vitro. Simulated digestion under controlled condition increased the release of bioactive peptides and essential amino acids from the protein samples when it is heat denatured. Total antioxidant activity and free radical scavenging



activity of the peptides released were also significant in the heat denatured and subsequent digested samples. The in vitro anti-inflammatory activities like inhibition of albumin denaturation and trypsin action were also found to be more in the digested protein samples after heat denaturation. In conclusion, quinoa and amaranth are good source of dietary protein rich in many of the essential amino acids, easily digestible and the digested peptides have good antioxidant and anti-inflammatory activity.

माइक्रोबियल प्रक्रिया तथा प्रौद्योगिकी प्रभाग

माइक्रोबियल प्रक्रिया तथा प्रौद्योगिकी प्रभाग (एमपीटीडी) का जनादेश जैव प्रौद्योगिकी के विशिष्ट अग्रणी क्षेत्रों में उच्च गुणवत्ता वाले अनुसंधान एवं विकास का संचालन करना है। पर्यावरणीय स्थिरता सुनिश्चित करते हुए क्षेत्रीय जैव स्रोतों की खोज और मूल्यवर्धन में महत्वपूर्ण जोर दिया जाता है। राष्ट्रीय और अंतर्राष्ट्रीय संगठनों के साथ नेटवर्किंग के माध्यम से प्रभाग की अनुसंधान एवं विकास तथा औद्योगिक परामर्श गतिविधियां राष्ट्रीय महत्व के कार्यक्रमों से जुड़े हुए हैं। माइक्रोबियल संसाधनों की खोज और दोहन करके जैव प्रक्रियाओं और उत्पाद विकास के केंद्रित क्षेत्रों के अनुसंधान में प्रभाग सक्रिय रूप से शामिल है। अनुसंधान के वर्तमान ध्यान केंद्रित क्षेत्रों में शामिल हैं i) औद्योगिक एंजाइम और मूल्यवर्धित रसायनों (ii) जैव ईंधन और बायोरिफाइनरी (iii) जैव सक्रिय अणु (iv) स्वास्थ्य और जीनोमिक्स (v) पादप सूक्ष्मजीव इंटरैक्शन और (vi) प्रोबायोटिक और एल्गल न्यूट्रास्यूटिकल्स। दूसरी पीढ़ी बायोइथेनॉल पर विशेष अनुसंधान एवं विकास के लिए प्रभाग में एक समर्पित "जैव ईंधन केंद्र" है। लिमोसेल्युलॉसिक बायोइथेनॉल के उत्पादन का पायलट संयंत्र, अब ओन-साइट ठोस-अवस्था किण्वन एंजाइम उत्पादन पायलट संयंत्र से समर्थित है, जो लागत प्रभावकता और हैडलिंग के लिए बेहतर अवसर प्रदान करता है। प्रभाग के आर एंड डी में विभिन्न माइक्रोबियल बायोप्रोसेस के विकास शामिल हैं और किण्वन प्रौद्योगिकी पर तथा प्रोबायोटिक, जैव-कीटनाशकों और जैव उर्वरक आदि के लिए माइक्रोबियल फॉर्मूलेशन पर काम करने के लिए मजबूत उद्योग संबंध भी है।

हाइलाइट

- जलीय दो चरण निष्कर्षण का उपयोग कर 90% शुद्धता के साथ किण्वित शोरबा से 1, 3- प्रोपैनडियोल का अलगाव और शुद्धीकरण
- स्ट्रेप्टोमाइजिस अल्बिडोफ्लुवस से कैराटीनस जीन को क्लोन किया गया और ईकोलाई में अभिव्यक्त किया गया। एंजाइम उत्पादन में 20 गुना सुधार के साथ कैराटीनस उत्पादन प्रक्रिया अनुकूलित की गयी
- समुद्री सूक्ष्मजीव नन्नोक्लोरोप्सिस ओश्यानिका में प्लांट ग्रोथ रेगुलेटर (पीजीआर) के मॉड्युलेशन द्वारा ओमेगा 3 फैटी एसिड, ईपीए के स्तर को बढ़ाने के लिए एक बायोप्रोसेस विकसित की। इसके बाद, एक वाणिज्यिक फर्म, अबान जैव प्रौद्योगिकी में 1000 लीटर्स का स्केल अप अध्ययन शुरू किया गया
- सेलेनोप्रोटीन टी (एसईएलटी) जीन की भविष्यवाणी की गई और नन्नोक्लोरोप्सिस ओश्यानिका सीएसएससीसी 201 से इसके अनुक्रमों की पुष्टि की गयी
- समुद्री सूक्ष्मजीव नन्नोक्लोरोप्सिस ओश्यानिका में कार्बनिक सेलेनियम सामग्री का संवर्धन किया गया और उत्पादन द्वारा युग्मित प्लाज्मा मास स्पेक्ट्रोमेट्री (आईसीपी- एमएस) द्वारा इसकी पुष्टि की गयी
- कार्यात्मक रूप से स्वतंत्र दो प्लांट ग्रोथ रेगुलेटर, किनेटीन और जीए 3 का नन्नोक्लोरोप्सिस ओश्यानिका सीएसएससीसी 201 में विकास, लिपिड उपज, पीयूएफ और ईपीए संचय पर प्रभाव के लिए व्यक्तिगत रूप से या संयोजन में मूल्यांकन किया गया

- मात्रात्मक पीसीआर द्वारा एसएपी 1 और एसएपी 2 की विभेदक अभिव्यक्ति का अभिलक्षण किया गया। एसएपी 1 और एसएपी 2 की समय सारिणी $\Delta\Delta$ सीटी वक्रविश्लेषण से पता चला कि 48 घंटे के दौरान नाइट्रोजन तनाव प्रेरित नमूने का एलएजीएलआईडीएडीजी होमिंग एंडोन्यूक्लीएज (एलएचई) नाइट्रोजन समृद्ध (नियंत्रण) नमूने से 4.2 गुना ऊंचा था। रिबोसोमल प्रोटीन एल 23 भी विनियमित किया गया और नियंत्रण की तुलना में 6 घंटे के नाइट्रोजन तनाव प्रेरित नमूने में 2.6 गुना वृद्धि देखी गई
- पूर्वोपचार किये मिर्च के फसलोत्तर अवशेषों के एंजाइमेटिक शर्करीकरण के बाद प्राप्त बायोमास हाइड्रोलाइजेट को बायोइथेनॉल, बायोपॉलिमर (पॉली-3-हाइड्रॉक्सीब्यूटिरेंट) और एंजाइम जाइलानेस के उत्पादन के लिए उपयुक्त पाया गया
- “लोकतक झील के फ्लोटिंग बायोमास (फुमडीस) का मूल्यवर्धन” नामक परियोजना के तहत बायोइथेनॉल उत्पादन के लिए बायोमास के गीले प्रसंस्करण को प्रयोगशाला पैमाने पर प्रदर्शित किया गया
- बायोमास हाइड्रोलाइजिंग एंजाइमों के उत्पादन का प्रारंभिक लागत विश्लेषण किया गया और सेल्युलेज और बीटा ग्लूकोसिडेस दोनों के लिए प्रतिस्पर्धी मूल्यों का संकेत दिया
- 16 एस आरआरएनए अनुक्रमण और पॉलीफासिक वर्गीकरण के आधार पर, एक नूतन पादप फायदेमंद *फ्लैवोबैक्टेरियम* उपभेदों की पहचान की और इसका नाम *फ्लैवोबैक्टेरियम पोक्काली स्पीसीज नव.* के रूप में प्रस्तावित किया
- संभावित जीवाणुरोधी और कैंसर विरोधी गतिविधि के साथ शक्तिशाली नूतन हेलोफिलिक एक्टिनोमाइसेज की पहली बार पहचान की गई
- एक नूतन पादप फायदेमंद स्फिनामोनस का संपूर्ण ड्राफ्ट जीनोम अनुक्रम पूरा किया गया

MICROBIAL PROCESSES AND TECHNOLOGY DIVISION (MPTD)

The mandate of the Microbial processes and Technology Division (MPTD) division is to conduct high quality R & D in specific frontier areas of Biotechnology. Significant emphasis is put in 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. The division is actively involved in research in the focussed areas for bioprocesses and products development by exploring and exploiting the microbial resources. The current focus of research are in the areas of i) Industrial enzymes and value added chemicals ii) Biofuels and biorefinary (iii) bioactive molecules iv) Health and genomics (v) plant microbe interactions and (vi) probiotic and algal nutraceuticals. The Division has a dedicated “Centre for Biofuels” for exclusive R&D on 2nd generation bioethanol. The pilot plant for the production of lignocellulosic bioethanol is now supported by on-site solid-state fermentation enzymes production pilot plant, bringing better cost-effective and handling opportunities. The Division is involved in R & D on developing different microbial bioprocess and has strong industry linkages to work on fermentation technology, microbial formulation for probiotic, biopesticides and biofertilizers etc.

Highlights

- 1,3-Propanediol was separated and purified from the fermented broth with 90% purity using aqueous two phase extraction.
- Keratinase gene from *Streptomyces albidoflavus* was cloned and expressed in *E coli*. Keratinase production process was optimized with 20-fold improvement in yield of the enzyme
- Developed a bioprocess to enhance the level of essential omega3 fatty acid, EPA in marine microalga *Nannochloropsis oceanica* by modulating the plant growth regulators. Subsequently, a scale up study of 1000 L was initiated at ABAN biotechnology, a commercial firm.
- Selenoprotein T (SelT) gene was predicted and its sequences confirmed from *Nannochloropsis oceanica* CAS CC201.
- Enriched the organic selenium content in marine microalgae *Nannochloropsis oceanica* and confirmed by Inductively Coupled Plasma Mass Spectrometry (ICP-MS).
- Two functionally independent plant growth regulators Kinetin and GA3 was evaluated individually or in combination for its effect on growth, lipid yield, PUFAs and EPA accumulation in *Nannochloropsis oceanica* CASA CC201.

- The differential expression of SAP1 and SAP2 were characterized by quantitative PCR. The time course $\Delta\Delta C_t$ curve analysis of SAP1 and SAP2 revealed that LAGLIDADG Homing Endonuclease (LHE) was 4.2 fold elevated during 48 hours of nitrogen stress induced samples than nitrogen rich (control) samples. Ribosomal protein L23 was also up regulated and 2.6 fold increment was observed at 6 hours of nitrogen stress induced samples compared to control.
- Biomass hydrolysate obtained after enzymatic saccharification of pretreated chili post-harvest residue was found to be suitable for the production of bioethanol, biopolymer (poly-3-hydroxybutyrate) and enzyme xylanases .
- Wet processing of biomass for bioethanol production was demonstrated at lab scale under the project on value addition of Loktak lake floating biomass (Phumdis).
- Preliminary cost analyses of the production of biomass hydrolyzing enzymes was performed which indicated competitive values for both cellulase and beta glucosidase.
- Based on the 16S rRNA sequencing and polyphasic taxonomy, identified a novel plant beneficial *Flavobacterium* strain and proposed its name as *Flavobacterium pokkali* sp nov.
- Potential novel halophilic actinomycetes with potent antibacterial and anticancer activity were identified for the first time.
- Whole draft genome sequence of a novel plant beneficial *Sphingomonas* was completed

Report On R&D Activities

1. Bio-Processes And Products Development

1.1. Industrial enzymes

1.1.1. Production of Keratinase using *Streptomyces albidoflavus* and whole genome sequencing of the actinomycete

As part of the DBT funded project with JNTBGRI on Keratinase enzyme production from *Streptomyces albidoflavus*, optimizations of the process parameters for production of the enzyme was continued and there was a 20-fold improvement in the yield of keratinase through solid state fermentation (Fig. 1).

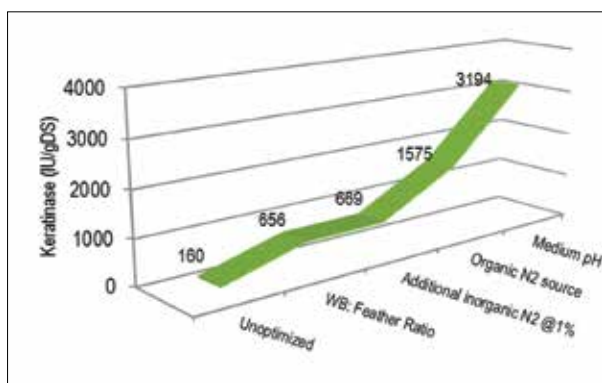


Fig 1: Improvement in Keratinase production by *S. albidoflavus* by process optimization

Whole genome shotgun sequencing of the organism was performed by NGS and the sequence was deposited in NCBI with accession No. PIBK00000000.1. Since Keratinase is a serine protease, the genome of *S. albidoflavus* was analysed for serine protease genes and among the 13 short listed genes, “ctg7180000009487_orf00002_822_1904”, (Named as Salb_S13A5_ker) which

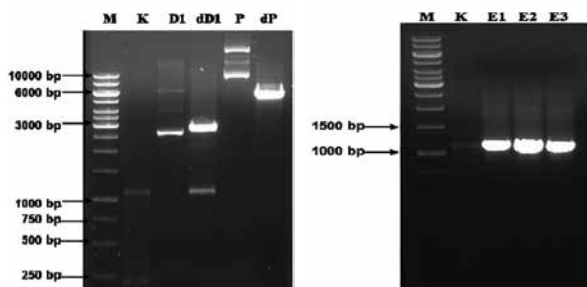


Fig 2: Confirmation of Keratinase gene amplification and cloning

showed the highest level of similarity with a serine protease from *S. albidoflavus* Fea-10 was selected for further studies. The gene was cloned in PET28A expression vector and was expressed from *E. coli*. Clones expressing the gene were selected by screening on gelatin plates and 5 clones among the 16 was found to be positive. (Fig 2)

Agarose gel electrophoresis of double digested recombinant pTZ57R/T and pET28a+, compared with undigested plasmids and PCR amplified Salb_S13A5_ker

Agarose gel electrophoresis of plasmids isolated from colonies 7, 13 and 15, amplified using gene-specific forward and reverse primers

- M : 1kb DNA ladder
- K : Salb_S13A5_ker (1083 bp)
- D1 : Recombinant pTZ57R/T with Salb_S13A5_ker
- dD1 : Double digested D1 plasmid
- P : pET28a+ (5369 bp)
- dP : Double digested pET28a+M : 1kb DNA ladder
- K : Salb_S13A5_ker (1083 bp)
- E1-E3 : Amplicons of keratinase gene using specific primers from clones E7, E13 and E15

The amplicons were sequenced to confirm identify.

>7PETF_F01.ab1

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AAGGAGATATACCATGGGCAGCAGCCATCATCATCAAC
ATCACAGCAGCGCCTGGTCCGCGCGGCAGCCATATGGCCA
RCATGACTGGTGGACAGCAAATGGGTTCGCGGATCCGAAT
TCGTGAACCACCGACGCATACCCAAACGGCGGGTCCCGTG
ACCGGTGCCGGCATCGCCGCACTGGTTCGCCGCCGGGCT
GACGTTCCAGACGGCAACGCCAGCAGCCGAGAGCGCCGA
ACCGCGACCCTCTCGGTGCCTCCGCGGGCAAGCTCGC}
CGACACCCTCGCGGTGACCTCGGCAAGGCGCCGCCGGGA
CGTACTACGACGCCAAGGCGAAGAACCTGGTGGTGAACG
TCCTCGACGAGGCCGCCACCAGGTCGAGGCGTCCGGT
GCCCAGGCCAGAATCGTTCGAGCACTCCCTCACCGCGCTG
AACGACGCCCGGCCACCCTCAAGGACCGGCCAGCATCGC
GGGCACCTCGTGGGCGATCGACCCGACCAGCAACAAGGTCGT
CGTACC GCCGACCGCACGGTTCGAGGGCAAGGAGCTGG
CGAAGCTCACCAAGGTGGTGGACGCGCTCGGTTCCAAG
GCCGAACCTCAAGCAGACCAAGGGTGAAGTTCAGCGGTTTCATC
GCGGGTGGCGACGCCATCCACGGTTCGCGCGGCCGCTG
CTCCCTCGGCTTCAAGTGGTGAAGGCGCGGAGCCGTACTT
```

CCTCACCGCCGGTCACTGCACCGAGGGCATCTCCAGCTG
 GTCCGAGACTCGGGCGGTTTCGGAGATCGGCACCACGGTCC
 AGTCAACTTCCCCGGCGACGACTACGGGCTGGTCCAG
 TACACCGGCTCCACCGAGACCCACGCGAGGTGAACCTGTAC

Assay for keratinase activity were conducted for the culture extracts of positive clones to confirm the identity of cloned protease as keratinase (Fig 3)

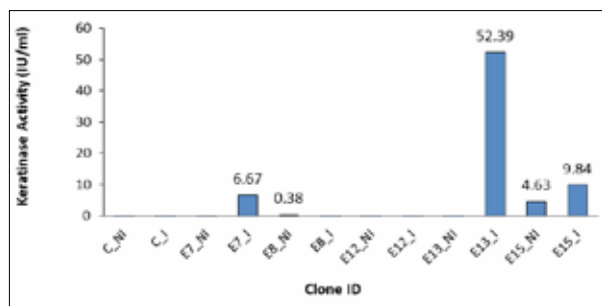


Fig 3: Confirmation of Salb_S13A5_ker protein expression by transformed colonies

1.1.2. Microbial Lipase

Lipases find applications in a variety of biotechnological fields such as food and dairy industries, detergent, agrochemical and oleo chemical industries. A newly isolated lipase producing cultures identified as *Pseudomonas guariconesis* was capable of hydrolyzing substrates like castor oil with an initial activity of 22 IU/ml determined by pNPP assay (Fig.4.). Further process parameter optimizations were in progress.

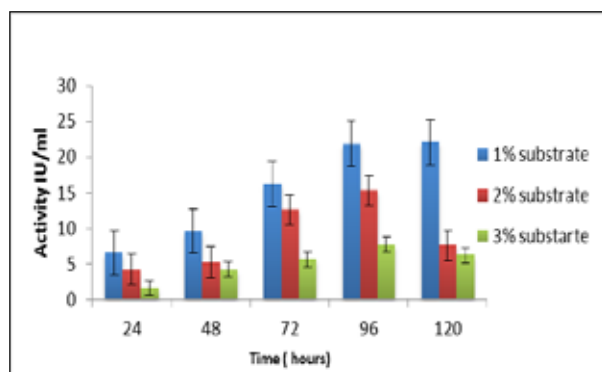


Fig 4. Lipase production by *Pseudomonas guariconesis*

1.1.3. Biomass hydrolyzing enzymes

1.1.3.1. Preliminary Cost Analyses of Biomass Hydrolyzing Enzymes

NIIST 2G ethanol process uses multiple enzyme sources and the in-house enzyme production is accomplished

using a filamentous fungus *Penicillium janthinellum*. Solid state fermentation process was used for production of enzymes and *P. janthinellum cellulase* production trials were conducted in production scale trays (each 1kg moldy bran capacity) to a maximum level of 20 kg in SSF pilot plant. Optimized conditions gave an average yield of 40-45 IU/gDS for cellulase. Based on above, and the cost for individual unit operations, a preliminary cost of production for cellulase was calculated. The estimate cost of production was ~Rs 246 Rs /Kg (60000 FPU) of enzyme. Interestingly, the highest cost factor for medium including its sterilization was contributed by the cost of cellulose. Of the total cost of Rs 59.86 Rs/Tray (kg), the cost of cellulose alone was Rs 50 (~84%). So any replacement for pure cellulose as inducer would make a tremendous impact on reducing the cost of medium.

Scaling up of Beta glucosidase (BGL) production from *Aspergillus niger*

BGL is a critical component in biomass hydrolyzing enzymes it aids in improving the efficiency of biomass hydrolyzing enzymes. NIIST was initially sanctioned an FTT project for scaling up BGL production and to develop a technology for production of this enzyme using solid state (SSF) and submerged fermentation (SmF) technologies. During the first year of the project, the production was improving ~3fold from 80 IU/gDS to 240IU/gDS and process was demonstrated at semi-pilot scale (50g capacity) trays. The experiments were extended to full scale trays (1kg capacity) and trials were conducted in the SSF pilot plant (Fig 5). Yield of enzyme was 150 IU/gDS which was lower than what was obtained in lab scale trials. Parameters specific to production scale trials (eg Bed height, relative humidity) are now being optimized to increase the yield.



BGL production in production scale trays (Day 0)

BGL production in production scale trays (Day 5)

Fig 5: BGL production in Pilot scale

Submerged fermentation production of the enzyme was also attempted in both shake flasks and in small capacity fermenters. While the enzyme yield in shake flasks were ~3.6 IU/ml on days 6 and 7, the yields obtained in fermenter were lower at a maximum of ~2 IU/ml (Fig 6). This is mostly due to aggregation of mycelia on baffles resulting in dead zones and the process is now being optimized to improve yields.

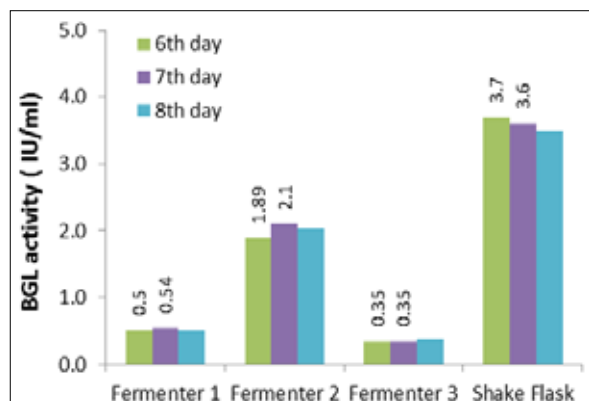


Fig. 6 a. BGL production under SmF



Fig. 6 b. SmF Production of BGL, fermenter trials

1.2 Biopolymers and Biosurfactants

1.2.1. Purification of 1, 3-propanediol from the fermented broth using aqueous two phase systems

An aqueous two phase extraction using K_2CO_3 : K_2HPO_4 /Isopropanol was investigated for the recovery of 1,3-propanediol from the fermented broth (Fig.7). Initially, the concentration of K_2CO_3 on phase formation, the partition co-efficient and recovery of 1,3-PDO was evaluated with a optimum salt concentration of 60%.

Later the partition co-efficient was improved using dual inorganic salts, K_2CO_3 and K_2HPO_4 with an optimum concentration of 45% and 15% respectively. Using Central Composite Design, pH and temperature on partition and recovery of 1,3-PDO was evaluated. With the optimized physical conditions and inorganic salts concentration, ATPS extraction was carried out in synthetic solution as well as fermented broth resulting in maximum 1,3-PDO partition co-efficient value of 42.46 and 56.93 and recovery yield of 97.69 and 98.27% respectively. A fair partition was observed with organic acids and 1,3-PDO, with removal of lactic acid and acetic acid up to 93.29 and 90.42 % respectively.

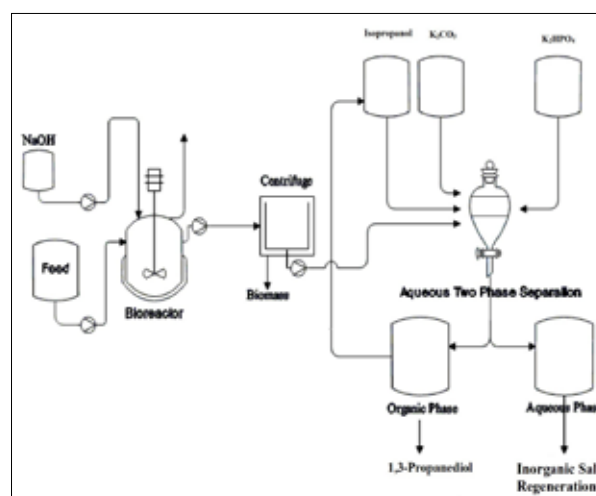


Fig 7: Schematic representation of fermented broth obtained from the upstream process and aqueous two phase extraction of 1,3-propanediol using K_2CO_3 + K_2HPO_4 /Isopropanol system

1.2.2. Whole cell based biocatalytic production of 2,5 furan dicarboxylic acid

2,5-furandicarboxylic acid (FDCA), is a valuable hydroxymethyl furan derivative which is reported as one of the top 12 green chemicals for the future by the US Department of energy. This valuable building block monomer is combined with mono-ethylene glycol and the polymer obtained through the esterification process is known as polyethylene furanoate (PEF). Polyethylene furanoate polymer can be used as analogs of petroleum based products such as polyethylene terephthalate (PET) and polybutylene terephthalate (PBT). So the FDCA based PEF can reduce the dependence of nonrenewable



Unlike conventional process of pretreatment where dried and milled biomass samples are used for pretreatment, the project required processing of wet biomass, since drying (even sun-drying) may not be a feasible option at Loktak, as the days with good sunlight may be lesser. The WPB was therefore subjected to wet grinding for size reduction and biomass loadings for pretreatment were adjusted calculating for the water content (Fig 11). The WPB slurry was subjected to dilute acid and alkali pretreatment following standard conditions established at NIIST.

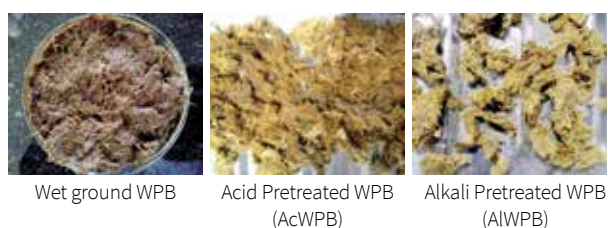


Fig 11: Wet ground and pretreated phumdi biomass

Analysis of the biochemical composition was performed by NREL methods and the carbohydrate content in biomass was established (Table 1)

Table 1: Composition of native and pretreated WPB

Component ↓/ Sample →	Native	Acid	Alkali
Cellulose %	34.82	42.37	57.04
Hemicellulose %	18.58	13.24	23.51
Lignin %	32.01	37.32	24.82
Ash %	3.90	2.05	0.37
Total %	89.31	94.98	105.74

The native mixed phumdi biomass had a high lignin content of 32% whereas the cellulose and hemicelluloses content was ~35% and 19% respectively. While acid pretreatment removed about 29% of hemicelluloses, the lignin removal as expected was low. For alkali pretreatment ~22% of lignin was removed.

Hydrolysis of the acid and alkali pretreated WPB was carried out in screw capped flasks in a total volume of 20ml with a biomass loading of 10% and enzyme loading of 20 FPU/g dry weight of pretreated biomass at 50 °C with shaking (100rpm) in a shaking water bath. Samples were withdrawn 0, 12, 24, 36 and 60hrs and were analyzed for total reducing sugars (TRS) by DNS method (Miller et al, 1959). The reaction conditions and sugar yields were as given in Table 2.

Table 2: Hydrolysis of pretreated WPB and efficiencies attained

Reaction Component/ Condition	Acid Pretreated WPB	Alkali Pretreated WPB
Biomass (g)	2.23 (2g dry wt)	2.26 (2g dry wt)
1M Citrate buffer stock PH 4.8 (ml)	1	1
Tween 80 (µl)	100	100
Antibiotic Solution (µl)	200	200
Enzyme (Zytex Cellulase 62FPU/ml)	650 (20FPU/g)	650 (20FPU/g)
Water (ml)	15.83	15.79
Total Volume (ml)	20	20
Total Reducing Sugars @ 36h (TRS) (mg/ml)	28.3	63.98
Total Reducing Sugars @36h (TRS) (mg/g)	283	639.8
Theoretical Maximum Sugar Yield (mg/g)	618.6	896.5
Efficiency (% of Theor. Max)	45.75	71.37

The study indicated that alkali pretreatment is better for wet phumdi biomass as it gave higher conversion efficiency.

2.3. Comparison of different alternative strategies for pretreatment of chili post harvest residue

Among the different alternative strategies of pretreatment of chili post harvest residue, sono-assisted acid pretreatment gave the better reducing sugar yield (0.465 g/g). Biomass hydrolysate obtained after enzymatic saccharification of pretreated chili post-harvest residue was found to be suitable for the production of bioethanol, biopolymer (poly-3-hydroxybutyrate) and xylanases. Table 3 gives an overview of the optimum conditions of different alternative strategies of pretreatment developed for chili post-harvest residue.

Table 3. Pretreatment of Chili Post Harvest Residue (CPHR)

Pretreatment type	Pretreatment conditions	Reducing Sugar Yield (g/g)	Reference
Surfactant – Ssisted Transition Metal Pretreatment (SATMP CPHR)	BL – 5% w/w Surfactant Conc. – 2% w/w FeSO ₄ Conc. – 2% w/w PT time – 20 min	0.245	Sindhu <i>et al.</i> , Journal of Energy and Environmental Sustainability 2017
Crude glycerol assisted surfactant pretreatment (CGASP CPHR)	BL – 25% w/w Surfactant Conc. – 4.5% w/w CG Conc. – 0.55% w/w PT time – 60 min	0.459	Sindhu <i>et al.</i> , Biofuels 2017
Sono-assisted acid pretreatment (SAAP CPHR)	BL – 15% w/w US time- 4 min Acid Conc. – 4% w/w PT time – 60 min	0.465	Sindhu <i>et al.</i> , Bioresource Technology 2016
Microwave-assisted surfactant pretreatment (MWASP CPHR)	BL – 5% w/w MW time- 1 min MW Power – 550 W Surfactant Conc. – 4% w/w PT time – 45 min	0.316	Sindhu <i>et al.</i> , Journal of Energy and Environmental Sustainability 2016
Ultrasound-assisted alkali pretreatment (USAAP CPHR)	BL – 15% w/w US time- 5 min Alkali Conc. – 4% w/w PT time – 15min	0.402	Sindhu <i>et al.</i> , Bioresource Technology 2017
Surfactant – assisted hydrothermal pretreatment SAHTP CPHR	BL – 20% w/w Surfactant Conc. – 3% w/w PT time – 30min	0.445	Sindhu <i>et al.</i> , Bioprocess and Biosystems Engineering 2018
Ultrasound assisted hydrothermal pretreatment USAHTP CPHR	BL – 25% w/w US time- 10 min PT time – 45min	0.436	Sindhu <i>et al.</i> , Annals of Agricultural and Crop Sciences 2017

3. Health and Genomics

3.1. Algal nutraceuticals

3.1.1. Biochemical and molecular characterization of nitrogen stress mediated lipid accumulation in *Scenedesmus quadricauda* CASA CC202

- Stress Associated Proteins (SAP) were identified from total protein samples of nitrogen rich and nitrogen stressed *Scenedesmus quadricauda* by MALDI-TOF analysis.
- Nitrogen stress associated proteins were identified as (1) mitochondrial orf151, (2) ribosomal protein L23, (3)

envelope membrane protein (Chloroplast) and (4) ATP synthase β subunit of *Acutodesmus obliquus*.

- SAP1 and SAP2 were confirmed at gene level in *S. quadricauda* as LAGLIDADG Homing Endonuclease (orf 42) and Ribosomal protein L23.
- The differential expression of SAP1 and SAP2 were characterized by quantitative PCR.

The time course $\Delta\Delta Ct$ curve analysis of SAP1 and SAP2 revealed that LAGLIDADG Homing Endonuclease (LHE) was 4.2 fold elevated during 48 hours of nitrogen stress

induced samples than nitrogen rich (control) samples (Fig.12). Ribosomal protein L23 was also up regulated and 2.6 fold increment was observed at 6 hours of nitrogen stress induced samples compared to control.

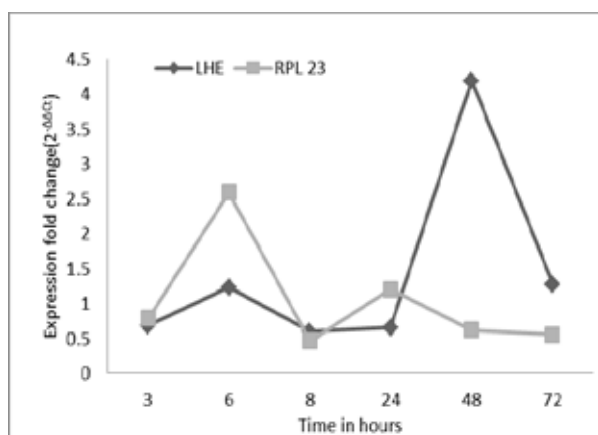


Fig. 12. The time course $\Delta\Delta C_t$ curve analysis of SAP1 and SAP2

3.1.2. Kinetin and GA3 act synergistically to produce Eicosapentaenoic acid (20:5n-3; EPA) in *Nannochloropsis oceanica* CASA CC201

Long chain poly unsaturated fatty acids (LC-PUFAs) including omega 3 and omega 6 fatty acids are a necessary component of the growth of higher eukaryotes. Arachidonic acid (AA, 20:4 ω -6), Eicosapentaenoic acid (EPA, 20:5, ω -3) and Docosahexaenoic acid (DHA, 22:6, ω -3) are the most nutritionally important essential bioactive compounds belonging to omega 3 (n-3) fatty acids. Eicosapentaenoic acid, a typical Omega-3 Polyunsaturated fatty acid (PUFA) which has many beneficial effects for humans and prevention of various human diseases Marine fish and its oil are the major dietary sources of EPA. But fish oil possesses a number of disadvantages like instability, odor, high purification cost, and the presence of environmental contaminants in fish. There are a number of alternative EPA sources like plants, fungi, bacteria and microalgae which are exploited for commercial production.

Microalgae are the primary producers of EPA in the marine ecosystem and fish get these PUFA by consumption of microalgae. Moreover, microalgae can grow fast under different culture conditions with high potential of Omega-3 fatty acid synthesis. There are several biochemical engineering methods used for lipid

induction in microalgae such as nutrient stress including nitrogen stress and phosphorous starvation, combined stress factors, irradiance, high salinity, pH, temperature, exposure to heavy metals and other chemicals, etc. Plant growth regulators are natural or synthetic chemical messengers affecting plant growth and development. These compounds are active at very low concentration even in the picomolar concentration. Marine microalgae as primitive eukaryotic plant cells have a close evolutionary relationship with plants and were often used for the production of high-value products. Microalgae share physiological similarities with higher plants. The physiological role of Plant growth regulators is mainly focused on higher plants. Particular research interests are made on microalgal genus *Nannochloropsis* due to its ability to synthesize omega 3 fatty acids, mainly EPA. In the present research work, major plant growth regulators were used as biochemical agents for the selective enrichment of EPA in marine microalgae *N. oceanica* CASA CC201.

Kinetin (KIN) and gibberellic acid (GA3), functionally different plant growth regulators, were evaluated individually and in combination for their effect on growth, lipid yield, poly unsaturated fatty acids (PUFAs) and eicosapentaenoic acid (EPA) accumulation in *Nannochloropsis oceanica* CASA CC201. It was observed that the treatment of KIN at a concentration of 0.215 ppm resulted in higher cell number (521×10^6 cells per ml) than the control (398×10^6 cells per ml), when compared with GA3, which had an adverse effect on cell number. KIN increases the specific growth rate to 0.24/day and doubling time to 2.86 days than control (4.38 days) (Table 4). Treatment of GA3 at a concentration of 50ppm gives the highest cellular lipid accumulation (61.5% DCW) compared to the control (35.5% DCW). The combination of KIN and GA3 exhibited a synergistic effect on total lipid yield (246.25 mg/L) compared to control (121.5 mg/L). A four-fold increase of EPA was noted due to the addition of KIN as compared to the control.

Table.4. Specific growth rate and doubling time of *N.oceanica* CASA CC201 grown under different concentrations of Kinetin (0.215ppm-1.075ppm), GA3 (10ppm-50ppm) and control.

	Control	Kinetin Concentration (ppm)					GA3 concentration (ppm)				
		0.215	0.43	0.645	0.86	1.075	10	20	30	40	50
Specific growth rate	0.15±0	0.24±0.01***	0.21±0.01**	0.21±0.01**	0.21±0.02**	0.22±0.02*	0.08±0.002***	0.08±0.02***	0.080±0.001***	0.08±0.002***	0.07±0.001***
Doubling time (day)	4.38±0	2.86±0.11***	3.23±0.13**	3.37±0.2**	3.28±0.28**	3.05±0.45*	8.7±0.18***	8.75±0.17***	8.62±0.17***	8.15±0***	9.02±0.05***

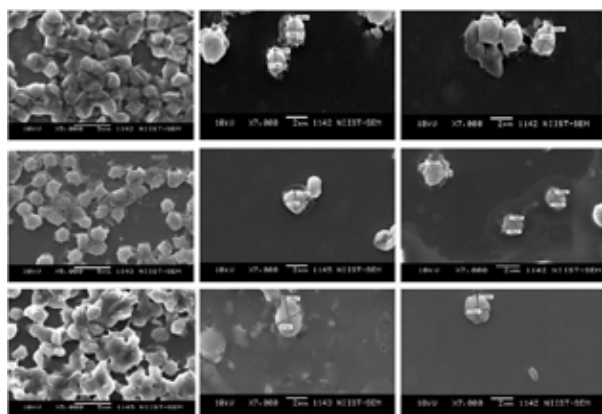


Figure 13: Cell size comparison of *N. oceanica* CASA CC201 after plant growth regulator supplementation. SEM images of *N. oceanica* CASA CC201. (a) Control, (b) Kinetin 0.215 ppm, (c) GA3 10 ppm. SEM images were taken at 5000X and 7000X magnification

3.1.3. Identification of selenoprotein T from *Nannochloropsis oceanica*

Selenium is a trace element and its importance as a micronutrient is realized recently. It executes its biological functions, such as acting as anti-oxidants, mainly through a class of proteins called Selenoproteins, in which Se exists in the form of an unusual amino acid; Selenocysteine (encoded by TGA, the universal stop codon). The main selenoprotein families which are characterized so far are Glutathione peroxidases (GPX1-8, of these 5 are selenium dependent) Iodothyronine Deiodinases and Thioredoxin reductases. Other selenoproteins discovered are SelP, SelH, SelW, SelR/X, SelN, SelS, SelK, SelM, SelT, SelO, SelV etc. The current study is trying to reveal the potential of *Nannochloropsis oceanica*, a marine microalga which is rich in poly unsaturated fatty acids, as source of Selenium enriched microalgal biomass. The present study detected the presence of Selenoprotein T from the whole genome of *Nannochloropsis oceanica* by using a bioinformatic pipeline called Selenoprofiles3, which

specifically predicts the presence of selenoproteins. It also predicted all the proteins those are the parts of the sophisticated machinery involved in the biosynthesis of Selenoproteins. The prediction of SelT was confirmed by PCR amplification and sequencing of a small region (323 bp) of *SelT* gene (Fig. 2). For the production of selenium enriched microalgal biomass, the alga was exposed to different levels of Sodium selenite concentrations. The accumulation of organic selenium in *Nannochloropsis* with respect to addition of inorganic selenium was determined by ICP MS analysis Table 2.

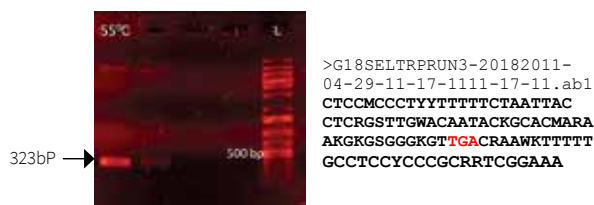


Fig. 14. Gel image showing PCR amplification of an internal region (323 bp) of *SelT* gene with characteristic feature of TGA (encircled) coding for Selenocysteine.

Table 5. Enrichment of Selenium content in *Nannochloropsis* as determined by ICP MS.

<i>Nannochloropsis oceanica</i> CASA CC201	
Control	Enriched
0.108 ppm	460.72 ppm

3.2. Probiotics and nutraceuticals

3.2.1. Exopolysaccharide (EPS) from food grade lactic acid bacteria

Food grade Lactic acid bacteria (LAB) produce a great variety of EPSs with different chemical composition and structure, thus providing useful functional properties in food systems. EPS production from two different isolates were standardized and Fig 15 shows the properties of purified EPS



	
<ul style="list-style-type: none"> • Purified from <i>Lb. Plantarum</i> • Composed of Glucose and mannose residues • Light brown coloured powder • Temperature tolerance up to 225 °C. • Non toxic to normal cell lines • Yield : 2.5-3.5 g/L • Has potential health applications –antioxidant, cholesterol absorbing 	<ul style="list-style-type: none"> • Purified from <i>Weissella confusa</i> • White, Dextran like EPS, composed of glucose • Pseudoplastic behaviour • 1% EPS can prevent nearly 75% syneresis • Temperature tolerance up to 260 °C • Non toxic to normal cell lines • Yield: 16-17 g/L • Can be used in food industry

Fig.15. Comparison of exopolysaccharide (EPS) obtained from two different isolates

3. 2. *Corynebacterium glutamicum* as the cell factory for the production of value added products from lignocellulosic derived sugars

The study targets on the production and scale up of pentonic acids, α,ω diamines and amino acids from lignocellulosic biomass using appropriate recombinant *C. glutamicum* strains. Global environmental concerns and depleting petroleum resources have stimulated the development of renewable bio-based alternatives. *C. glutamicum* is able to co-utilize mixed carbon sources, making it a preferential host for utilization of complex carbon sources such as second generation biomass (plant biomass that does not have any value as food and no or less value as fodder) for the production of commodity chemicals. Xylonic acid is a promising organic acid with important application as a green solvent and effective biocatalyst and precursor for bio plastic and polymer synthesis. The α,ω - diamines and amino acids serves as potential C5 building blocks of the valuable polyamides like nylon. Initiated a research

programs looking at the construction of recombinant *Corynebacterium glutamicum* strains for the production of above said chemicals and work is in progress

3.4. Plant-Microbe Interaction

3.4.1 PGPR tools for improving crop productivity in stressed agricultural systems:

3.4.1a Plant beneficial properties of a novel brackish adapted *Flavobacterium*.

Microbial community compositions in plant roots/ rhizosphere determined by culture dependent methods are often bias, contrary to the abundant bacterial phyla's represented using molecular tools in various microbiome studies. *Flavobacterium* is one such underestimated genus wherein several studies have proved their rhizosphere or root abundance especially during early plant growth stages whereas the cultured based estimations fail to support this findings. In fact, their rich gene reservoir for carbohydrate utilization or breakdown potential is poorly investigated in-vivo, which can open new avenues in plant-microbe interactions. Therefore, to understand the existence and ecology of this less studied genus, we targeted isolating *Flavobacterium* from roots of saline-tolerant rice plant, pokkali grown in brackish water flooded fields. We could isolate novel and diverse members belonging to this genus since 2014 which confirmed the indigenous nature of these novel isolates relative to the adaptation towards brackish conditions where the closest reference strains failed to do so. Among the many novel *Flavobacterium* strains

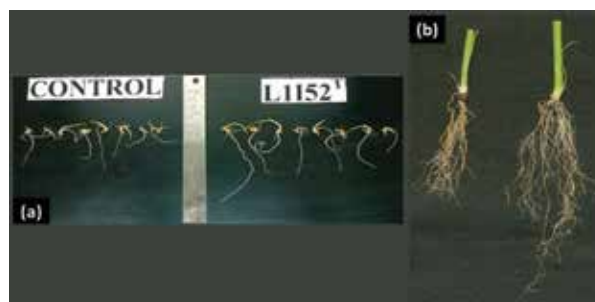


Fig. 16: The positive plant growth effect of L1152T on pokkali rice VTL-2 variety; (a) L1152T treated and untreated pokkali seeds after 7 days of incubation in 0.8% water agar plates, (b) root images showing L1152T treated and untreated seedling roots after 4 weeks of incubation in pots filled with autoclaved soil, (c) table showing plant growth parameters between L1152T treated and untreated plants (n = 24 plants) after 27 days of growth in pots filled with autoclaved paddy soil.

isolated, L1152T (*Flavobacterium pokkali* sp. nov) isolated in 2014 was chosen for in-depth study as it showed positive plant growth effect on young pokkali seedlings as proved through in-planta studies (Fig. 16 (a), (b), (c)). Saline-dependent root attachment behavior of L1152T was found to be an eco-specific trait where the isolate failed to attach in non-saline conditions (Fig. 17 (a), (b)). Further studies are underway to trace the diversity of *Flavobacterium* members in this complex ecosystem and to confirm the molecular factors involved in this unique plant-microbe interaction phenomenon.

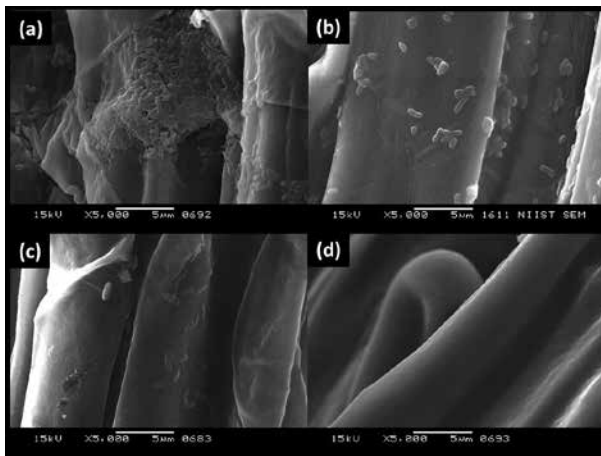


Fig. 17: Scanning electron micrographs showing the root attachment of L1152T in presence of natural seawater after; mild wash (a) and heavy wash (b) and in distilled water after; mild wash (c) and heavy wash (d)

3.4.1b Genome analysis of a novel plant beneficial *Sphingomonas*

A draft genome of a novel plant beneficial *Sphingomonas* was performed to understand its plant associated lifestyle wherein the genomes of plant associated sphingomonas are poorly documented. The draft genome of L3B27 consists of 18 contigs having genome size of 4223965 bp with N50 of 4171419 bp. The average G+C content of the strain L3B27 was 66.18%, a value which falls within the G+C content range of *Sphingomonas* strains. Annotation of the genome using RAST server revealed 3885 protein coding sequences, 52 number of tRNA genes, 3 rRNA operons. The draft genome analysis shows that the genome encode for various genes related to their plant association and brackish adaptation (Fig 1). Chemotaxis, motility and adhesion are the major

primary factors required for the successful colonization of microbes to a plant rhizosphere. The genome contains complete set of flagellar genes required for motility and genes related to chemotaxis, motility observed under microscope prove the functionality of these genes. Adhesion is possibly mediated by a lectin type hemagglutinin and type II secretion system and tight adherence genes. Other challenges faced by a microbe in the rhizosphere environments is ROS produced by the plant and competitors. To survive within the oxidative environment in the rhizosphere, strain L3B27 encode for various genes include superoxide dismutase, catalase and peroxidase. In addition, the strain is positive for catalase test. Some of the plant beneficial functions are also identified through genome analysis and are confirmed by phenotypic characterization as well. Plant growth hormone IAA production is one of the major plant growth promoting trait in PGPR strains and strain L3B27 produces IAA which confirmed by Salkowski assay. In complement, genome analysis revealed the presence of a tryptophan independent IAA production pathway. Volatile compounds acetoin and 2,3-butanediol produced by plant associated bacteria are also known to enhance plant growth. Set of genes required for the production

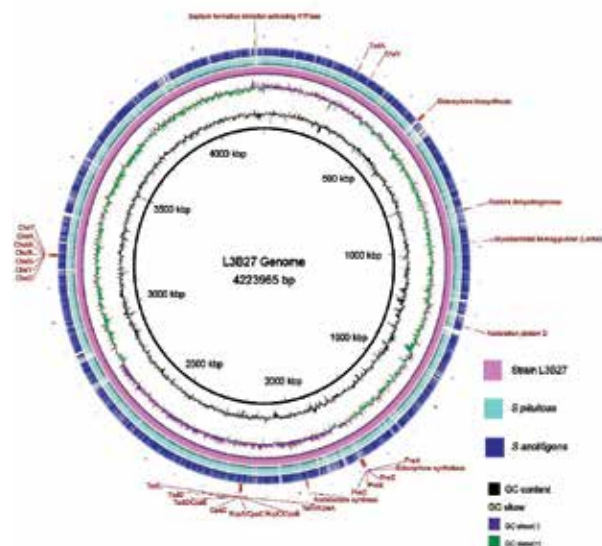


Fig. 18. Genomic representation of the *Sphingomonas* strain L3B27 genome. Rings from inside; 1-GC content, Ring 2-GC skew, Ring 3-5 Genomic sequencing identity with genomes of closely related type strains of *S. pituiosa* and *S. azotifigens* with *Sphingomonas* strain L3B27. Figure prepared using BRIG.

of these compounds are identified in the genome. The strain L3B27^T has developed various mechanism for efficient uptake of iron from the environment. It includes ferrichrome-iron receptors, iron uptake proteins and TonB dependent receptors. In addition, we have identified a siderophore vibrioferrin biosynthetic cluster, which is a marine type siderophore originally identified from *Vibrio parahaemolyticus*. Interestingly, vibrioferrin biosynthetic cluster not present their closely related strain, suggests acquisition of the gene cluster from marine environment. The strain L3B27 is positive for siderophore test, supports the functionality of the genes. Since L3B27 is isolated from a brackish environment, we have analysed genes related to osmoregulation. The osmoregulation is mediated by various types of sodium ion channels, choline dehydrogenase BetA, high affinity choline uptake protein BetT and an aquaporin Z.

3.5. Bioprospecting and taxonomic studies of marine microorganisms in search of novel anti-infectives.

Among 600 actinomycetes were screened for antibacterial activity, 56 potential actinomycetes strains which showed maximum zone of inhibition against the quality control strains. Out of which 28 strain's crude antimicrobial compound has been extracted by using Ethyl acetate, and the activity of the each extracts tested at 50 µg/ml. Only 18 extracts shown maximum (>20 mm Zone of inhibition) activity. Those 18 crude extracts been sent to CSIR-CDRI for further analysis. The strain NRK ACT 143 was found as a potential which showed activity with maximum zone of inhibition (>25 mm) against *S. aureus* (MCC 2408) only in

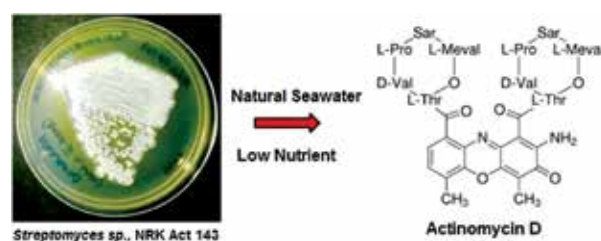


Figure 19: Strain NRK ACT 143 and Molecular structure of Actinomycin D

the presence of Natural Seawater or Sea salts. From the 16s rRNA gene sequence results the strain showed sequence similarity with *Streptomyces caeruleatus* (99.41%), the crude extract has been prepared from the strain mycelia free culture filtrate (MFC) in large volume of 75 L and 2.8 g of crude extract was generated. The final purification of crude compound was achieved through Recycling HPLC, the results obtained from both 1 D and 2D NMR and HRMS showed that this compound is Actinomycin D (Fig 19) with the molecular formula of $C_{62}H_{86}N_{12}O_{16}$ and molecular mass of 1255.45. Purification, Characterization and Identification of molecule was carried out in help with Dr. Ravi Shankar, Organic Chemistry Lab, CSTD, CSIR-NIIST.

Antifungal, antibacterial, anticancer, anti-inflammatory, anti-angiogenic studies were conducted for all 18 extracts sent to CSIR-CDRI, Lucknow. In that 7 extracts are more potential and showed antibacterial and anticancer activity respectively. All these 18 strains were identified through 16s rRNA gene sequence (Table 6). Further metabolite characterizations of the potential 7 crude extracts were ongoing.

Table 6: CDRI Antibacterial and Anticancer screening report of potential marine actinomycetes:

S.NO	Strain ID No	Extract code	Antibacterial activity	Anticancer activity (%)	Strain similarity (% of similarity)
	NRK Act 060	NRK-NIIST1/C94-S2/E1	<1 µg/ml	-	<i>Streptomyces pulveraceus</i> (99.42)
	NRK Act 114	NRK-NIIST1/C60/C95-S1/E1	<25 µg/ml	94%	<i>Streptomyces griseoincarnatus</i> (100)
	NRK Act 143	NRK-NIIST1/C71-S1/E1	<1 µg/ml	98%	<i>Streptomyces caeruleatus</i> (99.41)
	NRK Act 203	NRK-NIIST1/C96-S1/E1	-	94%	<i>Streptomyces enissocaesilis</i> (100)
	NRK Act 221	NRK-NIIST1/C97-S1/E1	-	99%	<i>Streptomyces ghanaensis</i> (99.66)
	NRK Act 406	NRK-NIIST1/C99-S1/E1	<1 µg/ml	87%	<i>Streptomyces caeruleatus</i> (99.35)
	NRK Act 446	NRK-NIIST1/C100-S1/E1	<1 µg/ml	84%	<i>Streptomyces parvulus</i> (100)

रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग

रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग संस्थान के निम्नलिखित तीन प्राथमिक क्षेत्रों पर ध्यान केंद्रित कर रहा है : 1. कार्बनिक और हाइब्रिड इलेक्ट्रॉनिक्स (ऊर्जा उत्पादन और भंडारण, ठोस अवस्था प्रकाश व्यवस्था, क्रोमोजेनिक कोटिंग्स और कम्प्यूटेशनल रसायन विज्ञान) 2. फ्लोरोसेंट सामग्री (सुरक्षा अनुप्रयोग, डायग्नोस्टिक्स, इमेजिंग प्रोब्स और अल्ट्राफास्ट गतिकी) 3. फाइटो फार्मास्यूटिकल्स और ड्रग इंटरमीडिएट्स (औषधीय पौधों का जैव मूल्यांकन और उन्नत फार्मास्यूटिकल इंटरमीडिएट्स)। इसके अलावा, प्रभाग द्वारा इन क्षेत्रों में भविष्य विज्ञान और क्षमता निर्माण का कार्य भी करता है। सीएसआईआर की विभिन्न विषयगत गतिविधियों में, अर्थात् ऊर्जा (पारंपरिक और अपरंपरागत) और ऊर्जा उपकरण, हेल्थकेयर तथा रसायन में प्रभाग सक्रिय रूप से भाग लेता है। इसके अलावा, सीएसआईआर की मिशन मोड परियोजनाओं में तथा हेल्थकेयर और न्यूट्रास्यूटिकल्स मिशन के लिए नैनोबायोसेंसर्स और माइक्रोफ्लुइडिक्स पर प्रभाग प्रमुख भूमिका निभाता है। बड़ी संख्या में विभिन्न उद्योगों और अन्य सरकारी एजेंसियों द्वारा वित्त पोषित महत्वपूर्ण परियोजनाओं के लिए भी प्रभाग ने पहल की है। उच्च प्रभाव कारक के साथ अंतर्राष्ट्रीय स्तर पर प्रतिष्ठित सहकर्मी-समीक्षा पत्रिकाओं में प्रभाग से इस वर्ष 75 से अधिक प्रकाशन हो चुके हैं।

वर्ष 2017-18 के दौरान प्रभाग की गतिविधियों और उपलब्धियों की मुख्य विशेषताएं नीचे दी गई हैं।

हाइलाइट

कार्बनिक तथा हाइब्रिड इलेक्ट्रॉनिक्स

- व्यवहार्यता प्रदर्शित करने के लिए विभिन्न सेंसर के साथ विशाल प्रकाश एकत्रण स्वदेशी डीएसएससी सौर मॉड्यूल सफलतापूर्वक एकीकृत किया गया
- धातु ऑक्साइड के क्रिस्टलीय नैनोशीट का उपयोग करके बहुआयामी इलेक्ट्रोक्रोमिक गिलासों का विकास किया, जहां ऑप्टिकल मॉड्यूलेशन ऊर्जा भंडारण के साथ जोड़ा जा सकता है, जो दृश्य सीमा (600 एनएम पर 63.2%) और अल्ट्रा उच्च निकट-आईआर शील्डिंग (1200 एनएम पर 77.3%) पर व्यापक एरियल कैपेसिटेंस (4 एमएफ/से.मी²) का प्रदर्शन करता है
- कार्बन कपड़े पर एक बाइंडर-मुक्त लचीला पीएनआई / Fe₃O₄ नैनो कंपोजिट इलेक्ट्रोड बनाया गया, जो 1V से 0 वी- के एक स्थिर पोटेंशियल विंडो में 4000 चार्ज-डिस्चार्ज चक्र के बाद भी 91% की साइकिल चालन स्थिरता बनाए रखते हुए 365 एफ जी -1 की अधिकतम विशिष्ट क्षमता का प्रदर्शन करता है
- सुपर कैपेसिटर्स के लिए स्व-संयोजन पॉलीएनीलाइन नैनो वयर्स से चिपका ग्राफीन-3-पेंटा डिसिलफिनाइल फॉस्फेट संकर नैनोकंपोजिट आधारित हरे टिकाऊ इलेक्ट्रोड विकसित किए गए
- मिथाइल अमोनियम बिस्मथ आयोडाइड (CH₃NH₃)₃Bi₂I₉, एक लेड-फ्री, शून्य-आयामी संकर पेरॉव्स्काइट सामग्री का उपयोग करके एक इलेक्ट्रोकेमिकल डबल-लेयर कैपेसिटर कैब्रिकेटेड किया गया

सुरक्षा अनुप्रयोगों और निदान के लिए फ्लोरोसेंट सामग्री

- एक ठोस अवस्था कार्बनिक उत्सर्जक द्वारा विशिष्ट मैकनोरेस्पॉन्सिव लुमिनेसेन्स, थर्मो क्रोमिसम, वापो क्रोमिसम और क्लोरीन गैस सेंसिंग का निदर्शन किया गया
- लैसोसोम में Zn^{2+} और पीएच विविधताओं को एक साथ पता लगाने के लिए एक फ्लोरोसेंट अणु आधारित नैनोप्रोब विकसित किया गया
- कैंसर स्क्रीनिंग के लिए डायग्नोस्टिक एसईआरएस- नैनोप्रोब विकसित किया गया
- लक्षित दवा वितरण प्रणाली (टीडीडीएस) और थेरोनोस्टिक नैनोप्रोब का विकास

भविष्य विज्ञान और क्षमता निर्माण

- साइक्लो डेक्सट्रिन की थर्मल नियंत्रित चरण-वार रिलीज के लिए एक समन्वय बहुलक आधारित जेल संश्लेषित किया गया
- सुरक्षा और फॉरेंसिक अनुप्रयोग के लिए एक उपयोगी एनआईआर फ़िल्टर का विकास
- एल्युमिना के सतह संशोधन द्वारा एक नई सुपर हाइड्रोफोबिक सामग्री
- किरल π -प्रणाली, जो कोलेजन जैसे कुछ बायोपॉलिमर्स के समान सुपर हेलिकल संरचनाएं बनाती है
- जैव अणु के पदानुक्रमित स्व-सम्मिलन के माध्यम से स्थायी जीवाणुरोधी अनुप्रयोगों के लिए बायोजेल का डिजाइन और विकास
- न्यूरोट्रांसमीटर का एक साथ संसूचन के लिए पीईडीओटी-टाइटेनिया-पॉली (डाइमिथाइल सिलोक्सान) (पीटीएस) के आधार पर लचीला इलेक्ट्रोकेमिकल ट्रांसड्यूसर विकसित किया
- सेरोटोनिन का संसूचन के लिए पीईडीओटी-अपचित ग्राफीन ऑक्साइड-सिल्वर संकर नैनो कंपोजिट संशोधित ट्रांसड्यूसर विकसित किया

- पारस्परिक रूप से सहायता प्राप्त डीएनए स्ट्रैंड्स के स्वतः समुच्चय के लिए तथा फुलेरिन नैनोक्लस्टर का अर्धचालक नैनोवयर्स में रूपांतरण के लिए एक सरल और नई योजना का प्रदर्शन किया गया

- एनआईआर उत्सर्जन के साथ मैकनोरेस्पॉन्सिव जेल का विकास

कम्प्यूटेशनल रसायन विज्ञान

- डीएफटी अध्ययन के माध्यम से ग्रब्स ओलेफिन मेटाथेसिस उत्प्रेरण में बॉन्ड खिंचाव आइसोमेरिज्म की घटना का पता लगाया गया है
- बेंजीन और पाइरीडिन व्युत्पन्न के संश्लेषण के लिए ग्रब्स और होवेडा-ग्रब उत्प्रेरक के लिए पूर्ण उत्प्रेरक चक्र स्थापित किया गया और नई उत्प्रेरक डिजाइन रणनीतियाँ प्रस्तावित हैं
- फ्लोरिनेटेड सुगंधित स्कैफोल्ड्स के आधार पर नोबल गैस, हाइड्रोजन और नाइट्रोजन को पकड़ लेने के लिए एक गैर सहसंयोजक बाध्यकारी रणनीति विकसित की

पादप दवाइयों एवं औषधि मध्यवर्ती

- क्षमता युक्त जैविक गतिविधि के साथ अणुओं के प्रति विषम और सजातीय उत्प्रेरक परिवर्तन
- नई एंटी कैंसर और एंटीबायोटिक लीड की तलाश में औषधीय रसायन अनुसंधान के लिए औषधीय रूप से प्रासंगिक अणुओं का संश्लेषण
- प्रचुर मात्रा में उपलब्ध प्राकृतिक संसाधनों का केमो प्रोफाइलिंग और स्थायी उपयोग: औषधीय पौधों से विविध स्कैफोल्ड्स के लिए रासायनिक रूप से अलगाव और अर्ध सिंथेटिक संशोधन
- मधुमेह और कार्डियोवैस्कुलर विकार जैसे जीवन शैली से संबंधित विकारों के लिए पादप अणुओं की जैविक जांच

CHEMICAL SCIENCES AND TECHNOLOGY DIVISION

The Chemical Sciences and Technology Division has been focusing on the following three priority areas of the Institute: 1. Organic and Hybrid Electronics (Energy generation and storage, solid state lighting, chromogenic coatings and computational chemistry) 2. Fluorescent materials (Security applications, diagnostics, imaging probes and ultrafast kinetics) 3. Phytopharmaceuticals and Drug Intermediates (Bio-evaluation of medicinal plants and advanced pharmaceutical intermediates). In addition, we work on futuristic sciences and capacity building in such areas.

The division actively participates in various thematic activities of CSIR, namely Energy (conventional and nonconventional) and Energy Devices, Healthcare and Chemicals. In addition, the division plays a major role in CSIR Mission Mode projects in Nanobiosensors and Microfluidics for Healthcare Nutraceuticals and Agro Mission. The division is also undertaking a large number of important projects funded by various industries and other government agencies. More than 75 research publications from the division have appeared in internationally reputed peer-reviewed journals with high impact factor. The highlights of the activities and achievements of the division during the year 2017-18 along with brief abstracts of important developments are given below.

Highlights

Organic & Hybrid Electronics

- Ambient light harvesting indigenous DSSC solar modules have been successfully integrated with various sensors to demonstrate the feasibility
- Developed and demonstrated methods to understand the recombination mechanism in DSSCs using various perturbation techniques
- Synthesized a range of cobalt and copper based alternate redox electrolytes with greater positive redox potentials compared to conventional I^-/I_3^- for attaining more voltage
- Solution processable carbazole derivatives developed for dopant-free single molecule white electroluminescence by room temperature phosphorescence
- Addressed the efficiency roll-off in a fluorescent OLED by facile electron transport layer doping and carrier confinement
- Attractive thermoelectric performance shown by Solution processable novel TE composites comprising of p-type fused thiophene-based polymers and carbon nanotubes and flexible free standing films made by combining fused thiophene-based polymers with Bi_2Te_3 nanoparticles
- Developed multifunctional Electrochromic glasses using crystalline nanosheets of metal oxides where optical modulation can be combined with energy storage, exhibiting high value of areal capacitance ($4mF/cm^2$) with broad optical modulation at visible range (63.2% at 600 nm) and ultra high near-IR shielding (77.3% at 1200 nm)
- Demonstrated dual electrochromic (transmissive-to-black) and electrofluorochromic (greenish



yellow-to-dark) response of a solution processable, electrochemically stable cross-linked polymer

- Electrode materials for supercapacitors were made using Fe₃O₄ and Zn-doped Fe₃O₄ (Zn/Fe₃O₄) nanoparticles by a simple co-precipitation method
- A binder-free flexible PANI/Fe₃O₄ nanocomposite electrode was fabricated over carbon cloth, exhibiting a maximum specific capacitance of 365 F g⁻¹ retaining a cycling stability of 91% even after 4000 charge-discharge cycles in a stable potential window from -1V to 0V
- Self-assembled polyaniline nanowires stippled graphene-3-pentadecylphenyl phosphate hybrid nanocomposite based green sustainable electrodes developed for supercapacitors
- Fabricated an electrochemical double-layer capacitor using methylammoniumbismuthiodide (CH₃NH₃)₃Bi₂I₉, a lead-free, zero-dimensional hybrid perovskite material

Fluorescent Materials for Security Applications and Diagnostics

- Demonstrated that confining a large number of fluorophores in a small volume can result in their high local concentration and concerted emission from the organic-inorganic hybrid fluorophore ensemble which can be further amplified by Forster Resonance Energy Transfer
- Heat-induced interconversion of molecular packing in acceptor-donor-acceptor type divinylbenzene derivatives and related luminescence shift studied
- Demonstrated distinct mechanoresponsive luminescence, thermochromism, vapochromism, and chlorine gas sensing by a solid-state organic emitter
- Developed a fluorescent molecule based nanoprobe to simultaneously detect Zn²⁺ and pH variations in lysosome
- Development of Diagnostic SERS-Nanoprobe for cancer screening
- Targeted drug delivery system (TDDS) and theranostic nanoprobe development

Futuristics and Capacity Building

- A coordination polymer based gel for the thermally controlled step-wise release of cyclodextrins was synthesised

- Development of an NIR filter useful for security and forensic application
- A new superhydrophobic material by the surface modification of alumina
- Chiral π -system that forms super helical structures similar to certain biopolymers such as collagen.
- Designed and developed Biogel through hierarchical self-organisation of biomolecule for sustainable antibacterial applications
- Flexible electrochemical transducers based on PEDOT-titania-poly(dimethylsiloxane) (PTS) for simultaneous detection of neurotransmitters developed
- PEDOT-reduced graphene oxide-silver hybrid nanocomposite modified transducer developed for the detection of serotonin
- Demonstrated a simple and new strategy for the mutually assisted self-assembly of DNA strands and fullerene nanoclusters into semiconducting nanowires
- Development of mechanoresponsive gel with NIR emission

Computational Chemistry

- The phenomenon of bond stretch isomerism in Grubbs olefin metathesis catalysis is discovered through DFT studies
- Full catalytic cycles for Grubbs and Hoveyda-Grubbs catalysts for benzene and pyridine derivative synthesis have been established and proposed new catalyst design strategies
- A noncovalent binding strategy to capture noble gases, hydrogen and nitrogen is developed based on fluorinated aromatic scaffolds

Phytopharmaceuticals and Drug Intermediates

- Heterogeneous and homogeneous catalytic transformations towards molecules with potential biological activity
- Synthesis of pharmaceutically relevant molecules for medicinal chemistry research in search for new anticancer and antibiotic leads
- Chemoprofiling and sustainable utilization of abundant natural resources: Isolation and semisynthetic modifications for chemically diverse scaffolds from medicinal plants

- Biological screening of phytomolecules for life style related disorders such as diabetes and cardiovascular disorders

The details of research in each of the above areas are given below.

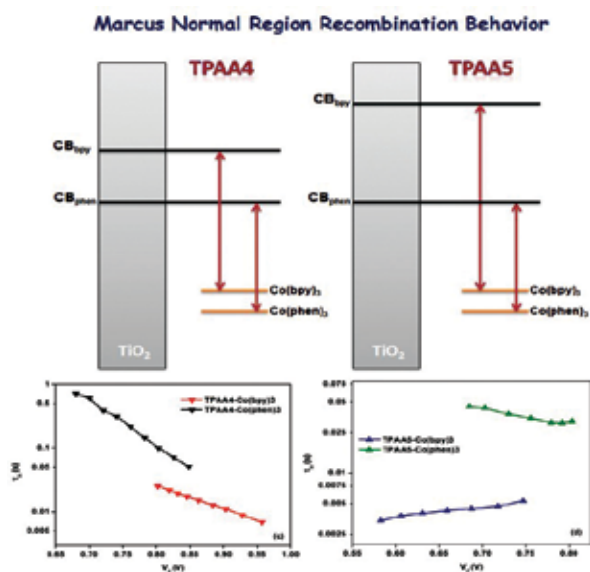
Organic and Hybrid Electronics

Photovoltaics & Lighting

Renewable Energy Activities at Chemical Sciences and Technology Division are now linked to the Energy theme of CSIR and comprise of research activities in the areas of Dye-Sensitized Solar Cells (DSSCs) and Organic Light Emitting Devices (OLEDs). Major research outputs are given below.

Photovoltaics

Probing Recombination Mechanism and Realization of Marcus Normal Region Behavior in DSSCs Employing Cobalt Electrolytes and Triphenylamine Dyes

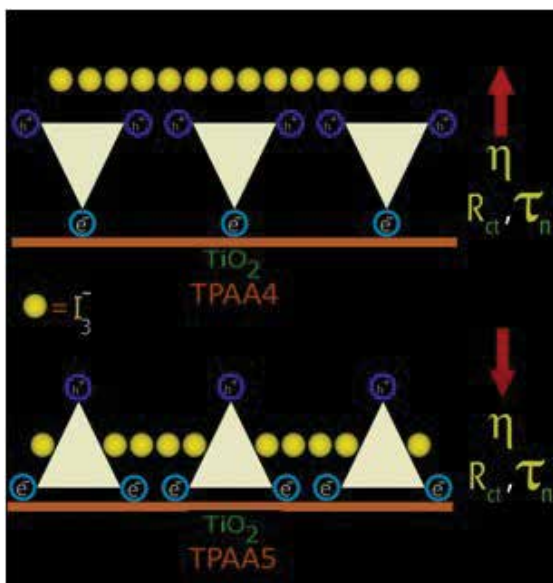


Cobalt-based outer sphere one electron redox shuttles represent an exciting class of alternative electrolyte to be used in dye-sensitized solar cells. The flexibility of redox potential tuning by varying the substituents on peripheral organic ligands renders them the advantage of achieving higher photovoltage. But higher recombination experienced in these systems by employing diffusion limited cobalt species prevents attaining higher photovoltage. The focus of this work is to systematically

investigate in detail the effect of structural variations and steric hindrance of organic triphenylamine dyes which differs in the number and nature of binding groups and peripheral hole accepting units on the recombination reactions and mass transport variations employing two different cobalt electrolytes $[Co(bpy)_3]^{3+/2+}$ and $[Co(phen)_3]^{3+/2+}$ having variable driving force for recombination. The detailed photovoltaic analysis gives us the information that modification of the architecture of organic dyes plays a decisive role in determining the performance, in particular, employing along with alternate one electron outer sphere redox systems. From our analysis, for both the dyes the charge recombination with the oxidized cobalt species was found to happen in the Marcus normal region which is attributed to the shift in conduction band (CB) which influenced the driving force for recombination. The current observation was quite exciting since it was documented before that both the redox systems have shown to exhibit Marcus inverted recombination behavior. The impact of structural variations of dyes, change in conduction band, effect of nature of electrolyte species and its interaction with semiconductor on the recombination reactions was explored in detail using a range of small and large perturbation techniques.

A detailed evaluation of charge recombination dynamics in dye solar cells based on starburst triphenylamine dyes

Understanding the charge transfer dynamics in dye solar cells (DSSCs) is imperative for the development of highly efficient devices. The loss in photocurrent due to recombination can be alleviated by removing holes formed in the oxidized dye molecules away from TiO_2 surface and also by preventing the approach of the oxidized species in the electrolyte coming near to the semiconductor. Focusing on elucidating these two parameters we fabricated I-/I³⁺- electrolyte based dye solar cells with two novel branched propeller shaped triphenylamine dyes TPA44 and TPA45 with broader absorption and higher molar extinction coefficient, which showed power conversion efficiencies of 6.52% and 4.60% respectively. The bulkiness of the co-donor along with the triple bond bridges provided further rigidity to the structure, thereby reducing aggregation of the dyes



on the TiO₂ surface. Both the dyes were structurally engineered in such a way to avoid the recombination of electrons from TiO₂. Detailed charge transfer dynamics of the devices were studied by employing extensive perturbation techniques such as electrochemical impedance spectroscopy (EIS), charge extraction (CE) and intensity-modulated photovoltage spectroscopy (IMVS).

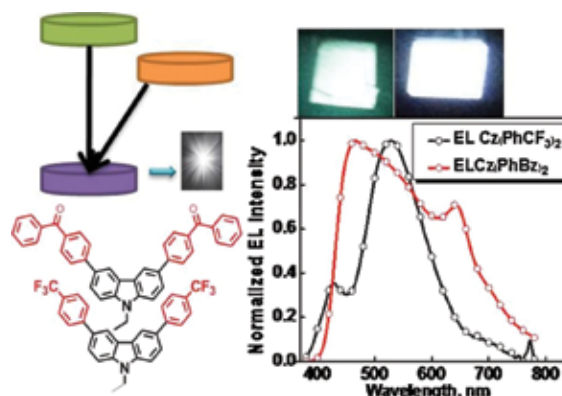
Enhancement of the photovoltaic performance in D3A porphyrin-based DSSCs by incorporating an electron withdrawing triazole spacer

In this study, we report the preparation of two novel zinc-porphyrin derivatives (ZnP-3DoH-click-CNCOOH and ZnP-3DoH-click-COOH) and two reference compounds (ZnP-3DoH-CNCOOH and ZnP-3DoH-COOH) as sensitizers in DSSCs. The photo-physical and electrochemical measurements along with the computational studies suggest that the four synthesized porphyrin derivatives exhibit appropriate light absorption characteristics as well as suitable molecular orbital levels for their use as sensitizers in DSCs. Following this strategy, four fold and eight fold increase of the device performance was observed regarding ZnP-3DoH-click-CNCOOH and ZnP-3DoH-click-COOH, respectively, when compared to the efficiencies achieved with the reference compounds (ZnP-3DoH-COOH and ZnP-3DoH-CNCOOH). A more detailed interpretation of the charge dynamics in these devices was carried out using charge extraction (CE) and open-circuit voltage decay (OCVD) measurements.

Organic Light Emitting Diodes

Solution processable carbazole derivatives developed for dopant free single molecule white electroluminescence by room temperature phosphorescence

White electroluminescence from a single molecule is a challenging topic in organic light emitting diode (OLED) research. Herein, we report the white light emission from a carbazole derivative, 9-ethyl-3,6-bis(4-(trifluoromethyl)phenyl)-carbazole (Cz(PhCF₃)₂), by harvesting both singlet and triplet emissions. The blue fluorescence and a broad emission from room temperature phosphorescence resulted in white light electroluminescence (EL) with a colour coordinate of (0.31, 0.44). We successfully synthesized another molecule namely 1,1'-(4,4'-(9-ethyl-9H-carbazole-3,6-diyl)bis(4,1-phenylene))diethanone Cz(PhBz)₂ and achieved a four-fold increase in the efficiency of the EL with a substitution change from -Ph-CF₃ to -Ph-CO-Ph with a colour coordinate of (0.29,0.35). The present route for the generation of white light emission from a solution processable single organic molecule utilizing both singlet and triplet excitons offers a promising way to improve the efficiency of future white OLEDs.



Addressing the efficiency roll-off in a fluorescent OLED by facile electron transport layer doping and carrier confinement

Organic light emitting diodes (OLEDs) often face the issue of decreasing power efficiency with increasing brightness. Loss of charge carrier balance is one of the factors contributing to the efficiency roll-off. We demonstrate that by using a combination of doped electron transport

layer (ETL) and a specially chosen electron blocking layer (EBL) having high hole mobility, this efficiency roll-off can be effectively suppressed. A tris-(8-hydroxyquinoline) aluminium (Alq₃) based OLED has been fabricated with 2,3,6,7-Tetrahydro-1,1,7,7-tetramethyl-1H, 5H,11H-10-(2-benzothiazolyl) quinolizino-[9,9a, 1n gh]coumarin (C545T) as the emissive dopant. Bulk doping of the ETL with lithium fluoride (LiF) was optimized to increase the luminous intensity as well as the current efficiency. An EBL with high hole mobility introduced between the EML and the hole transport layer (HTL) improved the performance drastically, and the device brightness at 9V got improved by a factor of 2.5 compared to that of the control device. While increasing the brightness from 100 cd/m² to 1000 cd/m², the power efficiency drop was 47% for the control device whereas only a drop of 15% was observed for the modified device.

Thermoelectric Materials and Devices

Fused thiophene based thermoelectric materials for energy generation/refrigeration

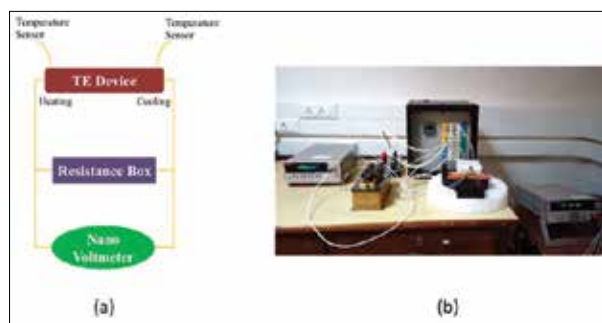
This is a major energy R&D activity that got the full funding support from the Gas Authority of India Ltd. (GAIL). Polymer nanocomposite based thermoelectric (TE) materials are a new class of functional materials that have immense potential for waste heat utilization, power generation and micro-refrigeration at a commercial scale. Devices based on these materials typically operate < 350 °C and could be used for on-the-spot sustainable power generation from thermal sources like hot water released by process plants, automotive exhausts, and even human/mammal body heat. The R&D is intended to generate relevant knowhow about the fabrication and implementation of these devices. Additionally, specialized



Photographs of free standing TE films

skills were needed to be developed from the ground-up for addressing the essential factors like adopting a materials/device fabrication scheme with better batch reproducibility, innovation in device design to maximize power conversion and finding the right interconnects for a low loss transport.

Initially, an action plan was established where we explored a three-point strategy to develop the hybrid TE nanocomposites that led to some novel TE composites comprising of p-type fused thiophene-based polymers and carbon nanotubes. The composites display encouraging thermoelectric performance. Additionally, we fabricated flexible free standing films by combining fused thiophene-based polymers with Bi₂Te₃ nanoparticles. Both p and n-type legs could be fabricated using this process. The identified p-type composites from strategy-II have been modified by doping with inorganic oxidising agent that increases both electrical conductivity and Seebeck coefficient due to the overlap of Fermi energy with the valance band. For doped PBDTT-FTTE:45wt% MWCNT at T=300K, the electrical conductivity is increased 6.68 times than the undoped nanocomposite. The highest power factor and ZT value obtained till date stands at 48.21 μW/m.K² and 0.08 respectively. Several prototypes of the miniaturized in-plane TEGs have been fabricated and the output power has been analyzed (TRL-4). All developed nanocomposites were completely solution processable, making the TE device fabrication compatible with printing/dispensing technique. This should lead to the realization of flexible TE devices for easy implementation and installation.



(a) Schematic diagram of the experimental set-up (b) Image of measurement set-up



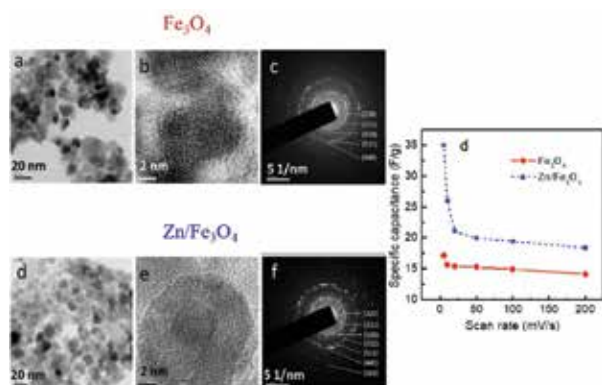
A phase-II of the project is sanctioned to promote these outputs to TRL-6 level leading to full scale commercialization.

Energy Storage

Improvement in the electrochemical performance of Fe_3O_4 nanoparticles by Zn doping

In the present study, we report the synthesis of Fe_3O_4 and Zn-doped Fe_3O_4 ($\text{Zn}/\text{Fe}_3\text{O}_4$) nanoparticles by a simple co-precipitation method. The morphology, structure and optical properties of the samples are characterized by Transmission Electron Microscopy (TEM), X-ray Diffraction, UV-visible spectroscopy, Fourier transform infrared spectroscopy (FTIR), energy dispersive spectroscopy (EDS) and UV-visible spectroscopy.

The electrochemical energy storage and photocatalytic properties of the nanoparticles are studied in detail, and the results are discussed. The electrochemical energy storage performances of the nanoparticles are tested in a symmetric two-electrode configuration, and the measurement demonstrated that Zn doping nearly doubles the energy storage properties of the Fe_3O_4 nanoparticles. The study of the photocatalytic degradation of methyl blue (MB) dye under UV irradiation in the presence of pure and doped Fe_3O_4 nanoparticles reveals that both nanoparticles act as ideal catalysts for degradation of MB dye.

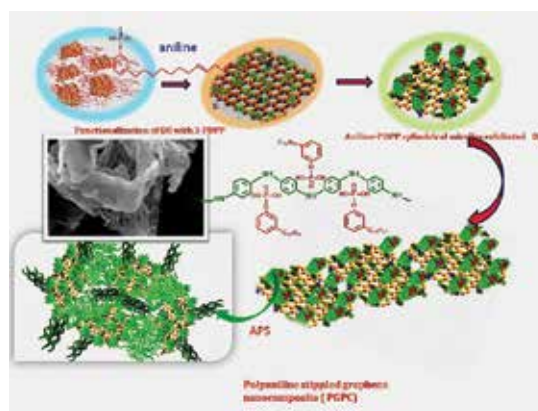


Development of a High-Performance Flexible Supercapacitor Anode Based On Polyaniline/ Fe_3O_4 Composite @ Carbon Cloth

Herein, we report for the first time, the synthesis of a binder-free flexible Polyaniline (PANI) and Iron Oxide (Fe_3O_4) nanocomposite (PANI/ Fe_3O_4) electrode by the

direct growth of active materials over carbon cloth. The carbon cloth substrate, with its three-dimensional porous structure, provides more electrolyte accessibility and acts as an effective conductive pathway for efficient electrical transport between the active materials and the current collector. The PANI/ Fe_3O_4 nanocomposite electrode exhibits a maximum specific capacitance of 365 F g⁻¹ in a stable potential window ranging from -1V to 0 V. Also it retains a cycling stability of 91% even after 4000 charge-discharge cycles at a constant current density of 5 A g⁻¹. These results indicate that PANI/ Fe_3O_4 nanocomposite electrode has a significant potential as an inexpensive anode for future electrochemical energy storage systems.

Self-assembled polyaniline nanowires stippled graphene-3-pentadecylphenyl phosphate hybrid nanocomposite based green sustainable electrodes for supercapacitors

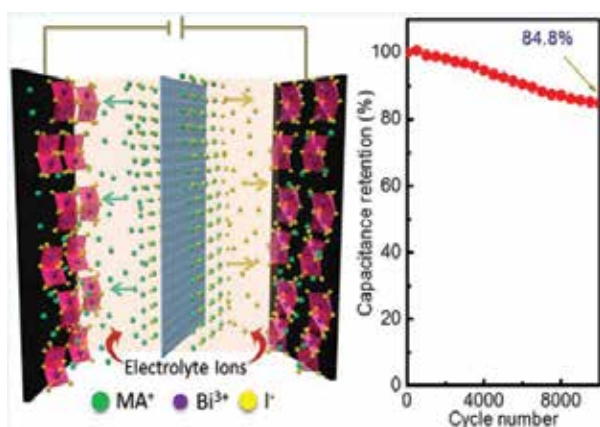


Conductive polymers have been extensively studied in supercapacitors since they are having excellent pseudocapacitive behaviour, light weight, flexible and easy processability. However its low cyclic stability limits its applications as supercapacitors.²⁰⁻²¹ Among the conductive polymers such as polyaniline (PANI), polypyrrole, polythiophene and their derivatives, PANI is considered the most promising material because of its high capacitive characteristics, low cost, simple preparation and environmental stability.²²⁻²⁴ Thus, the combination of conducting polymer intercalated graphene layers are expected to exhibit excellent electrical conductivity, good surface area and cycling stability and anticipated to exhibit high performance as cathode for double layer supercapacitors. Self-assembled polyaniline nanowires stippled graphene-3-PDPP nanocomposite (PGPC) was

prepared by in-situ polymerisation of aniline in presence of 3-pentadecylphenol phosphate (3-PDPP) modified graphene sheets. 3-PDPP is an amphiphilic dopant derivative of cardanol which is obtained as a by-product from the cashew industry. 3-PDPP serves a multifunctional role as a liquid crystalline template, surfactant, and dopant during the formation of PGPC hybrid nanocomposites, which is manifested from the studies made by XRD, FTIR morphology, and electrical conductivity. The formed PGPCs were further characterized for pore volume, BET surface area, TGA, electrical conductivity (2.3×10^{-3} S/cm) and electrochemical stability. Further, supercapacitors were fabricated with configuration (ITO-PGPC/ Na_2SO_4 /PGPC-ITO) and measured optimal specific capacitance (181.99 F/g) and energy density (58.23 Wh/kg) and cycling stability (> 2000).

Zero-dimensional methylammonium bismuth iodide-based lead-free perovskite capacitor

Symmetrical electrochemical capacitors are attracting immense attention because of their fast charging-discharging ability, high energy density, and low cost of production. The current research in this area is mainly focused on exploring novel low-cost electrode materials with higher energy and power densities. In the present work, we fabricated an electrochemical double-layer capacitor using methylammonium bismuth iodide ($\text{CH}_3\text{NH}_3\text{Bi}_2\text{I}_9$), a lead-free, zero-dimensional hybrid perovskite material. A maximum areal capacitance of 5.5 mF/cm^2 was obtained, and the device retained 84.8% of its initial maximum capacitance even after 10000 charge-discharge cycles. Impedance spectroscopy measurements revealed that the active layer provides a



high surface area for the electrolyte to access. As a result, the charge transport resistance is reasonably low, which is advantageous for delivering excellent performance.

Multifunctional chromogenic devices

In industrialized countries, people spend ~80% of their time indoors, mostly in buildings and vehicles. The developing countries would also plunge on the same trend with the advancing industrial growth. About 30-40% of the world's primary energy is used for providing a comfortable indoor environment, out of which $> 30\%$ is wasted due to inefficient windows. We initiated a research program to develop low-cost smart windows that can cut down the radiation losses (Intelligent coatings, 12th FYP). In addition, these tunable glasses are widely used for constructing smart mirrors and energy-efficient displays. During this program, our research group developed a variety of nanomaterials-based electrochromic systems, which are highly efficient and compatible/better than the current state of the art. The devices we developed till now have the advantages that are matching the industry requirements,

Cheap and scalable processing

High modulation of light throughput (better than the current state of art/standard imported device)- We attained a high "effective" coloration efficiency of $210 \text{ cm}^2/\text{C}$ at 600 nm wavelength for WO_3 based devices ($>$ highest reported)

High switching speed (better than SOA/standard imported device)

Uniformity of coating

Good cycling performance

In addition, we developed multifunctional electrochromic glasses where the smart function of optical modulation can be combined with energy storage. We fabricated a single active layer asymmetric transparent multifunctional smart device (MFSD) using crystalline nanosheets of metal oxides. This device can block near-infrared and visible spectrum by varying the applied potential up to -2.8 V . The MFSD showed a high value of areal capacitance (4 mF/cm^2) and in situ transmittance measurements proved its remarkable electrochromic function with broad optical

modulation at the visible range (63.2% at 600 nm) and ultra high near-IR shielding (77.3% at 1200 nm). The device exhibited high coloration efficiency (97.8 cm²/C at 900 nm) and excellent cycling stability (sustaining the similar optical modulation after 1000 cycles as an electrochromic device and retaining \approx 87% of its initial capacitance after 1000 continuous cycles).



Switching and UV-Vis-NIR through put of a MFSD. The stored charge can be functional for providing input power to a different device (in this case lighting up a LED)

Tetraphenylethene-diphenylamine based dual electrochromic and electrofluoro-chromic devices

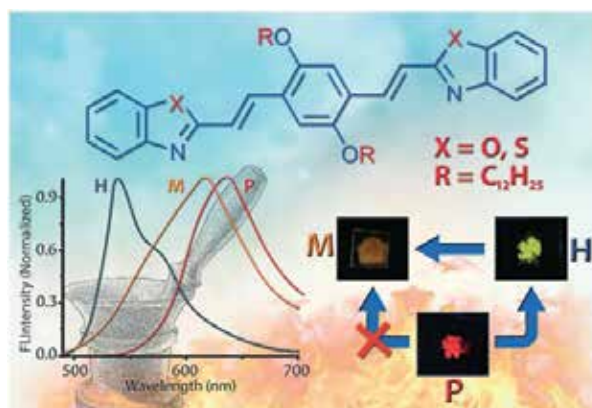
Electrochromic (EC) materials, which exhibit reversible change in their optical properties by electrochemical redox reactions, have been extensively investigated due to their potential applications in multicolor displays, smart windows, camouflage materials, E-paper, sunglasses, switchable rear-view mirrors etc. A major challenge in the design of electrochromic materials for automotive and building applications is their color tuning to achieve aesthetically pleasing color states. Though multicolorelectrochromism is desirable for display applications, neutral shades such as gray and black are favored for smart window, rear view mirror, ophthalmic and signage applications. Obtaining gray/black electrochromic coloration either in the neutral or in the redox states of organic EC materials with a highly transmissive complementary state is a challenging problem and is often achieved through strategies such as mixing and/or co-polymerization of multicolorelectrochromic components. A major reason for this is the lack of identified single component, organic electrochromic materials with redox states having absorption throughout the visible region. Herein, we reported cross-linkable, diphenylamine-tetraphenylethene derivative (TPOST) with terminal styryl units, that can form stable electrochromic polymer films on conducting electrodes and exhibits transmissive-to-black electrochromic and fluorescent-to-dark

electrofluorochromic dual behavior. The electrochromic polymer switches between a highly transmissive, light yellow colored neutral state ($L^* = 97$, $a^* = -5$, $b^* = 16$) and a black coloured oxidized state ($L^* = 41$, $a^* = 2$, $b^* = 8$) with high optical contrasts (up to 50% ΔT) and reasonably low switching times (< 10 s) were demonstrated over 1500 cycles using a basic electrochromic device design [FTO/EC layer/ gel electrolyte/ FTO]. Synthetic accessibility through simple routes, solution processability and favorable electrochromic switching parameters render these electrochromic materials as potential candidates for both smart window and signage applications.

Fluorescent materials for security and diagnostics and imaging probes

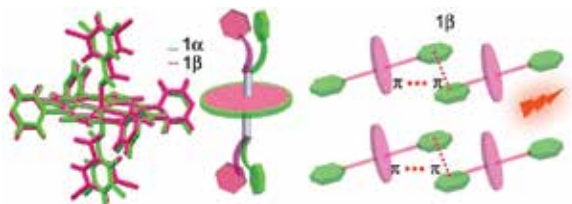
Reversible Switching of Solid-State Luminescence by Heat-Induced Interconversion of Molecular Packing

Dynamic switching of solid-state luminescence with high contrast and reproducibility is a challenging task but important for several optoelectronic applications. One promising approach towards this end is to control the mode of solid-state packing of luminescent organic chromophores with an external stimulus. Herein, we present the heat-induced interconversion of molecular packing in acceptor-donor-acceptor type divinylbenzene derivatives. This interconversion is associated with the switching of solid-state luminescence from red to greenish-yellow ($\Delta\lambda = 95$ nm). A detailed investigation of the photophysical properties provided molecular and supramolecular level comprehension of the factors guiding the luminescence switching. The transition between different packing modes is associated



with differential excited state coupling and excitation energy migration efficiencies due to the variance in the chromophore organization. Viewed more broadly, our findings illustrate that subtle control over energy migration processes in molecular assemblies by heating may result in functional organic materials with switchable luminescence.

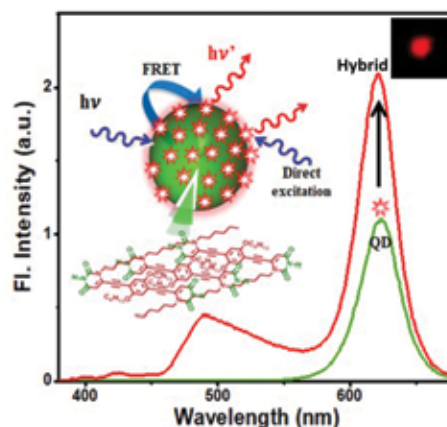
Polymorphism in Sn(IV)-Tetrapyrrolyl Porphyrins with Halogenated Axial Ligand: Structural, Photophysical, and Morphological Study



In this study, we report the first example of polymorphic Sn(IV)-tetrapyrrolylporphyrins axially armed with halogen (Cl, Br)-substituted carboxyphenyl ligands (structural formula $[Sn(tPyP)2+(A-)]_2$, where A is the axial ligand = 3,5-dichloro/dibromo benzoic acid). The two polymorphs of chloro-substituted Sn(IV)-tetrapyrrolylporphyrin (1α and 1β) display distinct photophysical and morphological properties in the solid state. X-ray diffraction study reveals that these polymorphs 1α and 1β greatly differ in supramolecular architecture and noncovalent interactions, which is responsible for their distinct solid-state properties. Molecules of the two polymorphs adopt different conformations of the axial carboxyphenyl ligand. Crystal packing of these polymorphs are dominated by intermolecular C-H \cdots Npyridine, C-H \cdots O, C-H \cdots π , and Cl \cdots Npyridine interactions. Theoretical study showed that the energy difference between the two polymorphs is ~ 8 kcal/mol. In addition to these polymorphs, a reference compound 2 with an axial bromo-substituted carboxyphenyl ligand is also synthesized and structurally characterized.

Organic-Inorganic Nanohybrids with Enhanced Brightness for Biophotonics

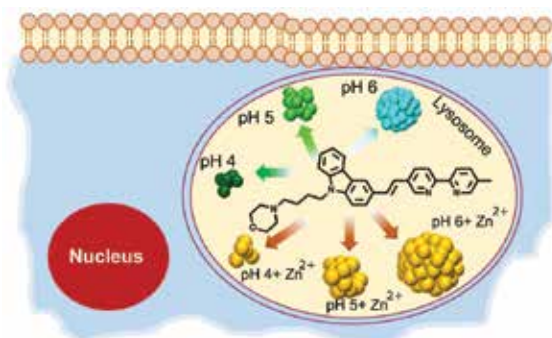
Fluorophores are an important class of materials which emit light from electronically excited states and have found extensive application in the field of sensors, LEDs, displays, bio-imaging and in many others. Fluorophores with high brightness are one of the essentials to enable



bio-imaging possible with low cost and benchtop instruments which reduces overall cost of analysis. In principle, the brightness is directly proportional to the number of fluorophores in the observer volume. In the present work, a new model for the preparation of brightly fluorescent material has been demonstrated through an organic-inorganic hybrid nanoparticle approach. Initially, spherical and highly fluorescent organic nanoparticles (FONPs, $\Phi_f = 0.38$) were prepared by self-organisation of oligo(phenyleneethynylene) (OPE) molecules. This organic core was then decorated with a shell of fluorescent CdSe/ZnS core-shell quantum dots (QDs) ($\langle d \rangle \cong 5.5$ nm, $\Phi_f = 0.27$) by the aid of a bifunctional ligand, mercaptopropionic acid. This enabled localisation of multiple QDs in a nanometric dimension (volume $\sim 1.8 \times 10^6$ nm 3). Additionally, high extinction coefficient ($\sim 4.1 \times 10^5$ M $^{-1}$ cm $^{-1}$) and good spectral match with the FONP's emission ($J(\lambda) \sim 4.08 \times 10^{16}$ M $^{-1}$ cm $^{-1}$ nm 4) made them a better Förster resonance energy transfer (FRET) pair ($\Phi_{\text{FRET}} = 0.8$). As a result, QD's fluorescence intensity got enhanced more than twofold. The fundamental calculations carried out indicated improvement of all the FRET parameters with an increase in the number of QDs around the FONPs. Both of these factors positively contributed to yield highly bright reddish luminescent hybrid particles as was visualised under a fluorescence microscope. Thus, we showed that confining a large number of fluorophores in a small volume can result in their high local concentration and concerted emission from the organic-inorganic hybrid fluorophore ensemble and its further amplification via Förster Resonance Energy Transfer could be one of the futuristic ways to realize improved materials for easy bio-imaging application.

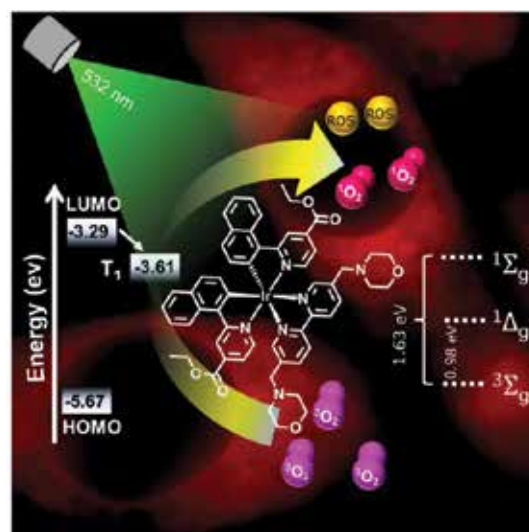
pH Controlled Nanoparticles Formation and Tracking of Lysosomal Zinc Ions in Cancer Cells by Fluorescent Carbazole-Bipyridine Conjugates

Fluorescent probes for simultaneous detection of multiple organelle specific analytes in cancer cells are essential for bioimaging applications. During the cellular abnormalities, among others important parameters (reactive oxygen species (ROS), enzymes, etc.) pH and Zn^{2+} are also altered in cells. We report the formation of nanoparticles of the fluorescent molecule CBL2 and its use as nanoprobes to simultaneously detect Zn^{2+} and pH variations in lysosome. Upon increasing the pH from 4-6, these probe form nanoparticles with increased size and enhanced fluorescence. Nanoparticles of CBL2 upon Zn^{2+} binding, exhibit pH responsive intensity change only at lysosomal pH window of 4-6 in the far red region at 610 nm and becomes silent above pH 7. Fluorescent imaging experiments on cancer cells revealed that the CBL2nanoprobe is capable of localizing at lysosomes and facilitates the detection of endogenous Zn^{2+} and pH variations. Furthermore, the lysosomal Zn^{2+} variation with external stimuli induced programmed cell death was effectively tracked using the nanoprobe.



A Cyclometalated Ir(III) Complex as Lysosome Targeted Photodynamic Therapeutic Agent for Integrated Imaging and Therapy in Cancer Cells

Organelle targeted photosensitizers (PSs) having luminescence properties are potential theranostic agents for simultaneous luminescence imaging and photodynamic therapy. Herein, we report a water soluble luminescent cyclometalated Ir(III) complex, Ir-Bp-Ly as lysosome targeted theranostic probe. Ir-Bp-Ly exhibits exceptional photophysical properties of good triplet

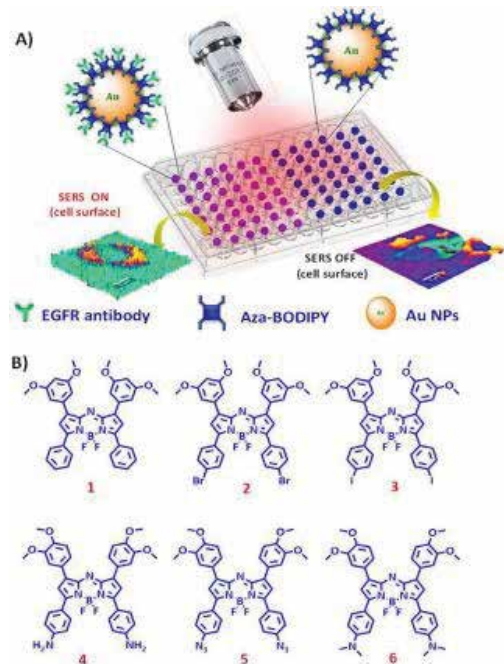


state quantum yield (0.90), singlet oxygen generation quantum yield (0.71 at pH 4) and long life time (1.47 μ s). Interestingly, Ir-Bp-Ly localized mostly in the lysosome because of the presence of morpholine units, suggesting its potential as a lyso-tracker. Ir-Bp-Ly displayed notable PDT effect in C6 glioma cells, as these PS efficiently generated ROS owing to the close proximity energy levels between triplet energy states of Ir-Bp-Ly and molecular oxygen (3O_2). The mechanism of cell death was studied through caspase-3/7 and flow cytometry analysis that clearly established the apoptotic pathway.

Unveiling NIR Aza-Boron-Dipyrromethene (BODIPY) Dyes as Raman Probes: Surface-Enhanced Raman Scattering (SERS) - Guided Selective Detection and Imaging of Human Cancer Cells

The development of new Raman reporters has attracted immense attention in diagnostic research based on surface enhanced Raman scattering (SERS) techniques, which is a well-established method for ultrasensitive detection through molecular fingerprinting and imaging. We unveiled for the first time, a set of six efficient Raman active aza-BODIPY dyes and their distinctive attribution could be extended at the molecular level detection through SERS techniques upon adsorption onto nano-roughened gold surface. Among the newly revealed Raman reporters, the amino substituted derivative 4 showed high signal intensity at very low concentrations

(ca. 0.4 μm for 4-Au). Interestingly, an efficient nanoprobe has been constructed by using gold nanoparticles as SERS substrate, and 4 as the Raman reporter (4-Au@PEG), which unexpectedly showed efficient recognition of three human cancer cells (lung: A549, cervical: HeLa, Fibrosarcoma: HT-1080) without any specific surface marker. We observed well reflected and resolved Raman mapping and characteristic signature peaks whereas, such recognition was not observed in normal fibroblast (3T3L1) cells. To confirm these findings, a SERS nanoprobe was conjugated with a specific tumor targeting marker, EGFR (Epidermal Growth Factor Receptor), a well-known targeted agent for human Fibrosarcoma (HT1080). This nanoprobe efficiently targeted the surface marker of HT1080 cells, thereby demonstrating its use as an ultrasensitive Raman probe for detection and targeted imaging, leaving normal cells unaffected.



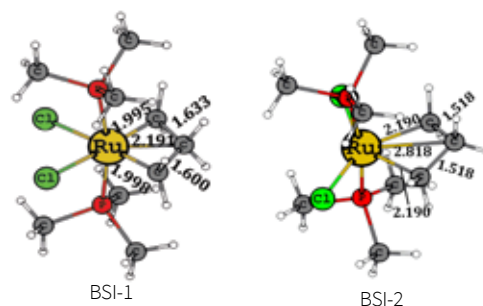
A) Schematic representation of the targeted SERS imaging using aza-BODIPY attached to NPs. B) Structures of the halogenated (first row) and N-substituted (second row) aza-BODIPY derivatives 1–6.

Computational Chemistry Research

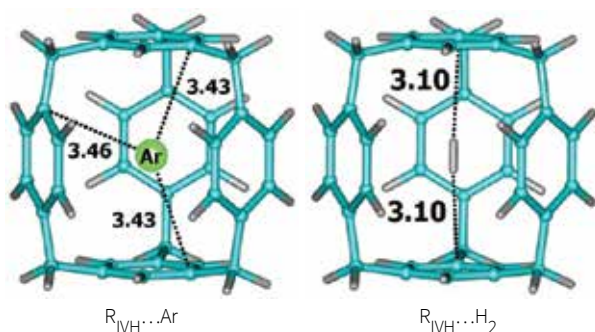
Computational chemistry is the branch of chemistry that simulate the behavior of chemical systems on a computer with the equations of quantum and classical physics. The information generated from simulation shows strong

correlation to experimental data on the structures, properties, and reactive behavior of chemicals. NIIST activities in this area are focused on the simulation of homogeneous organometallic catalytic systems, optoelectronic systems, and functional organic molecules and reactions using ab initio quantum mechanical (QM) and density functional theory (DFT) based methods.

Bond Stretch Isomerism (BSI). The phenomenon of existence of molecules in two isomers differing only in certain bond lengths is termed as BSI. Many BSI systems known in the literature are hypothetical models, and only a few are known characterized by crystallography techniques. A truly organometallic complex showing BSI due to metal-carbon bond length changes is never reported in the literature. Our DFT studies on the dissociative and associative mechanisms of Grubbs first and second generation olefin metathesis catalysis revealed that ruthenacyclobutane intermediate (BSI-1) observed in the celebrated Chauvin mechanism is not unique as it can change to a non-metathetic ruthenacyclobutane (BSI-2) via the phenomenon of bond stretch isomerism. BSI-1 and BSI-2 differ mainly in RuC_α , RuC_β , and $\text{C}_\alpha\text{C}_\beta$ bond lengths of the metallacycle. BSI-1 is metathesis active due to agostic bonding-assisted simultaneous activation of both $\text{C}_\alpha\text{C}_\beta$ bonds, giving hypercoordinate character to C_β whereas absence of such bonding interactions in BSI-2 leads to normal CC single bond distances and metathesis inactivity. The new mechanistic insights provided a strong basis for the use of bulky phosphine and N-heterocyclic carbene ligands in Grubbs catalyst design as this strategy promotes ligand dissociation and the formation of more stable BSI-1 than BSI-2. The study lifts the status of BSI from a concept of largely theoretical interest to a phenomenon of intense importance to describe an eminent catalytic reaction.



A noncovalent binding strategy: Fluorinated and non-fluorinated aromatic scaffolds have been designed to capture noble gases, H_2 and N_2 by maximising noncovalent interaction in them. These scaffolds made with two-, three-, four- and five-fluorinated benzene cores, linked with methylene units viz. R_I , R_{II} , R_{III} and R_{IV} as well as the corresponding non-fluorinated hydrocarbons viz. R_{IH} , R_{IIH} , R_{IIIH} and R_{IVH} showed a steady and significant increase in binding energy (E_{int}) with increase in the number of aromatic rings in the receptor. A stabilizing “cage effect” is observed in the cyclophane type receptors R_{IV} and R_{IVH} which is 26–48% of total E_{int} for all except the larger sized Kr, Xe and N_2 complexes. The E_{int} of the cage receptors is one of the highest interaction energy ranges reported for noble gases, H_2 and N_2 for a neutral carbon framework. Synthesis of such systems is promising in the study of molecules in confined environment.

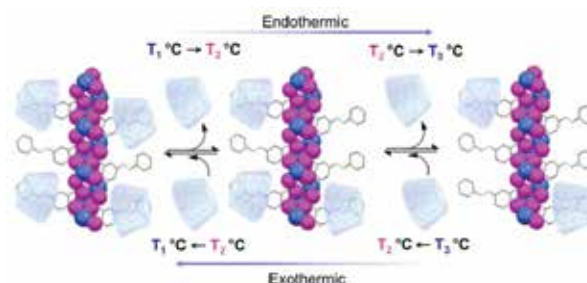


Futuristics and Capacity Building

Stepwise Control of Host–Guest Interaction Using a Coordination Polymer Gel

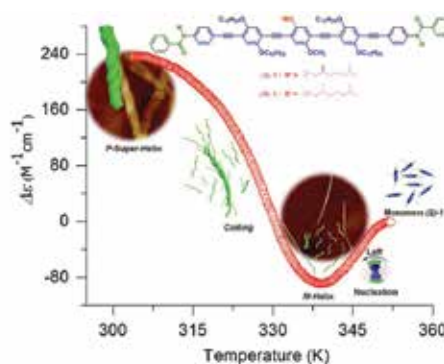
Precise control of host–guest interaction as seen in biological processes is difficult to achieve with artificial systems. In this work, we have exploited the thermodynamic benefits of a system in equilibrium to achieve controlled stepwise release and capture of cyclodextrin (guest) using a coordination polymer (Mg-CP) as the host and temperature as the stimulus. Since temperature is not a precision stimulus for artificial host–guest interaction, the present system is a distinct prototype that manifests temperature-controlled natural host–guest interaction. The described coordination polymeric host system, when incorporated into a hydrogel matrix, provides a microenvironment that facilitates the stepwise release of α -CD in response to temperature variation

within a quasi-solid state. The work demonstrated may pave the way towards thermally controlled delivery and monitoring of otherwise spectroscopically silent molecules such as cyclodextrins.



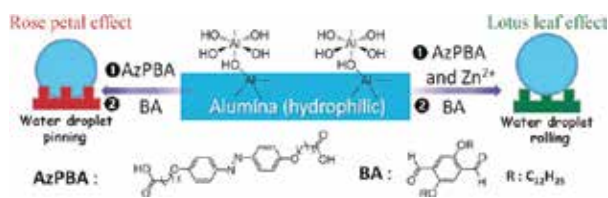
The Helix to Super-Helix Transition in the Self-Assembly of π -Systems: Superseding of Molecular Chirality at Hierarchical Level

Higher-order super-helical structures derived from biological molecules are known to evolve through opposite coiling of the initial helical fibers, as seen in collagen protein. A similar phenomenon is observed in a π -system self-assembly of chiral oligo(phenyleneethylene) derivatives (S)-1 and (R)-1 that explains the unequal formation of both left- and right-handed helices from molecule having a specific chiral center. Concentration- and temperature-dependent circular dichroism and UV/Vis spectroscopic studies revealed that the initial formation of helical aggregates is in accordance with the molecular chirality. At the next level of hierarchical self-assembly, coiling of the fibers occurs with opposite handedness, thereby superseding the command of the molecular chirality. This was confirmed by solvent-dependent decoiling of super-helical structures and concentration-dependent morphological analysis.



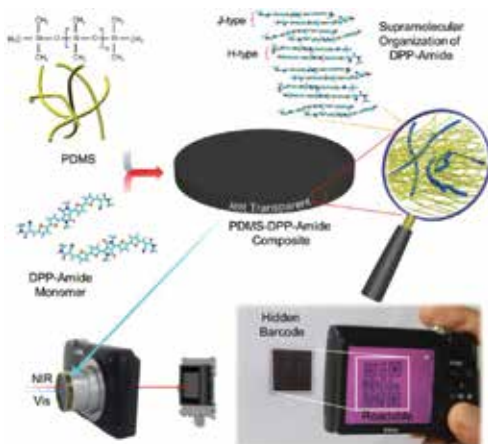
Creation of “Rose Petal” and “Lotus Leaf” Effects on Alumina by Surface Functionalization and Metal-Ion Coordination

Functional differences between superhydrophobic surfaces, such as lotus leaf and rose petals, are due to the subtle architectural features created by nature. Mimicry of these surfaces with synthetic molecules continues to be fascinating as well as challenging. In this work, we demonstrate how inherently hydrophilic alumina surface can be modified to give two distinct superhydrophobic behaviors. Functionalization of alumina with an organic ligand resulted in a rose-petal-like surface (water pinning) with a contact angle of 145° and a high contact angle hysteresis (69°). Subsequent interaction of the ligand with Zn^{2+} resulted in a lotus-leaf-like surface with water rolling behavior owing to high contact angle (165°) and low-contact-angle-hysteresis (2°). In both cases, coating of an aromatic bis-aldehyde with alkoxy chain substituents was necessary to emulate the nanowaxy cuticular feature of natural superhydrophobic materials.



A Supramolecular Nanocomposite as a Near-Infrared-Transmitting Optical Filter for Security and Forensic Applications

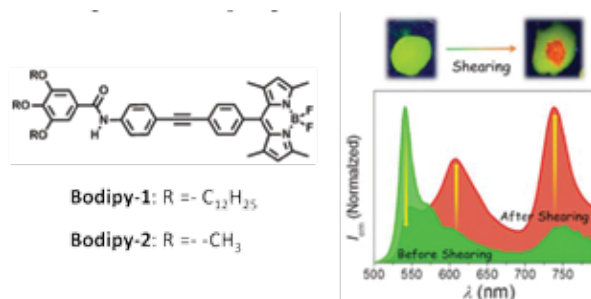
Seeing an object under dark, hiding an information from naked eye but can be seen with a special device or spotting a blood stain on a dark fabric obtained from a crime site



are important requirements from the safety view points. These are possible by using camera fitted with near infrared (NIR) transparent filters. Currently available NIR filters are based on inorganic materials that are expensive and brittle. We have developed a supramolecular dye based nanocomposite as NIR transparent filter that has very good UV-Vis light cut-off ability and flexibility. This filter can be fitted with commercially available camera for night vision photography, reading hidden information and barcodes and also for viewing blood-stain on dark fabrics.

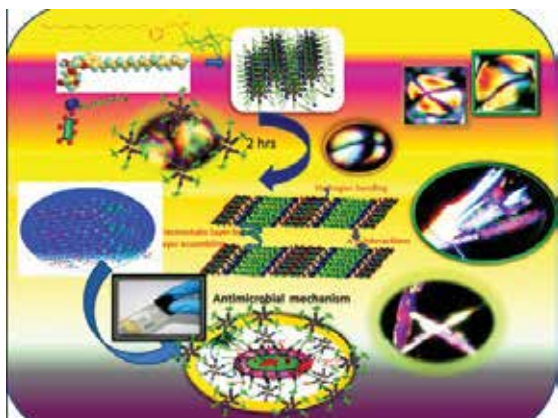
An Unprecedented Amplification of Near-Infrared (NIR) Emission in a Bodipy Derived π -System by Stress or Gelation

NIR emitting small organic molecules are relatively rare when compared to UV-Vis light emitting molecules, however they are important in the fields of materials and biology. In this work, we report an unprecedented strategy to generate and amplify near-infrared emission in an organic chromophore by mechanical stress or gelation pathways. A greenish-yellow emitting film of π -extended Bodipy-1, obtained from n-decane, became orange-red upon mechanical shearing, with a 15-fold enhancement in NIR emission at 738 nm. Alternatively, a DMSO gel of Bodipy-1 exhibited a 7-fold enhancement in NIR emission at 748 nm with a change in emission color from yellow to orange-red upon drying. The reason for the amplified NIR emission in both cases is established from the difference in chromophore packing, by single crystal analysis of a model compound (Bodipy-2), which also exhibited a near identical emission spectrum with red to NIR emission (742 nm). Comparison of the emission features and WAXS and FT-IR data of the sheared n-decane film and the DMSO xerogel with the single crystal data supports a head-to-tail slipped arrangement driven by the N-H/F-B bonding in the sheared or xerogel states, which facilitates strong exciton coupling and the resultant NIR emission.



Design and Development of Biogel through Hierarchical Self-Organisation of Biomolecule for Sustainable Antibacterial Applications

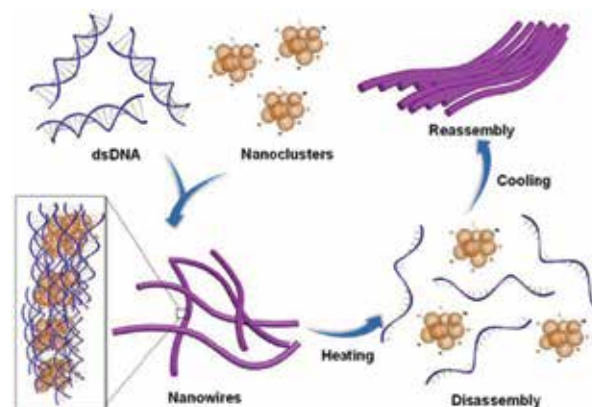
This work describes the design and development of biogel (PPG) through self-organisation of 3-pentadecylphenoxirane grafted polyglucopyranose and demonstration of its antimicrobial applications. 3-pentadecylphenoxirane (PO) is an epoxy derivative of 3-pentadecylphenol which is prepared from cashew nut shell liquid, an industrial waste of cashew industry. Polyglucopyranose (PG) is isolated from abundantly available under utilised jackfruit seed starch. During grafting epoxy converted to hydroxyl group and the grafted molecule is endowed with large number of hydroxyl group, aromatic ring and long hydrocarbon chain which undergo supramolecular organized structures through various noncovalent interactions such as electrostatic layer by layer assembling (ESLBL) interactions, π - π interactions and van der Waals interactions to form columnar and lamellar phases which are confirmed by microscopy, rheology and XRD. Later demonstrated its antimicrobial screening studies against Gram positive and Gram negative bacteria and dose and time dependent activity of the hydrogels. ROS production is also done to determine the antibacterial activity of PPG. This developed design strategy can be exploited for generating macroscopically self-organised biogel systems from small biomolecules for futuristic high performing multifunctional applications. A plausible mechanism for the formation of various self-organised structures were proposed from the studies made from FTIR, PLM, XRD and rheology and are shown in Figure.



Mechanism for the formation supramolecular organized structures

Fullerene Cluster Assisted Self-Assembly of Short DNA Strands into Semiconducting Nanowires

DNA nanotechnology has expanded over the last two decades to incorporate strategies to harness the sequence programmability of DNA for the construction of hierarchical nanostructures and subsequent use to organize functional motifs in an ordered fashion. Of several nanostructures



developed, DNA-based 1D nanowires are anticipated to be pertinent materials for smart connections between metal electrodes in nanodevices. Herein, we report a simple and general strategy, in which nanoclusters of a fullerene derivative act as stapler motifs in bringing ordered nanoscale assembly of short oligonucleotide duplexes into micrometer-sized nanowires. The optimum cluster size, availability of DNA anchoring motifs and the nature of the DNA strands controls the structure of these nanomaterials. For the construction of appropriate-sized nanoclusters, we have designed three fullerene derivatives, F-Py, F-An and F-PTz, consist of a pyridinium (Py), aniline (An) or phenothiazine (PTz) end group respectively, linked through a triethylene glycol chain, and possess unique hydrophobic-hydrophilic balance, which imparts amphiphilic character and significant solubility in polar solvents. The morphological analysis of F-Py, F-An and F-PTz in 10% DMSO-PBS by HRTEM reveals the self-assembly and nature of the aggregates. Among the three derivatives, F-An results in the formation of more or less uniform, spherical nanoclusters with sizes ranging from 3 to 5 nm. Due to the desirable size range (<5 nm) of the F-An nanoclusters, we have chosen F-An clusters formed in 10% DMSO-PBS for further investigation of

the interactions with dsDNA. Interactions between F-Annanoclusters and dsDNA investigated through UV/Vis absorption spectroscopy and circular dichroism spectroscopy confirms possible groove-binding and the intact B-form structure of the duplex. AFM analysis reveals the formation of nanowires that extend over several micrometres in length, with uniform thicknesses of about 80 or 120 nm (joined bundles) and an average height of 2 nm. Further, TEM studies confirmed the formation of long, uniform nanowires with an average thickness of about 12 nm. Results of the photophysical and morphological investigations of F-Annanoclusters in the presence of dsDNA support the mutually assisted self-assembly of F-Annanoclusters and dsDNA, resulting in extended nanostructures. Furthermore, horizontal conductivity measurements through conductive AFM confirmed the charge transport properties of these nanowires.

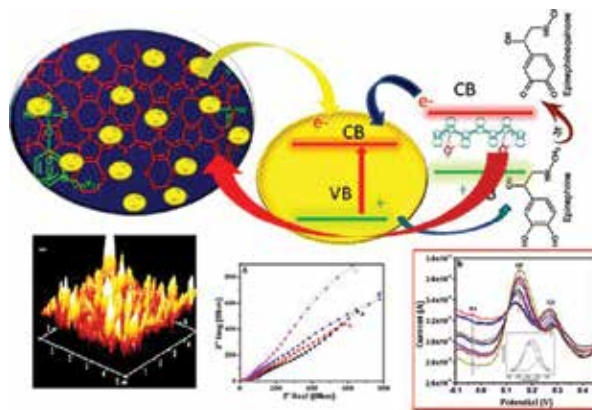
PEDOT-reduced graphene oxide-silver hybrid nanocomposite modified transducer for the detection of serotonin

PEDOT-reduced graphene oxide-silver hybrid nanocomposite (PEDOTNTs/rGO/Ag NPs) modified electrode as a transducer for the detection of serotonin. Structure and properties of the nanocomposites were characterized by XPS, XRD, SEM, TEM, FT-IR, UV-Visible, and Raman spectroscopy. The electrochemical impedance spectroscopic (EIS) results showed a very low charge transfer resistance (198 Ω) for the modified electrode and its sensing performance towards serotonin were studied by various electro-chemical techniques such as cyclic voltammetry (CV), differential pulse voltammetry (DPV) and chronoamperometry (CA). PEDOTNTs/rGO/AgNPs/GCE showed better performance by DPV with a lower detection limit of 0.1 nM with high operational stability, reproducibility (inter- and intra-electrode - 2.3%) response time (8s) and sensitivity (14.304 $\mu\text{AmM}^{-1}/\text{cm}^2$). It also showed a liner range from 1 nM to 0.5 mM (linear regression equation $y=6.33 \times 10^{-6}x + 0.153 \times 10^{-6}$). The kinetics of serotonin oxidation was studied by chronoamperometry and the catalytic rate constant calculated as $1.647 \times 10^3 \text{ mol}^{-1}\text{Ls}^{-1}$. Later, the modified electrode demonstrated as a transducer for the selective detection of serotonin in the presence of ascorbic acid, uric acid and tyrosine. Real sample analysis and interference studies suggested the

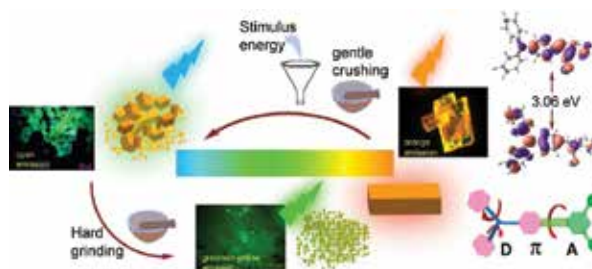
modified electrode can be exploited in pharmaceutical and medical fields.

Flexible Electrochemical Transducer Platform for Neurotransmitters

This work discusses on the development of a flexible electrochemical transducer film based on PEDOT-titania-poly(dimethylsiloxane) (PTS) for simultaneous detection of neurotransmitters. PTS films were characterized using various techniques using TEM, SEM, AFM, electrical conductivity, AC-impedance and thermo-mechanical stability. The electrocatalytic behaviour of the flexible PTS film towards the oxidation of neurotransmitters was investigated using cyclic voltammetry (CV) and differential pulse voltammetry (DPV). The fabricated transducer measured limit of detection of $100\text{nm} \pm 5$ with a response time of 15s, and sensitivity of $63\mu\text{AmM}^{-1}\text{cm}^{-2}$. The fabricated transducer film demonstrated for the simultaneous determination of epinephrine (EP), dopamine (DA), ascorbic acid (AA), and uric acid (UA) with no interference between the analyte molecules. Further, transducer performance is validated by performing with real samples. Results suggested that the fabricated



Distinct Mechanoresponsive Luminescence, Thermochromism, Vapochromism, and Chlorine Gas Sensing by a Solid-State Organic Emitter





flexible PTS transducer with superior electrocatalytic activity, stability and low response time can be exploited for the sensing of neurotransmitters and hence can be exploited at in vitro and in vivo conditions for the early detection of the various diseases. The efficient electron transfer process observed with the present PTS3 electrode system can be explained from the fundamental band alignment. The mixed phase of titania is the core driving force for enhanced transport of charge carriers in the composite electrode. In PTS electrode, upon electrical excitation, the charge carriers will efficiently move from the LUMO of PEDOT (~2.4 eV) which is higher than that of the conduction band of titania (~4.2 eV), and this will create an energy barrier for the back electron transport. The effective interaction of PEDOT chains on the surface of hierarchical titania can enhance the amount of charge carriers on the surface of the electrode.

In this study, we report a synthetically simple donor-acceptor (D-A)-type organic solid-state emitter that displays unique fluorescence switching under mechanical stimuli. Orange and yellow emissive crystals of 1 (1O, 1Y) exhibit an unusual "back and forth" fluorescence response to mechanical force. Gentle crushing (mild pressure) of the orange or yellow emissive crystal results in hypsochromic shift to cyan emissive fragments ($\lambda_{em} = 498-501$ nm) with a large wavelength shift $\Delta\lambda_{em} = -71$ to -96 nm, while further grinding results in bathochromic swing to green emissive powder $\lambda_{em} = 540-550$ nm, $\Delta\lambda_{em} = +40$ to 58 nm. Single-crystal X-ray diffraction study reveals that molecules are packed by weak interactions, such as C-H \cdots π , C-H \cdots N, and C-H \cdots F, which facilitate intermolecular charge transfer in the crystal. With the aid of structural, spectroscopic, and morphological studies, we established the interplay between intermolecular and intramolecular charge-transfer interaction that is responsible for this elusive mechanochromic luminescence. Moreover, we have also demonstrated the application of this organic material for chlorine gas sensing in solid state.

Phytopharmaceuticals and drug intermediates

The tropical position and high ranges of Western Ghats, close to sea level endow Kerala with abundant flora. The plethora of flora seen in Kerala gave way to unique ethnic preparations that are highly sought after for chronic diseases by patients worldwide. Traditional and Ayurvedic

therapeutic formulations draw on an impressive array of plants. These have not been scrutinized by modern scientific methods. Although several lead molecules and drug molecules have already been discovered from medicinal herbs, further scientific exploration in this area along with verification and standardization according to the modern system of medicine is required. Herbal drug development includes various steps, starting from collection of raw materials in the right growth stage of the plants, correct identification, pharmacognostic and chemical quality standardization. Addressing the standardization is very important and needs broader consideration. New methods have to be developed to enforce and regulate quality control and standardization of phytomedicines. In order to achieve an international acceptance to Ayurveda as an alternative, preventive and treatment modality, it becomes necessary to have scientific validation of new formulations and products being introduced. In this area we are focussing on the detailed phytochemical evaluation of plants that are reported to have medicinal activity or plants that are being traditionally used as herbal medicines or as part of herbal formulations.

Developing green and synthetic protocols for organic transformations towards molecules of interest in biology and fine chemicals is another important area of the activity.

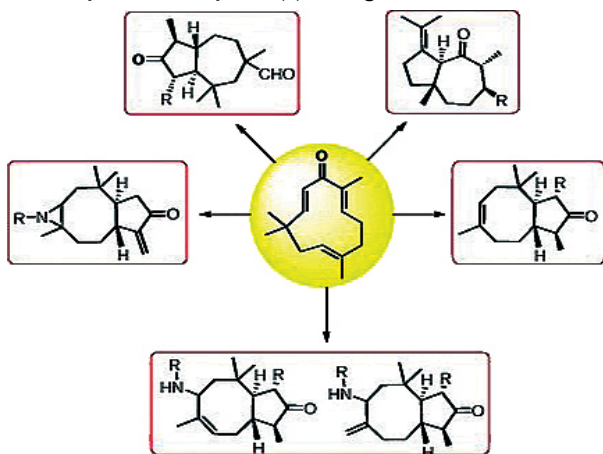
The main objectives of this program are

- *Research and Development in the area of phytochemicals*
- *To provide scientific support/validation to Ayurvedic industry/products*
- *Sustainable utilization of abundant natural resources for value added products*
- *Development of green processes towards molecules of interest in biology*

Lewis-Acid-Catalyzed Activation of Zerumbone towards Sesquiterpenoid Derivatives: Sustainable Utilization of Abundant Natural Resources for the Synthesis of Chemically Diverse Architectures

We have developed Lewis-acid-catalyzed cyclization reactions of zerumbone and its derivatives to access structurally diverse polycyclic compounds. The core

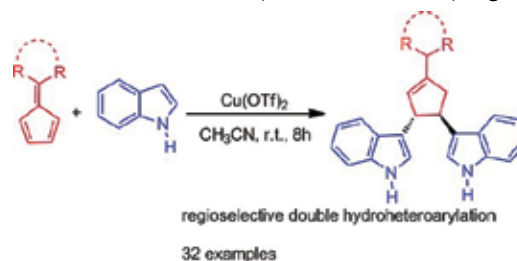
structures of the synthesized molecules, that is, [5.7] and [5.8] fused-ring systems, are found in many biologically active natural products. The highlight of the new method is its utilization of renewable resources to generate complex fused skeletons. Notably, Zingiberzerumbet (also known as bitter ginger) can be cultivated on a large scale, and can produce a mature rhizome within a seven-month period. Under Lewis acid catalysis, we readily synthesized an indole-substituted isodaucane moiety from the zerumboneindole adduct, as well as a [5.8] fused ring system from zerumbone and indole. Furthermore, aziridinated zerumbone also underwent Nazarov cyclization to afford a [5.8.3] fused-ring system. This strategy opens new opportunities for the synthesis of chemically diverse natural-product scaffolds that contain heterocyclic/carbocyclic appendages.



Lewis Acid Promoted Regioselective Double Hydro(hetero)arylation of 6,6'-Dialkyl-Substituted Pentafulvenes: A Facile Approach to Bisindole Derivatives

Bisindoles are recognized as an important structural motif in many natural products, pharmaceutical agents, and advanced functional materials. We have unraveled a unique reactivity of alkyl-substituted pentafulvenes for the synthesis of alkylidenecyclopentene-fused bisindoles. The results reveal that Lewis acid catalysis could be an easy method for the double endocyclic activation of pentafulvenes with indoles. The present methodology is an effective alternative to Bronsted acid/superacid catalysis, which leads to the self-polymerization of pentafulvenes. The protocol also offers bisindole derivatives with an isoprenyl moiety

bound to a cyclopentenylated ring system. Preliminary investigations to check the reactivities of other fulvenes such as triafulvenes and heptafulvenes are in progress



Efficient synthesis of pharmaceutically relevant indolo[2,3-b]quinolines, chromeno [2,3-b] indoles, 3-alkenyl-oxindoles, diindolylketones from 3,3'-diindolylmethanes

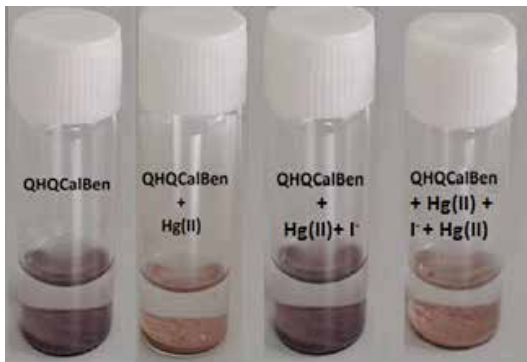
An easily accessible 3,3'-diindolylmethanes (DIMs) were utilized to generate a focussed library of indolo[2,3-b]quinolines, chromeno [2,3-b] indoles and 3-alkenyl-oxindoles under DDQ mediated oxidative conditions and diindolylketones under PIDA oxidative conditions. The mild conditions and excellent yields of the products make this method a good choice to access a diverse library of bioactive molecules from a common starting material.



Lower Rim-Modified Calix[4]arene-Bentonite Hybrid System as a Green, Reversible, and Selective Colorimetric Sensor for Hg²⁺ Recognition

Researches leading to design and development of reliable and economic organic-inorganic hybrid systems as sensors that can recognize hazardous metal ions by direct visual observation are of primary importance. Based on our previous experiences in developing calixarene based molecular sensors for selective detection of hazardous/environmentally benign metal ions, we initiated research in these lines, on developing an organic-inorganic hybrid sensor for the detection of Hg²⁺. Bentonite, a cheap support material, was chosen as the inorganic counterpart for developing the hybrid system which was intercalated with a modified calixarene derivative which selectively bound with Hg²⁺ ions. This hybrid system

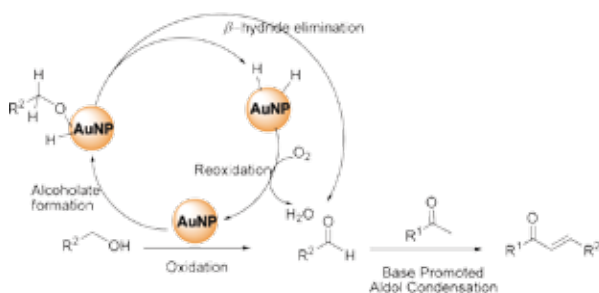
(QHQCAlBen) successfully performed as a colorimetric solid-state Hg²⁺ sensor. The sensor was found to be thermally stable, environmentally benign, economically affordable, reversible, portable and reusable.



Photograph showing naked eye detection of Hg²⁺ with QHQCAlBen and its reversibility with iodide solution.

An Efficient and Environmentally Benign Bentonite-Gold Nanohybrid-Catalyzed Oxidative Cross-Coupling of Ketones with Benzylic Primary Alcohols.

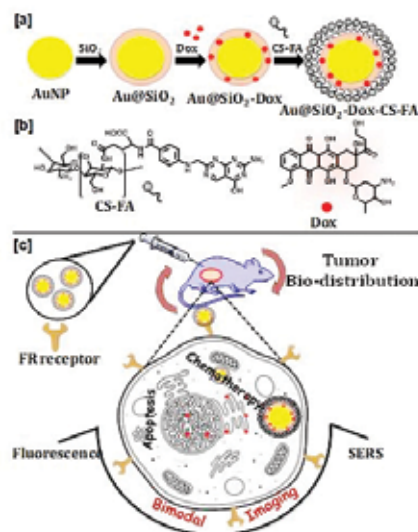
The highly efficient, environmentally benign and reusable heterogeneous bentonite-gold nanohybrid catalyst (AuMPBen) developed as part of the 12th FYP project (CSC00135) was found to successfully catalyse the oxidative C-C coupling of ketones and primary alcohols to produce α,β -unsaturated ketones in the presence of Cs₂CO₃ as base. The cascade C-C bond formation strategy using the catalyst is environmentally benign, economical, selective, easily separable and reusable, and works under mild reaction conditions. This nanohybrid system afforded a wide variety of α,β -unsaturated ketones in excellent yield with water as the only by-product. In addition, this heterogeneous catalyst was well applicable for the gram scale synthesis of α,β -unsaturated ketones.



Oxidative cross-coupling reaction of primary alcohols with ketones catalyzed by Au-MPBen

Emergence of Gold-Mesoporous Silica Hybrid Nanotheranostics: Dox-Encoded, Folate Targeted Chemotherapy with Modulation of SERS Fingerprinting for Apoptosis Towards Tumor Eradication

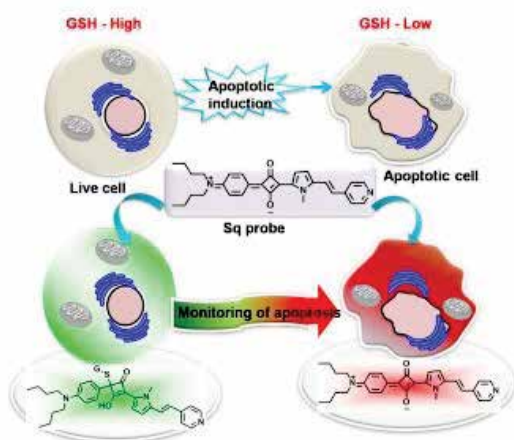
Strategically fabricated theranostic nanocarrier delivery system is an unmet need in personalized medicine. We developed a versatile folate receptor (FR) targeted nanoenvelop delivery system (TNEDS) fabricated with gold core silica shell followed by chitosan-folic acid conjugate surface functionalization by for precise loading of anti-cancer drug doxorubicin (Dox), resembled as Au@SiO₂-Dox-CS-FA. TNEDS possesses up to 90% Dox loading efficiency and internalized through endocytosis pathway leading to pH and redox-sensitive release kinetics. The superior FR-targeted cytotoxicity is evaluated by the nanocarrier in comparison with US Food and Drug Administration (FDA)-approved liposomal Dox conjugate, Lipodox. Therefore, this futuristic TNEDS is expected to be a potential alternative as a clinically relevant theranosticnanomedicine to effectively combat neoplasia.



Schematic representation of a) Various steps involved in the fabrication of Au@SiO₂-Dox-CS-FA starting from AuNPs. b) Chemical structure of chitosan-folic acid (CS-FA) and Dox. c) Biological evaluation after i.p. administration of TNEDS on tumor-bearing mice.

A Ratiometric Near-Infrared Fluorogen for the Real Time Visualization of Intracellular Redox Status during Apoptosis

Direct monitoring of apoptotic progression is a major step forward for the early assessment of therapeutic efficacy of certain treatments and the accurate evaluation of the spread of a disease. The regulatory role of glutathione (GSH) is explored as a potential biomarker for tracking apoptosis. For this purpose, a nearinfrared (NIR) squaraine dye is introduced that is capable of sensing GSH in a ratiometric manner by switching its emission from NIR (690 nm) to visible region (560 nm). The favorable biocompatible attributes of the probe facilitated the real-time monitoring of apoptotic process in line with the conventional apoptotic assay. Furthermore, the robust nature of the probe was utilized for the quantitative estimation of GSH during different stages of apoptosis. Through this study, an easy and reliable method of assaying apoptosis is demonstrated, which can provide valuable insights in translational clinical research.



Schematic illustration of the Sq dye for the ratiometric sensing of GSH during apoptosis.

BF₃·OEt₂ Mediated Tandem Annulation: A Strategy to Construct Functionalized Chromeno-, and Pyrano- Fused Pyridines

Chromone is an essential class of oxygen-containing heterocyclic compounds. Chromones are among the most exciting discoveries in the field of natural products which have successfully led to the development of many approved drugs and clinical trial agents. On the other hand, pyridine as privileged *N*-heterocycle is associated

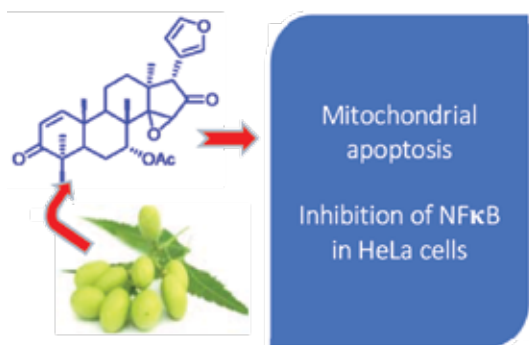
with various natural products and pharmaceuticals. The medicinal properties of these compounds are associated with their bi- and tricyclic molecular hybrids. The generation of hybrid pharmacophore through the fusion of medicinally active chromenones / pyranones and pyridines will undoubtedly enrich the structural template.



Therefore, the development of these enriched structural templates through the multiple bond-forming transformations involving multicomponent reactions (MCRs) in one-pot is the key to generating molecular diversity. Owing to the aforementioned biological importance of pyridines and related hybrids, recently we have unraveled a one-pot multicomponent cascade synthesis of pyridine appended heterocycles from the readily accessible arylidenones, alkynes and nitriles *via* BF₃·OEt₂ mediated cascade annulation. This simple protocol has led us to report the diverse library of chromeno[3,4-*c*]pyridines, thiochromeno[3,4-*c*]pyridines, pyrano[3,4-*c*]pyridines and thiopyrano[3,4-*c*]pyridines.

Epoxyazadiradione purified from the *Azadirachtaindica* induced mitochondrial apoptosis and inhibition of NFκB nuclear translocation in HeLa cells

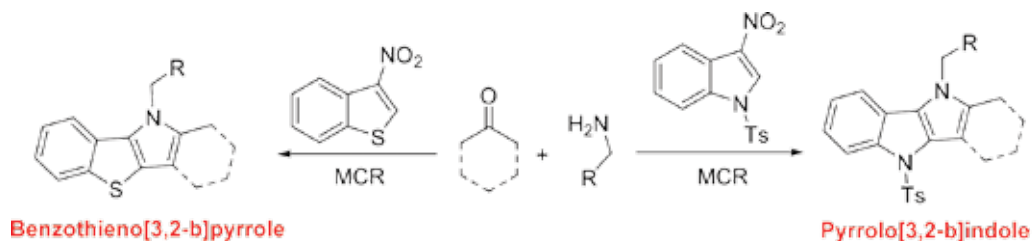
Epoxyazadiradione (EAD) is an important limonoid present in Neem (*Azadirachtaindica*) plant. In the present study, we have purified EAD from neem seed and studied its anticancer potential in human cervical cancer (HeLa) cells. Cell proliferation inhibition studies indicated that the GI₅₀ value of EAD as 7.5±0.0092 μM in HeLa cells, whereas upto 50 μM concentrations EAD did not affect the growth of normal H9C2 cells. The control drug cisplatin inhibited the growth of both HeLa and H9C2 cells with a GI₅₀ value of 2.92±1.192 μM and 4.22±1.568 μM respectively. Nuclear DNA fragmentation, cell membrane blebbing, phosphatidylserine translocation, upregulation of Bax, caspase 3 activity and PARP cleavage and downregulation



of Bcl2 in HeLa cells on treatment with EAD indicated the apoptotic cell death. Increase in caspase 9 activity and release of active cytochrome c to the cytoplasm on treatment with EAD confirmed that the apoptosis was mediated through the mitochondrial pathway. EAD also inhibited the nuclear translocation of NFκB in HeLa cells. Thus our studies demonstrated EAD as a potent and safe chemotherapeutic agent when compared to the standard drug cisplatin which is toxic to both cancer as well as normal cells equally.

Heteroannulation of 3-Nitroindoles and 3-Nitrobenzo[b]thiophenes: A Multicomponent Approach toward Pyrrole-Fused Heterocycles

The inherent nucleophilicity of indole can be reversed by the installation of electron-withdrawing groups on the *N*-atom and C-2 or C-3 carbon atoms. We were interested in exploiting the reactivity of electrophilic indoles for the development of a facile method for fusing the pyrrole moiety onto the indole core. In this line, we have developed a general method for the heteroannulation of *N*-protected 3-nitroindoles and 3-nitrobenzo [b]thiophenes. The methodology was applied for the synthesis of a number of pyrroloindoles starting from different cyclic and acyclic ketones, primary amines, and 3-nitroindoles and it was applied for the “pyrroloindolization” of natural products. We have also demonstrated the applicability of the heteroannulation strategy for the generation of pyrrolo[3,2-*b*]indoles on a gram scale.



पदार्थ विज्ञान तथा प्रौद्योगिकी प्रभाग

पदार्थ विज्ञान तथा प्रौद्योगिकी प्रभाग में अनुसंधान के फोकस क्षेत्र हैं- उन्नत कार्यात्मक सामग्रियों का विकास, खनिजों का इष्टतमीकरण और सामरिक, ऑटोमोबाइल, ऊर्जा और सामाजिक अनुप्रयोगों के लिए घटक। प्रभाग में, वर्ष 2017-18 के दौरान खनिज इष्टतमीकरण, ऊर्जा बचत के लिए बहुआयामी वर्णक, प्रकाश व्यवस्था अनुप्रयोगों के लिए लुमेनसेंट सामग्री, कार्बन डाइ ऑक्साइड अधिशोषण के लिए छिद्रपूर्ण सिरेमिक सामग्री, डाई निम्नीकरण के लिए नैनो फोटो उत्प्रेरक, मुद्रित इलेक्ट्रॉनिक्स के लिए सामग्री, चुंबकीय और चुंबक प्रशीतन सामग्री, बहुलक और बहुलक आधारित नैनो कंपोजिट, रणनीतिक और मोटर वाहन अनुप्रयोगों के लिए हल्की मिश्र धातु का विकास जैसे क्षेत्रों में अत्याधुनिक प्रौद्योगिकियों के विकास पर काम शुरू किया गया है। प्रभाग ने एससीआई पत्रिकाओं में 80 शोध पत्र प्रकाशित किए हैं और दो विदेशी पेटेंट के लिए मंजूरी प्राप्त है और बीस शोध छात्रों को पीएचडी प्राप्त हुई। इस अवधि के दौरान प्रभाग के कुछ शोध हाइलाइट नीचे दिए गए हैं-

हाइलाइट

- ऊर्जा बचत अनुप्रयोगों के लिए उच्च आईआर परावर्तन के साथ बहुकार्यात्मक अकार्बनिक कोलोरंट्स
- औद्योगिक परिसर में एनआईआईएसटी ब्लू वर्णक का प्रदर्शन
- एलईडी अनुप्रयोगों के लिए एकल चरणबद्ध सफेद और लाल फॉस्फोरस का विकास
- नूतन वाणिज्यिक उत्पादों और स्थायी व्यापार के लिए सिलिका रेत और सिरेमिक अवशेष का मूल्यवर्धन
- इलेक्ट्रिकल पोर्सिलेन इन्सुलेटर्स के लिए हाइड्रोफोबिक चमक कोटिंग्स का विकास
- उच्च प्रदर्शन उत्प्रेरक के रूप में ZIF-8 / आयरन-ग्राफीन नैनो कंपोजिट से व्युत्पन्न आयरन शामिल एन-डोपड छिद्र कार्बन
- चुंबकीय पी.डी.-Fe₃O₄-प्ललाई ऐश कंपोजिट कणों का उपयोग करके जलीय विलयन से कार्बनिक सिंथेटिक-रंगों को हटाने के लिए एक कुशल और लागत प्रभावी दृष्टिकोण के रूप में सिनर्जिस्टिक पर्सल्फेट सक्रियण
- पॉली प्रोपेलीन के उल्लेखनीय रूप से वर्धित क्रिस्टलाइजेशन दर और थर्मल स्थिरता के लिए अति उच्च विशिष्ट सतह क्षेत्र के साथ स्तरित डबल हाइड्रोक्साइड नैनोप्लेटलेट्स
- प्राचीन पॉली (मिथाइल मेथाक्राइलेट) बहुलक की तुलना में सिल्वर से सजा हुआ हेक्सागोनल के योग के साथ 363% की एक प्रभावशाली थर्मल चालकता वृद्धि (टीसीई) प्राप्त हुई
- एक ई आकार का पहनने योग्य माइक्रो स्ट्रिप पैच वाईमैक्स एंटीना का डिजाइन किया गया और पॉलिएस्टर कपड़े पर उसे फेब्रिकेट किया गया, जो भौगोलिक दृष्टि से दूरदराज इलाकों में फंस गये व्यक्तियों और वस्तुओं का पता लगाने के लिए उपयोगी है।
- सिंडियोटैक्टिक पॉलीस्टीरिन आधारित एरोजेल्स के लिए, रिपोर्ट की गयी सबसे कम पारद्युतिक स्थिरांक (के= 1.03 ±



- 0.02) की रिकॉर्ड तोड़नेवाली पारद्युतिक स्थिरांक प्राप्त हुई, जो हवा के पारद्युतिक स्थिरांक ($k = 1$) के बहुत करीब है।
- लचीले सबस्ट्रेट्स पर प्रिंट करने योग्य कार्बन नैनोट्यूब आधारित स्याही स्क्रीन विकसित किया, जो न्यूनतम सतह खुरदरापन (<65 एनएम) के साथ $0.5 - 13 \Omega / \text{वर्ग}$ की रेंज में शीट प्रतिरोध का प्रदर्शन करता है
 - निम्न ग्रेड इल्मेनाइट के उन्नयन पर पायलट संयंत्र पैमाने के परीक्षणों का सफल समापन और वीवी मिनरल्स के लिए विदेशी ग्राहकों द्वारा अंतिम उत्पादों का मूल्यांकन
 - एयरोस्पेस अनुप्रयोगों के लिए जिंक्रोनीयम/मैंगनीज संयोजन के साथ एल्यूमिनियम-मैंगनीशियम मिश्र धातु विकसित की गयी।
 - उच्च यांत्रिक और संक्षारण गुणों के साथ मैंगनीशियम-एंटीमोनी - सिलिकॉन मिश्र धातु विकसित की गयी
 - डेंड्राइट परिष्करण के साथ कंपोकास्टिंग तकनीक द्वारा संसाधित उच्च शक्ति एल्यूमिना नैनोपार्टिकल परिक्षिप्त एल्यूमिनियम-सिलिकॉन मिश्र धातु ने इंटरफेसियल बंधन और विस्थापन झुकाव में वृद्धि की

MATERIALS SCIENCE AND TECHNOLOGY DIVISION

Development of advanced functional materials, mineral beneficiation and components for strategic, automobile, energy and societal applications has been the focus areas of research in the Materials Science and Technology Division. In the year 2017-18, the division has embarked on the development of cutting edge technologies in the areas of mineral beneficiation, multifunctional pigments for energy savings, luminescent materials for lighting applications, porous ceramic materials for CO₂ adsorption, nano photo catalysts for dye degradation, materials for printed electronics, magnetic and magneto refrigeration materials, polymers and polymer based nano composites and light alloys development for strategic and automotive applications. This division has published 80 papers in SCI journals, granted two foreign Patents and has resulted in twenty PhDs. Some of the research highlights of the division during the period are given below

Highlights

- Multifunctional inorganic colorants with high IR reflectance for energy saving applications.
- Demonstration of NIIST blue pigment in the industrial premises.
- Development of single phased white and red phosphors for LED applications.
- An industry sponsored project supported by M/s English Indian Clays Ltd., Trivandrum for value addition of EICL silica sand and clay residue for novel commercial products and sustainable business.
- MOU was signed with the company M/s Aditya Birla Insulators, Kolkatta for the development of hydrophobic glaze coatings for electrical porcelain Insulators
- Fe Incorporated N-doped Porous Carbon Derived from ZIF-8/Fe-Graphene Nanocomposites as high performance catalysts .
- Synergistic persulfate activation as an efficient and cost-effective approach for removal of organic synthetic-dyes from aqueous solutions using magnetic Pd-Fe₃O₄-flyash composite particles.
- Layered Double Hydroxide Nanoplatelets with Ultrahigh Specific Surface area for significantly enhanced crystallization rate and thermal stability of polypropylene.
- An impressive thermal conductivity enhancement (TCE) of 363 % compared to pristine Poly(methyl methacrylate) polymer with the addition of Ag decorated hexagonal.
- An E-shaped wearable microstrip patch WiMAX antenna was designed and fabricated on polyester fabric, which is useful for locating persons and goods trapped in geographically remote terrains.
- A record breaking lowest reported dielectric constant ($\kappa=1.03\pm 0.02$), which is very close to the dielectric constant of air ($\kappa=1$) was reported for syndiotactic polystyrene based aerogels.
- Developed carbon nanotube based ink screen printable on flexible substrates, exhibiting a sheet resistance in the range of 0.5 - 13 Ω /sq with minimum surface roughness (<65 nm).
- Successful completion of pilot plant scale trials on upgradation of low grade ilmenite for W Minerals and evaluation of the final products by the overseas customers.
- Al-Mg Alloys with Zr/Mn additions developed for Aerospace applications.
- Mg-Sb- Si alloys developed with high mechanical and corrosion properties.
- High strength alumina nanoparticle dispersed Al-Si alloy processed by compocasting technique with dendrite refinement, enhanced interfacial bonding and dislocation bowing.

Brief report of the division's activities highlighting major achievements

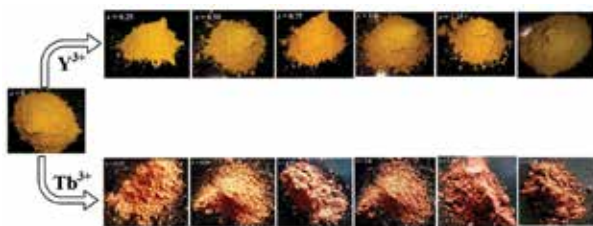
Multifunctional Inorganic Pigments

Synthesis and characterisation of eco-friendly Yellow pigments based on $(\text{LiLa})_{1/2}\text{WO}_4$ - BiVO_4 for energy saving applications:



New eco-friendly yellow inorganic pigments based on BiVO_4 having high NIR solar reflectance have been successfully designed. Doping of Li^+ , La^{3+} and W^{6+} into the trivalent and pentavalent site of the BiVO_4 system causes not only changes in the absorption properties but also in the improvement in its optical and reflective properties. The pigments prepared by conventional solid-state reaction method yielded uniform morphology and reduction in particle size resulting in significant improvements of NIR reflectance. Typically the pigment $[(\text{LiLa})_{0.125}\text{Bi}_{0.75}][\text{W}_{0.25}\text{V}_{0.75}]\text{O}_4$ displayed intense yellow color ($b^* = 83.53$) with near-infrared reflectance of 90%, much higher than the commercial sicopal yellow. These colorants demonstrated good coloring performance with high solar reflectance in cement blocks and on metal sheets. These compositions containing less toxic elements can be used as sustainable pigments in surface coating applications as energy saving products.

Pigmentary Colors from yellow to red in $\text{Bi}_2\text{Ce}_2\text{O}_7$ by rare earth ion substitutions as possible high NIR reflecting pigments for energy saving applications



A new series of high near-infrared (NIR) reflecting pigments with colors ranging from yellow to red by tuning the $\text{Bi}_2\text{Ce}_2\text{O}_7$ with rare earth ion substitutions on both A and B sites were synthesized by a solid state reaction method. The absorption edge is gradually red shifted on substitution from Y to Tb resulting colors yellow to red. The XPS analysis surmises the presence of the elements with trends of reduction in Ce^{3+} concentration on both substitutions. These results suggest that the color shift is mainly due to charge transfer band shift of the O^{2-} to Ce^{4+} (4f-5d) and deep red shift is due to introduction of additional energy level by terbium ions. A brilliant yellow hue was obtained for $\text{Bi}_{1.75}\text{Y}_{0.25}\text{Ce}_2\text{O}_7$ ($b^* = 51.4$), whereas $\text{Bi}_2\text{Ce}_{1.50}\text{Tb}_{0.50}\text{O}_7$ ($a^* = 15.0$) exhibited a red color. High NIR solar reflectance of 93% and 88% were obtained for $\text{Bi}_{0.5}\text{Y}_{1.5}\text{Ce}_2\text{O}_7$ yellow and $\text{Bi}_2\text{Ce}_{1.50}\text{Tb}_{0.50}\text{O}_7$ red pigments respectively. The application study of these selected pigments was investigated in the polymer matrix which demonstrates their coloring performance and hence suitable candidate materials for cool roof applications.

Value added Building Materials from clay contaminated silica sand:

The industry M/s English Indian Clays Ltd., (EICL), Trivandrum produces about 36000 T/ per month clay contaminated silica sand during the beneficiation of kaolin mineral. This sand with both fine and coarse size fractions is contaminated with approximately 17 to 22 wt.% of clay residue. A flowsheet has been developed for the removal of clay from contaminated silica sand to obtain construction grade sand. The beneficiation process has resulted in 17% coarse sand [$>500 \mu\text{m}$] and 77% fine-sand [$<500 \mu\text{m}$] along with 3-4% clay. Value addition was made on the fine and coarse sand to develop color sand; cool-tile; silica flour and sand reinforced composite polymer tiles. The products were demonstrated in lab scale and some of the value added products are shown in Fig.1

Construction grade



Color

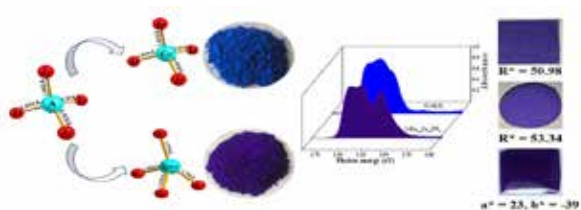


Color sand reinforced epoxy polymer composite



Fig. 1 Value added building materials from clay contaminated silica sand

An intense purple chromophore based on Co^{2+} in distorted tetrahedral coordination:



An intense purple, cost-effective inorganic pigment $\text{LiZn}_{1-x}\text{Co}_x\text{PO}_4$ ($0.1 \leq x \leq 0.8$) was synthesized by solid-state ceramic route. Development of exotic intense purple colour of these pigments was investigated by means of crystallographic as well as optical spectral studies. Structural refinement showed that chromophore of the pigment CoO_4 , formed with highly distorted geometry due to significantly shorter Co-O bonds. Structural changes attributed strongly on the spectral features leading to an excellent purple colour which is unusual for CoO_4 tetrahedral coordination. The hue of the purple colour can be controlled by tuning the Co content. Composition with very low Co^{2+} concentration (3.5 atomic wt%) exhibited intense purple colour, $a^* = +25.25$, $b^* = -52.32$, with an impressive NIR Solar reflectance ($R^* = 68\%$) and good chemical stability. The colour delivering performance of these purple pigments have also been evaluated by pigment incorporation in polymer matrix. Further these pigments can be a potential candidate for cool pigment by coating onto roofing materials like aluminum roofing sheets and concrete block.

Luminescent materials

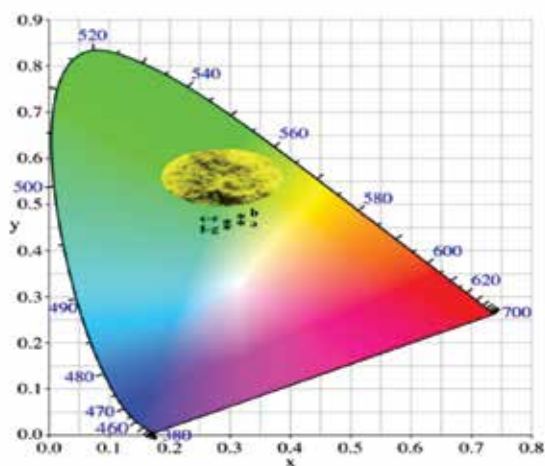
Narrow-Band Red-Emitting Phosphor, $\text{Gd}_3\text{Zn}_2\text{Nb}_3\text{O}_{14}:\text{Eu}^{3+}$ with High Color Purity for Phosphor-Converted White Light Emitting Diodes:

Narrow-band red emitting phosphor is a decisive component to develop phosphor-converted light emitting diodes with good CRI and low CCT for highly efficient illumination-grade lighting which are urgently needed to retrofit the incandescent tungsten-halogen lamps in the market. A narrow band red emitting $\text{Gd}_3\text{Zn}_2\text{Nb}_3\text{O}_{14}:\text{Eu}^{3+}$ phosphor was synthesized and characterized in order to improve the color qualities of warm white light emitting diodes. The developed phosphor exhibits a strong red emission peaking at 613 nm with a fwhm of merely ~ 3.50 nm under the 392 nm excitation. The enhanced electric dipole transition intensity arises from the symmetry distortion of Eu^{3+} ions caused by the introduction of Zn^{2+} ions in the lattice. The distortion of the A site symmetry and the red shift of the charge transfer energy leads to an intense ${}^5\text{D}_0 - {}^7\text{F}_2$ hypersensitive electric dipole transition under 392 nm excitation. The rigid and ordered network in the structure decreases the nonradiative relaxation leading to a sufficiently narrow band red emitting phosphors. The relative emission intensity was found to be maximum at $x = 0.40$ and is 3.9 times higher than that of the commercial red phosphor under the 392 nm excitation. These phosphors with remarkable CIE chromaticity coordinates (0.64, 0.35), good CCT values along with high color purity (94.2%) might be potential candidates in display devices as an efficient red phosphor.

Enhanced intrinsic greenish-yellow luminescence in CaMoO_4 by Si^{4+} acceptor doping as potential phosphors for white light emitting diode applications:

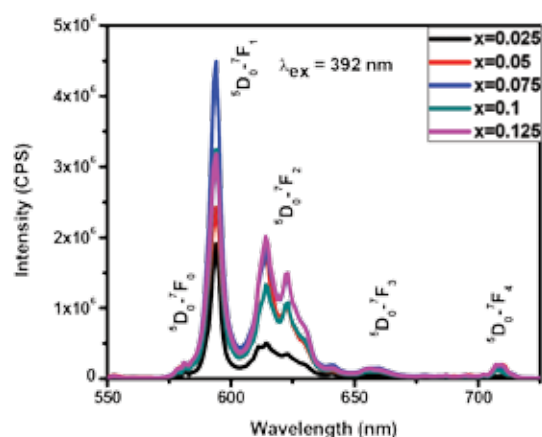
Intense broad greenish-yellow luminescence has been observed in CaMoO_4 by Si^{4+} acceptor doping. The broad luminescence is attributed to the charge transfer transitions in MoO_4^{2-} groups and defect luminescence. The Si^{4+} doping acts on two fronts, distorting the MoO_4 tetrahedron and inducing oxygen vacancies promoting acceptor levels near the VB edge. The XPS core level spectra analysis confirms to the binding energies of the elements and also indicates asymmetric broadening with increase of fwhm suggesting defects and oxygen vacancies in the system. Consequently, the distortion and disorder in the lattice generate intermediate energy levels within the band gap facilitating the enhanced luminescence of absorption and emission processes. The defect and charge transfer luminescence increases competitively

with Si^{4+} doping. The lifetime of the defect luminescence increases with Si^{4+} doping which suggests the increased radiative emission transitions without quenching. These factors broadened the luminescence covering the entire visible region (425 nm to 625 nm) enhancing the fwhm from 127 nm to 133 nm with emission intensities 1.5 times greater than the undoped one. The calculated CIE chromaticity coordinates falls in the greenish yellow region with values (0.31, 0.45).

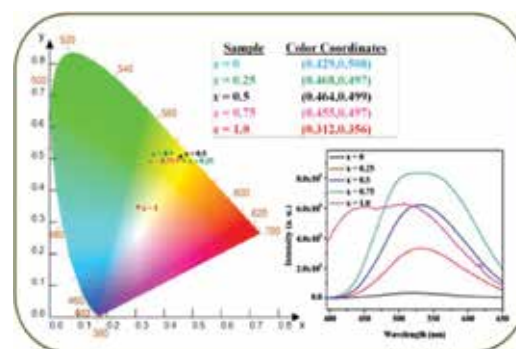


Synthesis and Photoluminescence Properties of New Perovskite Type Orange Red Emitting Phosphors: $\text{SrGd}_{(0.5-x)}\text{Nb}_{0.5}\text{O}_3 : x\text{Eu}^{3+}$ for WLED Applications:

Eu^{3+} doped $\text{SrGd}_{(0.5-x)}\text{Nb}_{0.5}\text{O}_3$ phosphors were synthesized using a high temperature solid state method. Powder XRD results confirm the orthorhombic phase and detailed investigations on the photoluminescence and UV absorption studies indicated that Eu^{3+} doped $\text{SrGd}_{0.5}\text{Nb}_{0.5}\text{O}_3$ phosphors has a strong absorption in the UV region. Intense orange red emission is observed for both near UV (392 nm) excitation and Blue (465 nm) excitations matching with the output wavelengths of UV and blue LED chips, which can be attributed to the magnetic dipole transition ($^5\text{D}_0 \rightarrow ^7\text{F}_1$) of Eu^{3+} . Concentration quenching is observed at 0.075 mol% Eu^{3+} doping. The phosphor samples exhibit better efficiency values compared to many phosphor materials reported in the literature. The results obtained suggests that the intense orange red emitting phosphors with better efficiency could be a promising phosphor candidate for white light emitting diode applications.



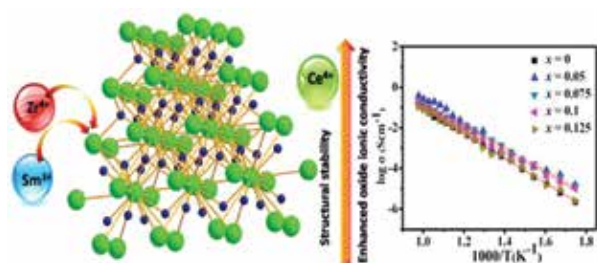
Novel self-activated full color emission phosphor in Y^{3+} doped $\text{Sr}_3\text{Bi}(\text{VO}_4)_3$ system: Synthesis and Luminescence Properties:



Development of self-activated vanadate phosphor $\text{Sr}_3\text{Bi}(\text{VO}_4)_3$ and tune the color from yellow to near white by doping with Y^{3+} ions was attempted. The host can be efficiently excited by ultraviolet (UV) light, and exhibits an orange emission peaking at 530 nm originating from VO_4^{3-} groups. For color tuning Y^{3+} ions were doped into the $\text{Sr}_3\text{Bi}(\text{VO}_4)_3$ phosphors which gave broad excitation and emission spectra. With increase in Y^{3+} ion concentration, we could obtain the full color emission covering the whole visible spectrum, with broad emission peaks in the blue-green region. As the prepared phosphors have their excitation wavelength in the near UV region and the emission spectra covers the entire visible spectrum, it is promising to be a possible full color emitting phosphor for WLED functions.

Oxide Ionic conductors for SOFC Applications

Enhanced Ionic Conductivity of Samarium doped Ceria Solid Electrolyte through stabilization of Ce^{4+} Oxidation states by Zr substitution:

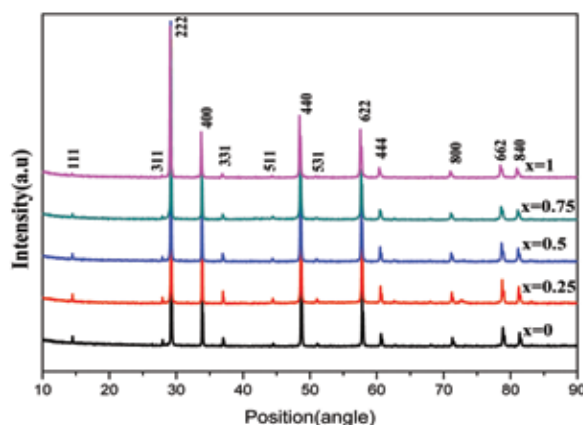


Enhancing the ionic conductivity of cerium oxide system is vital for low temperature solid oxide fuel cells (LT-SOFCs). A simple chemical sol-gel technique was employed to synthesis Zr substituted Samarium doped ceria (SDC) to enhance the ionic conductivity by stabilizing majority ceria as Ce^{4+} . The particle size was found to be ~ 20 nm. The valence state of the cations and the concentration of Ce^{4+} were established through X-ray photo electron spectroscopy (XPS). The results confirmed an increase in tetravalent cerium concentration from 56 % to 84%. Among the investigated compositions, ($x = 0.075$) exhibited higher ionic conductivity which was found to show a maximum value of $5.28 \times 10^{-1} (\text{S/cm})$ at 750°C . The substitution of Zr^{4+} in SDC stabilizes the cubic fluorite structure and it may hold back the ordering of oxygen vacancy which enhances ionic conductivity. The high ionic conductivity value and stability of Ce^{4+} in the present work proposes that the materials of this kind are promising good ionic conductors.

Study of structural and electrical properties of pyrochlore type compositions with multivalent environment:

Pyrochlore type compounds form an important class of materials in the field of material science which belongs to the space group $\text{Fd}3\text{m}$ with a general formula $\text{A}_2\text{B}_2\text{X}_6\text{Y}$, where A and B sites are occupied by the metal atoms having oxidation states $3+$ and $4+$ or $2+$ and $5+$ and the X and Y sites are anions. These oxides possess intrinsic oxide ion vacancies through these ordered vacancies conduction of oxide ion become feasible reducing the activation energy. Pyrochlore compositions with multivalent environment are a less explored area in this regard. A new series of Pyrochlore compositions, $\text{Sm}_2\text{Zr}_{(1-x)}(\text{YNb})_x\text{O}_7$ ($x = 0, 0.25, 0.5, 0.75, 1$) are prepared via conventional solid state reaction route. The XRD confirms the formation of the pure pyrochlore structure in these

compositions. As the substitution, increase the lattice parameter increase which is in line with the Vegard's law. The conductivity of the samples measured using the impedance spectroscopy is of the order 10^{-4} S/cm which is high compared to the other compositions similar to this.



POROUS CERAMIC MATERIALS

Heteroatom doped Heteroporous Carbon Catalysts for Oxygen Reduction Reaction:

Alkaline Fuel cells are recognized as highly efficient and green power generating sources with high power conversion rates for stationary/residential applications. The efficiency of such devices are however dependent on the effectiveness of oxygen reduction reaction (ORR). The sluggish cathodic reaction kinetics and the extensive use of Platinum (Pt) based catalyst are major obstacles for the wide spread applications of alkaline fuel cells. The immense scientific interest generated recently on heteroatom doped heteroporous carbon materials (mainly nitrogen and transition metals) testifies their significance as emerging Pt alternative catalysts for ORR. Doped nitrogen provides basic sites on porous carbon surface increasing the polarity and improving the adsorption and electrochemical capabilities, enabling them to be employed for catalysis. When a metal species is introduced in porous carbon structures, enhancement of ORR activity is effected both in terms of activity and stability. This is primarily accomplished due to the generation of higher number of activities that eventually enhances adsorption. Fe plays a vital role in increasing active site for ORR while Fe-N combination amplifies the ORR activity due to the interactions between the Fe and

N species on the carbon substrates. The modification of pore characteristics and engineering the morphological features of the carbon structures will lead to improved active site density that favourably contributes towards ORR. In the present study, two different precursor compositions that provide in-situ doping of heteroatoms in a porous carbon matrix is designed and the electrochemical properties are evaluated

1. Fe Incorporated N-doped Porous Carbon Derived from ZIF-8/Fe- Graphene Nanocomposites:

Morphological ensembles of carbon in the form of graphene, carbon nanotubes and carbon frameworks are thus developed by the carbonisation of Fe/Graphene/ZIF-8 composite precursor. The in-situ synthesis of ZIF-8 in dispersions of Fe^{3+} and graphene nanosheets yielded Fe doped frameworks with graphene dispersions. The high temperature pyrolysis of the as synthesized Fe-ZIF-8/graphene composites at 900°C resulted in the formation of Fe, N- co-doped carbon structures. The iron species such as $\text{Fe}/\text{Fe}_3\text{C}$ are accommodated in the carbon matrix with the formation of nanotubes. The derived carbon structures have more mesopores that resulted in more active site density and improved mass transfer. More over the Fe incorporation led to the formation of Fe-N sites that contributed favourably to the catalyst performance.

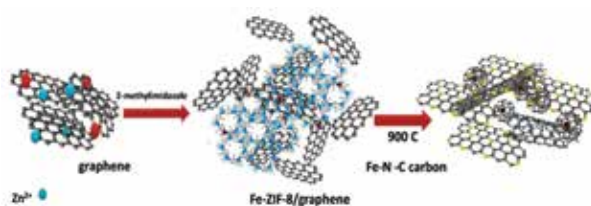


Figure: Schematic showing the formation of Fe, N co-doped carbon of varying morphologies from Fe-ZIF-8/graphene composite.

The electrocatalyst prepared using Zn/Fe ratio of 10 displayed enhanced electrocatalytic properties with an onset potential of 0.95 V and an half wave potential ($E_{1/2}$) of 0.82 V. The potential was maintained for the tested 5000 cycles with a minimal shift of 9 mV in its $E_{1/2}$. In comparison, the commercial Pt/C sample showed a reduction of 32 mV in ($E_{1/2}$) after 5000 cycles in alkaline conditions. Micro-meso porous architecture together with various morphological forms of carbon and the presence of active sites of Fe-N_x , $\text{Fe}/\text{Fe}_3\text{C}$ contributed to the favourable catalytic properties.

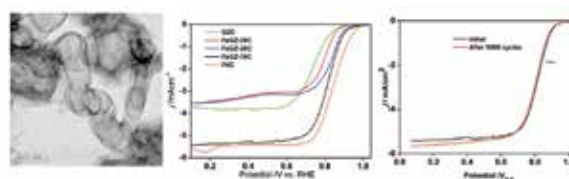


Figure: TEM image of the catalyst and the LSV plots depicting the electrocatalytic behaviour in comparison with Pt/C and accelerated durability test showing the stability of the catalyst

2. Chitosan Intercalated Metal Organic Gel as a Green Precursor of Fe Distributed N-Doped Mesoporous Graphitic Carbon:

Chitosan a nitrogen rich (6.89%) naturally occurring biopolymer with chelating property is found to be a good precursor for N-doped carbon. Upon treatment with an iron containing Metal Organic Gel (Fe-MOG), chitosan intercalated MOG with 3D gel network is obtained. Pyrolysis of the derived network in an inert atmosphere resulted in the formation of Fe, N-doped carbon with higher surface area of $565 \text{ m}^2\text{g}^{-1}$ and with heteroporous architecture (micro and mesoporosity). The amount of heteroatom was estimated to be 0.15 % Fe and 1.58 % nitrogen. Among the nitrogen species present, greater than 60 % is found to be in the form of graphitic nitrogen with higher activity. The ORR activity is expressed in terms of onset and half wave potential. These parameters

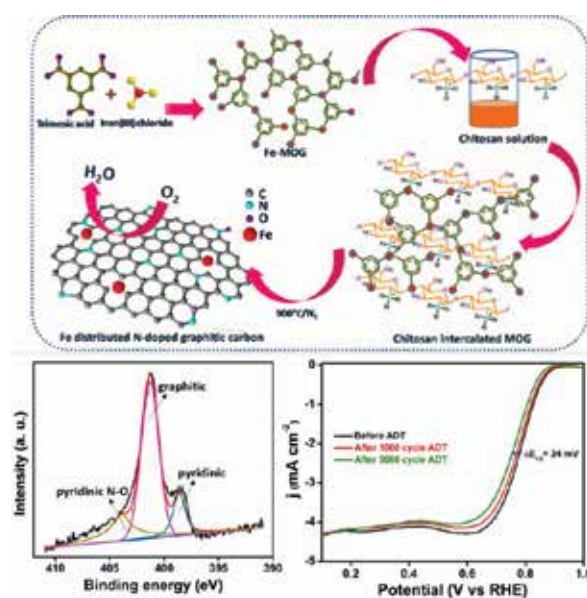


Figure: Schematic illustration of the formation of Fe, N doped carbon. XPS analysis showing N-doping accelerated durability analysis.

were found to be 0.925 V and 0.78 V respectively for the developed carbon which is also comparable with that of the state of the art Pt catalyst. A better durability up to 5000 cycles with a four-electron transfer makes it a promising catalyst towards ORR.

Germanium Incorporated Lithium Silicate as Highly Efficient Low Temperature Sorbents for CO₂ Capture:

Carbon dioxide emission from massive point sources such as industries and power plants increased the atmospheric CO₂ concentration to the value of ~400 ppm. This has, in turn, created severe environmental issues like global warming inducing undesirable weather patterns and natural calamities. It is, therefore, necessary to develop sustainable technologies for the effective removal of CO₂ from the point sources to reduce carbon foot prints in the atmosphere.

Out of the various CO₂ sorbents, Li₄SiO₄ qualifies as a potential material for commercial viability by virtue of its high absorption capacity (8 mmol g⁻¹) with appreciable kinetics in the temperature range of 500-700 °C. However, it suffers from kinetic limitations during the sorption process at temperatures below 500 °C. CSIR-NIIST in collaboration with Noritake Co. Ltd. Japan has developed a patented process for the development of high performing Li₄SiO₄ sorbents for CO₂ capture in the temperature range of 350-700 °C. In order to lower the sorption range of Li₄SiO₄ and to enhance the kinetics as well as the absorption capacity of Li₄SiO₄ material, germanium incorporated Li₄SiO₄ nanostructures are developed.

By employing a microwave sol-gel approach, needle shaped structures of germanium incorporated Li₄SiO₄ that displayed enhanced CO₂ absorption with significantly improved kinetics was realised. Absorption capacity of 324 mg g⁻¹ at the rate of 117 mg g⁻¹ was attained at 680 °C for the samples with the Si: Ge molar ratio of 1:0.183. Moreover, an appreciable capacity of 49 mg g⁻¹ at the rate of 36 mg g⁻¹ min⁻¹ was obtained at temperatures as low as 300 °C. The study thus highlights the possibility of employing germanium incorporated lithium silicates for the absorption of CO₂ at a wide range of temperatures, including the in-situ removal of CO₂ from chemical and petrochemical reactions such as water gas shift reaction.

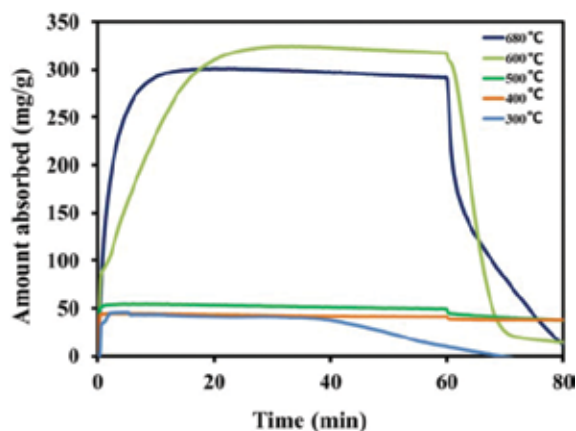


Figure: Isothermal absorption studies of Ge incorporated samples in the temperature range of 300-680°C

Hydrothermal Synthesized Magnetically Separable Mesostructured H₂Ti₃O₇/γ-Fe₂O₃ Nanocomposite for Organic Dye Removal via Adsorption and Its Regeneration / Reuse Through Synergistic Non-Radiation Driven H₂O₂ Activation:

Hydrogentitanate (H₂Ti₃O₇) nanotubes (HTN) are emerging class of adsorbent which also possess unique property of activating hydrogen peroxide (H₂O₂) to generate the reactive oxygen species (ROS), such as superoxide radical ions (O₂⁻) and hydroxyl radicals (•OH), effective in the decomposition of surface-adsorbed dye. However, HTN are non-magnetic which create hurdle in their effective separation from the treated aqueous solution. To overcome this issue, magnetic nanocomposites (HTNF) composed of HTN and maghemite (γ-Fe₂O₃) nanoparticles have been processed by subjecting core-shell magnetic

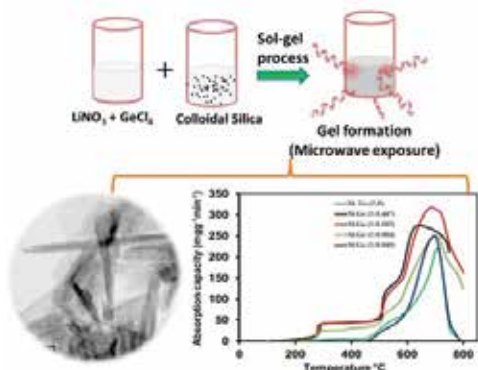
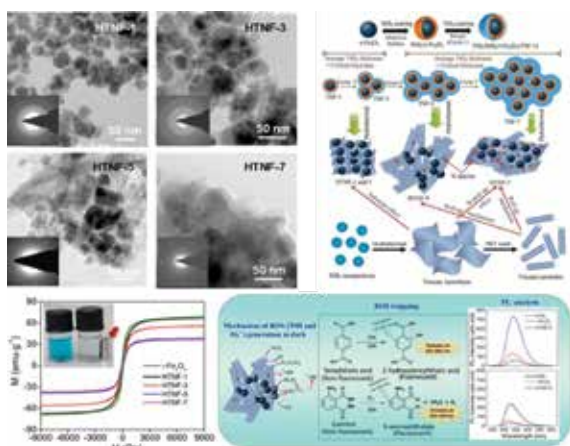


Figure: Schematic showing the preparation of Ge containing Li₄SiO₄ by microwave assisted sol gel process. TEM images of synthesised needle like structures. Dynamic thermogram of samples with varying Si:Ge ratio

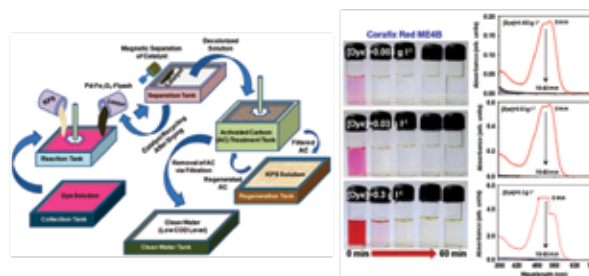
photocatalyst consisting of γ - Fe_2O_3 /silica (SiO_2)/titania (TiO_2), which is synthesized via combination of sol-gel and modified Stober processes, to the hydrothermal conditions. The amount of TiO_2 in the shell has been varied by changing the number of sol-gel coating cycles (1, 3, 5, and 7). The hydrothermal treatment results in the formation HTNF magnetic nanocomposite containing $\text{H}_2\text{Ti}_3\text{O}_7$ with different morphologies such as nanosheets, nanotubes, and mixed-one. HTNF-5 magnetic nanocomposite consisting of 31 wt% $\text{H}_2\text{Ti}_3\text{O}_7$, typically having nanotube morphology with the highest specific surface-area ($133 \text{ m}^2 \text{ g}^{-1}$) and pore-volume ($0.22 \text{ cm}^3 \text{ g}^{-1}$), exhibits the highest capacity (74 mg g^{-1}) for the adsorption of cationic methylene blue (MB) dye from an aqueous solution involving electrostatic attraction mechanism and pseudo-second-order kinetics. Very fast magnetic separation followed by regeneration of HTNF-5 magnetic nanocomposite has been demonstrated via non-radiation driven H_2O_2 activation. It has been ascertained for the first time that the underlying mechanism of dye-decomposition involves the synergy effect between the constituents of HTNF magnetic nanocomposite. (Shukla et al., Environ. Sci. Pollut. Res. 2017, doi: 10.1007/s11356-017-8381-2)



Synergistic Persulfate Activation as an Efficient and Cost-Effective Approach for Removal of Organic Synthetic-Dyes from Aqueous Solutions using Magnetic Flyash- Fe_3O_4 -Pd Composite Particles as Catalyst:

Magnetic flyash-magnetite (Fe_3O_4)- palladium (Pd) composite particles, synthesized via combination of

electroless and inverse co-precipitation techniques, have been utilized earlier for the removal of industrial azo reactive dyes from the aqueous solutions. The mechanism of dye-removal involves advanced oxidation process (AOP) such as the activation of costlier and hazardous oxidizer such as hydrogen peroxide (H_2O_2). The process also requires further backing-up with the adsorption treatment of activated carbon (AC) to control the enhanced chemical oxygen demand (COD) level of treated aqueous solution which not only increases the number of steps involved in the dye-removal process but also results in the generation of large amount of sludge. There is an urgent need to replace H_2O_2 with an efficient, cost-effective, and non-hazardous oxidizer which can resolve the aforementioned issues in the present dye-removal application. From this point of view, we utilized the magnetic flyash- Fe_3O_4 -Pd composite particles for the decoloration of aqueous solutions containing industrial azo reactive dye such as Corafix Red ME4B, via synergistic activation of persulfate anions ($\text{S}_2\text{O}_8^{2-}$) involving the catalytic and thermal contributions. In contrast to the activation of H_2O_2 , the synergistic activation of $\text{S}_2\text{O}_8^{2-}$ anions is noted to significantly reduce the COD level almost in a single step which reduces the dependency on the post adsorption treatment of AC. Moreover, the regeneration of AC in the present dye-removal application has been demonstrated using the synergistic activation of $\text{S}_2\text{O}_8^{2-}$ anions. The latter, hence, appears to be an efficient, cost-effective, and non-hazardous approach for the removal of organic synthetic-dyes from aqueous solutions by using the magnetic flyash- Fe_3O_4 -Pd composite particles as catalyst.



Silver decorated boron nitride nanosheets as hybrid filler in PMMA for high thermal conductivity

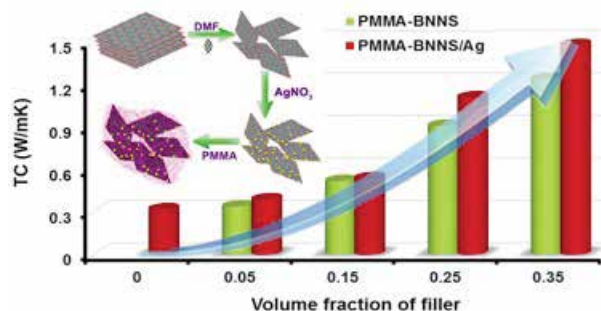


Fig. Dramatic variation thermal conductivity of PMMA with Ag decorated h-BN addition

In consumer electronics, managing the circuit heat dissipation is a vital issue that needs to be addressed urgently to improve the reliability and performances of devices. Over the last few decades, polymers gained pronounced attention as substrates, owing to their excellent design freedom, light weight and low cost. But, they have genuine drawbacks like high coefficient of thermal expansion (40- 200 ppm/K) and low thermal conductivity ($< 0.5 \text{ Wm}^{-1}\text{K}^{-1}$), which debilitate their wide range electronic applications. The low thermal conductivity of the substrate leads to inadequate heat dissipation, which adversely affect the performance and lifetime of circuits. Hence high thermal conducting and low dielectric loss polymer nanocomposites have gained tremendous attention in microelectronics technology. Against this background, Electronic Materials group in NIIST has developed a high thermal conducting, low dielectric constant and low loss polymer nanocomposite based on silver nanoparticle (AgNP) decorated boron nitride nanosheets (BNNS) as the filler in polymethyl methacrylate (PMMA) matrix. The nanocomposites were prepared through a facile solution blending process. Elemental mapping of the prepared nanocomposite indicates the uniform distribution of filler particle in PMMA matrix. An impressive high thermal conductivity (TC) enhancement of around 363% was achieved for nanocomposite of 0.35 V_f of hybrid filler (1.48 W/mK), compared to pristine PMMA (0.32 W/mK). The addition of AgNP reduces thermal contact resistance (R_c) by bridging individual BNNS, thereby improves thermal transport. Measured TC values were fitted with a

theoretical model that showed good agreement. Dielectric measurements performed at radio and microwave frequencies revealed that the nanocomposites show a low dielectric constant (< 5), low loss (10^{-2}) and very low ac conductivity (10^{-7}S/cm). The results suggest that silver decorated BNNS is a promising hybrid filler for effective thermal management.

Printed microstrip patch antenna on homemade substrate made of 'quench free' glass-ceramic composite

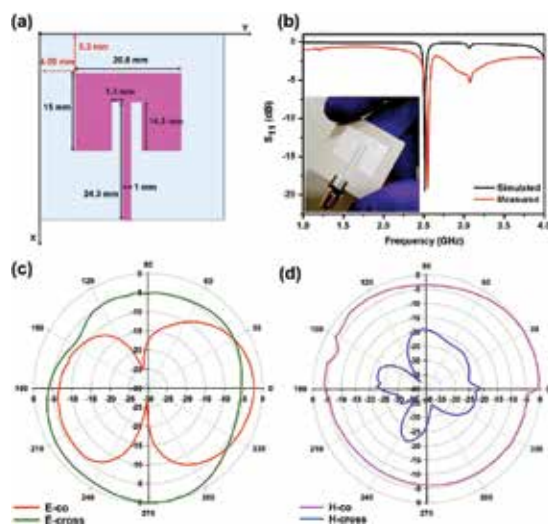


Fig. (a) Schematics of the designed patch antenna (b) return loss (S_{11}) of measured and simulated patch antenna with photograph of the fabricated antenna (inset), (c) and (d) measured radiation pattern of patch antenna along E- plane and H- plane respectively.

In order to design compact wireless devices, it is necessary to miniaturize the antenna size accordingly. There are several strategies used for antenna's size reduction. Among them, introduction of high dielectric constant materials as the substrates is most effective for miniaturization in patch antennas. However, the use of high dielectric constant material will result in the reduction of band width and radiation efficiency of the developed antenna. Hence, for the practical application, the desired range of dielectric constant suitable for patch antenna fabrication falls within the range 2.2 to 12. Polymers are unsuitable as substrates for achieving high dielectric constant, while there exist plenty of high dielectric constant ceramic materials. However, the realization of MPAs on ceramic substrate is challenging both from the design as well as practical perspectives. It

should be noted that, there are only very few reports on realizing microstrip patch antennas on high dielectric constant hard ceramic substrates. This is primarily because, besides addressing ceramics' inherent narrow bandwidth, the fine machining of the hard substrate and subsequent metallic cladding requires a lot of optimization. One of the most viable solutions is to go for printed antennas, which can minimize the problems of debonding of the radiating patch from the substrate.

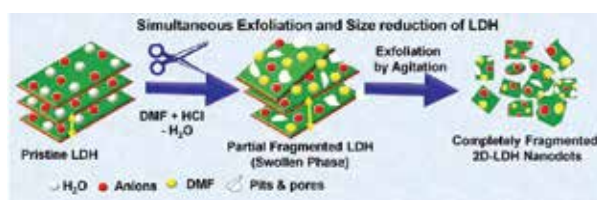
Our group in NIST has developed a facile model to synthesize glass ceramic composites and their subsequent use as a low loss, low firing substrate for printed patch antennas. 'Quench free glass' ceramic slurry and their crack free tapes were developed for low temperature co-fired ceramics (LTCC) applications. The structural, microstructural, mechanical and dielectric properties of the developed green and sintered tapes were investigated using the non-conventional method (NC) and compared with those developed from conventionally prepared composites (C). Interestingly, the novel method yielded tapes with more uniform and narrower microstructures. Further micro hardness analysis of sintered tape showed an improved value of 3.12 ± 0.01 GPa for SZT+ZBPT (NC) compared to 2 ± 0.01 GPa of SZT+ZBPT (C), indicating a more homogenized distribution of glass phase in 'quench free glass' composite. The microwave dielectric properties of tapes synthesized through the non-conventional method that were sintered at 900°C up to a densification of 95%, showed an ϵ_p of 11.64 and a $\tan\delta$ of 0.0024 at 5GHz.

For the realisation of compact wireless devices, judicious selection of high dielectric constant substrate that can miniaturize size of the antenna, is necessary. The present material, SZT+ZBPT (NC), is an ideal choice for hard ceramic substrate applications due to its interesting dielectric properties. A prototype of micro strip path antenna operating at 2.5 GHz was designed and fabricated on an accurately machined sintered LTCC tape based on SZT+ZBPT (NC) by creating patch and ground through flatbed screen printing technique. The radiation parameters of the newly designed ceramic antenna showed very good agreement between simulated and measured results, reiterating the efficacy of the new method to develop microelectronic and microwave communication substrates.

POLYMER NANOCOMPOSITES

Layered Double Hydroxide Nanoplatelets with Ultrahigh Specific Surface Area for Significantly Enhanced Crystallization Rate and Thermal Stability of Polypropylene:

Appropriate selection of additives for the semicrystalline polymers helps the polymer industries to develop plastics with improved durability and cost effective. One of our main focuses is to develop the multifunctional nanofillers for semicrystalline polymers. We have demonstrated that sonication-assisted delamination of layered double hydroxides resulted in the ultrathin nanosheets with drastically improved surface activity. We have showed that the lateral size of the LDH has a significant influence on the thermal stability and crystallization rate of polypropylene. We also investigated the influence of LDH intralayer metal constituents on the properties of polypropylene. Our results demonstrated that the nanocomposites prepared using three-metal-LDH showed better thermal and flame retardant properties compared to that of the nanocomposites prepared using two-metal-LDH. In continuation to that work, a facile method for the simultaneous delamination and the lateral size reduction of LDH is developed in our group. This method directly resulted in the delaminated mesoporous LDH nanoplatelets (nanodot LDH) with the high specific surface area (lateral 1 nm). Such prepared LDH was used as fillers for isotactic polypropylene. The incorporation



Schematic illustration of simultaneous delamination and size reduction of layered double hydroxides.

of nanodot LDH showed a remarkable improvement in the polymer properties with only 1 wt % loading. The uniformly dispersed LDH particles have a significant effect on the nucleation ability, thermal stability and mechanical properties of iPP. The nucleation ability of iPP in the presence of nanodot LDH is the best compared to other iPP nanocomposites reported using LDH as fillers in the literature. Furthermore, the microstructure of the iPP nanocomposites was systematically investigated at

multiple length scales in the presence of different-sized LDH, which is a key to understand the polymer properties.

Process Development for the Preparation of Transparent Crystalline Biodegradable Polymer Films (Nanoporous Films):

The role of a nonsolvent in controlling the crystallization and morphology of solvent-crystallized poly(L-lactide) (PLLA) films was investigated using various microscopy techniques and small- and wide-angle X-ray scattering (SAXS/WAXS). PLLA films crystallized in THF and acetone had 40-80 μm spherulites. When water was present in the solvent, a completely different morphology was observed in acetone and THF, and nanosized voids were observed. The surfaces of the films were smooth. In contrast, SEM studies revealed that the films crystallized in acetone and THF which had macroporous structures, had larger voids and film surfaces were rough because of the presence of globular structures. Voids appeared within the spherulites in THF/water treated film, whereas crystal nucleated at the surface of the nanosized voids in acetone/water treated PLLA films. The formation of such voids is attributed to the interface-enhanced crystal nucleation in a solvent/nonsolvent system where the nonsolvent increases the polymer crystal nucleation and the subsequent evaporation of the nonsolvent. The method described in this work can be extended to other polymers to control the morphologies of polymer films during the solvent-induced crystallization. PLLA films crystallized in THF and acetone were optically opaque. When water was present in the solvent, the films were translucent in THF, and had a completely different rod-like morphology and

the films were transparent in acetone. The differences in the transparency could be attributed to the differences in morphology as well as the surface roughness.

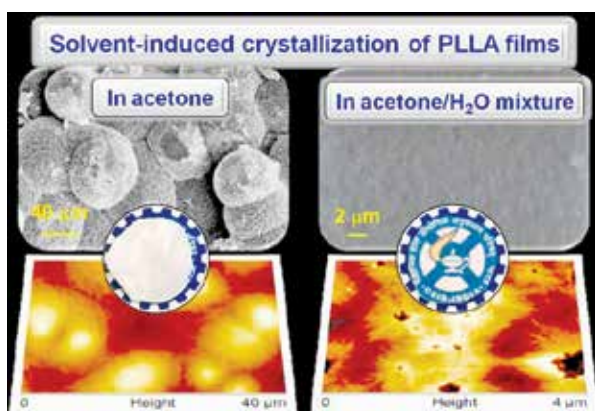
Natural Fibers (Coir) and Composites

Process Development for Surface Modification of Coir Fibers

The development of renewable and biodegradable materials has attracted significant attention in terms of meeting the growing demand for sustainable development, given the increase in environmental awareness. The use of reinforced composites with natural fibers is growing, but still in a small way because of the poor compatibility with polymer matrix. Therefore, their application was limited compared to synthetic fibers. Further, poor moisture resistance of natural fiber leads to incompatibility and poor wettability with hydrophobic polymers, results weak interaction at fiber/polymer interface. The solution for this issue is still an open scientific debate, with many different kinds of treatments being tested by different research groups. Among these methods, plasma treatment of natural fibers is considered as a very promising and the environmentally friendly method. This method has many advantages in surface modification including its effective alteration of surface properties and reducing the usage of environmentally hazardous chemicals. We have developed a process for the surface modification of coir fibers using plasma treatment method.

Rapid, Acid Free Synthesis of Graphene Oxide Quantum Dots as Excellent Fluorescent Probe for Bio-imaging and Environmental Monitoring:

Graphene Oxide Quantum Dots (GQDs) are a new class of carbon nanomaterials that have emerged recently and have attracted tremendous attentions for their potentials in sensing, catalysis, optoelectronic, bioimaging and energy related applications. Compared to other fluorescent materials, this carbon-based material, GQD possess several advantages like high photo stability, high aqueous dispersibility, tunable band gap, good biocompatibility and low cytotoxicity. GQDs consists of an atomic layer of nano-sized graphite which shows excellent properties of graphene like large surface area, high carrier transport mobility, superior mechanical



Surface morphologies of PLLA films crystallized in acetone and acetone/water mixture.

flexibility, and excellent thermal and chemical stabilities. We reported a rapid, acid-free, one-pot synthesis of size-tunable GQDs from graphene oxide (GO) by sonochemical method with intermittent microwave heating, keeping the reaction temperature constant at 90 °C. The GQDs were synthesized by oxidative cutting of GO using KMnO₄ as an oxidizing agent within a short span of time (30 min) in an acid-free condition. The as-synthesized GQDs were of high quality and exhibited better quantum yield, high product yield, and lower cytotoxicity. Furthermore, the GQDs were demonstrated as excellent fluorescent probes for bioimaging and label-free sensing of Fe(III) ions, with a detection limit as low as 10 μM.

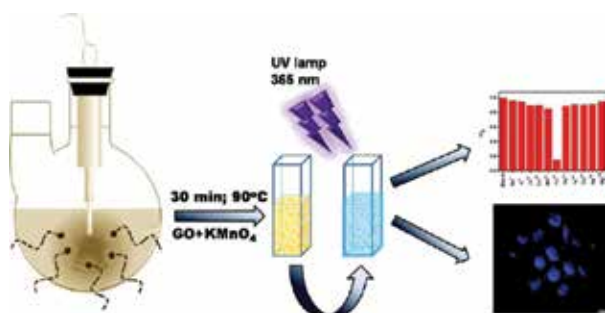


Figure. Schematic illustration of synthesis of GQDs for bioimaging and label-free sensing of metal ions

Magnetic Materials

Structural, Magnetic and Magnetocaloric studies in intermetallics and Oxides based materials for Room Temperature Magnetic Refrigeration Applications

Green and sustainable energy is the prime motivation of present-day research. Magnetic refrigeration based on magnetocaloric effect, has evolved as an environment-friendly and efficient alternative to conventional gas based compression refrigeration by eliminating the use of greenhouse gases and hazardous chemicals. Although numerous magnetic materials have been reported to show very high values of magnetocaloric effect (MCE) but still the practical utilization of this effect has not been realized since at room temperature and ambient conditions only a few materials exhibit this phenomenon. MCE is the thermal response of the magnetic material to an applied magnetic field and is induced by the coupling of magnetic sub lattice with an external magnetic field. It is defined as the reversible change in the magnetic

component of total entropy (and temperature) of a material upon the application or removal of magnetic field. Magnetic refrigerants, such as Gd-Si-Ge, Ni-Mn-Z (Z= In, Sn, Sb, Ga) based Heusler alloys and oxide based manganites have come to research focus of NIIST Trivandrum.

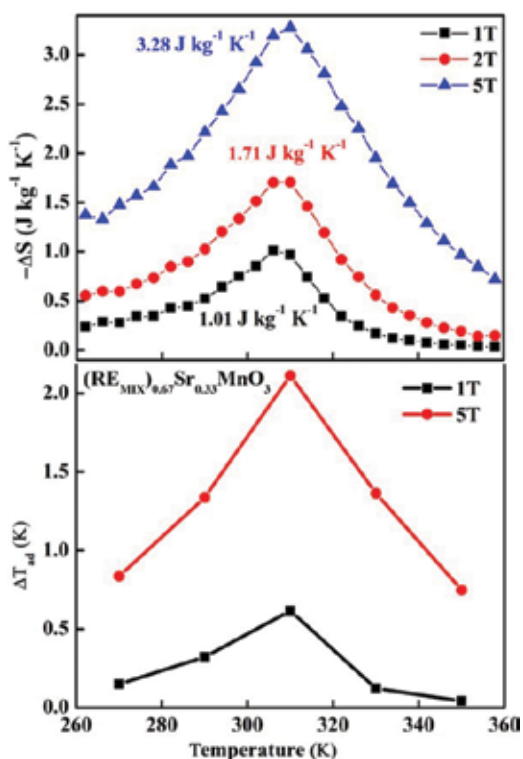
Intermetallics

Research on Gd-Si-Ge compounds are of special interest in NIIST owing to the existence of a strong correlation between its crystal structure and magnetic properties. Giant MCE in Gd-Si-Ge system has been attributed to the coupled magneto-structural transition from the high temperature monoclinic paramagnetic phase to the low temperature orthorhombic ferromagnetic phase that occurs in the vicinity of the magnetic ordering temperature. In addition to intermetallics, electron-doped manganites have also been found to exhibit large MCE under moderate applied fields.

Magnetocaloric properties of Nd substituted Gd₅Si₂Ge₂ with x=0, 0.05, 0.1 and 0.2 were evaluated in NIIST. The composition with x = 0.05 crystallizes in monoclinic Gd₅Si₂Ge₂ structure with P1121/a space group and undergoes a first order phase transition with a Curie temperature of 275 K. With increase in Nd content to x = 0.1, the compound is found to stabilize in orthorhombic Gd₅Si₄ phase with Pnma space group. The compounds with x = 0.1 and 0.2 undergoes a second order magnetic transition at 300 K and 293 K, respectively. A maximum entropy change for Gd_{5-x}Nd_xSi₂Ge₂ alloys with x = 0.05, 0.1, and 0.2 are 12.8, 7.6, and 7.2 J/kg K respectively, for a field change of 50 kOe. A large relative cooling power of 295, 205, and 188 J/kg are obtained for x = 0.05, 0.1, and 0.2, respectively, fulfilling the required criteria for a potential magnetic refrigerant in the room temperature regime.

Oxides

Rare-Earth manganites based on perovskite structures are another class of materials, have turned out as promising materials for room temperature magnetocaloric applications. Among these, A_{1-x}A_xMnO₃ (A = trivalent rare earth elements, A= divalent alkaline earth elements) has gained attention, particularly owing to its wide application area covering colossal magneto resistance to magnetocaloric applications. Recently, we have studied



the magnetocaloric properties of [REMIX] $_{0.67}\text{Sr}_{0.33}\text{MnO}_3$, in which an inexpensive mixed rare earth oxides precursors derived from the Monazite sand have used.

This compound is found to have significant values of entropy change (ΔS) and adiabatic temperature change (ΔT_{ad}) around 310K (shown in the figure) which is advantageous from an applied perspective of room temperature magnetic refrigerators. Interestingly, the material studied is cheaper in compared to the conventional RE based perovskites. We evidently present new information on the direct use of mixed rare earth oxides derived from monazite sand for the magnetic refrigeration applications and a very detailed study has been done to probe this phenomenon through magnetization.

MINERALS

Pilot plant scale trials on upgradation of low grade ilmenite by VV Minerals:

Based on the encouraging results of earlier laboratory scale and higher scale of studies on metallisation and rusting of 2 low grades of ilmenite, VV Mineral came forward to set up a pilot plant facility to process about 700

metric tonnes (350 tonnes each) of 2 grades of ilmenites (45% TiO_2 and 55% TiO_2). It was also planned to hire a commercial sponge iron rotary kiln of suitable capacity for the metallisation of ilmenite and set up a pilot plant at the premises of M/s. VV Titanium Limited, Tuticorin for further chemical processing such as rusting and leaching of metallised ilmenite. An agreement between CSIR-NIIST and VV Mineral was signed on July 07, 2016 to this effect.

Details of the plant scale reduction of 2 grades of ilmenite in a commercial DRI rotary kilns and erection and commissioning of 5 MT/batch capacity rusting reactor and 2 MT/batch leaching reactor were reported in 2016-17 along with the initial results. During the period under report, the pilot plant trials were completed at VV Titanium Pigment Pvt.Ltd., at Tuticorin, Tamil Nadu and all the required technical services were rendered by CSIR-NIIST during the entire course of pilot plant trials.

Rusting of metallised ilmenite and its subsequent leaching in the pilot plant:

Aeration Rusting:

All the rusting experiments were carried out in a stirred tank reactor of 14 M^3 volume capacity to handle 5 tonnes of metallised ilmenite /batch.

With a few initial rusting experiments carried out at 2 metric tonnes per batch, subsequent experiments were carried out at the rated capacity of the rusting reactor, namely 5 MT/batch. The solid to liquid ratio was maintained at 1:2.5 (w/v). Though, initial few trials were carried out using freshly prepared ferrous chloride as the catalyst, the same was replaced by ferrous chloride leach liquor recycled from the leaching reactor in the later trials. Rusting plant was commissioned on 14.01.2017. Rusting and acid leaching operations were completed on 22.05.2017. Following are the highlights of the rusting reactor operation:

Total quantity of reduced ilmenite handled = 346MT

Quantity of rusted product obtained:

TVP grade	=	71MT
HT grade	=	62MT
Mixed product	=	3MT
Iron Oxide obtained	=	170MT

The results of the chemical analysis of the few samples of the rusted product are given below:

Trial No	pH	RESULT	
		Total Iron (%)	TiO ₂ (%)
20	4.30	9.54	87.41
21	4.10	9.75	87.26
39	4.70	9.96	85.60
54	4.90	9.98	85.74
58	4.70	10.01	85.46
71	4.40	10.26	85.32
73	4.35	9.78	86.54

The average composition of the final leached product from different grades of ilmenite are as follows:

Ilmenite grade	TVP Grade	HT Grade
TiO ₂	88.80%	90.30%
Fe ₂ O ₃	9.34%	6.88%

Post Pilot Plant Activities:

After the successful completion of pilot plant trials, M/s. W Minerals has sent the final product samples to their existing overseas customers for the feedback in terms of product quality and commercial evaluation.

M/s. W Minerals had also carried out a few experiments on iron oxide by-product for sponge iron production in collaboration with a sponge iron manufacturer. Initial results are quite encouraging.

The customer feedback about the pilot plant product has been very favourable in terms of TiO₂ content and radio activity levels.

M/s. W Minerals informed NIIST that they shall look into the commercialization of the technology after finalizing the commercial evaluation of the technology and a scheme for iron oxide by-product utilization.

Mineralogical, geochemical and morphological characterisation of raw ilmenite, reduced ilmenite, leached ilmenite and synthetic rutile:

Kerala Minerals and Metals Limited (KMML) produce beneficiated ilmenite from ilmenite by adopting BCA process involving partial reduction of ilmenite followed by 2 - stage pressure leaching using 18-20% regenerated HCl acid in digesters for the selective removal of iron in the reduced ilmenite for the production of beneficiated

ilmenite containing more than 90% TiO₂ which is the feedstock for the production of rutile grade TiO₂ pigment.

However, during some of the production campaign, when the reduction roasting parameters were slightly changed, the resultant product from the roaster showed poor leachability and thereby resulting a substandard product of beneficiated ilmenite. KMML then approached CSIR-NIIST for a detailed analysis of the raw materials and intermediates and the final product from the point of view of mineralogy and morphological changes.

The scope of present investigation covers mineralogical, geo chemical and morphological investigations of KMML samples of raw ilmenite, reduced ilmenite, leached product and the final beneficiated ilmenite produced under changed process conditions and compare the results with the samples generated under normal campaign conditions. It is proposed to employ characterization tools such as optical microscopy for mineralogical investigations.

METALLIC MATERIALS

Al-Mg Alloys with Zr/Mn Additions for Aerospace applications:

Aluminium alloys that exhibit an optimal combination of strength, formability, fatigue resistance and corrosion resistance are desirable for the aerospace applications. The addition of magnesium to aluminium increases the strength through solid solution strengthening and improves their strain hardening ability. These alloys are the high strength non heat-treatable alloys and are therefore, used extensively for aerospace structural applications. These alloys derive their strength from the solid-solution strengthening due to magnesium. Other alloying elements such as scandium, chromium, manganese, and zirconium are added for the control of grain and subgrain structures, which also contribute to strengthening. The trace elements (Sc and Zr) precipitate the dispersive distribution of Al₃(Sc,Zr) phase, which refine the casting structure of the Al-Mg alloy and increases the strength notably. The effect can be more remarkable by partially replacing Sc with Zr to produce intermetallics of Al₃(Sc,Zr) dispersoids. Several experiments have been carried out to verify the feasibility of Sc and Zr additions for making high strength cast Al-Mg alloys. In this work, the role of alloying effects of Zr and Mn on the microstructure

and mechanical properties of Al-Mg wrought alloys were investigated to improve their mechanical properties so as to find cheaper alloying elements to replace scandium.

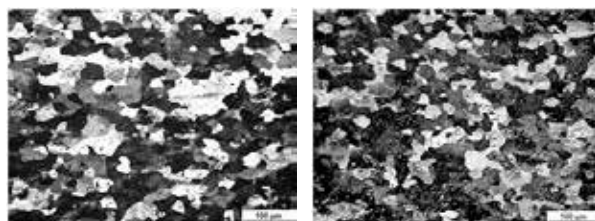
Al-Mg alloys containing 4-8% Mg were prepared with varying amounts of Zr and Mn (0.1 to 0.8% addition) and the cast ingots were rolled to make plates and sheets (6 mm and 2 mm). The mechanical properties, microstructure and the fracture behaviour of Zr containing alloys were characterised to find the alloys possessing higher strength coupled with higher ductility refined microstructure on addition of 0.2%Zr. The mechanical properties, microstructure and the fracture behaviour and studies on the weldability and corrosion behaviour of Mn containing alloys under progress.



Fig.1 Rolled sheets (upto 2mm) of Al-Mg alloys containing Zr

Table.1 Role of Zr additions on the mechanical properties of Al-Mg alloys

Sl. No.	Alloy	Yield strength (MPa)	UTS (MPa)	Elongation (%)
1	Al-4Mg	195	245	30
2	Al-6Mg	251	335	24
3	Al-8Mg	261	360	21
4	Al-4Mg-0.2Zr	200	255	16
5	Al-6Mg-0.2Zr	260	315	20
6	Al-8Mg-0.2Zr	270	375	24



(a) Al-4Mg alloy (b) Al-4Mg-.2Zr alloy
Fig.2 Role of 0.2% Zr additions on the Microstructure of Al-4Mg alloys

Microstructure, Mechanical Properties and Corrosion Behavior of Mg-Sb and Mg-Sb-Si alloys

The effect of the microstructure, mechanical properties as well as corrosion behavior of newly designed Mg-Sb (2, 4, 6, and 8 wt. %) and Mg-4Sb-Si (2, and 4 wt. %) alloys were investigated. The results showed that the microstructure of binary alloys were composed of α -Mg and Mg_3Sb_2 whereas that of ternary Mg-4Sb-Si (2, 4 wt. %) alloys (consisted of α -Mg, Mg_3Sb_2 and Mg_2Si intermetallic phases. Mg-4Sb-4Si alloy exhibited superior tensile, creep and corrosion properties in comparison to that of other studied alloys. The significant improvement in tensile properties at ambient temperature was associated with the dendrite refinement and presence of optimum amount of Mg_3Sb_2 intermetallics along with Mg_2Si intermetallics. Moreover, the presence of thermally stable Mg_3Sb_2 and Mg_2Si intermetallic phases in the ternary alloys restricted the grain boundary sliding and dislocation movement at high temperature and thus improved the creep resistance. The intermetallics played a key role in

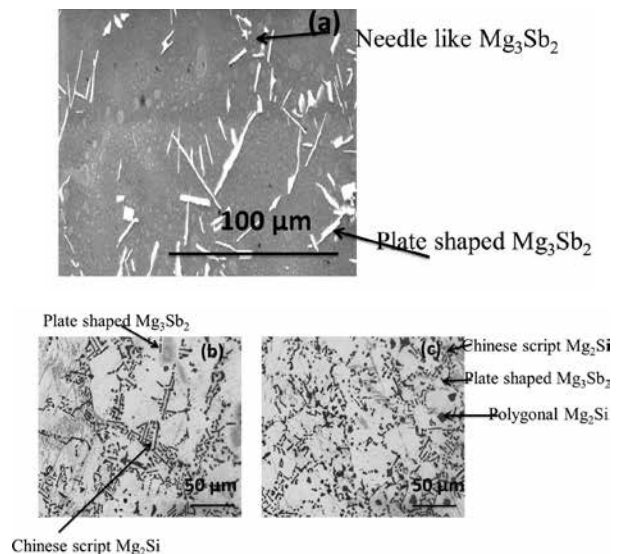


Figure 1: Microstructures of (a) Mg-8Sb (b) Mg-4Sb-2Si (c) Mg-4Sb-4Si showing morphology and distribution of different intermetallics

corrosion behavior of Mg alloys. Increase in the volume of Mg_3Sb_2 in Mg-Sb alloys reduced the corrosion resistance whereas Mg_2Si intermetallics improved the corrosion resistance of the Mg-Sb-Si alloys.

Development of alumina nanoparticle strengthened Al-Si alloy using compocasting process through dendrite refinement, interfacial bonding and dislocation bowing

Aluminum alloys with nanodispersions are gaining considerable attention as lightweight metallic materials in high-performance application areas of aerospace and defense sectors. Aluminum Nanocomposites (ANC) exhibits excellent mechanical properties, resistance to creep at the higher temperature and good fatigue strength compared to base aluminium alloys. The present investigation had evaluated the effect of varying percentage of alumina nanodispersions in strengthening and interfacial bonding with cast A356 aluminum alloy by modified compocasting followed by solidification using squeeze casting. Addition of 0.5 wt% Al_2O_3 nanoparticles to cast alloy shows remarkable enhancement in the yield strength from 204 to 323 MPa. They also exhibit higher hardness, UTS, compressive strength, thermal, tribological and corrosion properties. HRTEM image showed the insertion of Al lattice into the Al_2O_3 crystalline lattice contributing to strengthening of the alloy. The Al_2O_3 nanoparticles and the β'' are involved in the Orowan strengthening of Al nanocomposite. The presence of hard Al_2O_3 nanoparticles and the stronger bonding between particle and alloy constrain the dislocation motion leading to dislocation bowing. The theoretical estimation of Al -0.5 wt% Al_2O_3 nanocomposite yield strength shows

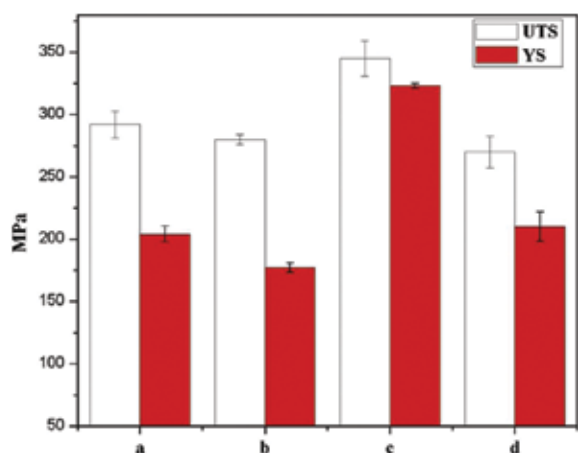


Figure 2. UTS and YS of (a) squeeze cast Al A356 alloy; (b) Al-0.25 wt% Al_2O_3 (c) Al-0.5 wt

% Al_2O_3 , and (d) Al-1wt% Al_2O_3 , nanocomposites by modified compocasting process.

that the contribution of Hall-Petch is predominant followed by Orowan and solid solution strengthening.

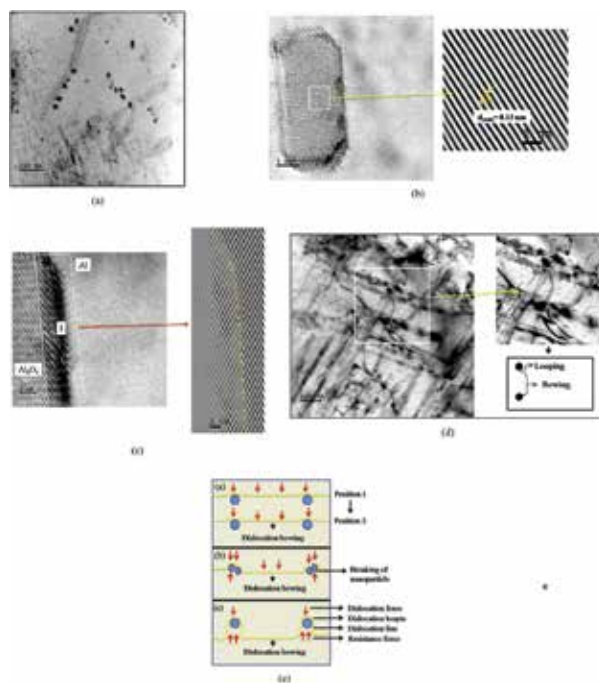


Fig. 3. HRTEM images of Al-0.5 wt% Al_2O_3 nanocomposite by modified compocasting process showing (a) Al_2O_3 nanoparticles in aluminium matrix; (b) Crystalline lattice of Al_2O_3 nanoparticle; (c) Al- Al_2O_3 interface bonding; (d) Dislocation looping and bowing in the Al- Al_2O_3 nanocomposite. Schematic diagram of (e) Dislocation mechanisms in three different types of AMNC.

Processing of Particle-Assisted Breath Figures in Polystyrene-Alumina Hybrid Free Standing Film:

Polystyrene-alumina hybrid free standing films with amino-functionalized breath figure (BF) cavities were fabricated from a suspension of the amino-functionalized amphiphilic-modified alumina particles in polystyrene/chloroform solution by employing a one-step casting process. The role of the film thickness and the particle concentration on the BF microstructural aspects such as the pore size, pore density, amino group surface density, etc. was reported. The dry film thickness increased from 0.91 to 5.6 μm on increasing the wet film thickness from 0.2 to 1 mm. The pore size increased with the film thickness, while the pore density and the porosity decreased. Relatively uniform pore size was observed for an $\sim 3 \mu\text{m}$ thick film in which the moderately ordered BF pattern was more or less maintained up to a particle concentration of 5 wt % of the polystyrene content. While the 0.91 μm

thick film exhibited through-pore structure, concavities were formed in thicker films. The particle-assisted BF formation favored the formation of amino-functionalized

cavities. The surface density of the amino functionality reduced on increasing the film thickness, whereas the density increased with the particle concentration.

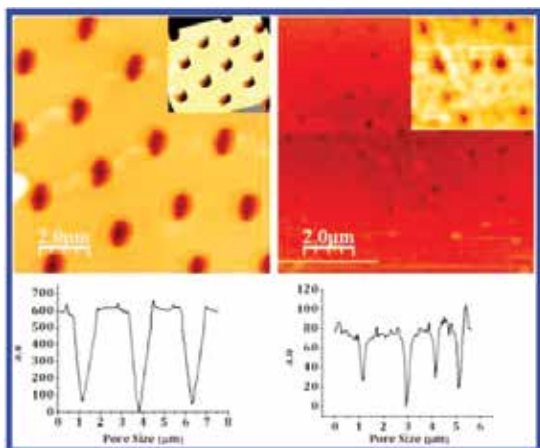


Fig 4. AFM 2D image and height profile of 0.91 μm thick film showing pore openings at the film surfaces (A) exposed toward air (corresponding 3D image is shown in inset) and (B) in contact with the substrate. The relatively low-size spots seen in B are assumed as surface roughness which might have been caused by particle setting.

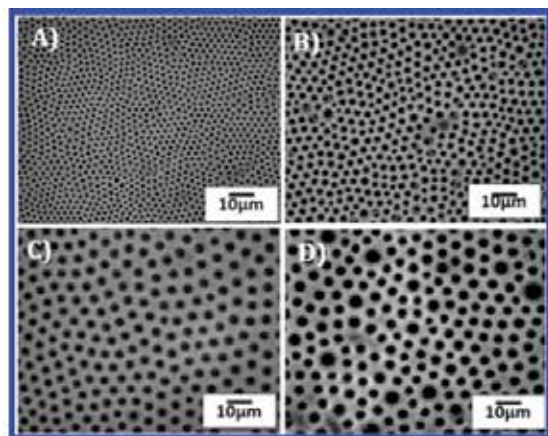


Fig 5. SEM images of 3 μm thick hybrid film containing different alumina particle concentration of (A) 3 wt %, (B) 4 wt %, (C) 5 wt %, and (D) 6 wt %.

पर्यावरण प्रौद्योगिकी प्रभाग

पर्यावरण प्रौद्योगिकी प्रभाग, प्रदूषण नियंत्रण और क्षेत्र के प्राकृतिक संसाधनों के मूल्यवर्धन के लिए स्वदेशी प्रौद्योगिकियों के सृजन में सक्रिय रूप से लगे हुए है। प्रभागीय गतिविधियां तीन मुख्य क्षेत्रों में यानि अपशिष्ट प्रबंधन, जल उपचार और पर्यावरण प्रभाव आकलन (ईआईए) पर केंद्रित हैं।

ऐसे समय में, जब मौजूदा प्रणालियों और प्रक्रियाओं की वजह से हमारे नाजुक पर्यावरण में अपूरणीय क्षति होती रहती हैं, इस ग्रुप ने शमन उपायों के लिए अपशिष्ट जल और प्रदूषण उपचार, फ्लू गैसों की सफाई, मिट्टी के उपचार और अपशिष्ट प्रबंधन समाधान में अपनी विशेषज्ञता के माध्यम से पहले से ही गठित दूषित पदार्थों को हटाने के लिए प्रौद्योगिकियों का एक आला बना दिया है। खनन और बंदरगाहों व हार्बर के दो क्षेत्रों में मान्यता के साथ एनआईआईएसटी केरल में एनएबीईटी-श्रेणी-ए मान्यता प्राप्त सलाहकार संगठन है। परियोजनाओं की सांविधिक मंजूरी के लिए सरकारी और निजी क्षेत्रों द्वारा प्रभाग की ईआईए सेवाओं का उपयोग किया जाता है। डीएसआईआर-एनआईआईएसटी-सीआरटीडीएच: एमएसएमई में पर्यावरण हस्तक्षेप के लिए एनआईआईएसटी में आम अनुसंधान व प्रौद्योगिकी विकास हब स्थापित किया गया है। सुखाये हुये नारियल, मछली भोजन और चावल मिल उद्योग के लिए प्रौद्योगिकी तथा परामर्श सेवाएं प्रदान की गई हैं।



एससीआई पत्रिकाओं में प्रकाशनों के अलावा, "विनाश के बिना विकास" का एक पारिस्थितिकी तंत्र बनाने के प्रयास के साथ आर एंड डी प्रयासों को अभिनव, लागत प्रभावी प्रौद्योगिकियों में स्थानांतरित किया गया है। 2017-18 के दौरान की गयी प्रमुख परियोजनाओं की मुख्य विशेषताएं नीचे दी गई हैं।

हाइलाइट

- जैविक अपशिष्ट डाइजस्टर- सह बायोगैस संयंत्र के फील्ड अधिष्ठापन और प्रौद्योगिकी हस्तांतरण
- केरल के लिए नगरपालिका ठोस अपशिष्ट प्रबंधन समाधान
- डाइऑक्सीन अनुसंधान और निगरानी
- इंडियन रेअर अर्थ लिमिटेड, कोल्लम, केरल द्वारा समुद्र तट रेत खनिजों के खनन के लिए पर्यावरण प्रभाव आकलन
- बीपीसीएल कोची रिफाइनरी : एफ्लुएंट ट्रीटमेंट प्लांट
- त्रावणकोर देवसम बोर्ड: कोट्टाराक्करा मंदिर के प्रवाह उपचार संयंत्र के डिजाइन के लिए कंसल्टेंसी
- हिंदुस्तान लाइफकेयर लिमिटेड: पीएमएसएसवाई योजना के तहत 10 मेडिकल कालेजों में सीवेज उपचार संयंत्र के लिए निविदा विनिर्देश और मूल्यांकन
- मछली कैनिंग कारखाना, अल-बद्र समुद्री भोजन लिमिटेड एसईपीजेड, कोची के लिए गंध नियंत्रण बायोफिल्टर
- तकनीकी सलाहकार सेवाएं
- शबरीमला सन्निधानम 5 एमएलडी सीवेज ट्रीटमेंट प्लांट (एसटीपी)- निरीक्षण और समस्या निवारण सलाह
- पंजा 10 एमएलडी सीवेज उपचार संयंत्र - प्रक्रिया डिजाइन अवधारणा और डिजाइन गणना का मूल्यांकन
- निट्टा जेलाटीन इंडिया लिमिटेड - हड्डी के दुर्बलीकरण के लिए हाइड्रोक्लोरिक एसिड की खपत को कम करने के तरीके
- एनआईआईएसटी लाइसेंसधारकों- गैलेक्सी एनवीरो प्रा. लिमिटेड, कालडी तथा एलक्सिस एनवीरोसिस्टम प्रा. लिमिटेड के लिए हैंडहोल्डिंग सेवा

ENVIRONMENTAL TECHNOLOGY DIVISION

The Environmental Technology Division is actively engaged in creating indigenous technologies for pollution control and value addition to the region's natural resources. The divisional activities converge into three main areas of waste management, water treatment and Environmental Impact Assessment (EIA).

At a time, when existing systems and processes are causing irreparable damage to our fragile environment, the group has made a niche in "end of the pipe" technologies for mitigation measures, through its expertise in waste water and effluent treatment, cleanup of flue gases, soil remediation and waste management solutions.



NIIST is a NABET accredited, Category A consultant organisation in Kerala with accreditation in the two areas of Mining and Ports & Harbour. The EIA services are used by government and private sector for statutory clearance of projects. The DSIR-NIIST-CRTDH: Common Research and Technology Development Hub for environmental interventions in MSMEs has been set up at NIIST. Technology and consulting services have been offered to desiccated coconut, fishmeal and rice mill industries.

Apart from publications in SCI journals, the R&D efforts have been translated into innovative, cost-effective technologies, striving to create an ecosystem of "development without destruction". Highlights of the major projects carried out during 2017-18 are enumerated.

Highlights

- Field installations and technology transfer of organic waste digester cum biogas plant.
- Municipal solid waste management solution for Kerala
- Dioxin research and monitoring
- Environment Impact Assessment for mining beach sand minerals by Indian Rare Earths, Kollam, Kerala.
- BPCL Kochi Refinery: Effluent Treatment Plant
- Travancore Dewasom Board: Consultancy for design of effluent treatment plant for Kottarakkara temple.
- Hindustan LifeCare Limited: Tender specification and evaluation for sewage treatment plant at 10 Medical Colleges under the PMSSY scheme
- Odour control biofilter for fish canning factory, Al-Badr Seafood Ltd. SEPZ, Kochi
- Technical advisory services
 - Sabarimala Sannidhanam 5 MLD sewage treatment plant (STP) – inspection and troubleshooting advice
 - Pamba 10 MLD sewage treatment plant – process design concept and evaluation of design calculations
 - Nitta Gelatine India Limited – methods to reduce consumption of hydrochloric acid for bone maceration.
 - Handholding service to NIIST licensees Galaxy Environ Pvt. Ltd. Kalady and Elixir Enviro System Pvt. Ltd.

Comprehensive Municipal Waste Management Scheme for Kerala

This project was sanctioned by the Department of Environment and Climate Change, Government of Kerala, in 2016 with a budget of Rs.1crore. The municipal waste management scheme examined various options for waste collection, transport, treatment process and final disposal. Costs (capex and opex) were estimated and the best option was chosen.

The following collection systems were analyzed:

- i. Door-to-door collection, wet and dry segregated household and commercial waste
- ii. Door-to-door collection, mixed household waste and wet commercial waste; Bin collection – dry commercial waste;

Option ii. was optimal. Segregated collection was sub-optimal because of the high cost of quality control required to maintain segregation efficiency. Quality control requires the waste collector to inspect waste before collection at each household. This requires time alongwith corresponding increase in wages. Without adequate control over quality of waste, downstream processing operation that assume segregation, will fail.

Taking Thiruvananthapuram as a model, the waste transport requirements were estimated. The number of garbage trucks and collection autorickshaws, the fuel and maintenance costs were calculated.

The optimal treatment process has the following components:

- i. BMT plant for biodrying mixed waste and dry waste with recovery of RDF
- ii. Anaerobic digestion of waste with power generation, dewatering and drying of digestate

The following options for utilization of RDF were examined.

- i. RDF fired thermal power plant
- ii. Coal fired thermal power with 10% RDF substitution
- iii. Cement kiln with 25% RDF substitution

Option III. Cement kiln is most economical and environmentally preferred option. Kerala has one cement factory which is a State Government Enterprise. The RDF

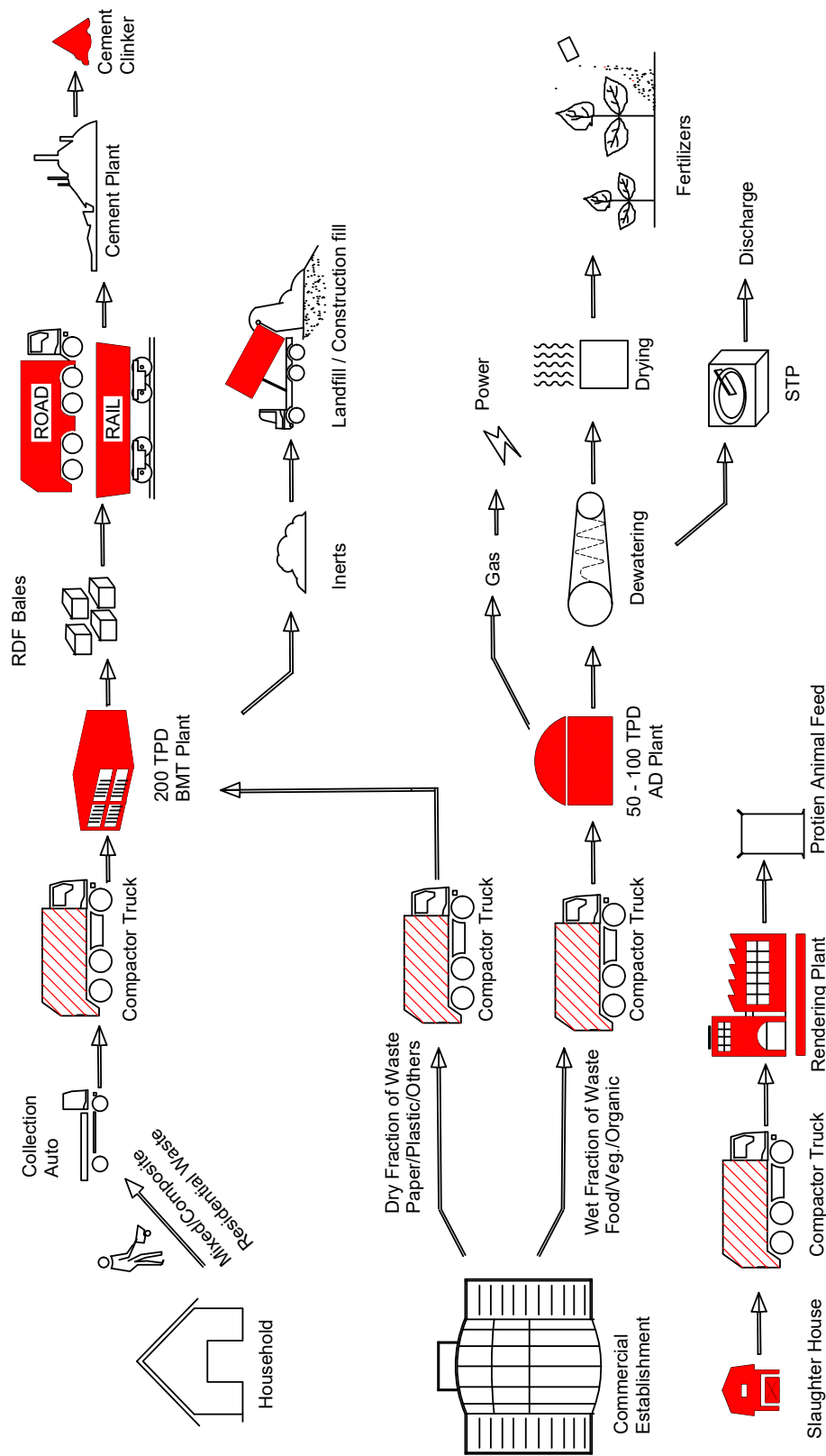
produced across the state can be used in just one factory. Suitable kiln burner and waste handling system is required for utilization of RDF in cement factory. The capital investment for cement kiln burner replacement is lower than that required for establishing a co-firing thermal power station. There is no residual ash for disposal as ash is incorporated into cement clinker. There is no need for exhaust gas treatment because combustion temperature and gas retention time in cement kiln is sufficient to prevent formation of dioxins.

BMT – biodrying is the key technology for the scheme. Biodrying is a method of using self-generated heat to dry municipal solid waste. After drying, the solid waste is mechanically processed to separate metals and inert materials such as glass and stones, to produce a combustible, high-calorie fraction comprising plastics, paper, dry organic materials, textile fabrics, rubber, leather etc. This fraction is shredded to required size and baled to produce RDF. It can be used as a fuel in thermal power generation. Process parameters required for design of a biodrying plant for mixed waste were determined in a series of biodrying experiments.



Waste loading in 45 cm diameter reactor vessel

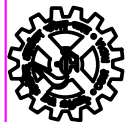
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AD : ANAEROBIC DIGESTION, BMT : BIOLOGICAL MECHANICAL TREATMENT RDF : REFUSED DERIVED FUEL STP : SEWAGE TREATMENT PLANT TPD : TONS PER DAY

NATIONAL INSTITUTE OF INTERDISCIPLINARY SCIENCE & TECHNOLOGY

Formerly
Regional Research Laboratory
CSIR
Industrial estate PO, Papanamcode, Trivandrum-695019



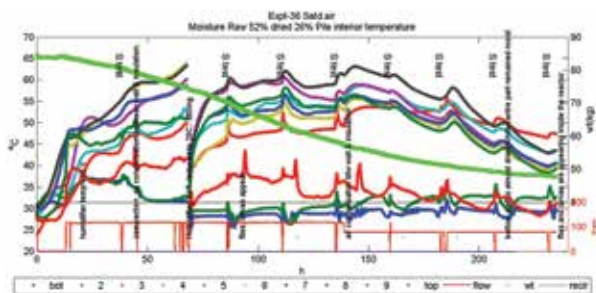
Scheme for Comprehensive MSW Management in Kerala

Designed	Alit Haridas
Drawn	Vijaya P
Checked	
Approved	

Client Government of Kerala

Revision

Various waste compositions were tested. Total of 37 experiments have been completed. Typical drying data is shown.



The temperature in the interior of the pile at various heights is shown, along with air flow, and weight loss. The drying is conducted for 10 d. Air saturated with moisture is pumped through the pile. Hence drying is exclusively by biologically generated heat. S-test refers to stopping air flow for 30 minutes and recording the rise in temperature. This indicates the heat production rate, a direct indicator of aerobic biological activity in the region of the pile.



Pile at start of experiment and after 33 days

**MSW Management for Kerala towns above 1 lakh population
Estimate of investment and user fee for full cost recovery basis:**

	Waste	Size; tpd	Pop. Lakh	Capital Rs./cr	No. reqd	Source of fund	Cost per kg waste
Door-to-door collection	Household mixed waste, Commercial wet and dry source separated	400	8	14.55	4	Govt	A ₹ 2.01 /kg waste collected
Anaerobic Digestion Plant	Source separated commercial food / vegetable market waste	100	8	52.70	7	Govt	B ₹ 0.69 /kg waste treated
Biological Mechanical Treatment plant	Mixed household waste / commercial dry waste	200	6	56.5	7	Govt	C ₹ 1.57 /kg waste treated
Rendering plant	Slaughterhouse offal / meat / chicken / fish mart waste	20	7	10	9	Private sector industry; profit making	
Sanitary landfill (36ha)	Residue from BMT	54	11	12.5	3	Govt	D ₹ 0.79 /kg waste landfilled
RDF co-processing at Malabar Cements Ltd	RDF utilization - option	528	32	290	1	Public sector industry	
RDF co-firing 200 MW Thermal power plant new at Kayamkulam	RDF utilization - option	487	32	1500	1	Public sector	15% ROE
Total cost = A + B + C + D*54/400							₹ 4.38 per kg
User fee = Total cost + 15% contractor or operator profit							₹ 5.04 per kg
Monthly user fee per house (4 pa)							₹ 300 per month
Total investment (Government sector)				₹ 860	cr		
Total investment (private and public sector industry)				₹ 380	cr		

Based on experiments conducted, the biodrying process design is formulated as :

1. Waste compostion: At least 60% organic waste with 55% to 60% moisture is suitable for biodrying, with moist air. Wastes with lower organic matter and moisture need to be dried physically with unsaturated air.
2. Air to be supplied in upflow mode. Downflow mode causes bottom layers to compact by wetness, causing high back pressure.
3. Air flow required 2 m³/kg waste/d;
4. Saturated air by air recirculation required for wastes with greater than 55% organic content.
5. Drying time 10 d
6. Mixing: Breakup agglomerates without mixing along depth on 4th day.
7. Bed height: 2 to 3 m. Lower bed height when waste moisture content is higher.
8. Air pressure: Varies from 150mm w.g. to 20 mm w.g.
9. Exhaust air odour destruction: Gas biofilter
10. Bed temperature maximum to be limited to 65oC. Mixing breakup of pile agglomerates required if temperature exceeds 65oC. Channels in pile through which dominant air flows occur should be not more than 45oC.
11. Temperature to be held above 50 °C for 24h within 4 days of loading for destruction of fly larve as they hatch

Following the laboratory investigations at NIIST, the bio drying concept is being proposed as a central technology for comprehensive waste management in Kerala.

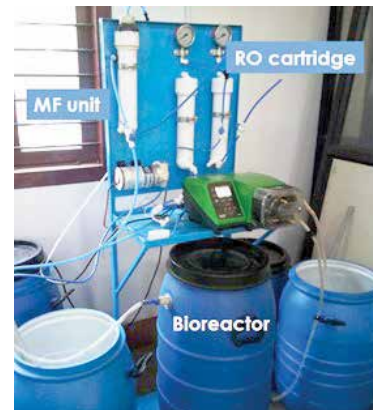
Bio-physical process for treating perchlorate contaminated ground water

CSIR-NIIST is the pioneer in environmental monitoring and remediation of perchlorate (rocket fuel) in India. An integrated bio-physical process unit was developed for generating potable water from perchlorate contaminated ground water. In this process, the NIIST bioprocess with perchlorate reducing bacterial system was integrated

with a microfiltration (MF) and a RO unit to guarantee potable quality water. A demonstration scale unit was fabricated capable of treating ~200L/day. The unit was tested with environmentally relevant perchlorate conc. (15,000 ppb, similar to contaminated sites), and the treated water has perchlorate below the permissible level of 15 ppb (~99.93% removal), TDS below 25 mg/L and without any bacterial cells. The RO reject (containing trace perchlorate) will be diverted to the bioreactor where it will be completely treated.



A perchlorate contaminated community well closed by health department in Keezhmad panchayat, Aluva.



Pilot scale bio-physical unit for treating perchlorate contaminated ground water.

The developed zero discharge process unit can be directly taken to the contaminated sites for generating potable water from the perchlorate contaminated community well water. Based on the study of NIIST, three of the heavily contaminated community wells are presently closed by the Kerala State health dept. The field installation of scale up unit can generate drinking water from these contaminated wells for the local community. This will be a sustainable approach compared to the existing practice of providing alternate drinking water to the local people. It has the added advantage of reducing the

environmental level of perchlorate at the contaminated site, thus preventing spreading of the pollutant to wider areas.

Field installation and Technology transfer of NIIST compact organic waste biogas plants

Field installation of four units of NIIST compact organic waste biogas plant was done during the period. Two units were designed for treating up to 50kg food waste (wet weight)/day. One of the units was installed at Regional Cancer Centre (RCC) Trivandrum. It is generating biogas mainly from the food waste from the hospital wards and canteen. The biogas generated was supplied to the RCC canteen. The biogas yield from the unit was nearly 7000 Lit/day. The official inauguration of the unit was done by Dr T.N. Seema, the chairperson of Clean Kerala Mission.

The second unit was installed at Marthoma Charity unit, Thiruvananthapuram. The performance data generated will be used for scaling up of the existing units to handle larger capacity. The average biogas yield from these units will be around 170 Lit/kg food waste with >65% methane. The total solid loading was maintained at ~4.5 Kg/M³.day. The volatile solids (VS) removal was found to be almost 90%, and the slurry was highly stable without and foul smell. It was calculated that the biogas yield from 250 Kg food waste will be ~ one 19 Kg LPG cylinder or 80 KWh (@160 L/kg food waste).

The third unit of medium size is installed at Pathiyoor panchayat in Alapuzha district (Kerala). This was done in a consultancy project mode with CPCRI-ICAR (Kayamkulam unit). The unit was installed at a farmer house for recovering biogas from cow dung. For this purpose, the original design of NIIST digester was customized with design modifications. Around 60 kg per day of cow dung was loaded into the reactor, and the biogas recovery was about 4000 Lit/day.



NIIST food waste biogas unit installed at RCC Trivandrum



NIIST biogas unit installed at Kayamkulam



Small capacity NIIST digester installed at a farmer house for recovering biogas from cow dung.

This technology was licensed to a Kerala-based industry, Swatch Future Energy Solutions, for a fee of Rs. 12 lakhs. As per the agreement with the industry, NIIST will be hand holding the industry for scaling up and field installation of more units.



Technology Document transfer of NIIST organic waste digester

Dioxin Research & Monitoring

CSIR-NIIST has the state of the art sophisticated analytical testing facilities and technical know-how for the monitoring of dioxins and furans. Ministry of Environment & Forests (MoEF) has recommended CSIR-NIIST as a referral laboratory for dioxin analysis for environmental clearances in sectors such as ship

breaking yard including ship breaking units, airport, common hazardous waste treatment plant, storage and disposal facilities, ports and harbours, CETPs, common municipal solid waste management facility etc. Kerala State Pollution Control Board has awarded CSIR-NIIST a project on “Determination of emission factors of dioxins from open burning of municipal solid wastes in Kerala”. The prime objective is to generate authentic data and to create an inventory of dioxin emission from open burning of municipal solid wastes in Kerala.

Kerala being one of the most densely populated states in India, solid waste management is a major issue. The semi-urban population spread, acute scarcity of land and inadequate investments in waste management has created a crisis situation. Kerala generates 6000 T of waste every day as per the survey done in 2006. The quantum of waste generated will be much higher in 2017 due to rapid improvement in quality of life. Unscientific & unhealthy practices such as open burning of municipal solid waste are prevailing in the state due to lack of an organized waste management plan. Waste incineration is a major source of unintentional production of dioxins and furans, which are highly toxic and persistent in the environment. It is reported that the emission of dioxins and furans are much higher during open burning of wastes in comparison to well-engineered waste incinerators. No reports are available in India on the emission factors of dioxins from such open burning practices.

The formation of dioxins depends on combustion conditions and waste composition. The typical waste composition of major cities in Kerala was collected. A simulated waste burning facility (Burn Hut) was constructed at CSIR-NIIST to carry out the waste combustion experiments. There are several difficulties to determine the emission factor of dioxins by sampling and analysing typical open burn sites. It includes (a) no control on the composition of waste (b) variation in air flow rates and wind direction and (c) dispersion of the target analyte into soil, ash and other sorbents in the waste making it difficult to quantify. The burn hut is equipped with blower fan to discharge desired air flow, platform with load cells to monitor the weight losses, thermocouples to monitor temperature and a stack sampling port to insert the isokinetic probe and a railed platform to set the

sampling equipments. Isokinetic dioxin stack samplers were employed for the particulate and vapour sampling. In 2- 3 waste dump yards, field sampling was also carried out for comparative evaluation with the emission factors observed in real field samples.

A series of experiments were carried out to optimize the analytical workflow and procedures for the sample extraction, cleanup and quantification. We have focussed on three types of samples (a) stack air (b) residual ash and (c) real waste dump yard soil. Manual as well as automated methods were employed for the extraction and cleanup. A state of the art high resolution gas chromatography coupled with triple quadruple mass spectrometer (Agilent Technologies) was employed for the quantification of dioxins and furans.

In a typical experiment, about 10 kg of composite waste is burned under simulated conditions in the burn hut and the stack sample and residual ash samples were collected. A representative quantity of ash (10 g) and the stack sample were analysed following the optimized workflow.

For emission factor calculation, we considered only the emission under wet condition, as MSW open burning is carried out using wet waste and the average moisture level is between 60% and 80%.

The average emission factor of dioxins to air and land is 5.1 & 34.71 $\mu\text{g PCDD-F TEQWHO/ ton}$ respectively of waste burned. The estimated annual emission of dioxins in Thiruvananthapuram city is 0.19 g TEQ per annum to air and 1.27 g TEQ per annum to residual ash (land). It was



Simulated waste combustion experiments and isokinetic stack sampling



Sampling of Dump yard soil for Dioxin emissions

calculated assuming an average quantity of 100 tons of wastes is being openly burned in Thiruvananthapuram.

A one day workshop on "Advanced Analytical Solutions in Dioxin Analysis" in collaboration with Agilent Technologies was organized on 5th January 2018 at CSIR-NIIST. The workshop was organized for knowledge dissemination and creating awareness to testing laboratories, industries, regulatory bodies, research institutes and environmentalists in the latest trends in dioxin analysis.

Environmental Impact Assessment study for mining area IREL NK block NK block- II EE.

Indian Rare Earths Ltd (IREL) has appointed CSIR-NIIST, to evaluate the environmental aspects and their possible associated impacts that would arise due to the proposed heavy mineral sand mining operations and to work out environmental management plans and environmental monitoring programme to prevent, control, minimize or eliminate the adverse environmental impacts envisaged

from the mining activity. A purely physical process separates the heaves and no chemicals are used. The mined out heaves are transported to mineral separation plant and the mined voids are refilled simultaneously making space for revegetation / resettlement. The mineral concentrate can be transported by trucks or by waterway using NWA developed TS canal.

The primary data generation are ongoing for the study area and the buffer area. No major industries exist in the core area except M/s. Kerala Minerals & Metals Limited (KMML) which is about 2.5 km from the IREL Mineral Separation Plant.

The monitoring programme shall specify the locations, parameters, and frequency of monitoring of significant aspects. Capacity building in terms of staff, technical expertise and monitoring facilities shall also be suggested. The report shall lay stress on the probable occupational health hazards involved and the remedial measures. Data regarding the existing socioeconomic conditions shall be collected and Social Impact Assessment (SIA) will be prepared.

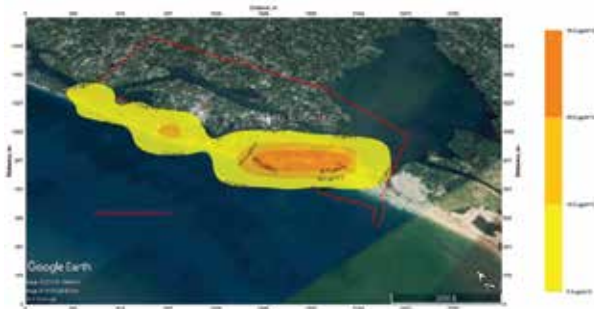
EIA study for the Block-IV and Block IV EE (Total ML area : 220.566 ha.) of Indian Rare Earths Ltd. Chavara, Kollam .

The proposed project includes two mine leases, Block-IV and Block Block IV EE. In block -IVEE, IRE proposes to enhance the capacity from 2,37,500 tpa to 7,50,000 tpa. The capacity expansion using two dredgers is mainly due to the pressure from the locals to mine the area at a faster rate and give back the land within three years.

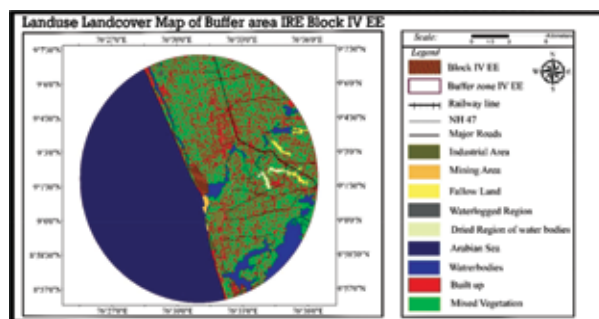
The core zone of this mining lease areas NK Block-IV: is 40.566 ha and NK Block-IV EE is 180 ha The buffer zone shall be 10 kilometers all around the periphery of the core zone for ML exceeding 50 ha and buffer zone shall be 5 kms in case of ML area up to 50 ha. The scope includes literature survey, field studies, impact assessment and preparation of the EIA document.

The EIA report is prepared based on the mining plan and the method of mining proposed to be adopted for the area and the production rate proposed for each area. It identifies the existing environmental conditions, predict impacts and suggest environmental safeguards and

develop post project monitoring programme to ensure environment friendly mining and transportation of the concentrate.



Site name	PM 10 Mean (Present conc.)	PM 10 Mean (During Mining)	NAAQS STANDARDS
PHC Vella-nathuruth	53	63	100
Cheriyazheekal	54	55	100
Amrithanan-damyi Math	49	50	100
Kozhikode	45	45	100



Feature	Block IV (Ha)
Fallow land	128
Marshy Land	29
Dried water bodies	93
Mixed vegetation	29856
Settlements	19600
Water bodies	1630

The dust emission prediction model developed using Envitrans MINE Fugitive Dust Modelling Pro shows incremental increase in pollution but the values are within the CPCB limit prescribed for PM10(100µg/m³per day).

The report looks into the viability of barge economics which appears to be a feasible option for transporting mineral concentrate using TS canal (part of NW3 waterway) to IREL plant. The mining of sand and separation of HM concentrates, eventually contributes to a reduction in the overall level of radiation in the environment, which is a relief to the inhabitants in the area.

550 families were covered under the socioeconomic survey in the project affected areas of Alappad, Panmana and Ayanivelikulangara of Kollam district. An amount of Rs. 159.00 lakhs is earmarked for post-project monitoring initially which include capital and recurring expenditure. The recurring expenditure will be about Rs. 113 lakhs/year.

Testing and Analytical Services

Facility for testing and analysis of water, soil and sediment samples for various physicochemical and water quality parameters is used by various government departments, research institutions, students from universities and colleges, public & private sector agencies and private individuals. The samples are routed through the testing and analytical cell.

Computational Modeling @ NIIST

The Computational Modeling group is a centre for interdisciplinary research, applying computational techniques to a wide range of phenomena and processes, leading to the creation of software technologies in diverse areas: metal casting and welding, hydrodynamics of multiphase chemical reactors like rotary kilns, stirred and fluidized bed reactors, systems biology and data analytics. This group also provides computational support to other groups within the Institute.

AutoCAST X1- FLOW+ software

Virtual Casting is a software package for the simulation of solidification process of industrial castings and was developed by CSIR-NIIST. In 2011, the **Virtual Casting Solver Technology** was transferred to 3D Foundry Tech Pvt. Ltd., (3DFT) a company incubated in the Indian

Institute of Technology Bombay. This company maintains and markets **AutoCAST** which uses an integrated easy-to-use environment for casting method design, solid modeling, and simulation. During 2012-13, **Virtual Casting Solver** was integrated with their casting design software **AutoCAST**, giving birth to **AutoCAST X1-FLOW⁺** software. During 2013-18, **AutoCAST X1-FLOW⁺** has been showcased at various Indian Foundry Exhibitions. Till date, More than 150 licenses of **AutoCAST-X1** has been sold to various ferrous, non-ferrous foundries and Academic Institutes in India and abroad by 3D Foundry Tech Pvt. Ltd.

The focus this year has been on the modification of the novel mold filling algorithm by including the pressure head and inertia effects. This innovative, realistic & quick mold filling software module has been released in the new version of **AutoCAST X1- Release 11.9.1**. Based on the new MOU which was signed during January 2017, we remain partners for rendering technical support to the private industry 3D Foundry Tech Pvt. Ltd., Mumbai for a period of five years starting from April 2017.

The first user meet of **AutoCAST** was held at Kolhapur on 15 Nov 2017. There were over 50 participants from across India: Kolkata, Belgaum, Shimoga, Kolhapur, Ichalkaranji. The Customers presented case studies covering quality and yield improvements.

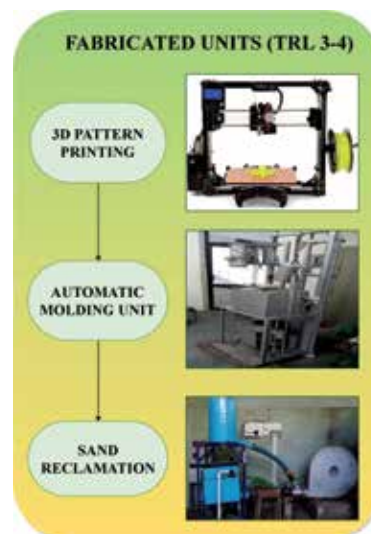


User meet of **AutoCAST X1**

AutoCAST X1-FLOW⁺ is available from 3D Foundry Tech Pvt. Ltd. 507-C, Ecstasy Business Park City of Joy, JSD Road, Mulund (W) Mumbai – 400 080, India. Phone: +91 98921 00072 E-Mail: babaprasad@autocast.co.in

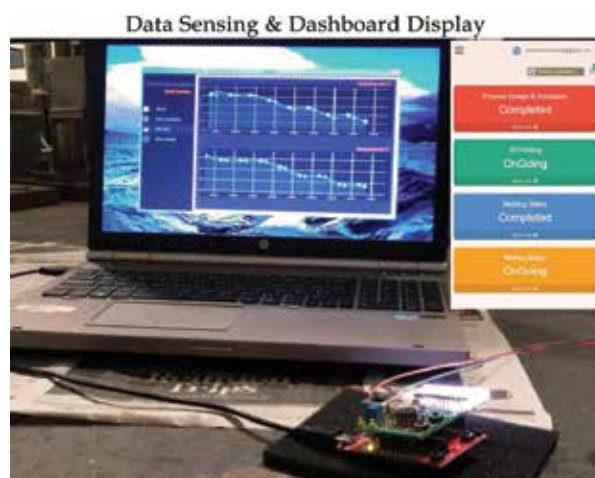
SMART Foundry2020

The project Sustainable Metal Casting by Advanced Research and Technology was sanctioned by DST for Rs. 8.25 crores with a contribution of RS. 1.25 crores from five



Printing, Molding Unit with sand reclamation system

private industrial partners, CSIR-NIIST being the project coordinator and the amount sanctioned for CSIR-NIIST is Rs. 3.32 crores for a period of three years. The objective is to develop and demonstrate an ultra compact SMART Foundry which will have fully integrated sensor driven systems with unique and novel features to make small intricate metal parts with high quality.

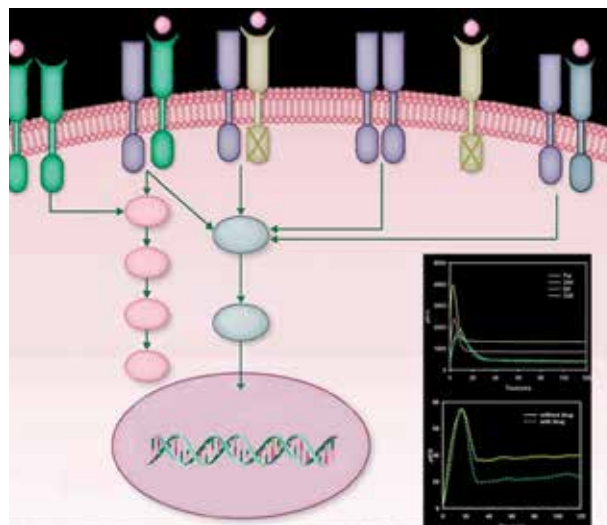


The entire facility can be set up as a micro manufacturing unit with very little investment.

Computational Biology

In silico prediction of ErbB signal activation from receptor expression profiles through a data analytics pipeline

The ErbB signaling pathway has been studied extensively owing to its role in normal physiology and its dysregulation in cancer. The popular reductionist approach of reverse engineering with equation-based modelling has succeeded in throwing light on the process of signal transduction, in parts and patches, generating repositories of unconnected data. Re-engineering by analytics and learning models can probe into these databanks to help piece together a system level understanding of signaling networks. Particularly, in an agent-based representation, patterns, structures, and system behaviour emerge by self-organization of interacting heterogeneous agents. The concept of a pipeline architecture has been used to construct an agent-based model to establish a



quantitative link between receptor expression, dimer concentrations and signaling outcomes. This knowledge can be translated to predict patient-specific ErbB activation and signaling dynamics which can eventually be used to guide personalized therapies.

RESEARCH PLANNING AND BUSINESS DEVELOPMENT

Contract Research Projects 2017-2018
Agro Processing And Technology Division

Client	Project Title	Project Leader
Dept. of Agricultural University, Govt.of Kerala	Setting up of technology business incubation centre	Mr V V Venugopal
Dept. of Agricultural University, Govt.of Kerala	Setting up a ginger processing plant at Wayanad	Mr V V Venugopal
KSCSTE	Can enrichment of Palm Neera Syrup cause immunomodulation	Dr M V Reshma
DBT	Bio processing of two coded anti-diabetic medicinal plants based on ethnomedical leads- A molecular pharmacological approach	Dr P Jayamurthy
KSCSTE	BisIndolylmethane conjugates of Biaryls: Role in apoptosis, cell cycle regulation and PI3K/AKT/mTOR signalling pathway in human breast and cervical cancer cells	Dr S Priya
Food Safety & Standards Authority of India	Occurrence of acrylamide, a heat induced food toxicant, in processed food products of India: mitigation strategies and health risks	Dr P Nisha
Dept. of Agriculture, Govt.of Kerala	Post-harvest operations for value addition of indigenous fruits and vegetables	Dr P Nisha
M/s. Arjuna Natural Extracts Limited	Antidiabetic validation of natural product fractions	Dr P Jayamurthy
M/s. Tata Chemicals Co. Ltd.,	In vitro evaluation of nutritional and probiotic activity of sweeteners	Dr P Nisha
DBT	Dissect the function of fundamental cilia-genes associated with ciliopathies in patients	Dr Shobi Veleri
DST	Role of mitophagy in cardiac hypertrophy: an in vitro cell line approach	Dr Vandana Shankar
Dept. of Health Research, New Delhi	Evaluation of beneficial effect of Boeravinone-B from <i>Boerhaavia diffusa</i> against diabetic cardiomyopathy through mitochondria mediated pathway in H9c2 cardiomyoblast and heart for development of nutraceuticals	Mr Salin Raj/ Dr Raghu K G
Dept. of Health Research, New Delhi	Development of biflavonoid based lead molecule (NIIST –OBT-2) from <i>Garcinia travancorica</i> for non-alcoholic fatty liver disease	Dr G Sindhu/ Dr Raghu K G

MICROBIAL PROCESSES AND TECHNOLOGY DIVISION		
DBT	Stereoselective synthesis of chiral alcohols of Pharmaceutical importance via microbial oxido reductases: Process development and scale-up	Dr P Binod
DST	Integrated technologies for economically sustainable bio- based energy	Dr Rajeev K Sukumaran
DST	Improved cultivation, taxonomy and functional characterization of rare and novel rhizobacterial genomes of plants grown in abiotic stress soils	Dr N Ramesh Kumar
Ministry of Earth Sciences	Bioprospecting and taxonomic studies of marine micro organisms in search of novel anti-infective	Dr N Ramesh Kumar
TIFAC	Centre for bio fuels Phase II	Dr Rajeev K Sukumaran
DBT	Characterization, recombinant expression, process scale up validation of selected hydrolases from native action bacteria for commercial exploitation	Dr Rajeev K Sukumaran
SERB, DST	Bioprospecting of microalgal resources for nutritionally important high value lipid production	Dr Muthu Arumugham
DBT	Investigation on the synergistic effect of phytohormones on omega -3- fatty acid production from <i>Nanochloropsis</i> sp.	Dr Muthu Arumugham
IBSD, Manipur	Exploration and exploitation of microflora from Marcha and soil samples from high altitude soils for the production of 2,5-furan dicarboxylic acid and selected industrially important enzymes	Dr P Binod
IBSD, Manipur	Loktak lake biomass (para- grass) based biorefinery for fuels and chemicals: Value addition through biotechnological and thermochemical platform	Dr Rajeev K Sukumaran
DBT	Direct utilization of agroresidual biomass for the production of α,ω -diamines as well as α,ω -amino acids: strain and process development using <i>Corynebacterium glutamicum</i>	Dr Madhavan Nampoothiri
KSCSTE	Molecular approach to enhance folate production in probiotic lactic acid bacteria	Dr Madhavan Nampoothiri
DBT	Development of a gene expression platform for heterologous protein production in the filamentous fungus <i>Aspergillus unguis</i>	Dr Rajeev K Sukumaran
M/s. T Stanes & Co. Ltd.,	The development of stabilized formulations of biopesticides and biofertilizers	Dr Rajeev K Sukumaran
M/s. Margosa Biogrow India Pvt. Ltd., Gujarat	Development of a bioprocess for the commercial production of Gibberellic acid	Dr Madhavan Nampoothiri
DST	Development of a sustainable process for the production of poly-3-hydroxybutyrate using kitchen and food waste	Dr R Sindhu
DST – INDO - NORDEN	Holistic processes and practices for clean energy in strengthening bio economic strategies	Dr. Binod P



CHEMICAL SCIENCES AND TECHNOLOGY DIVISION		
M/s. GAIL(India) Ltd.,	Organic based hybrid thermoelectric materials for low cost refrigeration usage	Dr Biswapriya Deb
MNRE	Dye Sensitized Solar Cell (DSSC)/ Quantum dot dye sensitized solar cell	Dr Joshy Joseph
DST	Design and synthesis of multifunctional organic – DNA conjugates for biomolecular applications	Dr Joshy Joseph
DST	Cucurbit[n] uril homologues and their derivatives as receptors for a few ionic and neutral analytes	Dr Rakesh Mishra
DST	Development of novel organic materials for photovoltaic applications	Dr C Vijayakumar
KSCSTE	Silver starch hydrogel hybrid nanocomposite for anti microbial wound healing applications	Dr J D Sudha
KSCSTE	Synthesis utility of dienaminodioate for synthesis of 1,2-Dihydropyridines and its resulting derivatives for evaluation of their anti-microbial, anti-tuberculosis & anti-malarial potential	Dr L Ravi Shankar
DST	Solar Hydrogen: An alternative avenue	Dr Suraj Soman
DST	Novel protocols for the construction of carbon-carbon and carbon- Hetero atom bonds mediated by nucleophilic hetero cyclic carbenes and phosphines	Dr K V Radhakrishnan
DST	Transition metal/ Lewis acid mediated reactions of strained diazanorbornes and carbonyl compounds: Efficient access to biologically relevant scaffolds	Dr K V Radhakrishnan
DST	Sulfonimidamides: Its synthesis and applications in organic synthesis; Development of new methodologies for the synthesis of heterocyclic systems	Dr Ganesh Chandra Nandi
DST	Fluorescent molecules and assemblies for sensing and imaging (J C Bose Fellowship)	Dr Ajayaghosh A
DST (FAST TRACK)	Design, synthesis and studies of self-assembling luminescent metallo- peptides	Dr Praveen V K
DST	Charge carrier transport in polymeric and organic semiconducting thin films for application in light emitting diodes, field-effect transistors and photovoltaic devices	Dr Narayanan Unni
DST	Investigation of ultra fast dynamics of chromophores involved in singlet exciton fission processes towards solar cell applications	Dr Karunakaran Venugopal
SERB, DST	Synthesis a library of Aza-C KRN 7000 and Aza galacto lipid analogues for immunomodulatory screening	Dr L Ravi Shankar
KSCSTE	Development of synthetic strategies for diverse compound collection of privileged structural motifs for medicinal chemistry	Dr L Ravi Shankar
DST	New materials for improved, cost-effective perovskites solar cells	Dr Joshy Joseph
SERB	Nano structured electrodes for energy storage devices	Dr Raghy Raghavan

DBT	Gold nanorod based targeted nanoprobe for cancer theranostics: Diagnosis by Surface Enhanced Raman Scattering (SERS) and fluorescence imaging and therapy by PDT and PTT	Dr K K Maiti
SERB	Modulating the morphology and molecular packing of self-assembled organic nanomaterials for efficient photo-induced electron transfer	Dr K Yoosaf
ISRO	Development of flexible solar cells through innovative photoanode/ Active layer systems	Dr J D Sudha
DST	Low cost photonic device for diagnostic applications	Dr Animesh Samanta
SERB	Quantum chemical modelling of CC and CN metathesis reactions and functional molecules containing unusual carbon-metal bonds	Dr C H Suresh
DBT	Development of novel NIR absorbing sensitizers and their nano-conjugates for the multi model cancer imaging and therapy	Dr Joshy Joseph
SERB	Nature Inspired chemical entities for healthcare applications	Dr B S Sasidhar
Ministry of Science & Technology, DST	Indigenous development of Semi-automatic equipments for large area dye-sensitized solar module fabrication	Dr Narayanan Unni
DST	Design and processing of nano structured hybrid composite materials for electro chemical energy storage	Dr Narayanan Unni
SERB, DST	Dynamic molecular, supramolecular and surface chemistry for spatiotemporal modulation of smart advanced functional materials	Dr Sreejith Shankar Pooppannal
DST	Development of multiplexing detection platform of breast cancer markers by non-invasive Surface Enhanced Raman Scattering (SERS)- Nanoprobe	Dr K K Maiti
SERB	Mechanical stimulation induced microscopic crystalline structure changes in molecular materials: Implications on drug formulation and mechanochromic behaviour	Dr Sunil Varughese
DBT	Development of a condensation/dipolar cycloaddition strategy towards highly functionalized heterocycles and its applications in medicinal/ material chemistry & chemical biology	Dr Jubi John
MATERIALS SCIENCE AND TECHNOLOGY DIVISION		
BRNS	Development of photo catalytic reactor based on the wide spectrum nanotitania- organic hybrids for decomposition of dyes and recovery of precious additive / solvent on spent laser dye solution	Dr Saju Pillai
M/s. Noritake Co. Ltd., Japan	Adsorbents for gas and vapour molecules. Rational design of materials, porous nano structures and surface chemistry	Dr S Ananthakumar
BRNS	Tailoring of magneto structural phase transitions near the room temperatures in inter metallic alloys for the magnetic refrigeration applications	Dr Vasundhara M



DST	Aluminium –Silicon piston alloy development by squeeze casting process for strategic application	Dr M Ravi
DST	Delaminated surfactant free layered double hydroxides as multifunctional fillers for semicrystalline polymers	Dr Bhoje Gowd
M/s. SRF Ltd.	Microstructure analysis of industrial yarns	Dr Bhoje Gowd
KMML	Mineralogical, geochemical and morphological characterisation of raw ilmenite, reduced ilmenite, leached ilmenite and synthetic rutile	Dr. Harikrishna Bhat
DST	Alumina based LTCC & HTCC substrate for hybrid microelectronic circuits in strategic sector applications	Dr K P Surendran
DST (TSDP)	Development of ceramic membranes and setting up of a pre-pilot plant manufacturing facility	Dr U S Hareesh
SERB	Developments of environmentally benign inorganic pigments for energy saving cool roof and anti-corrosive applications	Dr K G Nishanth
DST	Technology development of recycling of aluminium (SARAPS) alloys for industrial applications	Dr M Ravi
DST	Synthesis and characterization of broad spectrum ultraviolet filter with visible light emission and antioxidant activity: A potential multifunctional active ingredient with multitude of applications	Dr Adersh Ashok
Coir Board	Process development for enhancing the longevity of coir geotextiles (Coir Bhoovastra)	Dr V S Prasad
SERB	Development of magnetically modulated therapeutically active layered double hydroxide (LDH) as a nanomedicine with hyperthermia potential for cancer theranostics	Dr Manoj Raama Varma
Coir Board, Kochi	Bio plastic from poly(Lactic acid)/ Coir composites	Mr M Brahmakumar
Coir Board, Kochi	Process development for surface modification of coir fibres for enhanced spin ability	Dr Bhoje Gowd
SERB	Designing green, self-healing coatings for metal protection	Dr K G Nishanth
Aeronautical Research and Development Board	Quantitative assessment of hot tearing characteristics of aerospace magnesium alloys using instrumented constrained rod casting (CRC) technique	Dr A Srinivasan
ARMREB, New Delhi	Development of light weight functionally graded metal- ceramic composite armour materials for defence applications	Dr T P D Rajan
DST	Investigation of structural, optical, magnetic properties and electronic structure of binary inter-metallic alloys for the spintronic applications	Dr M Vasundhara
ISRO	Development of novel magnetodielectric materials for miniaturized microstrip patch antennas	Dr. Manoj Raama Varma

ICDD	Generation of structural data for new ceramic complex oxides	Dr. Prabakar Rao
M/s English Indian Clays, Trivandrum	Value addition of EICL Silica sand and clay residue for novel commercial products and sustainable business	Dr S Ananthakumar
M/s. Aditya Birla Insulators, West Bengal	Development of hydrophobic glaze for porcelain insulator	Dr. S. Ananthakumar
ENVIRONMENTAL TECHNOLOGY DIVISION		
DST	Novel hybrid nanostructured surface modified electrodes for sensors and biosensors	Dr K P Prathish
KSRSE, Govt.of Kerala	Analysis of water samples from Chimery, Vazhavi & Cheerakuzhi river basins	Dr. K P Prathish
DSIR	Common research and technology development- Hub for environmental intervention in the MSME Sector	Dr Ajit Haridas
DST	Algal biomass as a potential renewable resource of energy: Production of fuels & chemicals by heterogeneous catalysis	Dr Churchil Angel Antony Raj
Kerala State Pollution Control Board	Determination of emission factors of dioxins from open burning of municipal wastes in Kerala	Dr K P Prathish
DST	Development of chloride free saleable iron oxide from by-products of Titanium pigment production via chloride route	Dr K P Prathish
Department of Environment and Climate Change	Biodrying: A comprehensive model waste management scheme for Kerala	Dr Ajit Haridas
DST	SMART FOUNDARY (SMART= Sustainable Metalcasting using Advanced Research and Technology)	Dr S Savithri

CONSULTANCY PROGRAMMES 2017-18

Client	Project Title	Project Leader
M/s. Omgene Life Sciences Pvt. Ltd., Gujarat	Synthesis of ER-4	Dr L Ravi Shankar
M/s. Apicore Pharmaceuticals Pvt. Ltd. Vadodara	Characterization and confirmation of drug intermediates	Dr L Ravi Shankar
M/s. Western India Cashew Company Pvt. Ltd.	Estimation of phenolics in cashew –formulation and validation of procedure	Dr J D Sudha
Dept. of Agricultural University, Govt. of Kerala	Setting up of a ginger processing facility in Wayanad	Mr V V Venugopal
M/s. SRF Ltd., Chennai	Microstructure analysis of industrial yarns	Dr Bhoje Gowd
KMML, Kollam	Mineralogical, geochemical and morphological characterisation of raw ilmenite, reduced ilmenite, leached ilmenite and synthetic rutile	Dr Harikrishna Bhat
KMML, Kollam	EIA study for KMML pond	Dr J Ansari
IRE	EIA study for IRE block IV & IV EE, Kollam	Dr J Ansari
IRE	EIA and EMP study for IREL NK Block-II & NK Block-II EE	Dr J Ansari
M/s. HLL Infra Tech Services Ltd., Trivandrum	Hospital STP design	Dr Ajit Haridas
KSRSEC, Govt. of Kerala	Analysis of water samples from Peechi and Chalakkudy irrigation project	Dr K P Prathish
M/s. WAPCOS Ltd., Cochin	Odour control and effluent pre-treatment at Al Badr Fish Canning unit at CSEZ, Kakkanad	Dr Ajit Haridas
KSRSEC, Govt. of Kerala	Analysis of water samples from Chimery, Vazhavi & Cheera kuzhi river basins	Dr K P Prathish
M/s. 3D Foundry Tech Pvt. Ltd., Mumbai	Additional module for Flow+ for prediction of fill related and solidification related defects in investment casting process	Dr S Savithri

हस्ताक्षर किए एमओयू / समझौते					
क्र. सं.	शीर्षक	हस्ताक्षर की तारीख	एमओयू / समझौते	ग्राहक	परियोजना प्रधान
1	कास्टिंग भरने और टोसकरण सिमुलेशन के लिए बौद्धिक संपदा का हस्तांतरण	11.04.2017	26.09.2011 को निष्पादित समझौते के लिए अनुपूरक	मेसेर्स 3डी फाउंडरी टेक प्रा. लि., 507-सी इकटेसी बिजनेस पार्क, सिटि ऑफ जॉय, जेएसडी रोड, मूलंद (डब्ल्यू) मुंबई 400080, भारत	डॉ. एस सावित्रि
2	अकादमिक औद्योगिक अनुसंधान की साझेदारी -पीआईआरआईआर	12.04.2017	एमओयू	मेसेर्स केएससीएसटीई (केरला स्टेट कार्डसिल फॉर साइंस, टेकनोलॉजी एंड एंवायरमेंट) एंड विनविश टेक्नॉलाजी प्राइवेट लिमिटेड	डॉ. नारायणन उणिण
3	गैस और वाष्प अणुओं के लिए सिरेमिक एडसोरबेंट्स का विकास	28.04.2017	रूपान्तर विलेख	मेसेर्स नोरिटेक कं., लिमिटेड, 1-36 नोरिटेक-शिनमाची 3 कोमी, निशि-क्, नागोया 451-8501, जापान (नोरिटेक-आरडीसी)	डॉ. यू एस हरीश
4	इंजीनियरिंग विषयों में शिक्षा और वैज्ञानिक अनुसंधान पर पारस्परिक सहयोग का बढ़ावा।	24.05.2017	शैक्षणिक और वैज्ञानिक सहयोग के लिए एमओयू	मेसेर्स दी फैकल्टी ऑफ इंजिनियरिंग एंड ग्रेज्यूएट स्कूल ऑफ इंजिनियरिंग, कयोटो यूनिवर्सिटी, कयोटोडाईगाकू-कटसूरा, निशिक्यो-कू 6158630, कयोटो	डॉ. विजयकुमार सी
5	फैब्रिकेशन सिस्टम / तदनुकूलित मॉडल	01.06.2017	एमओयू	मेसेर्स एलिकसर टेक्नोलॉजी, बैंगलोर एंड मेसेर्स ईगैन कंसल्टेंट्स प्रा. लि., त्रिवेंद्रम, केरल, भारत	डॉ. नारायणन उणिण
6	औद्योगिक यार्न के सूक्ष्म संरचना विश्लेषण	01.06.2017	परामर्श परियोजना	मेसेर्स एसआरएफ लिमिटेड, सी-8 सफदरजंग डवलपमेंट एरिया, नई दिल्ली प्रिसिपल ऑफिस: मनाली, इंडस्ट्रियल एरिया, मनाली, चेन्नई- 600068, भारत	डॉ. भौजे गौड
7	एनआईआईएसटी-अकार्बनिक रंजक का मूल्यांकन	14.07.2017	पारस्परिक गैर प्रकटीकरण और सामग्री हस्तांतरण समझौते	मेसेर्स विबफास्ट पिगमेंट प्रा. लि., ('विबफास्ट'), सी-1,91/6, जी.आई.डी.सी., बैंक ऑफ इंडिया के पीछे, फेज-1, वटवा, अहमदाबाद, गुजरात, भारत	डॉ. निशांत के जी
8	शैक्षणिक और वैज्ञानिक सहयोग के लिए एमओयू	15.07.2017	एमओयू	मेसेर्स शिबौरा इंस्टिट्यूट ऑफ टेक्नोलॉजी, टोक्यो, जापान	डॉ. यू एस हरीश
9	परबॉइल चावल मिल इफ्लूएंट से रंग का निष्कासन	18.07.2017	तकनीकी हस्तांतरण	मेसेर्स गैलेक्सी एनविरोन (एसएसआई यूनिट के रूप में), एयरपोर्ट रोड, मडूर जंक्शन, कालडी, एर्नाकुलम, केरल, - 683 574	डॉ. अजित हरिदास
10	प्राकृतिक उत्पाद अंशों का एंटीडाइबेटिक सत्यापन	24.07.2017	सहयोगात्मक अनुसंधान के लिए समझौता	मेसेर्स अर्जुना नाचुरल एक्सट्रेक्टस लिमिटेड, डोर नं. 7/8, बैंक रोड, आलुवा, केरल - 683101 एंड आर एंड डी डिविजन, डोर नं. 187/डी, एरुमथला पीओ, कीप्रमाड - 683112, केरल	डॉ. जयमूर्ति पी
11	विभिन्न औषधीय पौधों और फोर्मूलेशन का विस्तृत वैज्ञानिक विश्लेषण	25.07.2017	एमओयू	मेसेर्स सरकारी आयुर्वेद कॉलेज, एमजी रोड, तिरुवनंतपुरम 695001	डॉ. के वी राधाकृष्णन
12	मोटर वाहन अनुप्रयोगों के लिए उच्च शक्ति एल्यूमीनियम मिश्र धातु का विकास	11.08.2017	गोपनीय	मेसेर्स टाटा मोटर्स लि., बॉम्बे हाउस, 24 होमी मोदी स्ट्रीट, मुंबई - 400 001, महाराष्ट्र, भारत	डॉ. एम रवि

13	रबर रसायनों के लिए सीएनएसएल आधारित रेजिन का विकास	23.08.2017	पारस्परिक गैर प्रकटीकरण समझौता	मेसेर्स एसोसिएटेड रबर केमिकल्स प्रा. लि., 34/1397 ए, एसोकेम चैंबर्स, एनएच-47 बाइपास, इडप्पल्ली, कोच्चि 682024	डॉ. जेडी सुधा
14	कम्यूनिटी साइज एनारोबिक डाइजेस्टर	30.08.2017	तकनीकी हस्तांतरण	मेसेर्स स्वच्छ फ्यूचर एनर्जी सॉल्यूशन, टीसी-42/1411(1), श्रीपादम 212 संगमम नगर, तिरुवनंतपुरम 695008	डॉ. बी कृष्णकुमार
15	रासायनिक परीक्षण (एमओयू का विस्तार)	15.09.2017 (एमओयू हस्ताक्षर करने की तिथि: 25.03.2013)	एमओयू का विस्तार (24.03.2018 तक विस्तार)	मेसेर्स एनवायरो डिजायन इको लैब्स, इको टॉवर, जनता जंक्शन, पलारीवट्टम, एर्नाकुलम, कोच्चि – 682025 /	डॉ. जे अंसारी
16	वृद्धि और लिपिड उत्पादन का आकलन करने के लिए 1000 लीटर क्षमतावाले खुले रेसवे तालाब में नैनोक्लारोप्सिस स्पीसीज की खेती	23.10.2017	गैर प्रकटीकरण समझौता	मेसेर्स अबान इंफ्रास्ट्रक्चर लिमिटेड, बॉयोटेकनॉलाजी डिविजन, जनप्रिया क्रेस्ट, 113, पांथोन रोड, इगमोर, चेन्नई – 600008	डॉ. मुत्तु अरुमुगम
17	वझनी, चिमनी और चीराकुशी सिंचाई परियोजना नदी घाटी का विश्लेषण और पोस्ट और प्री मानसून जल नमूनाकरण	28.10.2017	परामर्श परियोजना के लिए समझौता	मेसेर्स केरल स्टेट रिमोट एंड एनवायरनमेंट सेंटर (केएसआरईसी), विकास भवन, पीएमजी, तिरु. केरल, 695033	डॉ. के पी प्रतीश
18	वाणिज्यिक उपयोग के लिए अपशिष्ट प्रसंस्करण पर अनुसंधान और अपशिष्ट का ऊर्जा प्रौद्योगिकियों में विकास	30.10.2017	गोपनीय समझौता	मेसेर्स जीजे नेचर केयर एंड एनर्जी प्रा. लि., XXIV/603 थोलानिकुन्नेल बिल्डिंग, तिरुवांकुलम पीओ, कोच्चिन, केरल – 682305	डॉ. अजित हरिदास
19	मैसर्स ओमजेन लिमिटेड को तकनीकी परामर्श	10.11.2017	परामर्श परियोजना के लिए समझौता	मेसेर्स ओमजीन लाईफ साइंस प्रा. लि., 333 जीआईडीसी इंडस्ट्रियल एस्टेट, मखारपुरा, वडोदरा, गुजरात 390010, भारत	डॉ. एल रवि शंकर
20	स्वदेशी फलों और सब्जियों के मूल्य संवर्धन के लिए फसलोत्तर आपरेशन	20.11.2017	एमओयू	निदेशक, कृषि विकास विभाग और किसान कल्याण विभाग, तिरुवनंतपुरम, केरल	डॉ. पी निशा
21	गैर प्रकटीकरण समझौते के लिए समझौता	24.11.2017	गैर प्रकटीकरण समझौता	मेसेर्स आईटीसी लि., 37, जवाहरलाल नेहरू रोड, कोलकता - 700 071, भारत	डॉ. माधवन नंपूतिरि
22	पोर्सिलेन बिजली के इंसुलेटर पर अकार्बनिक / कार्बनिक हाइड्रोफोबिक सतह कोटिंग्स के अनुप्रयोग	06.12.2017	सहयोगात्मक / सहकारी के लिए समझौता	मेसेर्स आदित्य बिरला इंस्ट्रूमेंट्स, प्रभास नगर, रिश्रा, जिला, हुगली, वेस्ट बंगाल – 712249, भारत	डॉ. एस अनंतकुमार
23	तकनीकी परामर्श परियोजना प्रदान करने के लिए समझौता (सुगामाडेक्स इंच्यूरिटी एसडी-2 और डाइड्रोजेस्टेरॉन इंटरमीडिएट डीजी2)	12.12.2017	परामर्श परियोजना के लिए समझौता	मेसेर्स ओमजीन लाईफ साइंस प्रा. लि., 333 जीआईडीसी इंडस्ट्रियल एस्टेट, मखारपुरा, वडोदरा, गुजरात 390010, भारत	डॉ. एल रवि शंकर

24	स्वीटनरों की पौष्टिक और प्रीबॉयोटिक गतिविधि का विट्रो मूल्यांकन	20.12.2017	सहयोगात्मक अनुसंधान के लिए समझौता	मेसेर्स टाटा केमिकल्स लि., बॉम्बे हाउस, 24 होमी मोदी स्ट्रीट, फोर्ट मुंबई – 400 001, महाराष्ट्र, भारत	डॉ. निशा पी
25	सोलानम निग्राम से उत्तरोसिड बी का अलगाव, संरचना स्पष्टीकरण और उत्तराइड बी अनुरूपताओं का संश्लेषण	08.01.2018	सहयोगात्मक समझौता	राजीव गांधी सेंटर फॉर बायोटेक्नोलॉजी, पूजप्पूर, तायकॉड पीओ, त्रिवेंद्रम	डॉ. एल रवि शंकर
26	कौशल विकास	05.02.2018	एमओयू	मेसेर्स एग्रीकल्चर स्किल काउंसिल ऑफ इंडिया (एएससीआई), 6वां फ्लोर, जीएनजीटी टॉवर, बिल्डिंग नं-10, सेक्टर-44, गुरुग्राम, हरियाणा – 122004, भारत	डॉ. निशा पी
27	मौजूदा समुद्र तट धोने के खनन और एमएसपी के लिए पर्यावरणीय प्रभाव आकलन अध्ययन का संचालन	23.02.2018	परामर्श सेवाओं के लिए समझौते का संशोधन	मेसेर्स केरल मिनरल एंड मेटल्स, चवरा, कोल्लम – 691583, केरल	डॉ. जे अंसारी
28	कॉयर जिआं टैक्स्टाइल्स की दीर्घायु बढ़ाने के लिए (कॉयर भुवन्छ) प्रक्रिया विकास	संशोधन दिनांक 06.03.2018 (मूल एमओयू 03-08.2016 को हस्ताक्षरित)	एमओयू का संशोधन /	कॉयर बोर्ड रजिस्टर्ड एट कॉयर हाउस, एमजी रोड, कोच्चि – 682016	डॉ. वी बी मणिलाल
	पॉली (लैक्टिक एसिड) / कॉयर कंपोजिट्स से जैव-प्लास्टिक			कॉयर बोर्ड रजिस्टर्ड एट कॉयर हाउस, एमजी रोड, कोच्चि – 682016	डॉ. वी बी मणिलाल
	वर्धित स्पिनबिलिटी के लिए कॉयर फाइबर का सह संशोधन के लिए प्रक्रिया विकास			कॉयर बोर्ड रजिस्टर्ड एट कॉयर हाउस, एमजी रोड, कोच्चि – 682016	डॉ. वी बी मणिलाल
29	जिब्रोरेलिक एसिड के वाणिज्यिक उत्पादन के लिए बायोप्रोसेस का विकास	15.03.2018	प्रायोजित अनुसंधान के लिए समझौता	मेसेर्स मरगोसा बायोग्रो इंडिया प्रा.लि., 113-सिल्वर लाइन, सायाजीगंज, वडोदरा- 390005, गुजरात	डॉ. माधवन नंपूतिरि
30	अपशिष्ट प्रबंधन के लिए पायलट परियोजना का कार्यान्वयन	23.03.2018	एमओयू	मेसेर्स एयरपोर्ट अथॉरिटी ऑफ इंडिया, त्रिवेंद्रम इंटरनेशनल एयरपोर्ट, तिरुवनंतपुरम – 695008	डॉ. कृष्णकुमार बी
31	फर्नीचर अनुप्रयोगों के लिए पॉलिमर / कॉयर कंपोजिट्स का उत्पादन	28.03.2018	एमओयू	मेसेर्स नेशनल कॉयर रिसर्च एंड मैनेजमेंट इंस्टिट्यूट (एनसीआरएमआई), (केरल सरकार), कुडप्पनाक्कुन्नु, पीओ, तिरुवनंतपुरम – 695043, केरल	श्री ब्रह्मकुमार एम

MoUs / AGREEMENTS SIGNED					
SN	Title	Date	MoU/ Agreement	Client	Project Leaders
1	Transfer of intellectual property for casting filling and solidification simulation	11.04.2017	Addendum to Agreement executed on 26.09.2011	M/s. 3D Foundry Tech Pvt. Ltd., 507-C ECTASY Business Park, Citi of Joy, JSD Road, Mulund (W) Mumbai 400080, India	Dr.S Savithri
2	Partnering Academic Industrial Research -PAIR	12.04.2017	MoU	M/s. KSCSTE (Kerala State Council for Science, Technology and Environment) and Vinvish Technologies Private Limited	Dr.Narayanan Unni
3	Development of ceramic adsorbents for gas and vapor molecules	28.04.2017	Deed of Variation	M/s. Noritake Co., Limited., 1-36 Noritake-Shinmachi 3 Chome, Nishi-ku, Nagoya 451-8501, Japan (Noritake-RDC)	Dr.U S Hareesh
4	Promote mutual cooperation on education and scientific research in the engineering discipline.	24.05.2017	MOU for Educational and scientific cooperation	M/s. The Faculty of Engineering and Graduate School of Engineering, Kyoto University, Kyotodaigaku-Katsura, Nishikyo-ku 6158530, Kyoto, Japan	Dr.Vijayakumar C
5	Fabrication system/Tailor made models	01.06.2017	MoU	M/s. Elixer Technology, Bangalore and M/s. Engen Consultants Pvt. Ltd., Trivandrum, Kerala, India	Dr.Narayanan Unni
6	Microstructure Analysis of Industrial Yarns	01.06.2017	Consultancy Project	M/s. SRF Limited, C-8, Safdarjung Development Area, New Delhi <u>PRINCIPAL OFFICE</u> ; Manali Industrial Area, Manali, Chennai - 600068, India	Dr.Bhoje Gowd
7	Evaluation of NIIST -Inorganic Pigments	14.07.2017	Mutual Non-Disclosure and Material Transfer Agreement	M/s. VIBFAST Pigments Pvt. Ltd., ("VIBFAST"), C-1, 91/6, G.I.D.C., Behind Bank of India, Phase-I, VATWA, Ahmedabad, Gujarat, India	Dr.Nishanth K G
8	MoU for Educational and Scientific Cooperation	15.07.2017	MoU	M/s. Shibaura Institute of Technology, Tokyo, Japan	Dr.U S Hareesh
9	Removal of colour from parboil rice mill effluent	18.07.2017	Technology Transfer	M/s. Galaxy Environ (as SSI Unit), Airport Road, Mattoor Junction, Kalady, Ernakulam, Kerala - 683 574	Dr.Ajit Haridas
10	Antidiabetic validation of natural product fractions	24.07.2017	Agreement for Collaborative Research	M/s. Arjuna Natural Extracts Limited, Door No. 7/8, Bank Road, Aluva, Kerala - 683101 and R & D Division at Door No. 187/D, Erumathala P O, Keezhmad - 683112, Kerala	Dr.Jayamurthy P
11	Detailed scientific analysis of different medicinal plants and formulations	25.07.2017	MoU	M/s. Government Ayurveda College, MG Road, Thiruvananthapuram 695001	Dr. K.V Radhakrishnan

12	Development of high strength Aluminum Alloy for Automotive Applications	11.08.2017	Confidentiality Agreement	M/s. Tata Motors Ltd., Bombay House, 24 Homi Mody Street, Mumbai - 400 001, Maharashtra, India	Dr.M Ravi
13	Development of CNSL based resin for rubber chemicals	23.08.2017	Mutual Non-Disclosure Agreement	M/s. Associated Rubber Chemicals Pvt. Ltd., 34/1397 A, Assochem Chambers, NH-47 Bypass, Edapally, Kochi 682024	Dr.J D Sudha
14	Community size Anaerobic Digester	30.08.2017	Technology Transfer	M/s. Swatch Future Energy Solution, TC-42/1411(1), Sreepadam, 212 Sangamam Nagar, Thiruvananthapuram 695 008	Dr.B Krishnakumar
15	Chemical Testing (EXTENSION OF MOU)	15.09.2017 (MoU signed date: 25.03.2013)	Extension of MoU (Extension Upto 24.03.2018)	M/s. Envirosigns Eco Labs, Eco Tower, Janatha Junction, Palarivattom, Ernakulam, Kochi - 682025	Dr. J Ansari
16	Cultivation of Nannochloropsis sp. in 1000L capacity open raceway pond to assess growth and lipid production	23.10.2017	Nondisclosure Agreement	M/s. ABAN Infrastructure Limited., Biotechnology Division, Janapriya Crest, 113, Pantheon Road, Egmore, Chennai-600008	Dr.Muthu Arumugam
17	Post and Premonsoon water sampling and analysis of vazhany, chimony and cheerakuzhy irrigation project river basins	28.10.2017	Agreement for consultancy project	M/s. Kerala State Remote and Environment Centre (KSREC), Vikas Bhavan, PMG, TVPM, Kerala 695033	Dr.K P Prathish
18	Research and develop waste processing and waste to energy technologies for commercial use.	30.10.2017	Confidentiality Agreement	M/s. GJ Nature Care & Energy Pvt. Ltd., XXIV/603. Tholanikunnel Buildings, Thiruvankulam P O, Cochin, Kerala - 682305	Dr.Ajith Haridas
19	Providing technical Consultancy to M/s. Omgene Ltd	10.11.2017	Agreement for consultancy project	M/s. Omgene Life Sciences Pvt. Lt.d, 333 GIDC Industrial Estate, Makharpura, Vadodara, Gujarat - 390010, India	Dr. L Ravi Shankar
20	Post Harvest operation for value addition of indigenous fruits and Vegetables	20.11.2017	MoU	Director, Department of Agriculture Development and Farmers Welfare Department, Thiruvananthapuram, Kerala	Dr.P Nisha
21	Agreement for Non-Disclosure Agreement	24.11.2017	Non Disclosure Agreement	M/s. ITC Ltd., 37, Jawaharlal Nehru Road, Kolkata - 700 071, India	Dr.Madhavan Nampoothiri
22	Application of Inorganic/Organic Hydrophobic Surface coatings on porcelain electrical Insulators.	06.12.2017	Agreement for collaborative / Co operative	M/s. Aditya Birla Insulators, Prabhas Nagar, Rishra, Dist. Hooghly, West Bengal - 712249, India	Dr.S Ananthakumar



23	Agreement is for providing Technical Consultancy project (Sugammadex impurity SD-2 & Dydrogesterone intermediate DG2)	12.12.2017	Agreement for consultancy project	M/s. Omgene Life Sciences Pvt. Lt.d, 333 GIDC Industrial Estate, Makharpura, Vadodara, Gujarat - 390010, India	Dr. L Ravi Shankar
24	Vitro Evaluation of Nutritional and Prebiotic Activity of Sweeteners	20.12.2017	Agreement for Collaborative Research	M/s. TATA Chemicals Limited, Bombay House, 24, Homi Mody Street, Fort, Mumbai, Maharashtra 400001, India	Dr.Nisha P
25	Isolation, structure elucidation of uttoside B form solanum nigrum and synthesis of Uttroside B analogues	08.01.2018	Collaboration Agreement	M/s. Rajiv Gandhi Centre for Biotechnology, Poojappura, Thycaud PO, Trivandrum	Dr. L Ravi Shankar
26	Skill Development	05.02.2018	MoU	M/s. Agriculture skill council of India (ASCI), 6th Floor, GNGT Tower, Building No-10, Sector-44, Gurugram, Haryana - 122004, India	Dr.Nishy P
27	Conducting Environmental Impact Assessment study for the Existing beach wash mining & MSP	23.02.2018	Amendment of Agreement for Consultancy Services	M/s. Kerala Minerals and Metals, Chavara, Kollam- 691583, Kerala	Dr.J Ansari
28	Process development for enhancing the longevity of coir geo textiles (COIR BHOOVA STRA)	Amendment dtd: 06.03.2018 (Original MoU signed dtd: 03.08.2016)	Amendment of MoU	Coir Board,Registered at Coir House, M G Road, Kochi- 682 016	Dr.V B Manilal
	Bio- Plastics from poly(Lactic Acid)/ Coir Composites			Coir Board,Registered at Coir House, M G Road, Kochi- 682 016	Dr.V B Manilal
	Process development for surface modification of coir fibers for enhanced spinnability			Coir Board,Registered at Coir House, M G Road, Kochi- 682 016	Dr.V B Manilal
29	Development of a bioprocess for the commercial production of Gibberellic acid	15.03.2018	Agreement for Sponsored Research	M/s. Margosa Biogrow India Pvt. Ltd., 113-Silver line, Sayajigunj, Vadodara-390005, Gujarat	Dr.Madhavan Nampoothiri
30	Implementation of pilot project for waste management	23.03.2018	MoU	M/s. Airports Authority of India, Trivandrum International Airport, Thiruvananthapuram - 695008	Dr.Krishnakumar B
31	Production of Polymer/ Coir Composites for Furniture Applications	28.03.2018	MoU	M/s. National Coir Research & Management Institute (NCRM), (Govt. of Kerala), Kudappanakkunnu P.O, Thiruvananthapuram - 695043, Kerala	Mr.Brahmakumar M

पेटेंट भारत में दायर

एनएफ सं.	शीर्षक	आविष्कारक	पूर्ण दर्ज करने की तारीख	आवेदन सं.
0165NF2017/ इंडिया	डेवलपमेंट ऑफ़ सुपर हाइड्रोफोबिक कोटिंग्स फॉर एनर्जी सेविंग मैकेनिकल मोशन एंड रिलेटेड अप्लिकेशंस	अय्यप्पन पिल्लै अजयघोष, बलरामन वेधनरायणन, राहुल देव मुखोपाध्याय	18/अक्तूबर/2017	201711037002
0218NF2017/ इंडिया	प्रोसेस फॉर दि प्रिपेरेशन ऑफ़ पैरिलियम साल्ट्स	शशिधर बालप्पा सोमप्पा, चेट्टियाल थोड़ी फाथिमथ सल्फीना, अय्यप्पन पिल्लै अजयघोष	06/फरवरी/2018	201811004385
0219NF2017/ इंडिया	हाइब्रिड प्लानर लाइट कॉन्सेंट्रेटर विथ अडाप्टेबल ट्रांसपेरेंसी	आदर्श अशोक, अय्यप्पन पिल्लै अजयघोष, अनिमेष एम रामचंद्रन	15/मार्च/2018	201811008500

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एनएफ सं.	शीर्षक	आविष्कारक	पूर्ण दर्ज करने की तारीख	आवेदन सं.
0163NF2014/ यूरोप	लांथानम फॉस्फेट बेस्ड कोटिंग्स एंड मोनोलिथ्स आस नॉन-रिएक्टिव सरफेसेस फॉर मोलटेन मेटल्स	शंकर शशिधरन, राजेश कोम्बन, अब्दुल अजीज़ पीर मोहमद, सोलाइअप्पन अनंतकुमार, उण्णिक्कणन नायर, सरस्वती हरीश, कृष्णा गोपकुमार वार्यर	18/अप्रैल/2017	15816254.5
0112NF2014/ यूरोप	न्यू इनऑर्गेनिक ब्लू पिगमेंट्स फ्रॉम कोबाल्ट डोपड मैग्नीशियम हैविंग ट्रांजीशन एलिमेंट ऑक्सिडेंट्स एंड ए प्रोसेस फॉर प्रेपरिंग दि सेइम	पडला प्रभाकर राव, सरस्वती दिव्या	02/अगस्त/2017	15828669.0

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एनएफ सं.	शीर्षक	आविष्कारक	अनुमोदित तारीख	पेटेंट सं.
0352NF2005/ इंडिया	ए प्रोसेस फॉर दि इन-सीटू प्रिपेरेशन ऑफ़ $MgAl_2O_4$ री-इंफोर्स्ड एल्युमीनियम मैट्रिक्स कंपोजिट्स यूसिंग सॉलिड सिलिका	वडक्के मडत्तिल श्रीकुमार, रामन मारीमुत्तु पिल्लै, बेल्लामुत्तु चंद्रशेखर पाई, ताप्ताविला पोन्नु देवराज राजन, मधुसूधन चक्रबोर्ती	26/मई 2017	283590

0015NF2006/ इंडिया	ए प्रोसेस फॉर दि डिटेक्शन एंड क्वॉन्टिफिकेशन ऑफ़ सिंगल स्ट्रैंड डीएनए यूसिंग फ्लोरोसेंट मार्कर अंडर फिजियोलॉजिकल पीएच कंडीशंस	दानबोईना रामय्या, एलिजाबेथ कुरुविला चामी अरुमुखन, नूयंपडित्तरईल माधवन सौम्या, अरिम्बूर रंजीत	19/जून/2017	284314
0098NF2007/ इंडिया	आन इम्प्रोव्ड प्रोसेस फॉर दि आइसोलेशन ऑफ़ 2, 5-डाइ हाइड्रोक्सी -1, 4-बेंजोक्विनोन डेरिवेटिव्स लाइक एम्बेलिन फ्रॉम नेचुरल रिसोर्सेज	चामी अरुमुखन, नूयंपडित्तरईल माधवन सौम्या, अरिम्बूर रंजीत	18/जुलाई/2017	285296
0052NF2009/ इंडिया	मॉलिक्यूलर इम्प्रिंटेड पॉलीमर पार्टिकल्स या माइक्रो बीड्स फॉर सेलेक्टिव डी- टॉक्सिकेशन ऑफ़ एंडोसल्फान कंटामिनेटेड नेचुरल वाटर्स एंड प्रोसेस फॉर प्रिपेरेशन देरोफ़	करमला प्रसाद, जोसफ मेरी ग्लैडिस, तलशिला प्रसाद राव	01/अगस्त/2017	285979
0169NF2010/ इंडिया	मेटल ऑक्साइड मॉडिफाइड एंड अन्मॉडिफाइड मोलेक्यूलरली इम्प्रिंटेड कंडक्टिंग पॉलीमर फिल्म बेस्ड एक्वस एमिनोएसिड सेंसर्स	वर्गीस सौम्या, कृष्णा पिल्लै पद्मजा कुमारी प्रतीश, तलशिला प्रसाद राव	05/दिसंबर 2017	290312
0102NF2012/ इंडिया	ए प्रोसेस फॉर डीकम्पोजीशन ऑफ़ आर्गेनिक सिंथेटिक डाइज यूसिंग सेमीकंडक्टर -ऑक्ससाइड नैनो ट्यूब्स वाया डार्क कैटैलिसिस	शुक्ला सत्यजीत विष्णु, वार्यर कृष्णा गोपकुमार, बाबू बबिता कुन्नतुपरम्बिल	01/ मार्च /2018	293723
0147NF2009/ इंडिया	नोवल पोर्फिरीन डेरिवेटिव्स फॉर फोटो डायनामिक थेरेपी (पीडीटी): ए प्रोसेस फॉर दि प्रिपेरेशन देरोफ़ एंड देयर यूस आस पीडीटी एजेंट्स एंड फ्लुओरोसेन्स प्रोब्स फॉर बायोलॉजिकल अप्लिकेशन्स	दानबोईना रामय्या , सुनीश सी करणकरन, वाडक्कनचेरिल एस जिशा, तवेरेकरे के चन्द्रशेखर, अलगर श्रीनिवासन, माधवन राधाकृष्ण पिल्लै, शिवकुमारी आशा नायर, सनीश बाबू पी सरस, चिंतलागिरी मोहन राव, कुचला श्रीधर राव	14/ मार्च /2018	294263
0239NF2003/ इंडिया	सिंथेसिस ऑफ़ अल्ट्राफाइन रूटाइल फेज टाइटेनियम डाइऑक्साइड पार्टिकल्स	जेराल्ड देवदासगयम सुरेंदर, अनी करियुम्पानूर जॉन, कुमारापिल्लै राजेंद्र प्रसाद, शिवरामन सावित्रि	23/मार्च/2018	294839

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एनएफ सं.	शीर्षक	आविष्कारक	अनुमोदित तारीख	पेटेंट सं.
0022NF2013/ चीन	सेमीकंडक्टर ऑक्साइड नैनो ट्यूब्स -फ्लाइं ऐश एंड सेमि कंडक्टर ऑक्साइड नैनो ट्यूब्स -मेटल ऑक्साइड कम्पोजिट पार्टिकल्स, देयर प्रोसेसिंग वाया आयन-एक्सचेंज मैकेनिज्म, एंड मेथड्स फॉर देयर री साइकिलिंग इन दि डार्क-रिमूवल अप्लिकेशंस देरोफ़	शुक्ला सत्यजीत विष्णु, पांडिञ्जाटईल हरीश, नारायणी हर्षा, जोस मनु, करुणाकरण रम्या	10/मई/2017	201480002356.7
0102NF2012/ चीन	ए प्रोसेस फॉर डीकम्पोजीशन ऑफ़ आर्गेनिक सिंथेटिक डाइज यूसिंग सेमीकंडक्टर -ऑक्ससाइड नैनो ट्यूब्स वाया डार्क कटैलिसीस	शुक्ला सत्यजीत विष्णु, वार्यर कृष्णा गोपकुमार, बाबू बबिता कुन्नतुपरम्बिल	31/मई/2017	CN 104736485 B
0188NF2011/ चीन	ए नोवल मेथड ऑफ़ डेवलपिंग नैनो -स्ट्रक्चर्ड सिल्वर ऑक्साइड फिल्म बेस्ड एक्वस वोलाटामेट्रिक पेस्टिसाइड सेंसर	पनंपिल्लिल विजयम्मा शुभा, वर्गीस सौम्या, तलशिला प्रसाद राव	30/जून/2017	ZL201380007195.6
0188NF2011/ जापान	ए नोवल मेथड ऑफ़ डेवलपिंग नैनो -स्ट्रक्चर्ड सिल्वर ऑक्साइड फिल्म बेस्ड एक्वस वोलाटामेट्रिक पेस्टिसाइड सेंसर	पनंपिल्लिल विजयम्मा शुभा, वर्गीस सौम्या, तलशिला प्रसाद राव	30/जून/2017	6167114
0180NF2012/ ग्रेट ब्रिटेन	ए स्क्रैनिंग बेस्ड फ्लोरोसेंट प्रोब फॉर सेलेक्टिव लेबलिंग एंड सेंसिंग ऑफ़ सिरम एल्ब्यूमिन प्रोटीन्स, पीएच मॉनिटरिंग एंड थिओल इमेजिंग इन सेल्स एंड ए प्रोसेस फॉर दि प्रिपेरेशन देरोफ़	अय्यप्पन पिल्लै अजयघोष, पालाप्पुरवन अनीस	04/ अक्टूबर 2017	3039082
0180NF2012/ फ्रांस	ए स्क्रैनिंग बेस्ड फ्लोरोसेंट प्रोब फॉर सेलेक्टिव लेबलिंग एंड सेंसिंग ऑफ़ सिरम एल्ब्यूमिन प्रोटीन्स, पीएच मॉनिटरिंग एंड थिओल इमेजिंग इन सेल्स एंड ए प्रोसेस फॉर दि प्रिपेरेशन देरोफ़	अय्यप्पन पिल्लै अजयघोष, पालाप्पुरवन अनीस	04/ अक्टूबर 2017	3039082

0180NF2012/ डेन्मार्क	ए स्क्रुरैन बेस्ड फ्लोरोसेंट प्रोब फॉर सेलेक्टिव लेबलिंग एंड सेंसिंग ऑफ़ सिरम एल्ब्यूमिन प्रोटीन्स, पीएच मॉनिटरिंग एंड थिओल इमेजिंग इन सेल्स एंड ए प्रोसेस फॉर दि प्रिपेरेशन देरोफ़	अय्यप्पन पिल्लै अजयघोष, पालाप्पुरवन अनीस	04/ अक्तूबर .2017	3039082
0180NF2012/ यूरोप	ए स्क्रुरैन बेस्ड फ्लोरोसेंट प्रोब फॉर सेलेक्टिव लेबलिंग एंड सेंसिंग ऑफ़ सिरम एल्ब्यूमिन प्रोटीन्स, पीएच मॉनिटरिंग एंड थिओल इमेजिंग इन सेल्स एंड ए प्रोसेस फॉर दि प्रिपेरेशन देरोफ़	अय्यप्पन पिल्लै अजयघोष, पालाप्पुरवन अनीस	04/ अक्तूबर 2017	3039082
0180NF2012/ यूएस	ए स्क्रुरैन बेस्ड फ्लोरोसेंट प्रोब फॉर सेलेक्टिव लेबलिंग एंड सेंसिंग ऑफ़ सिरम एल्ब्यूमिन प्रोटीन्स, पीएच मॉनिटरिंग एंड थिओल इमेजिंग इन सेल्स एंड ए प्रोसेस फॉर दि प्रिपेरेशन देरोफ़	अय्यप्पन पिल्लै अजयघोष, पालाप्पुरवन अनीस	17/अक्तूबर 2017	9791451
0009NF2012/ यूएस	ब्लू कलर्ड इनऑर्गेनिक पिगमेंट्स, हैविंग नियर इंफ्रारेड रिफ्लेक्टेंस , बेस्ड ओण मिक्सचर्स ऑफ लंथानम , स्ट्रॉन्शियम, कॉपर एंड लिथियम सिलिकेट एंड प्रोसेस देरोफ़	मुण्डलपुडी लक्ष्मीपति रेड्डी, शीतू जोस	31/अक्तूबर /2017	9803063
0082NF2013/ जापान	सेल्फ हीलिंग सिलिका बेस्ड लो के डाइइलेक्ट्रिक इंक फॉर प्रिंटेड इलेक्ट्रॉनिक अप्लिकेशन्स	कुषिचालिल पीतांभरन सुरेंद्रन, मैलाडिल थॉमस सेबेस्टियन, जोबिन वर्गीस	24/नवंबर /2017	6246938
0102NF2012/ ऑस्ट्रेलिया	ए प्रोसेस फॉर डीकम्पोजीशन ऑफ़ आर्गेनिक सिंथेटिक डाइज यूसिंग सेमीकंडक्टर -ऑक्ससाइड नैनो ट्यूब्स वाया डार्क कटैलिसीस	शुक्ला सत्यजीत विष्णु, वार्यर कृष्णा गोपकुमार, बाबू बबिता कुन्नतुपरम्बिल	07/ दिसंबर /2017	2013303756
0183NF2012/ जापान	ए नावेल अज़ा बॉडीपी डेरीवेटिव फॉर दि सेलेक्टिव डिटेक्शन ऑफ़ नाइट्राइट आयन्स इन वाटर : ए प्रोसेस देरोफ़ एंड इट्स अप्लिकेशन इन वेस्ट वाटर मैनेजमेंट अप्लिकेशन	डनबोईना रामय्या: , नागप्पन पिल्लै आदर्श, मधेश शन्मुगसुन्दरम	15/दिसंबर/2017	6258355

PATENTS

FILED IN INDIA

NFNO	TITLE	INVENTORS	COMP. FILING DATE	APPLICATION NO.
0165NF2017/ IN	DEVELOPMENT OF SUPERHYDROPHOBIC COATINGS FOR ENERGY SAVING MECHANICAL MOTION AND RELATED APPLICATIONS	AYYAPPANPILLAI AJAYAGHOSH, BALARAMAN VEDHANARAYANAN, RAHUL DEV MUKHOPADHYAY	18/OCT/2017	201711037002
0218NF2017/ IN	PROCESS FOR THE PREPARATION OF PYRYLIUM SALTS	SASIDHAR BALAPPA SOMAPPA, CHETTIYAL THODI FATHIMATH SALFEENA, AYYAPPANPILLAI AJAYAGHOSH	06/FEB/2018	201811004385
0219NF2017/ IN	HYBRID PLANAR LIGHT CONCENTRATOR WITH ADAPTABLE TRANSPERENCY	ADERSH ASOK, AYYAPPANPILLAI AJAYAGHOSH, ANIMESH M RAMACHANDRAN	15/MAR/2018	201811008500

FILED IN FOREIGN COUNTRIES

NFNO	TITLE	INVENTORS	COMP. FILING DATE	APPLICATION NO.
0163NF2014/ EP	LANTHANUM PHOSPHATE BASED COATINGS AND MONOLITHS AS NON-REACTIVE SURFACES FOR MOLTEN METALS	SANKAR SASHIDHARAN, RAJESH KOMBAN, ABDUL AZEEZ PEER MOHAMED, SOLAIAPPAN ANATHAKUMAR, UNNIKRIISHNAN NAIR SARASWATHY HAREESH, KRISHNA GOPAKUMAR WARRIER	18/APR/2017	15816254.5
0112NF2014/ EP	NEW INORGANIC BLUE PIGMENTS FROM COBALT DOPED MAGNESIUM HAVING TRANSITION ELEMENT OXIDES AND A PROCESS FOR THE PREPARING THE SAME	PADALA PRABHAKAR RAO, SARASWATHY DIVYA	02/AUG/2017	15828669.0

GRANTED IN INDIA

NFNO	TITLE	INVENTORS	GRANT DATE	PATENT NO.
0352NF2005/ IN	A PROCESS FOR THE IN SITU PREPARATION OF MGAL2O4 REINFORCED AL MATRIX COMPOSITES USING SOLID SILICA SOURCES	VADAKKE MADATHIL SREEKUMAR, RAMAN MARIMUTHU PILLAI, BELLAMUTTU CHANDRASEKHARA PAI, THAZHAVILAI PONNU DEVARAJ RAJAN, MADHUSUDHAN CHAKRABORTY	26/MAY/2017	283590
0015NF2006/ IN	A PROCESS FOR THE DETECTION AND QUANTITATION OF SINGLE STRAND DNA USING FLUORESCENT MARKER UNDER PHYSIOLOGICAL PH CONDITIONS	DANABOYINA RAMAIAH, ELIZABETH KURUVILLA	19/JUN/2017	284314



0098NF2007/ IN	AN IMPROVED PROCESS FOR THE ISOLATION OF 2, 5-DIHYDROXY-1, 4-BENZOQUINONE DERIVATIVES LIKE EMBELIN FROM NATURAL RESOURCES	CHAMI ARUMUGHAN, NUYAMPADITHARAYIL MADHAVAN SOUMYA, ARIMBOOR RANJITH	18/JUL/2017	285296
0052NF2009/ IN	MOLECULAR IMPRINTED POLYMER PARTICLES ORMICRO BEADS FOR SELECTIVE DETOXIFICATION OF ENDOSULPHAN CONTAMINATED NATURAL WATERS AND PROCESS FOR PREPARATION THEREOF	KARAMALA PRASAD, JOSEPH MARY GLADIS, TALASILA PRASADA RAO	01/AUG/2017	285979
0169NF2010/ IN	METAL OXIDE MODIFIED AND UNMODIFIED MOLECULARLY IMPRINTED CONDUCTING POLYMER FILM BASED AQUEOUS AMINOACID SENSORS	VARGHESE SAUMYA, KRISHNA PILLAI PADMAJA KUMARI PRATHISH, TALASILA PRASADA RAO	05/DEC/2017	290312
0102NF2012/ IN	A PROCESS FOR DECOMPOSITION OF ORGANIC SYNTHETIC DYES USING SEMICONDUCTOR-OXIDES NANOTUBES VIA DARK CATALYSIS.	SHUKLA SATYAJIT VISHNU, WARRIER KRISHNA GOPAKUMAR, BABU BABITHA KUNNATHUPARAMBIL	01/MAR/2018	293723
0147NF2009/ IN	NOVEL PORPHYRIN DERIVATIVES FOR PHOTODYNAMIC THERAPY (PDT): A PROCESS FOR THE PREPARATION THEREOF AND THEIR USE AS PDT AGENTS AND FLUORESCENCE PROBES FOR BIOLOGICAL APPLICATIONS	DANOBOYINA RAMAIAH, SUNEESH C KARUNAKARAN, VADAKKANCHERIL S JISHA, TAVAREKERE K CHANDRASHEKHAR, ALAGAR SRINIVASAN, MADHAVAN RADHAKRISHNA PILLAI, SIVAKUMARI ASHA NAIR, SANEESH BABU P SARAS, CHINTALAGIRI MOHAN RAO, KUNCHALA SRIDHAR RAO	14/MAR/2018	294263
0239NF2003/ IN	SYNTHESIS OF ULTRAFINE RUTILE PHASE TITANIUM DIOXIDE PARTICLES	GERALD DEVDASAGAYAM SURENDER, ANI KARIUMPANOR JOHN, KUMARA PILLAI RAJENDRA PRASAD, SIVARAMAN SAVITHRI	23/MAR/2018	294839

GRANTED IN FOREIGN COUNTRIES

NFNO	TITLE	INVENTORS	GTANT DATE	PATENT NO.
0022NF2013/ CN	SEMICONDUCTOR OXIDE NANOTUBES-FLYASH AND SEMICONDUCTOR OXIDE NANOTUBES-METAL OXIDE COMPOSITE PARTICLES, THEIR PROCESSING VIA ION-EXCHANGE MECHANISM, AND METHODS FOR THEIR RECYCLING IN THE DYE-REMOVAL APPLICATION THEREOF	SHUKLA SATYAJIT VISHNU, PADINHATTAYIL HAREESH, NARAYANI HARSHA, JOSE MANU, KARUNAKARAN REMYA	10/MAY/2017	201480002356.7

0102NF2012/ CN	A PROCESS FOR DECOMPOSITION OF ORGANIC SYNTHETIC DYES USING SEMICONDUCTOR-OXIDES NANOTUBES VIA DARK CATALYSIS.	SHUKLA SATYAJIT VISHNU, WARRIER KRISHNA GOPAKUMAR, BABU BABITHA KUNNATHUPARAMBIL	31/MAY/2017	CN 104736485 B
0188NF2011/ CN	A NOVEL METHOD OF DEVELOPING NANO-STRUCTURED SILVER OXIDE FILM BASED AQUEOUS VOLTAMMETRIC PESTICIDE SENSOR	PANAMPILLIL VIJAYAMMA SUBHA, VARGHESE SAUMYA, TALASILA PRASADA RAO	30/JUN/2017	ZL201380007195.6
0188NF2011/ JP	A NOVEL METHOD OF DEVELOPING NANO-STRUCTURED SILVER OXIDE FILM BASED AQUEOUS VOLTAMMETRIC PESTICIDE SENSOR	PANAMPILLIL VIJAYAMMA SUBHA, VARGHESE SAUMYA, TALASILA PRASADA RAO	30/JUN/2017	6167114
0180NF2012/ GB	A SQUARINE BASED FLUORESCENT PROBE FOR SELECTIVE LABELING AND SENSING OF SERUM ALBUMIN PROTEINS, pH MONITORING AND THIOL IMAGING IN CELLS AND A PROCESS FOR THE PREPARATION THEREOF	AYYAPPANPILLAI AJAYAGHOSH, PALAPPURAVAN ANEES	04/OCT/2017	3039082
0180NF2012/ FR	A SQUARINE BASED FLUORESCENT PROBE FOR SELECTIVE LABELING AND SENSING OF SERUM ALBUMIN PROTEINS, pH MONITORING AND THIOL IMAGING IN CELLS AND A PROCESS FOR THE PREPARATION THEREOF	AYYAPPANPILLAI AJAYAGHOSH, PALAPPURAVAN ANEES	04/OCT/2017	3039082
0180NF2012/ DE	A SQUARINE BASED FLUORESCENT PROBE FOR SELECTIVE LABELING AND SENSING OF SERUM ALBUMIN PROTEINS, pH MONITORING AND THIOL IMAGING IN CELLS AND A PROCESS FOR THE PREPARATION THEREOF	AYYAPPANPILLAI AJAYAGHOSH, PALAPPURAVAN ANEES	04/OCT/2017	3039082
0180NF2012/ EP	A SQUARINE BASED FLUORESCENT PROBE FOR SELECTIVE LABELING AND SENSING OF SERUM ALBUMIN PROTEINS, pH MONITORING AND THIOL IMAGING IN CELLS AND A PROCESS FOR THE PREPARATION THEREOF	AYYAPPANPILLAI AJAYAGHOSH, PALAPPURAVAN ANEES	04/OCT/2017	3039082



0180NF2012/ US	A SQUARINE BASED FLUORESCENT PROBE FOR SELECTIVE LABELING AND SENSING OF SERUM ALBUMIN PROTEINS, pH MONITORING AND THIOL IMAGING IN CELLS AND A PROCESS FOR THE PREPARATION THEREOF	AYYAPPANPILLAI AJAYAGHOSH, PALAPPURAVAN ANEES	17/OCT/2017	9791451
0009NF2012/ US	BLUE COLORED INORGANIC PIGMENTS, HAVING NEAR INFRARED REFLECTANCE, BASED ON MIXTURES OF LANTHANUM, STRONTIUM, COPPER AND LITHIUM SILICATE AND PROCESS THEREOF	MUNDLAPUDI LAKSHMIPATHI REDDY, SHEETHU JOSE	31/OCT/2017	9803063
0082NF2013/ JP	SELF HEALING SILICA BASED LOW κ DIELECTRIC INK FOR PRINTED ELECTRONIC APPLICATIONS	KUZHICALIL PEETHAMBHARAN SURENDRAN, MAILADIL THOMAS SEBASTIAN, JOBIN VARGHESE	24/NOV/2017	6246938
0102NF2012/ AU	A PROCESS FOR DECOMPOSITION OF ORGANIC SYNTHETIC DYES USING SEMICONDUCTOR-OXIDES NANOTUBES VIA DARK CATALYSIS.	SHUKLA SATYAJIT VISHNU, WARRIER KRISHNA GOPAKUMAR, BABU BABITHA KUNNATHUPARAMBIL	07/DCE/2017	2013303756
0183NF2012/ JP	A NOVEL AZA BODIPY DERIVATIVE FOR THE SELECTIVE DETECTION OF NITRITE IONS IN WATER: A PROCESS THEREOF AND ITS APPLICATION IN WASTE WATER MANAGEMENT	DANABOYINA RAMAIAH, NAGAPPANPILLAI ADARSH, MADHESH SHANMUGASUNDARAM	15/DCE/2017	6258355

परीक्षण और विश्लेषणात्मक सेवा सेल

परीक्षण और विश्लेषणात्मक सेवा सेल, (टीएससी) केरल और उसके आसपास के अनुसंधान विद्वानों, शिक्षाविदों और उद्योगों के परीक्षण और विश्लेषण की आवश्यकता का समन्वय करता है। अत्याधुनिक सुविधाओं वाले अत्यंत परिष्कृत विश्लेषणात्मक उपकरण उपलब्ध होने से सीएसआईआर-एनआईआईएसटी छात्रों, लघु उद्योगों और उद्यमियों की जरूरतों को पूरा करता है और इस तरह इन अत्याधुनिक उपकरणों का अधिकतम उपयोग होता है। यद्यपि ये उपकरण संस्थान में ही अनुसंधान एवं विकास गतिविधियों की आवश्यकताओं के लिए हैं, एक नीति के रूप में एनआईआईएसटी द्वारा इन सुविधाओं के उपयोग का विस्तार भुगतान के आधार पर सामान्य रूप से आम जनता के लिए और विशेष रूप से छात्रों के लिए किया जाता है। जो संस्थान में उपलब्ध परीक्षण और विश्लेषणात्मक सुविधाओं का लाभ उठाना चाहता है, उपर्युक्त सेल के समन्वयक के साथ एक लिखित अनुरोध के साथ संपर्क कर सकता है और नमूनों के विश्लेषण और परीक्षण संचालित करने के लिए आवश्यक दिशा निर्देश प्राप्त कर सकता है। जबकि बाहर से छात्रों / एजेंसियों से प्राप्त विश्लेषण और परीक्षण की आवश्यकता को पूरा करने के लिए संस्थान अपने स्तर पर पूरी कोशिश करता है, एक विशेष विश्लेषणात्मक सुविधा पर अतिरिक्त लोड की परिस्थितियों में या इस तरह के उपकरण खराब और मरम्मत के अधीन होने पर या काम को क्रियान्वित करने के लिए सुविधा / विशेषज्ञता उपलब्ध न होने पर बाहरी अनुरोध को स्वीकार या अस्वीकार करने का अधिकार एनआईआईएसटी सुरक्षित रखता है। इस अवधि के दौरान, बाहरी एजेंसियों और छात्रों से नमूने के परीक्षण और विश्लेषण से 12.80266 लाख रुपये का राजस्व उत्पन्न हुआ। लाभार्थियों में 76 छात्र, 90 आर एंड डी संस्थान और 16 उद्योग शामिल हैं। ट्रांसमिशन इलेक्ट्रॉन माइक्रोस्कोपी (एचआरटीईएम) ने 6.73 लाख रुपए और एसईएम / एक्सआरडी और एनएमआर / एमएस सुविधाओं ने क्रमशः 2.76 लाख और 4.76 लाख रुपए एकत्रित किये। टीएससी ने चयनित प्रमुख उपकरणों का संकलन भी किया है और व्यापक उपयोग के लिए विवरण सीएसआईआर (एनलिटि सीएसआईआर) और आई-एसटीईएम भारतीय विज्ञान, प्रौद्योगिकी और इंजीनियरिंग सुविधाएं मानचित्र, <https://www.i-stem.ac.in/> के राष्ट्रीय पोर्टलों में होस्ट किए जाते हैं:

TESTING AND ANALYTICAL SERVICES CELL

Testing and Analytical Services Cell (TASC) coordinates the testing and analysis requirement of research scholars, academicians and industries in and around Kerala. With very sophisticated analytical equipment with state of art facilities, CSIR-NIIST caters to the needs of the students, small scale industries and entrepreneurs and thereby maximize the utilization of these sophisticated equipments. Though these equipments are meant for the requirements of the ongoing R&D activities of the Institute, as a policy NIIST extends utilization of these facilities for the public in general and students in particular on payment basis. During the period, a revenue of Rs.12.80266 lakhs was generated from the testing and analysis of the samples from the external agencies and students. The beneficiary includes 76 numbers of students, 90 numbers of R & D institutions and 16 number of Industries. Transmission Electron Microscopy (HRTEM) collected 6.73 lakhs, SEM/XRD and NMR/MS facilities generated Rs.2.76 lakhs and Rs. 4.76 lakhs respectively. TASC has also made compilation of selected major equipments and the details are hosted in National portals of CSIR (AnalytiCSIR) and I-STEM: Indian Science, Technology and Engineering facilities Map, <https://www.i-stem.ac.in/> for the wider usage

ज्ञान संसाधन केंद्र

सूचना सेवाएं

ज्ञान संसाधन केंद्र, अंतर्विषयी अनुसंधान के लिए आवश्यक अनुसंधान सूचना संसाधनों और सूचना प्रौद्योगिकी सेवाओं के साथ वैज्ञानिक, तकनीकी कर्मियों और शोध छात्रों का समर्थन करता है। वर्ष 2017-18 की अवधि के दौरान, 13635 किताबों, 10947 मानकों और पत्रिकाओं के 11387 बाउंड वॉल्यूम्स के साथ केआरसी ने अपने संग्रह की वृद्धि की। वर्ष 2017-18 के दौरान, संग्रह में 43 हिंदी किताब सहित 112 नई किताब शामिल की गईं। इसके अतिरिक्त, 47 किताब मुफ्त में प्राप्त हुईं। केंद्र, विभिन्न ई-पत्रिकाओं, खुले संसाधनों और साइफैंडर, वेब ऑफ साइंस, डेरेंट इनोवेशन इंडेक्स, क्यूपेट, एएसटीएम जैसे डेटाबेस के लिए भी पहुंच प्रदान करता है। एनआईआईएसटी शोधकर्ताओं की अतिरिक्त जानकारी की आवश्यकताओं को अन्य सीएसआईआर, डीएसटी संस्थानों से संसाधन साझाकरण के माध्यम से पूरा किया जाता है। पारंपरिक सेवाओं के अलावा, वैज्ञानिकों और छात्रों के अनुरोध पर साहित्य खोज, पेटेंट खोज और प्रशस्त पत्र विश्लेषण किए गए थे। उच्च गुणवत्ता वाले पत्रिकाओं में अपने शोध पत्र के प्रकाशन के लिए केआरसी ने शोधकर्ताओं की सहायता की और साहित्यिक चोरी की जांच और पूर्व आर्ट खोज में भी मदद की। केंद्र स्वचालित है और ई-गवर्नेंस के मानदंडों की पुष्टि करता है। केआरसी संस्थान की वेबसाइट, सोशल मीडिया पेज और संस्थागत भंडार का प्रबंधन, रखरखाव और अद्यतन करता है। संस्थागत भंडार में वर्तमान में 2613 पत्रिका लेख, 286 पीएचडी थीसिस और 200 न्यूज आइटम्स शामिल हैं। केंद्र की तरफ से एक द्विवार्षिक न्यूजलेटर "एनआईआईएसटी समाचार" का भी प्रकाशन किया गया। संदर्भ प्रबंधन सॉफ्टवेयर, साहित्य खोज, पूर्व आर्ट खोज, खुली पहुंच, अनुसंधान मूल्यांकन, शोधकर्ताओं के लिए सोशल मीडिया, साहित्य चोरी की रोक, प्रभावी संचार इत्यादि में केआरसी नियमित रूप से प्रशिक्षण प्रदान कर रहा है।

सूचना प्रौद्योगिकी सेवाएं

मौजूदा उच्च एंड सर्वर, स्टोरेज डिवाइस, यूटीएम डिवाइस और कोर स्विच का रखरखाव, जो सभी स्टाफ सदस्यों और शोधकर्ताओं के लिए ईथरनेट और वायरलेस कनेक्टिविटी के साथ ओएफसी लिंक पर समर्पित पट्टे लाइनों

के माध्यम से उच्च गति नेटवर्क प्रदान करता है, के अलावा डेटा सेंटर को अपग्रेड किया गया और रसायन विज्ञान प्रभाग के लिए तीन उच्च एंड सर्वर होस्ट किए गए। सुरक्षित और प्रभावी नेटवर्क प्रबंधन के लिए सोफोस से एक नया उच्च एंड यूटीएम डिवाइस शामिल किया गया।

प्रयोगशाला की सभी इंटरनेट आवश्यकताओं को पूरा करने के लिए आईटी लैब समय - समय पर अपना मौजूदा इंटरनेट बैंडविड्थ को बढ़ाता है। वर्तमान में, प्रयोगशाला एनकेएन से 100 एमबीपीएस लीज्ड लाइन और बीएसएनएल से 26 एमबीपीएस लीज्ड लाइन से जुड़ी हुई है। वेब आधारित उपकरण का उपयोग करके लिंक की नियमित निगरानी की जाती है, जो सिस्टम और नेटवर्क कार्यक्षमता के संबंध में रियल टाइम और एंड-टू-एंड दृश्य प्राप्त करने में सक्षम बनाता है। आईटी लैब ने नव निर्मित डिस्पेंसरी बिल्डिंग के लिए नेटवर्क कनेक्टिविटी प्रदान की और गेस्ट हाउस को अतिरिक्त फाइबर केबलिंग भी प्रदान की गयी। इस सुविधा से, कैम्पस में सभी इमारत जिगाबिट फाइबर ऑप्टिक बैकबॉन के माध्यम से एक दूसरे से जुड़े हुए हैं। कैम्पस नेटवर्क पर बड़ी संख्या में हाई एंड पर्सनल कंप्यूटर को जोड़ने के लिए अलग-अलग वीएलएएन बनाए गए हैं और वायर्ड और वायरलेस नेटवर्क के माध्यम से कुल इंटरनेट कनेक्शन 1050+ हैं। वैज्ञानिकों को निवास से एनआईआईएसटी में अपने कार्यालय कंप्यूटर को जुड़ने में अनुमति देने के लिए आईटी लैब सुरक्षित वीपीएन कनेक्टिविटी भी प्रदान करती है। आईटी प्रयोगशाला ने एक सुरक्षित वायरलेस नेटवर्क के साथ एनआईआईएसटी के सभी क्षेत्रों को कवर करके वाई-फाई सुविधा भी लागू की है।

एनआईआईएसटी के उपयोगकर्ताओं और प्रयोगशाला के आगंतुकों के सूचनार्थ अनुसंधान परिणामों, नोटिस और परिपत्र, लॉरल्स और अन्य जानकारी प्रदर्शित करने के लिए प्रयोगशाला के अंदर सात अलग-अलग स्थानों में डिजिटल डिस्प्ले सिस्टम लागू की गयी। रिपोर्टिंग अवधि के दौरान दरवाजे और द्वारों पर सुरक्षित पहुंच लागू की गई।

आईटी लैब आधार सक्षम बायोमीट्रिक उपस्थिति प्रणाली के सुचारू

संचालन और कर्मचारीगण, शोध छात्र और पेंशनभोगियों को संस्थागत पहचान पत्र जारी करने का भी प्रबंधन करती है। संस्थागत उद्देश्यों के लिए इकाई की तरफ से हेवी ड्यूटी कलर मल्टी-फ़ंक्शन लेजर प्रिंटर और ए 3 / ए 4 स्कैनर जैसे विभिन्न प्रकार के प्रिंटर के माध्यम से मुद्रण और स्कैनिंग सुविधा भी प्रदान करती है। प्रयोगशाला के आईटी उत्पादों और उपकरणों के अधिग्रहण में गुणवत्ता आश्वासन सुनिश्चित करने में भी आईटी लैब सहायता प्रदान करती है। प्रयोगशाला ने द्विभाषी रूप में संस्थान की वेबसाइट के संशोधन और सुधार के लिए पहल की थी। तीन अंतर्राष्ट्रीय सम्मेलनों अर्थात्, सीएसएमएटी 2017, ईएस 8 और आईसीएसएसपी 2018 के लिए वेबसाइटों के विकास में भी आईटी प्रयोगशाला शामिल थी। आईटी लैब 500 से अधिक डेस्कटॉप, लैपटॉप, साथ ही प्रयोगशाला में उपलब्ध अन्य कंप्यूटर बाह्य उपकरणों के लिए एएमसी का प्रबंधन करती है। उपयोगकर्ताओं को सॉफ्टवेयर इंस्टॉलेशन, पुनर्स्थापना, मरम्मत, सॉफ्टवेयर अपडेट, नेटवर्क और आईटी से संबंधित मुद्दों को हल करने में सहायता प्रदान करने के लिए आईटी प्रयोगशाला एक सहायता डेस्क रखती है। व्यापक प्रचार देते हुए और प्रशिक्षण कार्यक्रम के सुचारू संचालन के लिए कौशल

प्रशिक्षण टीम का समर्थन करते हुए आईटी लैब संस्थान के कौशल विकास कार्यक्रम में भी सक्रिय रूप से शामिल है।

आईटी लैब विभिन्न अनुप्रयोगों का प्रबंधन भी करती है, जैसे भंडार व क्रय सॉफ्टवेयर, संस्थागत रिपोजिटरी, लिब्सुइट, केमड्रा, सिग्माप्लॉट, ओर्जिन के लिए डी स्पेस और कोहा इत्यादि। हमने दूरस्थ पहुंच के माध्यम से पत्रिकाओं तक पहुंचने के लिए एजप्रॉक्सी भी स्थापित की है। अनुप्रयोगों के और मेल और वेबसाइट सामग्री के आवधिक बैकअप के लिए एक बैकअप समाधान भी स्थापित है। सर्वर ग्रेड एंटीवायरस सॉफ्टवेयर के प्रसारण के लिए प्रयोगशाला ने लाइसेंस प्राप्त किया है जो एनआईआईएसटी में वायरस मुक्त नेटवर्क वातावरण प्रदान करता है।

आरटीआई

भारत में हर सार्वजनिक प्राधिकरण के कामकाज में पारदर्शिता और जवाबदेही को बढ़ावा देने के लिए वैज्ञानिक और तकनीकी मामलों के लिए संस्थान में सूचना का अधिकार अधिनियम -2005 का कार्यान्वयन।

KNOWLEDGE RESOURCE CENTRE

Information services

The Knowledge Resource Centre supports scientists, technical personals and research scholars with Research information resources and Information Technology services required in interdisciplinary research. During the period 2017-18, KRC enhanced the collection to 13635 Books, 10947 Standards and 11387 Bound Volumes of Periodicals. During 2017-18 112 new books including 43 Hindi books were added to the collection. Additionally, 47 books were received gratis. The Centre provide access to various e-journals, open resources and databases viz SciFinder, Web of Science, Derwent Innovation Index, Qpat and ASTM. The additional information requirement of NIIST researchers fulfilled through resource sharing from other CSIR, DST institutes. Apart from traditional services, Literature search, Patent search, Citation analysis were carried out on requests from scientists and students. KRC also assisted researchers to publish in high-quality journals and helped in plagiarism check and prior art search. The centre is automated and confirms to the norms of e-governance.

KRC also manages, maintain and update the institute website, social media pages and institutional repository. The IR presently consists of 2613 journal articles, 286 PhD Theses and 200 News items. The center published a biannual newsletter 'NIIST Samachar'. KRC is regularly providing training on reference management software, literature search, prior art search, open access, research evaluation, social media for researchers, preventing plagiarism, and effective communication etc.

Information technology services

The data center was upgraded and hosted three high end servers for the Chemical Sciences division apart from maintaining the existing high end servers, storage devices, UTM devices and core switches which provides

high speed network through dedicated leased lines on OFC link with Ethernet and wireless connectivity to all staff members and research scholars. A new high end UTM device from SOPHOS was included for secured and effective network management.

IT Lab enhances its existing internet bandwidth from time to time to fulfill all the Internet requirements of the lab. At present, the laboratory is linked with 100 mbps leased line from NKN and also 26 mbps leased line from BSNL. The links are regularly monitored using web based tool that enables to gain a real-time, end-to-end view with respect to system and network performance.

IT Lab provided network connectivity to the newly constructed dispensary building and also provided redundant fibre cabling to Guest House. By this facility, all the buildings in the campus are interconnected through gigabit fiber optic backbone. Separate VLANs have been created to connect a large no of High end personal computers to the campus network making the total internet connection to 1050+ through wired and wireless network. IT lab also provides secured VPN connectivity to allow scientists to connect to their NIIST office computers from home. IT lab has also implemented Wi-Fi facilities covering all areas of NIIST with a secured wireless network.

Digital Display System was implemented in seven different locations inside the laboratory for exhibiting research outcomes, notices and circulars, laurels and other information to NIIST users and visitors of the laboratory. Also, secured access to doors and gates were implemented during the reporting period.

IT Lab manages the smooth functioning of AADHAR enabled Biometric Attendance System and also for the issuing of Institutional identity cards for the staff members,

research scholars and pensioners. The unit also provides printing and scanning facility for institutional purposes through a wide variety of printers such as Heavy Duty Color Multi-Function Laser Printers and A3/A4 Scanners. The lab also provides assistance in ensuring Quality assurance in the acquisition of IT products and devices of the lab.

The lab had taken initiative for modification and revamping of the institute's website in bilingual format. IT lab was also involved in the development of websites for three International Conferences namely, CSMAT 2017, EAS8 and ICSSP 2018.

The lab manages the AMC for more than 500 desktops, laptops as well as other computer peripherals in the lab. IT lab also maintains a help desk that helps users in solving issues related to software installations, reinstallations, repairs, software updates, network and IT related issues.

IT Lab also activity involved in the Skill Development

Programme of the Institute by giving wide publicity and also supporting the skill training team for the smooth functioning of the training program.

The lab also manages various applications like Stores and Purchase Software, D-Space and Koha for Institutional Repository, Libsuite, Chemdraw, Sigmaplot, Origin. We had also installed Ezproxy for accessing the journals through remote access. A backup solution is also installed for generating periodic backup of the applications and also backup for mails and website contents. The lab has procured licenses for deploying server grade antivirus software which provides virus-free network environment at NIIST.

RTI

Implementation of Right to Information Act-2005 in the institute for Scientific & Technical matters to promote transparency and accountability in the working of every public authority in India.



List of Publications 2017

- 1. ABHILASH (P), NAIR (K S), SURENDRAN (K P)**
Silver-Decorated Boron Nitride Nanosheets as an Effective Hybrid Filler in PMMA for High-Thermal-Conductivity Electronic Substrates
ACS Omega; **2(12):8825-8835; 2017**
- 2. ABHILASH (V), MANU (M V), SAVITHRI (S), PILLAI (U S)**
Numerical Simulation and Experimental Validation of Free Surface Flows During Low Pressure Casting Process
Journal of Materials Processing Technology; 244:320-330; 2017
- 3. ADARSH (N), RAMYA (A N), MAITI (K K), RAMAIAH (D)**
Unveiling NIR Aza-Boron-Dipyrromethene (BODIPY) Dyes as Raman Probes: Surface-Enhanced Raman Scattering (SERS)-Guided Selective Detection and Imaging of Human Cancer Cells
Chemistry - A European Journal; 23(57):14286-14291; 2017
- 4. AJESH (V), JUMAILA (C U), BAIJU (T V), RADHAKRISHNAN (K V)**
Palladium-Catalyzed Cross-Coupling of Aryl Iodides with Heterobicyclic Olefins: Access to Hydroarylated and Heteroannulated Motifs
ChemistrySelect; 2(21):5913-5916; 2017
- 5. AJU THARA (T R), PRABHAKAR RAO (P), DIVYA (S), ATHIRA (K V R), SREENA (T S)**
Enhanced Near Infrared Reflectance with Brilliant Yellow Hues in Scheelite Type Solid Solutions, (LiLaZn)_{1/3}MoO₄-BiVO₄ for Energy Saving Products
ACS Sustainable Chemistry & Engineering; 5(6):5118-5126; 2017
- 6. AKSHAY (V R), SUNEESH (M V), VASUNDHARA (M)**
Tailoring Thermoelectric Properties through Structure and Morphology in Chemically Synthesized n-Type Bismuth Telluride Nanostructures
Inorganic Chemistry; 56(11):6264-6274; 2017
- 7. ALWIN (S), SAHAYA SHAJAN (X), KARUPPASAMY (K), WARRIER (K G K)**
Microwave Assisted Synthesis of High Surface Area TiO₂ Aerogels: A Competent Photoanode Material for Quasi-Solid Dye-Sensitized Solar Cells
Materials Chemistry and Physics; 196:37-44; 2017
- 8. ANGULAKSHMI (N), KAR (G P), BOSE (S), BHOJE GOWD (E), THOMAS (S), STEPHAN (A M)**
A High-Performance BaTiO₃-Grafted-GO-Laden Poly(Ethylene Oxide)-Based Membrane as an Electrolyte for all-Solid Lithium-Batteries
Materials Chemistry Frontiers; 1(2):269-277; 2017
- 9. ANJALI (B A), SURESH (C H)**
Interpreting Oxidative Addition of Ph-X (X = CH₃, F, Cl, and Br) to Monoligated Pd(0) Catalysts Using Molecular Electrostatic Potential
ACS Omega; 2(8):4196-4206; 2017
- 10. ANJU (A J), BINOD (P), PANDEY (A)**
Production and Characterization of Microbial Poly- γ -Glutamic Acid from Renewable Resources
Indian Journal of Experimental Biology; 55(7):405-410; 2017
- 11. ANJU (K S), MAINAK DAS, ADINARAYANA (B), SURESH (C H), SRINIVASAN (A)**
Meso-Aryl [20]p Homoporphyrin: The Simplest Expanded Porphyrin with the Smallest Möbius Topology
Angewandte Chemie-International Edition; 56(49):15667-15671; 2017
- 12. ANUPAMA (C), SHIPRA (G), VASUNDHARA (M), JOSHI (S R), MUTTA (G R), JAI SINGH**
Study of Structural, Optical and Magnetic Properties of Cobalt Doped ZnO Nanorods
RSC Advances; 7(80):50527-50536; 2017
- 13. ANUPAMA (V N), DIVYA (P S), RAVINDRAN (S C), ANIE (M), JASMIN (G R), PRADEEP (S), PEREIRA (B), KRISHNAKUMAR (B)**
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Ecotoxicology and Environmental Safety; 144:490-497; 2017
- 14. ANUSREE (V M), SUJITHA (B S), ANAND (J), ARUMUGAM (M)**
Dissolved Inorganic Carbonate Sustain the Growth, Lipid and Biomass Yield of *Scenedesmus Quadricauda* Under Nitrogen Starved Condition
Indian Journal of Experimental Biology; 55(10):702-710; 2017
- 15. APARNA (P S), VIJAYAN (A), RAVEENDRAN (S P), SURESH (E), LUXMI VARMA (R), RADHAKRISHNAN (K V)**
Ruthenium/Iridium-Catalyzed C-2 Activation of Indoles with Bicyclic Olefins: An Easy Access to Functionalized Heterocyclic Motifs
Synlett; 28(05):572-576; 2017

- 16. ARUN (B), AKSHAY (V R), MUTTA (G R), VENKATESH (CH), VASUNDHARA (M)**
Mixed Rare Earth Oxides Derived from Monazite Sand as an Inexpensive Precursor Material for Room Temperature Magnetic Refrigeration Applications
Materials Research Bulletin; 94:537-543; 2017
- 17. ARUN (K B), JAYAMURTHY (P), ANUSHA (C V), MAHESH (S K), NISHA (P)**
Studies on Activity Guided Fractionation of Pomegranate Peel Extracts and Its Effect on Antidiabetic and Cardiovascular Protection Properties
Journal of Food Processing and Preservation; 41(1):e13108; 2017
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- 217. SREELEKSHMI (R V), BRAHMAKUMAR (M), SUDHA (J D), MENON (A R R)**
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एनआईआईएसटी वैज्ञानिकों द्वारा विदेश दौरा			
नाम	दौरा किया देश	अवधि	यात्रा का उद्देश्य
डॉ. बिनोद पी	फिनलैंड	08.04.2017 -14.04.2017	आईएनएनओ-इंडिगो बायोएनेर्जी सम्मेलन में भाग लेने के लिए
डॉ. बिनोद पी	चीन	21.05.2017 -24.05.2017	औद्योगिक बायोप्रोसेसेस पर 7 वां अंतर्राष्ट्रीय फोरम में भाग लेने के लिए और आमंत्रित व्याख्यान देने के लिए
डॉ. के माधवन नम्पूतिरि	चीन	21.05.2017- 24.05.2017	औद्योगिक बायोप्रोसेसेस पर 7 वां अंतर्राष्ट्रीय फोरम में भाग लेने के लिए और आमंत्रित व्याख्यान देने के लिए
डॉ. रमेश कुमार एन	जर्मनी	07.08.2017 -30.09.2017	मैक्स प्लैंक इंडियन मोबिलिटी अनुदान के भाग के रूप में मैक्स प्लैंक संस्थान में शोध करने के लिए
डॉ. मनोज रामवर्मा	स्लोवेनिया	19.08.2017 - 29.08.2017	डीएसटी की ओर से इंडो स्लोवेनियाई परियोजना के संबंध में दौरा
डॉ. बिनोद पी	चीन	17.11.2017 -19.11.2017	बायोमास उपयोग प्रौद्योगिकियों पर (आईएसबीयूटी 2017) पहली अंतर्राष्ट्रीय संगोष्ठी में भाग लेने तथा व्याख्यान देने के लिए
डॉ. विश्वप्रिया देब	थाईलैंड	18.11.2017 - 23.11.2017	ईकाँ मैटेरियल्स 2017 (आईसीईएम 13) बैंकॉक, थाईलैंड में 13 वें अंतर्राष्ट्रीय सम्मेलन में भाग लेने तथा आमंत्रित व्याख्यान देने के लिए
डॉ. विजयकुमार	थाईलैंड	18.11.2017 - 23.11.2017	ईकाँ मैटेरियल्स 2017 (आईसीईएम 13) बैंकॉक, थाईलैंड में 13 वें अंतर्राष्ट्रीय सम्मेलन में भाग लेने तथा आमंत्रित व्याख्यान देने के लिए
डॉ. ई भोजे गौड	ताइवान	22.03.2018 -21.06.2018	नेशनल ट्सिंग हुआ विश्वविद्यालय, हिनचु, ताइवान में रमन रिसर्च फेलोशिप का लाभ उठाने के लिए
डॉ. यू एस हरीश	जापान	30.03.2018 -07.04.2018	नोरिटेक कंपनी लिमिटेड में परियोजना समीक्षा बैठक, और टोक्यो इंस्टीट्यूट ऑफ टेक्नोलॉजी, जापान की यात्रा

विदेशी वैज्ञानिकों / प्रतिष्ठित व्यक्तियों के एनआईआईएसटी का दौरा			
नाम	देश से	अवधि	यात्रा का उद्देश्य
डॉ. श्रीनिवास वेंकटरमन	सगिापुर	03.04.2017	कार्यात्मक एलफाटकि पॉली कार्बोनेट्स पर: संश्लेषण, जलीय सेल्फ-असेंबली और बायोमेडिकल अनुप्रयोग पर व्याख्यान देने के लिए
सहा. प्रो. डॉ आर्टम बदास्यान	स्लोवेनिया	08.05.2017 - 12.05.2017	नोवा गोरिका विश्वविद्यालय और एनआईआईएसटी के बीच "होल डोपड डबल पेरोव्स्काइट्स फोर सेंसर और स्पिट्टिरोनक्स अनुप्रयोगों " नामक भारतीय-स्लोवेनियाई द्विपक्षीय अनुसंधान परियोजना के भाग के रूप में
प्रो एम एम शर्मा	मुंबई	11.05.2017	राष्ट्रीय प्रौद्योगिकी दिवस व्याख्यान
डॉ मंजुनाथ एस	बैंगलोर	29.05.2017	अन्स एफईएम सोल्यूशन्स का उपयोग कर' ठोसकरण, सीएफडी, मैकेनिकल विश्लेषण' पर व्याख्यान देने के लिए
डॉ. के आर रवि	कोयम्बटूर	20.06.2017	मशिन धातु डिजाइन में कैल्फाड ट्रिफ्लोरोमिथिलेन में चुनौतियों और अवसरों पर ए व्याख्यान देने के लिए
प्रो पी देशलहरा	यूएस	05.07.2017	बेहतर हाइड्रोकार्बन उपयोग के लिए उत्प्रेरक सामग्री के तर्कसंगत डिजाइन पर व्याख्यान देने के लिए
प्रो आर नारायनसामी	तरिचिरिपल्लि	06.09.2017	ऑटोमोटिव और एयरोस्पेस उद्योगों में इस्तेमाल की ल्यूमीनियम मशिन धातु के क्रायोरोलॉजी और फॉर्मिंग सीमा आरेख पर व्याख्यान देने के लिए
डॉ. देवर्षी दासगुप्ता	बैंगलोर	13.09.2017	स्कैटरिंग और माइक्रोस्कोपी तकनीक के माध्यम से एच-बॉन्डेड आणविक असेंबली के क्रिस्टलाइजेशन की समझ पर व्याख्यान
प्रो हरिमत्सु तकाबा	जापान	04.10.2017	कम्प्यूटेशनल कैमिस्ट्री एंड इंफॉर्मेटिक्स का उपयोग कर 'कार्यात्मक सामग्री के डिजाइन' पर व्याख्यान देने के लिए
डॉ. वदिया चक्रपाणी	न्यू यार्क	07.11.2017	ट्रांज़िशन धातु ऑक्साइड के इलेक्ट्रॉनिक और इलेक्ट्रोकेमिकल गुणों को मॉड्यूल करने के लिए डिफ़ैक्ट इंजीनियरिंग पर व्याख्यान देने के लिए
डॉ. फेरटि अबडि	ट्यूनीशिया	21.12.2017 - 16.01.2018	डीएसटी, नई दल्लि द्वारा अफ्रीकी शोधकर्ताओं के लिए सी वी रमन इंटरनेशनल

FOREIGN VISITS BY NIIST SCIENTISTS

Name	Country Visited	Duration	Purpose of visit
Dr Binod P	Finland	08.04.2017 - 14.04.2017	To attend INNO-INDIGO Bioenergy Conference
Dr Binod P	China	21.05.2017 - 24.05.2017	To attend Conference and deliver invited talk in the 7 th International Forum on Industrial Bioprocesses
Dr K Madhavan Nampoothiri	China	21.05.2017 - 24.05.2017	To attend Conference and deliver invited talk in the 7 th International Forum on Industrial Bioprocesses
Dr Ramesh Kumar N	Germany	07.08.2017 - 30.09.2017	To conduct research at Max Planck Institute as part of Max Planck Indian Mobility grant
Dr Manoj Rama Varma	Slovenia	19.08.2017 - 29.08.2017	Visit in connection to Indo Slovenian Project on behalf of DST
Dr Binod P	China	17.11.2017 - 19.11.2017	To attend and deliver a talk in the 1 st International Symposium on Biomass Utilization Technologies (ISBUT 2017)
Dr Bishwapriya Deb	Thailand	18.11.2017 - 23.11.2017	To attend and deliver an invited talk at the 13 th International Conference on Ecomaterials 2017 (ICEM 13) Bangkok, Thailand
Dr Vijayakumar	Thailand	18.11.2017 - 23.11.2017	To attend and deliver an invited talk at the 13 th International Conference on Ecomaterials 2017 (ICEM 13) Bangkok, Thailand
Dr E Bhoje Gowd	Taiwan	22.03.2018 - 21.06.2018	For availing Raman Research Fellowship at National Tsing Hua University, Hsinchu, Taiwan
Dr U S Hareesh	Japan	30.03.2018 - 07.04.2018	Project review meeting at Noritake Co. Ltd., and visit to Tokyo Institute of Technology, Japan

VISITS OF FOREIGN SCIENTISTS / EMINENT PERSONALITIES TO NIIST

Name	Country From	Duration	Purpose of visit
Dr Shrinivas Venkataraman	Singapore	03.04.2017	To deliver a lecture on "Functional aliphatic polycarbonates: Synthesis, aqueous self-assembly and biomedical applications"
Asst Prof Dr Artem Badasyan	Slovenia	08.05.2017 – 12.05.2017	As the part of Indian-Slovenian bilateral research project between University of Nova Gorica and NIIST entitled "Hole doped double perovskites for sensor and spintronics applications"
Dr Manjunath S	Bangalore	29.05.2017	To Deliver a lecture on "Solidification, CFD, Mechanical Analysis using Ansys FEM Solutions"
Dr K R Ravi	Coimbatore	20.06.2017	To Deliver a lecture on "Challenges and Opportunities in CAL-PHAD Approach in Alloy Design"
Prof P Deshlahra	US	05.07.2017	To Deliver a lecture on "Rational Design of Catalytic Materials for Improved Hydrocarbon Utilization"
Prof R Narayanasamy	Tiruchirappalli	06.09.2017	To Deliver a lecture on "Cryorolling and Forming Limit Diagram of Aluminium alloys used in Automotive and Aerospace industries"
Dr Debarshi Dasgupta	Bangalore	13.09.2017	Delivered a lecture on "Understanding Crystallization of H-Bonded Molecular Assemblies through Scattering & Microscopy Techniques"
Prof Hiromitsu Takaba	Japan	04.10.2017	Delivered a lecture on "Design of Functional Materials using Computational Chemistry and Informatics"
Dr Vidya Chakrapani	New York	07.11.2017	Delivered a lecture on "Defect Engineering for Modulating Electronic and Electrochemical Properties of Transition Metal Oxide"
Dr Ferid Abidi	Tunisia	21.12.2017 – 16.01.2018	CV Raman International Fellowship for African Researchers by DST, New Delhi

पीएचडी से सम्मानित (अप्रैल 2017 – मार्च 2018)

क्रम सं.	नाम	थीसिस का शीर्षक	पर्यवेक्षक	विश्वविद्यालय	अवार्ड किया
1	शेरीमा आर एम	मेटल नैनोपार्टिकल्स / कार्बन क्वांटम डॉट्स बेस्ड इलेक्ट्रो केमिकल सेंसर फॉर सिलेक्टेड बायोलॉजिकल कंपाउंड्स	डॉ टी प्रसाद राव और डॉ के वी राधाकृष्णन	एसीएसआईआर	अप्रैल 2017
2	किरण एस धर	मेटाबोलिक इंजीनियरिंग ऑफ़ सी- ग्लूटामिकम फॉर सैलिटोल प्रोडक्शन फ्रॉम पेंटोसेस	डॉ के माधवन नंपूतिरी	कुसाट	अप्रैल 2017
3	विजी एम	डिजाइन ऑफ़ नोबेल ट्रांजीशन मेटल कॉम्प्लेक्स : स्टडी ऑफ़ कैटेलेटिक, आयन रिक्मिशन एंड बायोलॉजिकल प्रॉपर्टीज	डॉ डी रामय्या	एसीएसआईआर	मई 2017
4	नागराज नायक	डिजाइन, सिंथेसिस एंड सेल्फ-असेंबली ऑफ़ β -सैक्लोडेक्सट्रिन बेस्ड मैटेरियल्स फॉर ड्रग डिलिवरी एंड फोटो इन्ड्यूस्ड इलेक्ट्रॉन ट्रांसफर अप्लिकेशन्स	डॉ के आर गोपिदास	एसीएसआईआर	मई 2017
5	दिव्या सूसन फिलिप्स	ए स्टडी ओण सिंगल एंड मल्टीफोटोन एक्टिव स्फुरैन डेरिवेटिव्स	डॉ ए अजयघोष	एसीएसआईआर	मई 2017
6	वेदनारायणन बी	सेल्फ-असेंबल्ड फंक्शनल हाइब्रिड मैटेरियल्स ऑफ़ कार्बन अलोट्रोप्स एंड एक्सटेंडेड π -सिस्टम्स फॉर वेरियस अप्लिकेशन्स	डॉ ए अजयघोष	एसीएसआईआर	मई 2017
7	शरन्या एस	डेवलपमेंट ऑफ़ नोबेल मेथोडोलोजिज टुवर्ड्स फंक्शनलिज्ड सैक्लोपेंटानोइड्स	डॉ के वी राधाकृष्णन	केरल विश्वविद्यालय	मई 2017
8	राहुल देव मुखोपाध्याय	केमिस्ट्री एंड अप्पलिकेशन ऑफ़ ए प्यू टेलर-मेड मेटल-आर्गेनिक मैटेरियल्स	डॉ ए अजयघोष	एसीएसआईआर	जून 2017
9	श्री मनु के एम	फैब्रिकेशन एंड कैरेक्टराइजेशन ऑफ़ एलुमिनियम कंपोजिट्स बाइ स्कवीज इन्फिल्ट्रेशन एंड कोम्पोकास्टिंग टेक्निक्स	डॉ टी पी डी राजन	एसीएसआईआर	जुलाई 2017
10	मनु जोस	टाइटानिया, टाइटानेट एंड फ्लाई ऐश बेस्ड नैनो स्ट्रक्चर्स एंड नैनो कंपोजिट्स फॉर आर्गेनिक डार्क रिमूवल फ्रॉम एक्वस सोल्यूशन्स	डॉ सत्यजीत शुक्ला	एसीएसआईआर	जुलाई 2017
11	प्रकाश एस पी	एक्सप्लोइटेशन ऑफ़ डयाजोनियम केमिस्ट्री: सिंथेसिस, कैरेक्टराइजेशन एंड अप्लिकेशन्स ऑफ़ मेटल नैनो पार्टिकल-लिंकड आर्गेनिक फ्रेमवर्क्स एंड नैनो ग्राफिटिक मैटेरियल्स	डॉ के आर गोपिदास	एसीएसआईआर	अगस्त 2017
12	विष्णु एस	ए स्टडी ऑफ़ डोनर-अक्सेप्टर इंटरैक्शन्स इन π -जेल्स एंड π कंजुगेटेड पॉलीमर्स	डॉ ए अजयघोष	एसीएसआईआर	अगस्त 2017
13	इंदु शशिधरन	केमिकल एंड बायोलॉजिकल इन्वेस्टिगेशन्स ओण फाइटो केमिकल्स ऑफ़ टर्मिनलिया चेबुला	डॉ ए सुन्दरेशन	केरल विश्वविद्यालय	अगस्त 2017
14	लक्ष्मी वी	पार्टिकल असिस्टेड माइक्रो पैटेनिंग ऑफ़ पॉलीमर अलुमिने नैनो कम्पोजिट फिल्म	डॉ टी पी डी राजन	कुसाट	अगस्त 2017
15	लिंजा वष्रयल	सॉल-जेल नैनो असेंबली ऑफ़ अलुमिनो-सिलोक्सेन हाइब्रिड जेल्स एंड हैरार्किकली पोरस एरोजेल आर्किटेक्चर्स फॉर बायोफंक्शनल अप्लिकेशन्स	डॉ एस अनंतकुमार	केरल विश्वविद्यालय	अगस्त 2017
16	रम्या के	डीएफटी स्टडीज ओण दि नेचर, स्ट्रेंथ एंड कोऑपरेटिविटी ऑफ़ इंटर मॉलिक्यूलर इंटरैक्शन्स इन डाइपोलर आर्गेनिक मोलेक्युल्स, पोलियन्स एंड कार्बन रिंग्स	डॉ सुरेश सी एच	केरल विश्वविद्यालय	अगस्त 2017

17	श्रीदेवी के	आर्गेनिक नैनो पार्टिकल्स कंपोज्ड ऑफ़ फ्री केमिस्ट्री डेनड्रिटिस : सिंथेसिस, कैरेक्टराइजेशन एंड अप्लिकेशन्स	डॉ के आर गोपिदास	कुसाट	अगस्त 2017
18	विनायक एम वी	डिजाइन, सिंथेसिस, फोटो फिजिकल स्टडीज एंड अप्लिकेशन्स इन डार्ई सेंसिटीज़ेड सोलर सेल्स ऑफ़ ए फ्यू ट्राइफेनीलामिन	डॉ के आर गोपिदास	केरल विश्वविद्यालय	अगस्त 2017
19	संदीप सी	मेसो -ग-एक्सटेंडेड बॉडीपी डेरिवेटिव्स : सेल्फ -असेंबली, ऑप्टिकल प्रॉपर्टीज एंड अप्लिकेशन्स	डॉ ए अजयघोष	एसीएसआईआर	सितंबर 2017
20	वैजू पी	स्ट्रक्चरल चेंजस प्रोब्ड इन पॉलीमर -साल्वेंट सिस्टम्स अट् मॉलिक्यूलर, क्रिस्टलाइन एंड लमेल्लर लेंथ -स्केल्स ड्यूरिंग क्रिस्टलाइजेशन एंड फेज ट्रांसिशन	डॉ ई भोजे गौड़	एसीएसआईआर	सितंबर 2017
21	जयकुमार ई	प्रोसेसिंग एंड कैरेक्टराइजेशन ऑफ़ फ़कशनैली ग्रेडेड मेटल एंड पॉलीमर कंपोजिट्स	डॉ टी पी डी राजन	कुसाट	सितंबर 2017
22	सुयाना पी	इन्वेस्टीगेशंस ओण ग्राफिटिक कार्बन नाइट्राइड बेस्ड सेमिकंडक्टर हेटेरो जंक्शंस फॉर फोटोकैटैलिटिक अप्लिकेशन्स	डॉ. यू एस हरीश	एसीएसआईआर	अक्तूबर 2017
23	श्यामा एच पी	फोटो केमिकल इन्वेस्टीगेशन ऑफ़ सीजीजियम कुमिन सीड्स एंड इट्स इम्पैक्ट इन एमेलिओरेट डिस्सेस लाइफस्टाइल असोवा	डॉ. पी. जयमूर्ति	कुसाट	अक्तूबर 2017
24	महेश के वी	मैक्स फेज टेरनरी कार्बाइड्स : सिंथेसिस, नैनो कंपोजिट्स एंड एक्सफोलिएटेड 2डी मैक्सिन /मैक्सिन नैनो स्ट्रक्चर्स फॉर मल्टिफंक्शनल अप्लिकेशन्स	डॉ एस अनंतकुमार	केरल विश्वविद्यालय	अक्तूबर 2017
25	नीतू के एस	नैनो स्ट्रक्चर्ड कंडक्टिंग पॉलीमर बेस्ड ट्रांसड्यूसर्स थ्रू लिक्विड क्रिस्टलाइन टेम्पलेट पोलीमेराइजेशन	डॉ. जे.डी. सुधा एवं डॉ. ए आर आर मेनोन	केरल विश्वविद्यालय	अक्तूबर 2017
26	राजी जी आर	स्ट्रक्चरल, मैग्नेटिक एंड मैग्नेटो कैलोरिक स्टडीज इन NiMn-बेस्ड हैसलेर अलॉय्स	डॉ. मनोज रामवर्मा	केरल विश्वविद्यालय	अक्तूबर 2017
27	रेश्मी वी जी	सिंथेसिस एंड कैरेक्टराइजेशन ऑफ़ पोरस सिरेमिक्स फॉर मैटेलिक कंपोजिट्स	डॉ टी पी डी राजन & डॉ. सी. पवित्रन	केरल विश्वविद्यालय	October 2017
28	शिमी एम	फ्लुओरोसेंटली लेबल्ड कार्बोहाइड्रेट्स आस टार्गेटेड ट्यूमर इमेजिंग प्रोब्स एंड आस पी एच रेस्पॉन्सिव जेलटर्स	डॉ. सुरेश दास एवं डॉ. के वी राधाकृष्णन	एसीएसआईआर	नवंबर 2017
29	बकू नागेंद्र	हाइली डिस्पेसर्ड पाली प्रोपाइलिन /लयेर्ड डबल हाइड्रोक्साइड नैनो कंपोजिट्स : प्रिपरेशन, स्ट्रक्चर एंड दयर प्रॉपर्टीज	डॉ ई भोजे गौड़	एसीएसआईआर	नवंबर 2017
30	जसनामोल पी पी	मैग्नेटिक, ट्रांसपोर्ट एंड मैग्नेटो ट्रांसपोर्ट प्रॉपर्टीज ऑफ़ परोव्स्किट्स La ₂ BMnO ₆ (B=Fe, Cu, and Cr)	डॉ मनोज राम वर्मा	एसीएसआईआर	दिसंबर 2017
31	माया आर जे	बेंटोनाइट बेस्ड आर्गेनिक -इनऑर्गेनिक हाइब्रिड मैटेरियल्स : अप्लिकेशन्स टुवर्ड्स ग्रीन कटैलिसीस एंड आस मरक्युरी सेंसर	डॉ लक्ष्मी वर्मा	एसीएसआईआर	दिसंबर 2017
32	राहुल एम ओंगुगल	डिजाइन, सिंथेसिस, स्टडी ऑफ़ दि सेल्फ -असेम्बलिंग एंड लुमिनेसेन्ट प्रॉपर्टीज ऑफ़ सम 1,3,4-ऑक्साडयाजोल एंड 2,1,3-बेंज़ो ऑक्साडयाजोल डेरिवेटिव्स	डॉ सुरेश दास	एसीएसआईआर	दिसंबर 2017
33	लक्ष्मीकांत टी एम	डिजाइन, सिंथेसिस एंड फोटो फिजिकल स्टडीज ऑफ़ डार्ईकीटो प्यरॉलोप्यरॉल -बेस्ड स्माल मोलेक्युल्स एंड दयर अप्लिकेशन्स इन बल्क हेटेरो जंक्शन सोलर सेल	डॉ के आर गोपिदास	एसीएसआईआर	दिसंबर 2017



34	राजी वी वी	स्टडीज ओण डेवलपमेंट ऑफ ओर्गनो - मॉडिफाइड नैनो - कयोनिन्स आस री-इन्फोर्सिंग फिल्लर्स फॉर रबर इंडस्ट्री	डॉ ए आर आर मेनन	केरल विश्वविद्यालय	दिसंबर 2017
35	शुभा पी वी	इंवेस्टीगेशंस ओण दि वेट केमिकल सिंथेसिस ऑफ़ सिरेमिक अडसोर्बेंट्स फॉर कार्बन डाइऑक्साइड कैप्चर	डॉ यू एस हरीश	कुसाट	दिसंबर 2017
36	निशांत गोपाल	बायो रिफाइनिंग ऑफ़ वीट ब्रान फॉर दि प्रोडक्शन ऑफ़ फेरुलोयल एस्टर्स, फेरुलिक एसिड एंड देयर अप्लिकेशन्स	डॉ के माधवन नम्पुतिरी	एसीएसआईआर	जनवरी 2018
37	निशा एन	डिजाइन एंड फेब्रिकेशन ऑफ़ एसईआरएस गाइडेड टारगेटेड नैनो प्रोब्स टुवर्ड्स कैंसर मैनेजमेंट	डॉ कौस्तुभ कुमार मैती	एसीएसआईआर	जनवरी 2018
38	रेष्मा एम वी	फाइटो कॉस्टीग्यूंट स्टडीज ऑफ़ पालमिरा पाम (बोरासेसफलाबेलीफेर लीन) सैप , इट्स वैल्यू एडेड सिरप एंड प्रोसेस ऑप्टिमाइजेशन	डॉ के पी पद्मकुमारी अम्मा	कुसाट	जनवरी 2018
39	इंडुजा आई जे	डेवलपमेंट ऑफ़ लो -लॉस एल्यूमिना बेस्ड कोफयरबिल सिरेमिक सबस्ट्रेट्स एंड डाई इलेक्ट्रिक इंग्स फॉर माइक्रोवेव अप्लिकेशन्स	डॉ मनोज राम वर्मा एवं डॉ एम टी सेबास्टियन	केरल विश्वविद्यालय	जनवरी 2018
40	सम्राट घोष	सेल्फ -असेंबली एंड प्रॉपर्टीज ऑफ़ लो बैंड गैप डाइक्रीटो प्यरॉलोप्यरॉल डेरिवेटिव्स	डॉ ए अजयघोष	एसीएसआईआर	फरवरी 2018
41	सुमेश बाबू	β -साइक्लोडेक्सट्रिन फसिलिटेटेड डोनर -अक्सेप्टर सुप्रामॉलिक्यूलर सेल्फ -असेंबल्ड सिस्टम्स फॉर चार्ज ट्रांसफर एंड इलेक्ट्रॉन ट्रांसफर अप्लिकेशन्स	डॉ के आर गोपिदास	एसीएसआईआर	फरवरी 2018
42	अरुण गोपी	एक्सप्लोइटिंग नॉनकोवर्लेट इंटरैक्शन्स फॉर दि प्रिपरेशन ऑफ़ क्वांटम डॉट -आर्गेनिक क्रोमोफोर हाइब्रिड नैनोस्ट्रक्चर्स	डॉ यूसफ करुवाथ	एसीएसआईआर	फरवरी 2018
43	सी एच चंद्रशेखर	डेवलपमेंट ऑफ़ नोबेल मेटल -फ्री मल्टी कॉम्पोनेन्ट एंड ऑक्सीडेटिव रिएक्शन मेथोडोलोजिज़ फॉर दि कंस्ट्रक्शन ऑफ़ बायोलॉजिकली रिसेवेंट मोलेक्युल्स	डॉ एल रवि शंकर	एसीएसआईआर	फरवरी 2018
44	गायत्री टी एच	रेयर अर्थ बेस्ड मिक्सड मेटल ऑक्साइड्स फॉर एनर्जी अप्लिकेशन्स	डॉ एस अनंतकुमार	एसीएसआईआर	मार्च 2018
45	अखिल एस करण	फेब्रिकेशन एंड कैरेक्टराइजेशन ऑफ़ फ़ंक्शनैली ग्रेडेड मेटल एंड पॉलीमर कम्पोजिट बाइ स्वीकैटिअल सेन्ट्रीफ्यूगल कास्टिंग टेक्निक्स	डॉ टी पी डी राजन	कुसाट	मार्च 2018
46	सौम्या एस	इंवेस्टीगेशंस ओण जिंग ऑक्साइड एम्बेडेड पॉलीमर मैट्रिक्स नैनो कम्पोजिट कोटिंग्स एंड फिल्म्स फॉर यूवी/आईआर शील्डिंग सोलर थर्मल कण्ट्रोल सर्फेस	डॉ एस अनंतकुमार	केरल विश्वविद्यालय	मार्च 2018

Ph.D Awarded (April 2017 – March 2018)

Sl. No.	Name	Thesis Title	Supervisor	University	Awarded
1	Shereema R M	Metal nanoparticles / carbon quantum dots based electrochemical sensors for selected biological Compounds	Dr. T Prasad Rao & Dr. K V Radhakrishnan	AcSIR	April 2017
2	Kiran S Dhar	Metabolic engineering of cglutamicum for xylitol production from pentoses.	Dr. K Madhavan Nampoothiri	CUSAT	April 2017
3	Viji M	Design of Novel Transition Metal Complexes: Study of Catalytic, Ion Recognition and Biological Properties	Dr. D Ramaiah	AcSIR	May 2017
4	Nagaraj Nayak	Design, Synthesis and Self-assembly of β -Cyclodextrin Based Materials for Drug Delivery and Photoinduced Electron Transfer Applications	Dr. K R Gopidas	AcSIR	May 2017
5	Divya Susan Philips	A Study on Single and Multiphoton Active Squaraine Derivatives	Dr. A Ajayaghosh	AcSIR	May 2017
6	Vedhanarayanan B	Self-assembled Functional Hybrid Materials of Carbon Allotropes and Extended π -Systems for Various Applications	Dr. A Ajayaghosh	AcSIR	May 2017
7	Saranya S	Development of Novel Methodologies towards Functionalized Cyclopentanoids	Dr. K V Radhakrishnan	University of Kerala	May 2017
8	Rahul Dev Mukhopadhyay	Chemistry and Applications of a Few Tailor-made Metal-Organic Materials	Dr. A Ajayaghosh	AcSIR	June 2017
9	Sree Manu K M	Fabrication and Characterization of Aluminum Composites by Squeeze Infiltration and Compocasting Techniques	Dr. T P D Rajan	AcSIR	July 2017
10	Manu Jose	Titania, Titanate, and Flyash Based Nanostructures and Nanocomposites for Organic Dye Removal from Aqueous Solutions	Dr. Satyajit Shukla	AcSIR	July 2017
11	Prakash S P	Exploitation of Diazonium Chemistry: Synthesis, Characterization and Applications of Metal Nanoparticle-Linked Organic Frameworks and Nanographitic Materials	Dr. K R Gopidas	AcSIR	August 2017
12	Vishnu S	A Study of Donor-Acceptor Interactions in π -Gels and π Conjugated Polymers	Dr. A Ajayaghosh	AcSIR	August 2017
13	Indu Sasidharan	Chemical and Biological Investigations on Phytochemicals of Terminalia Chebula	Dr. A Sundaresan	University of Kerala	August 2017
14	Lakshmi V	Particle assisted micropatterning of polymer alumina Nanocomposite film	Dr. T P D Rajan	CUSAT	August 2017
15	Linsha Vazhayal	Sol- Gel Nanoassembly of Alumino- Siloxane Hybrid Gels and Hierarchically Porous Aerogel Architectures for Biofunctional Applications	Dr. S Ananthakumar	University of Kerala	August 2017



16	Remya K	DFT Studies on the Nature, Strength and Cooperativity of Inter Molecular Interactions in Dipolar Organic Molecules, Polyynes and Carbon Rings.	Dr. Suresh C H	University of Kerala	August 2017
17	Sreedevi K	Organic Nanoparticles composed of fri chemistry dendrites: Synthesis, characterisation and application	Dr. K R Gopidas	CUSAT	August 2017
18	Vinayak M V	Design, synthesis, Photophysical studies and applications in dye sensitized solar cells of a few triphenylamine	Dr. K R Gopidas	University of Kerala	August 2017
19	Sandeep C	Meso- π -Extended Bodipy Derivatives: Self-Assembly, Optical Properties and Applications	Dr. A Ajayaghosh	AcSIR	September 2017
20	Shaiju P	Structural Changes Probed in Polymer-Solvent Systems at Molecular, Crystalline and Lamellar Length-Scales during Crystallization and Phase Transitions	Dr. E Bhoje Gowd	AcSIR	September 2017
21	Jayakumar E	Processing and characterization of functionally Graded metal and polymer composites	Dr. T P D Rajan	CUSAT	September 2017
22	Suyana P	Investigations on Graphitic Carbon Nitride based Semiconductor Heterojunctions for Photocatalytic Applications	Dr. U S Hareesh	AcSIR	October 2017
23	Syama H P	Photochemical investigation of syzygiumcumiseeds and its impact in ameliorate diseases lifestyle assowa	Dr. P Jayamurthy	CUSAT	October 2017
24	Mahesh K. V.	MAX phase ternary carbides: Synthesis, nanocomposites and exfoliated 2D MAXene/MXene nanostructures for multifunctional applications	Dr. S. Ananthakumar	University of Kerala	October 2017
25	Neethu K. S.	Nanostructured Conducting Polymer Based Transducers Through Liquid Crystalline Template Polymerization	Dr. J.D. Sudha & Dr. A.R.R. Menon	University of Kerala	October 2017
26	Raji G. R.	Structural, magnetic and magnetocaloric studies in NiMn-based Heusler alloys	Dr. Manoj Raama Varma	University of Kerala	October 2017
27	Resmi V.G.	Synthesis and Characterization of Porous Ceramics for Metallic Composites	Dr. T P D Rajan & Dr.C.Pavithran	University of Kerala	October 2017
28	Shimi M	Fluorescently Labeled Carbohydrates as Targeted Tumor Imaging Probes and as pH Responsive Gelators	Dr. Suresh Das & Dr. K V Radhakrishnan	AcSIR	November 2017
29	Baku Nagendra	Highly Dispersed Polypropylene/Layered Double Hydroxide Nanocomposites: Preparation, Structure and their Properties	Dr. E Bhoje Gowd	AcSIR	November 2017
30	Jasnamol P P	Magnetic, transport and magnetotransport properties of perovskites La ₂ BMnO ₆ (B=Fe, Cu, and Cr)	Dr. Manoj Raama Varma	AcSIR	December 2017
31	Maya R J	Bentonite Based Organic-Inorganic Hybrid Materials: Application Towards Green Catalysis and as Mercury Sensor	Dr. Luxmi Varma	AcSIR	December 2017

32	Rahul M Ongungal	Design, Synthesis, Study of the Self-Assembling and Luminescent Properties of Some 1,3,4-Oxadiazole and 2,1,3-Benzooxadiazole Derivatives	Dr. Suresh Das	AcSIR	December 2017
33	Lakshmykanth T M	Design, Synthesis and Photophysical Studies of Diketopyrrolopyrrole-Based Small Molecules and their Application in Bulk Heterojunction Solar Cell	Dr. K R Gopidas	AcSIR	December 2017
34	Raji V V	Studies on Development of Organo – modified Nano – kaolins as Reinforcing fillers for Rubber Industry.	Dr. A R R Menon	University of Kerala	December 2017
35	Subha P V	Investigations on the wet chemical Synthesis of ceramic adsorbents for carbon dioxide capture	Dr. U S Hareesh	CUSAT	December 2017
36	NishantGopalan	Biorefining of wheat bran for the production of feruloyl esterase, ferulic acid and their applications	Dr. K Madhavan Nampoothiri	AcSIR	January 2018
37	Nisha N	Design and Fabrication of SERS Guided Targeted Nanoprobes Towards Cancer Management	Dr. Kaustabh Kumar Maiti	AcSIR	January 2018
38	Reshma M V	Phytoconstituent Studies of Palmyra Palm (Borassus flabellifer Linn) Sap, its value added syrup and process optimization	Dr. K P Padmakumari Amma	CUSAT	January 2018
39	Induja I J	Development of low-loss alumina based cofirable ceramic substrates and dielectric inks for microwave applications	Dr. Manoj Raama Varma & Dr. Sebastian M T	University of Kerala	January 2018
40	Samrat Ghosh	Self-Assembly and Properties of Low Band Gap Diketopyrrolopyrrole Derivatives	Dr. A Ajayaghosh	AcSIR	February 2018
41	Sumesh Babu	β -Cyclodextrin Facilitated Donor-Acceptor Supramolecular Self-Assembled Systems For Charge Transfer And Electron Transfer Applications	Dr. K R Gopidas	AcSIR	February 2018
42	Arun Gopi	Exploiting Noncovalent Interactions for the Preparation of Quantum Dot-Organic Chromophore Hybrid Nanostructures	Dr. Yoosaf Karuvath	AcSIR	February 2018
43	C H Chandrasekhar	Development of Novel Metal-Free Multicomponent and Oxidative Reaction Methodologies for the Construction of Biologically Relevant Molecules	Dr. L Ravi Shankar	AcSIR	February 2018
44	Gayathri T H	Rare earth based mixed metal oxides for energy applications	Dr. S Ananthakumar	AcSIR	March 2018
45	Akhil S. Karan	Fabrication & Characterization of Functionally graded metal & polymer composite by Sequential Centrifugal casting Techniques	Dr. T P D Rajan	CUSAT	March 2018
46	Soumya S.	Investigations on ZnO Embedded Polymer Matrix Nanocomposite Coatings and Films for UV/IR Shielding Solar Thermal Control Surfaces	Dr. S Ananthakumar	University of Kerala	March 2018

अनुसंधान परिषद

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प्रबंधन परिषद्

(01/01/2016 से 31/12/2017 की अवधि के लिए)

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डॉ. विजयमोहनन के. पिल्लै

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आमंत्रित)

डॉ. सुन्दरेशन

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डॉ. अनंतकुमार एस

व. प्रधान वैज्ञानिक

डॉ. राजीव के. सुकुमारन

व. वैज्ञानिक

डॉ. पी. निशा

वैज्ञानिक

श्री आर. राजीव

व. अधीक्षण अभियंता

सीओएफए/एफएओ, एनआईआईएसटी

सदस्य सचिव

सीओए/एओ, एनआईआईएसटी

RESEARCH COUNCIL

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Prof. Ashwini Kumar Nangia
Director
CSIR-National Chemical Laboratory,
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SECRETARY (up to February 2018)

Dr. A Sundaresan
Chief Scientist, CSIR-NIIST

SECRETARY (From March 2018)

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Period 01/01/2016 to 31/12/2017

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(Special Invitee)

Dr P Nisha
Scientist

Dr Sundaresan
Chief Scientist & Head, RPBD

Sri R Rajeev
Sr. Superintending Engineer

Dr Elizabeth Jacob
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CoFA/FAO, NIIST

MEMBER SECRETARY

CoA / AO, NIIST

सुखी और समृद्ध सेवानिवृत्त जीवन के लिए शुभकामनाएं
Best Wishes for Happy and Prosperous Retired Life



श्री एम एम श्रीकुमार
मुख्य वैज्ञानिक
सेवानिवृत्त: 31.05.2017

Shri M M Sreekumar
Chief Scientist
Retired: 31.05.2017



डॉ. यू टी सुब्रमण्यम पिल्लै
मुख्य वैज्ञानिक
सेवानिवृत्त: 31.05.2017

Dr. U T Subramonian Pillai
Chief Scientist
Retired: 31.05.2017



श्री सी पी नारायणन
प्रयोगशाला सहायक
सेवानिवृत्त: 31.07.2017

Shri C P Narayanan
Lab Assistant
Retired: 31.07.2017



श्री एम सी शाजी
व. प्रधान वैज्ञानिक
सेवानिवृत्त: 31.08.2017

Shri M C Shaji
Sr. Principal Scientist
Retired: 31.08.2017



श्री पी बी विजयकुमार
प्रयोगशाला सहायक
सेवानिवृत्त: 30.09.2017

Shri P B Vijayakumar
Lab Assistant
Retired: 30.09.2017



डॉ. के आर गोपिदास
मुख्य वैज्ञानिक
सेवानिवृत्त: 30.11.2017

Dr. K R Gopidas
Chief Scientist
Retired: 30.11.2017



श्री एन सुधिलाल
वरिष्ठ तकनीशियन (3)
सेवानिवृत्त: 30.11.2017

Shri N Sudhilar
Senior Technician (3)
Retired: 30.11.2017



श्री वी आंटनी
वरिष्ठ तकनीशियन (2)
सेवानिवृत्त: 30.11.2017

Shri V Antony
Senior Technician (2)
Retired: 30.11.2017

पदोन्नति / PROMOTIONS



श्री शाजिकुमार वी के
वरिष्ठ तकनीकी अधिकारी (2)

Shri Shajikumar VK
Senior Technical Officer (2)



श्री ए पीर मोहम्मद
वरिष्ठ तकनीकी अधिकारी (2)

Shri A Peer Mohammed
Senior Technical Officer (2)



श्री प्रवीण कन्नल
वरिष्ठ तकनीशियन(1)

Shri Praveen Kannal
Senior Technician(1)



श्री एम जयदीप
वरिष्ठ तकनीशियन (1)

Shri M Jayadeep
Senior Technician(1)



श्री हरीश राज वी
तकनीकी अधिकारी

Shri Harish Raj V
Technical Officer

नई नियुक्तियां / NEW APPOINTMENTS



डॉ. सुब्रता दास
वरिष्ठ वैज्ञानिक
Dr. Subrata Das
Senior Scientist



डॉ. लक्ष्मी राकेश कुमार यासरला
वैज्ञानिक
Dr. Lakshmi Rakesh Kumar Yasarla
Scientist

सीएसआईआर-एनआईआईएसटी में स्वागत
WELCOME TO CSIR-NIIST
(स्थानान्तरण पर) (On Transfer)



डॉ. के जयशंकर
वरिष्ठ वैज्ञानिक
Dr. K. Jayasankar
Senior Scientist



डॉ. श्रीजाकुमारी एस एस
वैज्ञानिक
Dr. Sreejakumari S.S
Scientist

पुरस्कार एवं सम्मान/AWARDS AND HONOURS



डॉ बी एस शशिधर / Dr B S SASIDHAR
केरल राज्य युवा वैज्ञानिक पुरस्कार (केएसवाईएसए) - 2017
Kerala State Young Scientist Award (KSYSYA) - 2017



डॉ प्रिया एस / Dr. PRIYA S
डीएसटी-एसईआरबी परियोजना (मोरस अल्बा एल से शुद्धीकृत एक लेक्टिन से प्रेरित मानव स्तन कैंसर कोशिकाओं में अनोईकिस के मैकेनिज्म पर अध्ययन) वर्ष 2010-15 के दौरान लाइफ साइंस श्रेणी में एसईआरबी की शोध हाइलाइट्स में चयनित।
The DST-SERB project (Study on the mechanism of anoikis in human mammary cancer cells induced by a purified lectin from *Morus alba* L.) selected in the research highlights of SERB during 2010-15 in Life Science category.

निधन-सूचना / OBITUARY



श्री पी. सोमन / Shri. P.Soman
(1957-2017)

श्री पी. सोमन का निधन दिनांक 17-04-2017 को हुआ। तिरुवनंतपुरम के मूल विवासी श्री पी. सोमन वर्ष 1982 में एनआईआईएसटी में शामिल हुए। मृत्यु के समय, आप प्रयोगशाला सहायक ग्रेड I(4) के रूप में काम कर रहे थे।

Shri. P.Soman passed away on 17-04-2017. Hailing from Thiruvananthapuram, he joined NIIST in 1982. At the time of demise, he was working as Lab Assistant Gr. I (4)



श्री के. एम. प्रकाश / Shri. K. M. Prakash
(1964-2017)

श्री के. एम. प्रकाश का निधन 17-11-2017 को हुआ। पालक्कड के मूल निवासी, श्री प्रकाश वर्ष 1989 में एनआईआईएसटी में शामिल हुए। मृत्यु के समय, आप वरिष्ठ तकनीशियन (2) के रूप में काम कर रहे थे।

Shri. K. M. Prakash passed away on 17-11-2017. Hailing from Palakkad, he joined NIIST in 1989. At the time of demise, he was working as Senior Technician (2)

31/03/2018 को कर्मचारी समूह की सूची

डॉ ए अजयघोष
निदेशक

निदेशक का कार्यालय

श्री किरन जे.एस
तकनीकी सहायक
श्री विष्णु गुर्जर
कनिष्ठ आशुलिपिक

कृषि प्रसंस्करण तथा प्रौद्योगिकी प्रभाग

डॉ बी एस दिलीप कुमार
व.प्रिंसिपल वैज्ञानिक एवं प्रधान
डॉ. ए. सुन्दरेशन
मुख्य वैज्ञानिक तथा निदेशक के सलाहकार

डॉ के जी रघु
प्रिंसिपल वैज्ञानिक

श्री बी वी वेणुगोपाल
प्रिंसिपल वैज्ञानिक

डॉ (श्रीमती) एम वी रेष्मा
वरिष्ठ वैज्ञानिक

डॉ (श्रीमती) पी निशा
वैज्ञानिक

डॉ पी जयमूर्ति
वैज्ञानिक

डॉ(श्रीमती) प्रिया एस
वैज्ञानिक

डॉ (श्रीमती) बीना जोय
प्रिंसिपल तकनीकी अधिकारी

श्री डी आर शोभन कुमार
वरिष्ठ तकनीकी अधिकारी(1)

माइक्रोबियल प्रोसेस तथा प्रौद्योगिकी प्रभाग

डॉ के माधवन नंपूतिरि
प्रिंसिपल वैज्ञानिक एवं प्रधान

डॉ राजीवकुमार सुकुमारन
वरिष्ठ वैज्ञानिक

डॉ पी बिनोद
वैज्ञानिक

डॉ एन रमेश कुमार
वैज्ञानिक

डॉ मुत्तु अरुमुगम
वैज्ञानिक

श्री एम किरन कुमार
वैज्ञानिक

डॉ. लक्ष्मी राकेश कुमार यासरला
वैज्ञानिक

रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग

डॉ (श्रीमती) आर लक्ष्मी वर्मा
वरिष्ठ प्रिंसिपल वैज्ञानिक तथा प्रधान

डॉ के वी राधाकृष्णन
प्रिंसिपल वैज्ञानिक

डॉ सी एच सुरेश
प्रिंसिपल वैज्ञानिक

डॉ के एन नारायणन उष्णि
प्रिंसिपल वैज्ञानिक

डॉ कौस्ताभ कुमार मैती
वरिष्ठ वैज्ञानिक

डॉ बिश्वप्रिया देव
वरिष्ठ वैज्ञानिक

डॉ करुणाकरन वेणुगोपाल
वरिष्ठ वैज्ञानिक

डॉ. सुनिल वर्गास
वरिष्ठ वैज्ञानिक

डॉ यूसुफ करुवात
वैज्ञानिक

डॉ एल. रविशंकर
वैज्ञानिक

डॉ जोशी जोसफ
वैज्ञानिक

डॉ बी एस शशिधर
वैज्ञानिक

डॉ सी विजयकुमार
वैज्ञानिक

डॉ (श्रीमती) जे डी सुधा
प्रिंसिपल तकनीकी अधिकारी

श्रीमती सौमिनी मैथ्यू
वरिष्ठ तकनीकी अधिकारी (1)

श्री रोबर्ट फिलिप
वरिष्ठ तकनीकी अधिकारी (1)

श्रीमती एस विजी
वरिष्ठ तकनीकी अधिकारी (1)

श्री किरन मोहन
तकनीकी अधिकारी

पदार्थ विज्ञान तथा प्रौद्योगिकी प्रभाग

डॉ पी प्रभाकर राव
मुख्य वैज्ञानिक तथा प्रधान

डॉ के हरिकृष्ण भट्ट
मुख्य वैज्ञानिक

डॉ मनोज रामावर्मा
वरिष्ठ प्रिंसिपल वैज्ञानिक

डॉ एम रवि
वरिष्ठ प्रिंसिपल वैज्ञानिक

डॉ एस अनन्तकुमार
वरिष्ठ प्रिंसिपल वैज्ञानिक

डॉ टी पी डी राजन
प्रिंसिपल वैज्ञानिक

डॉ एस वी शुक्ला
वरिष्ठ वैज्ञानिक

डॉ यु एस हरीश
वरिष्ठ वैज्ञानिक

डॉ ई भोजे गौड
वरिष्ठ वैज्ञानिक

डॉ ए श्रीनिवासन
वरिष्ठ वैज्ञानिक

डॉ एम सुन्दराराजन
वरिष्ठ वैज्ञानिक

डॉ. के. जयशंकर
व. वैज्ञानिक

डॉ. सुब्रता दास
व. वैज्ञानिक

डॉ के पी सुरेन्द्रन
वैज्ञानिक

डॉ सजु पिल्लै
वैज्ञानिक

डॉ (श्रीमती) एम वसुंधरा
वैज्ञानिक

डॉ के.जी.निशांत
वैज्ञानिक

डॉ. एस.एस. श्रीजाकुमारी
वैज्ञानिक

डॉ वी एस प्रसाद
प्रिंसिपल तकनीकी अधिकारी

श्री एम ब्रह्मकुमार
प्रिंसिपल तकनीकी अधिकारी

श्री ए पीर मोहम्मद
वरिष्ठ तकनीकी अधिकारी (2)

डॉ. एस. रामस्वामी
वरिष्ठ तकनीकी अधिकारी (1)

श्री वी. हरीश राज
तकनीकी अधिकारी

श्री एम.पी.वर्का
प्रयोगशाला सहायक

पर्यावरण प्रौद्योगिकी प्रभाग

डॉ (श्रीमती) एलिजबेथ जेकब
मुख्य वैज्ञानिक तथा प्रधान

डॉ अजित हरिदास
मुख्य वैज्ञानिक

डॉ (श्रीमती) एस सावित्रि
वरिष्ठ प्रिंसिपल वैज्ञानिक

डॉ. जे अंसारी
वरिष्ठ प्रिंसिपल वैज्ञानिक

डॉ बी कृष्णकुमार
वरिष्ठ वैज्ञानिक

श्री बी अब्दुल हलीम
वैज्ञानिक

डॉ के पी प्रतीश
वैज्ञानिक
श्रीमती विजयाप्रसाद
वरिष्ठ तकनीकी अधिकारी (3)
श्री वी के पाजिकुमार
वरिष्ठ तकनीकी अधिकारी (1)
श्री जोशी जोर्ज
वरिष्ठ तकनीकी अधिकारी (1)
श्रीमती पी एम सहरूबा
तकनीकी अधिकारी
श्री टी पी पौलोस
वरिष्ठ तकनीशियन (3)

एस एंड टी सेवा प्रभाग इंजीनियरिंग एवं सेवा प्रभाग

डॉ जे अंसारी
वरिष्ठ प्रिंसिपल वैज्ञानिक तथा प्रधान
श्री आर राजीव
वरिष्ठ अधीक्षण अभियंता
श्री जी चन्द्रबाबु
अधीक्षण अभियंता
श्री चन्द्रशेखर नीलम
सहायक कार्यपालक अभियंता
श्री बी कार्तिक
सहायक अभियंता (सिविल)
श्री पी अरुमुगम
सहायक अभियंता (सिविल)
श्री एस. हरिदासन पिल्लै
व. तकनीशियन (1)
श्री एम जयदीप
तकनीशियन (2)
श्री के एस प्रमोद
तकनीशियन (2)
श्री के सुरेश कण्णन
तकनीशियन (2)
श्री यु धरणीपति
तकनीशियन (2)
श्री बी.राधाकृष्णन
तकनीशियन (2)
श्री टी वी सतीश
ग्रुप सी गैर तक. (एमएसीपी)

नॉल्लिज रिसोर्स सेंटर

डॉ.(श्रीमती) पी निशा
वरिष्ठ प्रिंसिपल वैज्ञानिक तथा प्रधान
श्री वी मणी
वैज्ञानिक
श्री एस वी रिबिन जोन्स
वैज्ञानिक
श्री एम रामसामि पिल्लै
प्रिंसिपल तकनीकी अधिकारी
श्री एस पुष्कन
तकनीकी अधिकारी
श्री पी एन शिवनकुट्टि नायर
वरिष्ठ तकनीशियन (2)

श्री जी नागश्रीनिवासु
वरिष्ठ तकनीशियन (2)
श्री पुष्पाकुमार के आर नायर
ग्रुप सी गैर तक. (एमएसीपी)

अनुसंधान योजना तथा व्यवसाय विकास

डॉ सी चन्द्रशेखरा भट्ट
वरिष्ठ प्रिंसिपल वैज्ञानिक तथा प्रधान
श्री सी के चन्द्रकान्त
प्रिंसिपल वैज्ञानिक
श्री आर एस प्रवीण राज
वरिष्ठ वैज्ञानिक
डॉ दीपा बालन
वैज्ञानिक
श्री बी वेणुगोपाल
वरिष्ठ तकनीशियन (2)

प्रशासन

श्रीमती एस शोभना
प्रशासन अधिकारी
श्री के एफ जोसफ
अनुभाग अधिकारी(सा)
श्री एम के शिवदासन
अनुभाग अधिकारी(सा)
श्री टी जे बाबु
वरिष्ठ सुरक्षा अधिकारी
श्रीमती के एस लतीदेवी
हिन्दी अधिकारी
डॉ. सादत सलीम
चिकित्सा अधिकारी
श्री के पी कृष्णन
सहायक अनुभाग अधिकारी
श्रीमती मेर्सी जोसफ
सहायक अनुभाग अधिकारी
सुश्री टी एस लता
सहायक अनुभाग अधिकारी
सुश्री नीतू इंदुचूडन
सहायक अनुभाग अधिकारी
श्रीमती पी.एस. पद्मिनी
वरिष्ठ आशुलिपिक (एमएसीपी)
श्री ओ.वी.शशिकुमार
वरिष्ठ आशुलिपिक (एमएसीपी)
श्री आर के रमेशकुमार
व. सचिवालय सहायक
श्री बी सतीशकुमार
क. सचिवालय सहायक
सुश्री सजिता ए.एल
क. सचिवालय सहायक
सुश्री टी.एम. अश्वती
क. सचिवालय सहायक
श्री प्रवीण कन्नाल
व. तकनीशियन (1)
श्री टी एच बशीर
वरिष्ठ तकनीशियन (2)

श्रीमती शाना एस. नायर
स्टाफ नर्स
श्रीमती एम गीता
प्रयोगशाला सहायक
श्री के उष्णिक्कृष्णन
ग्रुप सी गैर तकनीकी (एमएसीपी)
श्री के मधु
बेयरर (एमएसीपी)
श्री ए श्रीकुमारन
वाशबॉय (एमएसीपी)

वित्त एवं लेखा

श्री डी पी मारेट
वित्त एवं लेखा अधिकारी
श्रीमती पी वी विजि
अनुभाग अधिकारी (वित्त एवं लेखा)
श्रीमती रमणी देवराज
अनुभाग अधिकारी (वित्त एवं लेखा)
श्रीमती जी.गीता
सहायक अनुभाग अधिकारी
श्री संजीव सदानन्दन
सहायक अनुभाग अधिकारी
श्रीमती कोमला सोमन
सहायक अनुभाग अधिकारी
श्री विष्णु वी एल
कनिष्ठ आशुलिपिक
श्री पी रजित
मल्टी टास्किंग स्टाफ

भण्डार एवं क्रय

श्री दुलीप कुमार
भण्डार एवं क्रय नियंत्रक
श्री सी एम कृष्णदास
सहायक अनुभाग अधिकारी
श्री एम अनिलकुमार
सहायक अनुभाग अधिकारी
श्री एस राजु
वरिष्ठ आशुलिपिक (एमएसीपी)
सुश्री शीवा सैतू
क. सचिवालय सहायक
श्रीमती एल लता
वरिष्ठ तकनीशियन (2)
श्री वी अजयकुमार
वरिष्ठ तकनीशियन (2)
श्री टी आर सुरेश कुमार
वरिष्ठ तकनीशियन (2)
श्री टी के घोष
ग्रुप सी गैर तकनीकी (एमएसीपी)
श्री जी भक्तवल्सलम
ग्रुप सी गैर तकनीकी



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Director

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Mr Vishnu Gurjar
Junior Stenographer

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Chief Scientist & Advisor to Director
Dr K G Raghu
Principal Scientist
Mr V V Venugopalan
Principal Scientist
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Senior Scientist
Dr (Mrs) P Nisha
Scientist
Dr P Jayamurthy
Scientist
Dr (Mrs) S Priya
Scientist
Dr (Mrs) Beena Joy
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Mr D R Soban Kumar
Senior Technical Officer (1)

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Senior Scientist
Dr P Binod
Scientist
Dr N Ramesh Kumar
Scientist
Dr Muthu Arumugam
Scientist
Mr M Kiran Kumar
Scientist
Dr Lakshmi Rakesh Kumar Yasarla
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Principal Scientist
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Principal Scientist
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Senior Scientist
Dr Biswapriya Deb
Senior Scientist
Dr Karunakaran Venugopal
Senior Scientist
Dr Sunil Varughese
Senior Scientist
Dr Yoosaf Karuvath
Scientist
Dr L Ravi Shankar
Scientist
Dr Joshy Joseph
Scientist
Dr B S Sasidhar
Scientist
Dr C Vijayakumar
Scientist
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Mrs Saumini Mathew
Senior Technical Officer (I)
Mr Robert Philip
Senior Technical Officer (I)
Mrs S Viji
Senior Technical Officer (I)
Mr Kiran Mohan
Technical Officer

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Dr K Harikrishna Bhat
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Senior Principal Scientist
Dr S Ananthakumar
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Dr T P D Rajan
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Dr U S Hareesh
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Dr E Bhoje Gowd
Senior Scientist
Dr A Srinivasan
Senior Scientist
Dr M Sundararajan
Senior Scientist
Dr K Jayasankar
Senior Scientist
Dr Subrata Das
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Dr Saju Pillai
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Scientist
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Scientist
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Scientist
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Principal Technical Officer
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Dr Ajit Haridas
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Dr (Mrs) S Savithri
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Senior Scientist
Mr B Abdul Haleem
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Mr Joshy George
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Mr G Chandra Babu
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Mr Chandra Shekar Neelam
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Mr P Arumugam
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Mr K Suresh Kannan
Technician (2)

Mr U Dharanipathy
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Mr B Radhakrishnan
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Mrs Mercy Joseph
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Mrs T S Latha
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Mrs Neethu Induchoodan
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Mr P Rejith
Multi Tasking Staff

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Mr G Bhakthavalsalam
Group C (NT)

घटनाएं और समारोह राष्ट्रीय प्रौद्योगिकी दिवस समारोह -2017



भारत के तकनीकी नवाचारों और उत्कृष्टता के इतिहास को मनाने के लिए हर साल 11 मई को राष्ट्रीय प्रौद्योगिकी दिवस मनाया जाता है। यह दिन इसलिए महत्व रखता है कि वर्ष 1998 को इसी दिन भारत ने पोखरण में परमाणु बमों का सफलतापूर्वक परीक्षण किया था। सीएसआईआर-एनआईआईएसटी में 11 मई, 2017 को राष्ट्रीय प्रौद्योगिकी दिवस मनाया गया। सीएसआईआर-एनआईआईएसटी के निदेशक, डॉ. ए. अजयघोष ने स्वागत भाषण दिया और मुख्य अतिथि प्रो. एम.एम. शर्मा, पूर्व निदेशक, रसायन प्रौद्योगिकी संस्थान, मुंबई का परिचय दिया। प्रो. एम. एम. शर्मा ने “तेजी से आर्थिक विकास को गति प्रदान करने के लिए नवाचार की महत्वपूर्ण भूमिका” पर प्रौद्योगिकी दिवस व्याख्यान दिया। इनोवेशन के महत्व पर जोर देते हुए उन्होंने कहा कि अच्छे विज्ञान से नवीन विचार पैदा किये जा सकते हैं, जिन्हें मानव जाति के लाभ के लिए नवाचारों, प्रौद्योगिकियों में बदला सकता है, और यह सीधे आर्थिक विकास को प्रभावित करता है। बॉल पेन, हेलीकाप्टर, ट्रांजिस्टर, सीडी, डीएनए, टीके, एंटीबायोटिक्स, मोबाइल फोन, एनेस्थेटिक एजेंट जैसी कुछ प्रौद्योगिकियाँ, जिन्होंने व्यापार की बुनियादी बातों को बदल दिया है, का हवाला देते हुए रसायन इंजीनियरिंग के दिग्गज ने व्यक्त किया कि नवाचारों को निर्धारित नहीं किया जा सकता है, जिसका परिपक्व होने के

लिए पर्याप्त समय की आवश्यकता होती है और कई नवाचारों ने इस प्रक्रिया के लिए कई वर्षों का समय लिया है। उन्होंने यह भी बताया कि इनोवेशन प्रबंधन के लिए मुश्किल है और दबाना आसान है और इनोवेटर को अक्सर परेशान किया जाता है क्योंकि रचनात्मकता इंस्टिंक्ट, अनिश्चितता, फ्रीडम और आईकोनोकलाजम पर पनपती है, जबकि प्रबंधन आम सहमति, नियंत्रण, निश्चय, और यथास्थिति की मांग करता है। दुनिया में महान नवाचारों का आधा महान अंतर्दृष्टि से आया है, दूसरा आधा संयोगवश हुआ है और उनमें से कोई भी एक शेड्यूल पर नहीं है और सफल नवाचार के लिए पूर्वानुमान पथ नहीं है। नवाचार को विकसित करने के लिए धैर्य एक अनिवार्य शर्त है। एनआईआईएसटी की उपलब्धियों की सराहना करते हुए प्रो. शर्मा ने जोर दिया कि नवाचार के लिए विज्ञान और इंजीनियरिंग के बीच एक सशक्त रिश्ता आवश्यक है। गलतियाँ आम हैं, न कि लोग या फर्म अक्षम हैं क्योंकि वे लगातार ज्ञान के किनारे पर नाच रहे हैं। विफलता से सीखने की क्षमता महत्वपूर्ण है और भारत में प्रगति करने के लिए नवाचारों को प्रभावित करने वाला एक महत्वपूर्ण कारक विफलताओं के स्वामित्व की कुल कमी है। डॉ. ए. सुन्दरेशन, प्रमुख, आरपीबीडी ने धन्यवाद प्रस्ताव दिया।



प्रौद्योगिकी दिवस समारोह का दृश्य



प्रो. एम.एम. शर्मा, पूर्व निदेशक, रसायनिक प्रौद्योगिकी संस्थान, मुंबई प्रौद्योगिकी दिवस व्याख्यान देते हुए

'कृषि प्रसंस्करण में संभावनाओं' पर कार्यशाला



कृषि विकास एवं किसान कल्याण विभाग के निदेशक श्री बिजू प्रभाकर कार्यशाला का उद्घाटन करते हुए

सीएसआईआर एनआईआईएसटी तिरुवनंतपुरम में 23 मई 2017 "कृषि प्रसंस्करण में संभावनाओं" पर एक दिवसीय आर एंड डी संगोष्ठी का आयोजन किया, जिसका उद्घाटन कृषि विकास एवं किसान कल्याण विभाग के निदेशक श्री बिजू प्रभाकर ने किया। श्री बिजू प्रभाकर ने इस क्षेत्र के उत्पादन के प्राथमिक प्रसंस्करण के नए उद्यमों के दायरे पर जोर दिया और

ऐसी प्रौद्योगिकियों के विकास और लोकप्रियकरण में सीएसआईआर एनआईआईएसटी के प्रयासों की सराहना की। उन्होंने संस्थान द्वारा विकसित प्रशीतन अवशोषण निराद्रीकृत ड्रायर (आरएडीडी) और उसकी अपार क्षमता पर प्रकाश डाला और सूचित किया कि किसानों के लाभ के लिए राज्य सरकार ऐसी 14 इकाइयों को स्थापित करने जा रही है। डॉ. ए. अजयघोष, निदेशक सीएसआईआर- एनआईआईएसटी ने उद्योगों को आश्वासन दिया कि औद्योगिक समस्याओं को सुलझाने में संस्थान अपने प्रयासों पर पुनः फोकस कर रहा है और संस्थान के साथ उपलब्ध विशाल विशेषज्ञता और बुनियादी ढांचे का उपयोग करने के लिए उन्होंने उद्योगों से आग्रह किया। ए.के. फ्लेक्स एंड एरोमैटिक्स, कोचीन, मेसेर्स ब्राह्मणस खाद्य उत्पाद, मेसेर्स पीसीपीसीएल पालक्काड, स्पाइसेस बोर्ड, एफएसएसएआई और किन्फरा से उद्योग प्रतिनिधियों द्वारा प्रस्तुतियां दी गईं। संस्थान में बड़े पैमाने पर प्रौद्योगिकियों का विकास और फिर उसे प्रारंभिक संयंत्र और वाणिज्यिक स्तर पर कैसे विस्तार किया जाता है, पर एक प्रस्तुति भी दी गई। संस्थान द्वारा टर्नकी आधार पर स्थापित किए गए कुछ उद्यमों को भी प्रस्तुति के दौरान हाइलाइट किया गया।

विश्व पर्यावरण दिवस

5 जून, 2017 को सीएसआईआर-एनआईआईएसटी के परिसर में पौधे लगाकर संस्थान में विश्व पर्यावरण दिवस मनाया गया। जेएनटीबीजीआरआई ने औषधीय पौधों और विभिन्न अन्य वृक्ष पौधों को प्रदान किया। विश्व पर्यावरण दिवस में कर्मचारियों और छात्रों को संबोधित करते हुए निदेशक, सीएसआईआर-एनआईआईएसटी ने परिसर में हरियाली के रोपण और रखरखाव के महत्व पर जोर दिया। उन्होंने पौधों को प्रदान करने के लिए जवाहरलाल नेहरू उष्णकटिबंधीय वनस्पति उद्यान अनुसंधान संस्थान (जेएनटीबीजीआरआई) को धन्यवाद दिया। सीएसआईआर-एनआईआईएसटी के कर्मचारियों और छात्रों द्वारा संस्थान परिसर में पौधे लगाये गए। पौधों को सीएसआईआर-एनआईआईएसटी के कर्मचारियों और छात्रों के बीच भी वितरित किया गया।



विश्व पर्यावरण दिवस का दृश्य

जिज्ञासा 2017 - वैज्ञानिक-छात्र कनेक्ट कार्यक्रम

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद (सीएसआईआर) ने केन्द्रीय विद्यालय संगठन (केवीएस) के सहयोग से राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान में एक व्यापक वैज्ञानिक-छात्र कनेक्ट कार्यक्रम लॉन्च किया है। केन्द्रीय विद्यालय की पूर्ण धारा के साथ पूरे देश की सीएसआईआर

प्रयोगशालाओं में आयोजित "जिज्ञासा" कार्यक्रम, 350 केन्द्रीय विद्यालय स्कूलों के लगभग 75,000 छात्रों और 1,000 शिक्षकों को जोड़ने की उम्मीद है। सीएसआईआर-एनआईआईएसटी में 12 - 16 जून 2017 तक एक सप्ताह के लिए " जिज्ञासा " कार्यक्रम आयोजित किया गया,

जिसका उद्घाटन सीएसआईआर-एनआईआईएसटी के निदेशक डॉ. ए. अजयघोष ने किया। तिरुवनंतपुरम शहर के छह केंद्रीय विद्यालयों से लगभग 85 केंद्रीय विद्यालय छात्रों और शिक्षकों ने इस कार्यक्रम में भाग लिया। सीएसआईआर-एनआईआईएसटी में जिज्ञासा का समन्वय डॉ सी एच सुरेश, प्रधान वैज्ञानिक और डॉ आर लक्ष्मी वर्मा, वरिष्ठ प्रधान वैज्ञानिक व प्रमुख, रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग द्वारा किया गया। इस कार्यक्रम में मूल प्रयोगशाला प्रयोग, लोकप्रिय विज्ञान व्याख्यान, विज्ञान प्रश्नोत्तरी, विज्ञान फिल्म, प्रयोगशाला दौरा और वैज्ञानिकों और शोध छात्रों के साथ संपर्क शामिल थे। डॉ मनोज रामावर्मा, डॉ यू. एस. हरीश, डॉ के. के. मैती, डॉ. बी कृष्णकुमार, डॉ. टी.पी.डी. राजन, डॉ. वी. करुणाकरण, डॉ एल. रविशंकर, डॉ. के यूसुफ, डॉ. पी. निशा, और डॉ. पी. बिनोद सहित वैज्ञानिकों ने इस कार्यक्रम में भाग लिया।

विज्ञान के छात्रों और शिक्षकों के एक बड़े समूह के साथ सीएसआईआर संस्थानों के वैज्ञानिकों और अनुसंधान छात्रों को जोड़ने की अवधारणा देश



16 जून 2017 को सीएसआईआर-एनआईआईएसटी ऑडिटोरियम में 'टीम जिज्ञासा-2017' का समापन समारोह

में विज्ञान शिक्षा के क्षेत्र के लिए बहुत ही प्रेरणादायक है। निश्चित रूप से, कार्यक्रम का सफल और दीर्घकालिक संचालन हमारी शिक्षा प्रणाली में बड़े पैमाने पर सुधार के लिए नेतृत्व करेंगे और यह वैज्ञानिक कैरियर में महत्वाकांक्षी लक्ष्यों को प्राप्त करने के लिए पथ का नेतृत्व करने के लिए छात्रों, शिक्षकों और यहां तक कि माता-पिता को सशक्त बनाएगा।

दुर्लभ पृथ्वी और समुद्र तट रेत खनिजों के उपयोग" पर एक दिवसीय उद्योग - संस्थान कार्यशाला

उन्नत अनुप्रयोगों के लिए अपने महत्व के आधार पर दुर्लभ पृथ्वी और समुद्र तट रेत खनिज भारतीय खनन उद्योगों में एक प्रमुख भूमिका निभा रही है। भारतीय दुर्लभ पृथ्वी संघ (आरईएआई) के संयुक्त तत्वावधान में सीएसआईआर-एनआईआईएसटी ने 27 जून, 2017 को "दुर्लभ पृथ्वी और समुद्र तट रेत खनिज का उपयोग" विषयक एक दिवसीय उद्योग-संस्थान कार्यशाला का आयोजन किया। प्रदूषण की कमी से जुड़ी समस्या सहित खनिज खनन / प्रसंस्करण में नवीनतम घटनाओं पर चर्चा करने के लिए संस्थान के शोधकर्ताओं और खनिज उद्योग के लिए एक आम प्लेटफॉर्म प्रदान करना कार्यशाला का उद्देश्य था। इंडियन रेअर अर्थ्स लिमिटेड के अध्यक्ष व प्रबंध निदेशक (आईआरईएल) तथा आरईएआई के अध्यक्ष श्री डी. सिंह ने कार्यशाला का उद्घाटन किया। उन्होंने शोधकर्ताओं और खनिज उद्योगों से स्थानांतरणीय अनुसंधान के लिए आम हित के क्षेत्रों की पहचान के लिए अनुरोध किया। सीएसआईआर-एनआईआईएसटी के निदेशक डॉ. ए. अजयघोष ने अपने अध्यक्षीय संबोधन में वैज्ञानिक तथा तकनीकी हस्तक्षेप आवश्यक उद्योगों के मुद्दों के लिए अनुसंधान संस्थानों के साथ सहयोग करने के लिए खनिज उद्योगों को आमंत्रित किया। सीएसआईआर-एनआईआईएसटी के पूर्व निदेशक डॉ ए. डी. दामोदरन ने सीएसआईआर-एनआईआईएसटी में खनिज गतिविधियों के विकास की गाथा और कई प्रारंभिक संयंत्र परीक्षणों के माध्यम से प्रयोगशाला से उद्योगों तक उनके



डॉ. ए. डी. दामोदरन, पूर्व निदेशक, सीएसआईआर-एनआईआईएसटी विशेष व्याख्यान देते हुए

स्थानांतरण पर विशेष व्याख्यान दिया। डॉ एम एल पी रेड्डी, सचिव, आरईएआई तथा मुख्य वैज्ञानिक (सेवानिवृत्त) सीएसआईआर-एनआईआईएसटी ने सभा का स्वागत किया। कार्यशाला का संयोजक डॉ. के. हरिकृष्णा भट्ट ने धन्यवाद प्रस्ताव दिया। श्री आंटनी फ्रांसिस, केरल मिनरल्स एंड मेटल्स लिमिटेड, (केएमएमएल), श्री सी. स्वामीदास, वी वी मिनरल्स और डॉ. के. जॉन्सन, त्रावणकोर टाइटैनियम प्रोडक्ट्स लिमिटेड (टीटीपीएल) ने आमंत्रित व्याख्यान दिया। डॉ. के. हरिकृष्णा भट्ट, सीएसआईआर-एनआईआईएसटी ने समुद्र तट रेत खनन, टाइटैनियम पिगमेंट का उत्पादन और सिंथेटिक रूटाइल की तैयारी से जुड़े मुद्दों पर व्याख्यान दिया। कार्यशाला में सीएसआईआर-एनआईआईएसटी, वीएसएससी और आईआरईएल के वैज्ञानिकों ने भाग लिया।

हिंदी सप्ताह - 2017 का आयोजन

संस्थान में 11-14 सितंबर 2017 के दौरान हिंदी सप्ताह मनाया गया। दिनांक 11 सितंबर को सुबह 10.00 बजे हिंदी सप्ताह का औपचारिक उद्घाटन समारोह आयोजित किया गया।

आयोजन समिति के अध्यक्ष डॉ. पी. प्रभाकर राव ने समारोह में उपस्थित सभी का स्वागत किया। उन्होंने अपने स्वागत भाषण में केंद्र सरकार कार्यालयों में हिंदी दिवस और हिंदी सप्ताह के आयोजन की प्रासंगिकता पर संक्षिप्त



डॉ. पी. प्रभाकर राव, अध्यक्ष, आयोजन समिति, प्रतिभागियों का स्वागत करते हुये



संस्थान निदेशक डॉ. ए. अजयघोष उद्घाटन सत्र में अध्यक्षीय भाषण देते हुये

जानकारी प्रस्तुत की और प्रतिभागियों से यह आग्रह किया कि वे अपने कार्यालयीन कार्यों में राजभाषा हिंदी का अधिकाधिक प्रयोग करते हुये सरकार की राजभाषा नीति के कार्यान्वयन में सर्वोत्तम योगदान करें। डॉ. ए. अजयघोष, निदेशक, सीएसआईआर-एनआईआईएसटी ने उद्घाटन सत्र की अध्यक्षता की। उन्होंने अपने अध्यक्षीय भाषण में बताया कि हिंदी एक समृद्ध भाषा है और यह भारत की राष्ट्रीय तथा सांस्कृतिक एकता की कड़ी है। जहाँ तक सरकारी कामकाज में इसके प्रयोग का संबंध है, हमें अपने मन में ऐसा निश्चय करना होगा और अपना कर्तव्य मानना होगा कि सरकारी कामकाज में इसके प्रयोग के लिए किसी संकल्प की आवश्यकता न पड़े। आज भारत एक विश्व शक्ति के रूप में उभरा है। हमें राजभाषा हिंदी को ज्ञान-विज्ञान, सूचना प्रौद्योगिकी जैसे क्षेत्रों से जोड़कर इन क्षेत्रों के लाभ को जन-जन तक पहुँचाना चाहिए। उन्होंने प्रतिभागियों से यह आग्रह किया कि छोटा-मोटा सरकारी कामकाज मूल रूप में हिंदी में करने के लिए प्रयास करें और राजभाषा नीति संबंधी अपेक्षाओं को पूरा करते हुए अपना सरकारी कामकाज अधिक से अधिक हिंदी में करने का दृढ़ संकल्प लें। उन्होंने हिंदी दिवस/हिंदी सप्ताह के आयोजन से जुड़े सभी अधिकारी व कर्मचारी गण को बधाई दी और राजभाषा हिंदी के प्रचार-प्रसार के लिए सभी के योगदान और प्रयासों की प्रशंसा की और बाद में वर्ष 2017 के हिंदी सप्ताह समारोह के औपचारिक उद्घाटन की घोषणा की।

उद्घाटन के तुरंत बाद संस्थान के भंडार व क्रय नियंत्रक श्री दुलीप कुमार ने "तनाव प्रबंधन" पर प्रस्तुति दी। अपनी प्रस्तुति में उन्होंने तनाव क्या है, तनाव के विभिन्न चरण, तनाव को कैसे प्रबंधित किया जा सकता है और तनाव रहित होने के लिये सरलतम, सबसे सस्ती उपलब्ध तकनीकों पर प्रतिभागियों को जानकारी दी। उन्होंने जीवन और इसकी समस्याओं को एक मौके के रूप में मान लेने के लिए प्रतिभागियों से आग्रह किया। दूसरा पावर पॉइंट प्रस्तुतीकरण का विषय था- "दैनिक जीवन में उपयोगी पॉलिमरों"। संस्थान में रामनुजन फैलो डॉ. संजीब बनर्जी ने अपनी प्रस्तुति में दैनिक जीवन में महत्वपूर्ण कुछ पॉलिमर, उनकी रासायनिक संरचना और मानव स्वास्थ्य पर उनके प्रभाव पर विस्तार से बताया। प्रस्तुतीकरण के दोनों विषय वर्तमान परिप्रेक्ष्य में अत्यंत महत्वपूर्ण होने के कारण सभी प्रतिभागियों ने इसका पूरा फायदा उठाया और वक्ताओं की खूब प्रशंसा की। श्रीमती एस. शोभना, प्रशासन अधिकारी ने धन्यवाद ज्ञापित किया। इसके पश्चात पूरे सप्ताह के दौरान परियोजना स्टाफ, अनुसंधान छात्र आदि सहित संस्थान के संपूर्ण स्टाफ सदस्यों निम्नलिखित प्रतियोगिताएं आयोजित की गयीं।

- 1) हिंदी ऑनलाइन प्रश्नोत्तरी (11 सितंबर से 13 सितंबर तक)
- 2) हिंदी प्रश्नोत्तरी (12 सितंबर 2017)
- 3) हिंदी अंताक्षरी (13 सितंबर 2017)
- 4) हिंदी वाद-विवाद (14 सितंबर 2017)

14 सितंबर 2017 को हिंदी दिवस के रूप में मनाया गया और समापन समारोह व पुरस्कार वितरण उसी दिन शाम 4.00 बजे आयोजित किया गया। डॉ. पी. प्रभाकर राव, अध्यक्ष, हिंदी सप्ताह आयोजन समिति ने समारोह की अध्यक्षता की। डॉ. एस.आर. जयश्री, सहायक प्रोफेसर, हिंदी विभाग, एम जी कॉलेज, तिरुवनंतपुरम समारोह में मुख्य अतिथि थी। डॉ.पी. निशी, प्रमुख, केआरसी तथा सदस्य, आयोजन समिति ने स्वागत भाषण दिया और समारोह में उपस्थित सभी को मुख्य अतिथि का परिचय दिया। मुख्य अतिथि ने अपने भाषण में हिंदी को राजभाषा एवं राष्ट्रभाषा बनाने का औचित्य और राजभाषा की उत्तरोत्तर प्रगति में सरकारी कर्मचारियों की भूमिका पर अत्यंत रोचक व्याख्यान दिया। निदेशक-प्रभारी डॉ. ए. सुन्दरेशन ने विभिन्न प्रतियोगिताओं के सफल भागीदारों को पुरस्कार वितरित किये।



श्री दुलीप कुमार, भंडार व क्रय नियंत्रक "तनाव प्रबंधन" पर अपनी प्रस्तुति देते हुये



डॉ. संजीब बनर्जी "दैनिक जीवन में उपयोगी पॉलिमरों" पर अपनी प्रस्तुति देते हुये

सीएसआईआर-एनआईआईएसटी साइंस आउटरीच प्रोग्राम

सीएसआईआर- राष्ट्रीय अंतरविषयी विज्ञान तथा प्रौद्योगिकी संस्थान, तिरुवनंतपुरम ने विभा (विज्ञान भारती) के साथ मिलकर विज्ञान तथा प्रौद्योगिकी मंत्रालय और पृथ्वी विज्ञान मंत्रालय द्वारा संयुक्त रूप से आयोजित तीसरे भारत अंतर्राष्ट्रीय विज्ञान महोत्सव (आईआईएसएफ-2017) की एक अग्रदूत घटना के रूप में छात्रों और जनता के लिए 18 सितंबर, 2017 को एक दिवसीय साइंस आउटरीच कार्यक्रम का आयोजन किया। आउटरीच प्रोग्राम का लक्ष्य सीएसआईआर- एनआईआईएसटी की आर एंड डी गतिविधियों के बारे में जनता के बीच जागरूकता पैदा करना और युवा दिमाग में एक वैज्ञानिक मनोदशा जगाना है, क्योंकि किसी भी चरण में, हमारे राष्ट्र का विकास, विज्ञान और नवाचार की उन्नति के साथ जुड़ा हुआ है।

साइंस आउटरीच कार्यक्रम का उद्घाटन प्रो. के. गिरीश कुमार, प्रोफेसर, कोचीन विज्ञान तथा प्रौद्योगिकी विश्वविद्यालय, कोच्चि द्वारा किया गया। अपने उद्घाटन भाषण में उन्होंने प्रभावी संचार और विज्ञान की लोकप्रियता के महत्व को हाइलाइट किया। विज्ञान प्रकाशन आम आदमी के लिए सरल

और समझने में आसान होना चाहिए। अध्यक्षीय संबोधन में, सीएसआईआर- एनआईआईएसटी के निदेशक, डॉ. ए. अजयघोष ने मानव जीवन में विज्ञान के महत्व के बारे में जनता को जागरूक बनाने की जरूरत पर बल दिया। हालांकि कई बार विज्ञान एक बैकसीट लेता है, मानव जाति के विकास के लिए यह अभिन्न और अनिवार्य है।

लोकप्रिय विज्ञान व्याख्यान, वैज्ञानिकों के साथ छात्रों का इंटरैक्शन, प्रयोगशाला दौरा, प्रौद्योगिकियों की प्रदर्शनी आदि शामिल कार्यक्रम में स्कूल और कॉलेजों से लगभग 150 छात्रों और शिक्षकों ने भाग लिया। डॉ. यू.एस. हरीश, वरिष्ठ वैज्ञानिक, सीएसआईआर-एनआईआईएसटी ने "सामग्री विज्ञान में लोकप्रिय प्रगति: कुछ प्रकरण अध्ययन" पर बात की और डॉ. बी. कृष्णकुमार, वरिष्ठ वैज्ञानिक, सीएसआईआर-एनआईआईएसटी ने "अपशिष्ट संसाधन कारखानों" पर बात की। कार्यक्रम में सीएसआईआर- एनआईआईएसटी की विभिन्न गतिविधियों पर एक वीडियो शो भी शामिल था।

कार्यात्मक रंजकों और उन्नत सामग्रियों पर (ईएस 8) 8 वीं पूर्व एशिया संगोष्ठी

सीएसआईआर-एनआईआईएसटी, तिरुवनंतपुरम में 20-22 सितंबर 2017 के दौरान कार्यात्मक रंजकों और उन्नत सामग्रियों पर (ईएस 8) 8 वीं पूर्व एशिया संगोष्ठी आयोजित की गई। ईएस 8 द्विवार्षिक सम्मेलन की श्रृंखला के अंतर्गत आती है, जो पूर्व में जापान (2003, 2009, 2015), ताइपेई (2005), कोरिया (2007), और चीन (2011, 2013) में आयोजित की गयी थी और सीएसआईआर के प्लैटिनम जयंती समारोह के भाग के रूप में पहली बार यह भारत में आयोजित की गयी। नूतन रंजकों और स्याही के विकास पर सीएसआईआर-एनआईआईएसटी लगातार लगे हुए है और ईएस 8 ने युवा शोधकर्ताओं, छात्रों और उद्यमियों के बीच सफल बातचीत के लिए एक उत्कृष्ट मंच प्रदान किया। ईएस 8 में सर्वोच्च वैज्ञानिक क्षमता के तीन दिन के रोमांचक और प्रेरक कार्यक्रम शामिल थे। भारत, जापान, कोरिया, सिंगापुर, ऑस्ट्रेलिया, ताइवान और स्विट्जरलैंड, से लगभग 300 प्रतिभागियों के साथ पूर्व एशियाई देशों के बाहर पहली बार मेजबानी की यह संगोष्ठी अपनी श्रृंखला में सबसे बड़े आयोजनों में से एक थी। 19 सितंबर, 2017 को, "अपने अनुसंधान को प्रभावी ढंग से कैसे संप्रेषण कर सकता है- मैनुस्क्रिप्ट लेखन से शुरू होकर स्वीकृति एवं प्रमोशन" विषय पर छात्रों के लिए एक पूर्व-संगोष्ठी कार्यशाला के माध्यम से संगोष्ठी का शुभारंभ हुआ। अमेरिकी केमिकल सोसाइटी ने इस कार्यशाला का संचालन किया और 80 से अधिक छात्रों ने कार्यशाला में सक्रिय रूप से भाग लिया। डॉ. आर लक्ष्मी वर्मा, प्रमुख, सीएसटीडी और अध्यक्ष, एपीसी ने सभा का स्वागत किया और



पूर्व-संगोष्ठी कार्यशाला (ईएस 8- 2017) सितंबर 19, 2017

सीएसआईआर-एनआईआईएसटी के निदेशक डॉ. ए. अजयघोष ने इस कार्यशाला का उद्घाटन किया। डॉ. वर्मा ने अपने स्वागत भाषण के दौरान बताया कि किसी भी वैज्ञानिक संप्रेषण का उद्देश्य नए वैज्ञानिक ज्ञान को सही और स्पष्ट रूप से फैलाना और संप्रेषण करना है। उद्घाटन संबोधन में, डॉ. अजयघोष ने "प्रभावी वैज्ञानिक संप्रेषण की कला" का महत्व बताया, जिसे दो घंटे के इंटरैक्टिव सत्र के दौरान डॉ. दीक्षा गुप्ता (प्रबंध संपादक, एसीएस ओमेगा) और उनकी टीम ने विस्तार से बताया। सभी उपस्थित छात्रों को भागीदारी प्रमाणपत्र दिया गया।

20 सितंबर 2017 को एक रंगीन उद्घाटन समारोह के साथ संगोष्ठी शुरू हुई। डॉ. अजयघोष के स्वागत संबोधन के साथ संगोष्ठी शुरू हुई और डॉ. सुरेश दास (कार्यकारी उपाध्यक्ष, केएससीएसटीई, केरल सरकार) ने समारोह की अध्यक्षता की। प्रो. हिरोयुकी नाकाजुमी (ओसाका प्रीफेक्चर यूनिवर्सिटी, जापान) ने संगोष्ठी के संदर्भ और परिसंचरण के आयामों पर विस्तार से बताया। तीन सहोदर संस्थानों के निदेशक – डॉ. एस.चंद्रशेखर (निदेशक, सीएसआईआर-आईआईसीटी, हैदराबाद), डॉ. विजयमोहनन के. पिल्लै (निदेशक, सीएसआईआर-सीईसीआरआई, काँकडुडी) और डॉ. बी. चंद्रशेखरन (निदेशक, सीएसआईआर-सीएलआरआई, चेन्नई) सम्माननीय अतिथि थे। डॉ. एस चंद्रशेखर ने उद्घाटन भाषण दिया और डॉ. पिल्लै और डॉ. चंद्रशेखरन ने सार पुस्तक का लोकार्पण किया। डॉ. के. एन. नारायणन उष्ण (सीएसआईआर-एनआईआईएसटी, तिरुवनंतपुरम और संयोजक, ईएएस 8) के धन्यवाद ज्ञापन के साथ उद्घाटन समारोह संपन्न हुआ। प्रो. जी डी यादव (उप-कुलपति और आर टी मोदी प्रतिष्ठित प्रोफेसर, आईसीटी, मुंबई) द्वारा प्रारंभिक पूर्ण व्याख्यान दिया गया और डॉ. सुरेश दास ने सत्र की अध्यक्षता की। प्रो. यादव ने अपने व्याख्यान में ठोस एसिड / बेस उत्प्रेरक का उपयोग करके बायोमास से व्युत्पन्न कार्यात्मक सामग्री के क्षेत्र में हुई प्रगति के बारे में विस्तार से चर्चा की। व्याख्यान में सस्ते और अक्षय पर्यावरण अनुकूल स्रोतों से मूल्य वर्धित उत्पादों की प्राप्ति के लिए हरे और टिकाऊ रसायन शास्त्र के महत्व पर बल दिया। संगोष्ठी में विभिन्न प्रायोजकों और विक्रेताओं द्वारा विशेष रूप से प्रदर्शित प्रदर्शनी स्टाल थे और डॉ. बी चंद्रशेखरन ने इसका उद्घाटन किया। तकनीकी कार्यक्रम में छात्रों के लिए दो पोस्टर सत्र और फ्लैश टॉक सत्र के साथ 6 पूर्ण व्याख्यान, 16 आमंत्रित व्याख्यान, 6 युवा वैज्ञानिक व्याख्यान और उद्योगों से 4 आमंत्रित व्याख्यान शामिल थे। संगोष्ठी के पहले दो दिनों में छात्र प्रतिभागियों द्वारा कुल मिलाकर 130 पोस्टर प्रस्तुत किए गए। सात सर्वश्रेष्ठ पोस्टर को एसीएस ओमेगा सर्वश्रेष्ठ

पोस्टर पुरस्कार (3 पुरस्कार) और ईएएस 8 सर्वश्रेष्ठ पोस्टर पुरस्कार (4 पुरस्कार) के लिए चयन किया गया। तीन सर्वोत्तम फ्लैश टॉक प्रस्तुतकर्ता को आरएससी बेस्ट टॉक अवार्ड दिया गया। संगोष्ठी के समापन सत्र के दौरान पुरस्कार विजेताओं को पुरस्कार प्रदान किए गए। डॉ. डेर-गन चो ने घोषणा की कि ईएएस श्रृंखला में 9वें संगोष्ठी वर्ष 2019 में ताइवान में आयोजित की जाएगी। संगोष्ठी के अध्यक्षों की (डॉ. अजयघोष और प्रो. नाकाजुमी) समापन टिप्पणियों के बाद सम्मेलन का समापन हुआ। डॉ. विजयकुमार सी नायर (सह-संयोजक, ईएएस 8, सीएसआईआर-एनआईआईएसटी, तिरुवनंतपुरम) ने धन्यवाद ज्ञापन दिया।

सीएसआईआर स्थापना दिवस

सीएसआईआर-एनआईआईएसटी में 26 सितंबर, 2017 को सीएसआईआर स्थापना दिवस मनाया गया। डॉ. ए. सुन्दरेशन, मुख्य वैज्ञानिक तथा प्रमुख, आरपीबीडी, सीएसआईआर-एनआईआईएसटी ने स्वागत भाषण दिया और सभा को मुख्य अतिथि का परिचय दिया। मुख्य अतिथि डॉ. एन. पूर्णचंद्र राव, निदेशक, नेशनल सेंटर फॉर अर्थ साइंस स्टडीज, तिरुवनंतपुरम ने "भारतीय उपमहाद्वीप में भूकंप और सुनामी - हम कैसे तैयार हैं?" विषय पर सीएसआईआर स्थापना दिवस व्याख्यान दिया।

उन्होंने अपने भाषण में भूकंप और सुनामी कैसे होती है और उसका प्रमुख कारण क्या है आदि के बारे में बताया। उन्होंने भारत में भूकंप प्रवण क्षेत्रों को चित्रित किया और भूकंप और सुनामी होने पर हमें क्या-क्या सामान्य चेतावनी संकेत मिलते हैं, के बारे में बताया तथा सुनामी घटनाओं की भविष्यवाणी के तरीकों के बारे में और प्रमुख कारणों को किस प्रकार कम किया जा सकता है, का वर्णन किया। उन्होंने कहा कि दिसंबर 2004 के सुनामी के बाद, भारत ने सुनामी चेतावनी प्रणाली की स्थापना और उनकी निगरानी में प्रमुख कदम उठाए हैं। डॉ. लक्ष्मी वर्मा, अध्यक्ष, अकादमिक कार्यक्रम समिति ने धन्यवाद प्रस्ताव दिया। खुले दिन के भाग के रूप में विभिन्न शैक्षिक संस्थानों से लगभग तीन सौ छात्र ने सीएसआईआर-एनआईआईएसटी का दौरा किया।



एनआईआईएसटी स्थापना दिवस- 2017



6 अक्टूबर, 2017 को सीएसआईआर-एनआईआईएसटी में एनआईआईएसटी स्थापना दिवस मनाया गया। संस्थान निदेशक डॉ ए अजयघोष ने स्वागत भाषण दिया और मुख्य अतिथि का परिचय दिया। मुख्य अतिथि डॉ कुचेरिया पी इसहाक, उप कुलपति, एपीजे अब्दुल कलाम तकनीकी विश्वविद्यालय, तिरुवनंतपुरम ने स्थापना दिवस व्याख्यान दिया। उन्होंने अपने भाषण में राज्य में उच्च शिक्षा की गुणवत्ता को बढ़ाने



की आवश्यकता पर बल दिया। मुख्य अतिथि द्वारा सीएसआईआर-एनआईआईएसटी की वर्ष 2016-17 की वार्षिक रिपोर्ट जारी की और डॉ ए सुन्दरेशन, मुख्य वैज्ञानिक और प्रमुख, आरपीबीडी, सीएसआईआर-एनआईआईएसटी ने उसकी पहली प्रति प्राप्त की। डॉ लक्ष्मी वर्मा, अध्यक्ष, अकादमिक कार्यक्रम समिति ने धन्यवाद प्रस्ताव दिया।

सतर्कता सप्ताह- 2017

संस्थान में सतर्कता जागरूकता सप्ताह-2017 का आयोजन 30 अक्टूबर, 2017 को सतर्कता शपथ ग्रहण के साथ शुरू हुआ। उद्घाटन समारोह में स्टाफ सदस्यों को संबोधित करते हुए निदेशक ने इस साल का विषय "मेरा लक्ष्य-भ्रष्टाचार मुक्त भारत" के संबंध में और सप्ताह लंबे आयोजन के दौरान होने वाली गतिविधियों के बारे में जानकारी दी। उन्होंने स्टाफ सदस्यों को हिंदी और अंग्रेजी दोनों भाषा में शपथ दिलायी और सभी से सीवीसी की साइट पर जाकर ई-प्रतिज्ञा लेने की भी सलाह दी। कर्मचारियों और शोध छात्रों के बीच सतर्कता के बारे में जागरूकता पैदा करने के लिए 31 अक्टूबर को टीए / डीए / एलटीसी, आचरण नियमावली, क्या करें और क्या न करें आदि पर कार्यशाला आयोजित की गयी और इसके बाद उक्त विषयों पर एक प्रश्नोत्तरी भी आयोजित की गयी।

दिनांक 1 नवंबर को "विकासात्मक गतिविधियों के साथ भ्रष्टाचार सह-मौजूदा है?" विषय पर स्टाफ सदस्यों और छात्रों के लिए अलग से वाग्मिता प्रतियोगिता आयोजित की गयी।

दिनांक 3 नवंबर को इस वर्ष का विषय- "मेरा लक्ष्य- भ्रष्टाचार मुक्त भारत पर" पैनल चर्चा आयोजित की गयी। भारत को भ्रष्टाचार से मुक्त करने के लिए पैनल द्वारा प्रस्तुत सुझावों का संक्षेप निम्नानुसार है:-

1. डिजिटली सक्षम शासन से प्रणाली की पारदर्शिता में सुधार लाने में मदद मिली है, जिसकी वजह से सरकार के सार्वजनिक विभागों में भ्रष्टाचार को कम करने में मदद मिली है।

2. भ्रष्टाचार के कारणों में से एक है- पूर्ण अधिकार। इसलिए नागरिकों की भागीदारी सुनिश्चित करने के लिए उच्चतम स्तर से स्थानीय परिषद स्तर तक विभिन्न पदानुक्रमित स्तर पर अधिक अधिकार का वितरण भ्रष्टाचार को कम करने में मदद करेगा।
3. राजनीतिक दलों के निधिकरण में पारदर्शिता होनी चाहिए।
4. राजनीतिज्ञ शामिल मामलों को निपटाने के लिए विशेष अदालतों की स्थापना, प्रणाली में भ्रष्टाचार को कम करने के लिए प्रेरित करेगा।
5. भ्रष्टाचार अब समाज में एक संस्कृति की तरह बन गया है। इसलिए इससे छुटकारा पाने के लिए गुणवत्तापूर्ण शिक्षा आवश्यक है।



6. आरटीआई, लोकपाल और लोकायुक्त के कार्यान्वयन का सुदृढीकरण देश को भ्रष्टाचार मुक्त बनने में सहायक होगा ।
7. आम लोगों की बुनियादी जरूरत जैसे भोजन, अस्पताल, शिक्षा आदि सरकारी प्रणाली के माध्यम से करनी चाहिए ताकि ऐसी मूलभूत सुविधा में भ्रष्टाचार को कम किया जा सकता है, जिससे सामान्य जनता को अपनी बुनियादी जरूरतों को पूरा करने के लिए कोई कठिनाई नहीं होगी ।
8. महिलाओं का सशक्तीकरण और दहेज जैसी कई बुरी प्रथाओं को रोकने से भ्रष्टाचार को कम करने में मदद मिलेगी ।
9. कानून का क्रियान्वयन और दोषी को सजा सुनिश्चित करना भ्रष्टाचार को कम करने के लिए आवश्यक है।
10. जागरूक और सतर्क पुलिस प्रणाली (जैसा कि सिंगपुर के मामले में) निश्चित रूप से भ्रष्टाचार को कम करने में मदद करेगी ।

6 नवंबर सुबह को "क्या डिजिटलीकरण के कार्यान्वयन से भ्रष्टाचार कम हो गया है" विषय पर डिबेट का आयोजन किया गया। विषय पर गहरा ज्ञान रखनेवाले पक्ष और विपक्ष ने खूब बहस किया, जिसकी दर्शकों

द्वारा सराहना की गई। दर्शकों को भी विषय पर अपने विचार व्यक्त करने का अवसर दिया गया। कर्मचारियों के बीच तथा इस सप्ताह के दौरान प्रयोगशाला का दौर किये लोगों के बीच सतर्कता और भ्रष्टाचार विरोध के बारे में जागरूकता पैदा करने के लिए विभिन्न स्थानों पर रखी प्रदर्शन प्रणाली के माध्यम से सतर्कता और भ्रष्टाचार विरोध पर नारे और प्रसिद्ध उद्धरण प्रदर्शित किए गए। सभी के लाभ के लिए संस्थान के इंटरनेट पोर्टल पर "भारत को भ्रष्टाचार से कैसे मुक्त करें" पर एक हैंडबुक प्रदर्शित किया गया है। समापन समारोह और विभिन्न प्रतियोगिताओं के विजेताओं को पुरस्कार वितरण 6 नवंबर 2017 को आयोजित किया गया।

डॉ शेक दरवेश साहिब, आईपीएस, अपर पुलिस महानिदेशक, (सतर्कता एवं भ्रष्टाचार-विरोध ब्यूरो) समारोह में मुख्य अतिथि थे। समापन भाषण में, मुख्य अतिथि ने अपने कैरियर में सामना की विभिन्न घटनाओं का हवाला देते हुए, प्रतिभागियों से आग्रह किया कि अपने सभी सरकारी और निजी लेनदेन में ईमानदार रहें और अपनी अगली पीढ़ी के लिए ये आदतें विकसित करें, ताकि हमारे देश को भ्रष्टाचार मुक्त बनाने में हम सफल हो सकें।

स्वच्छता पखवाड़ा

भारत सरकार / सीएसआईआर से प्राप्त अनुदेशों के अनुसार संस्थान ने प्रयोगशाला के अंदर और संस्थान के बाहरी परिसर में व्यापक सफाई गतिविधियों का आयोजन किया। सभी आर एंड डी और गैर-आर एंड डी प्रभागों से साफ-सफाई की गतिविधियों को पूरा करने और अप्रयुक्त/अप्रचलित आइटम / फाइलों को स्वच्छता पखवाड़े के दौरान बाहर

पर प्रश्नोत्तरी प्रतियोगिता आयोजित की गयी। स्टाफ सदस्यों ने सक्रिय रूप से प्रतियोगिता में भाग लिया। सभी प्रशासनिक अनुभागों में पुरानी फाइलों की निराई की और 3 बेकार वाहनों का निपटारा किया गया। प्रयोगशाला और इसके परिसर की गहन सफाई की गई और स्वच्छता पखवाड़े को सच्ची भावना से मनाया गया।



निकालने का अनुरोध किया गया। 1 नवंबर, 2017 को कर्मचारी समूह को स्वच्छता शपथ दिलायी गयी।

सुरक्षा समिति ने 14 नवंबर 2017 को सफाई दिन के रूप में मनाने के लिए सभी वैज्ञानिक विभागों से अनुरोध किया। इसके अनुसार हर प्रभाग ने अपनी अपनी सफाई प्रक्रिया का आयोजन किया।

धूमन और कीट नियंत्रण उपायों को भी किया गया। स्वच्छता पखवाड़े के भाग के रूप में 14 नवंबर, 2017 को "साफ-सफाई और स्वच्छता"



कैंपस में सफाई गतिविधियाँ

उत्तेजित स्थिति में रसायन विज्ञान तथा भौतिकी

रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग की आउटरीच गतिविधियों के भाग के रूप में, 24 नवंबर, 2017 को "उत्तेजित स्थिति में रसायन विज्ञान तथा भौतिकी" पर एक दिवसीय राष्ट्रीय सेमिनार आयोजित किया गया था। सेमिनार में उच्चतम वैज्ञानिक क्षमता को रोमांचक और प्रेरणादायक कार्यक्रम शामिल थे। छात्रों, वैज्ञानिकों और उद्योग प्रतिनिधियों समेत भारत के विभिन्न भागों से लगभग 200 प्रतिभागियों ने संगोष्ठी में भाग लिया और



डॉ. गोपिदास, मुख्य वैज्ञानिक, सीएसटीडी भाषण देते हुए।

संगोष्ठी ने न केवल वैज्ञानिक प्रगति का प्रदर्शन किया बल्कि शोध के इस क्षेत्र में मौजूद अवसरों और चुनौतियों को भी प्रस्तुत किया। लेजर स्पेक्ट्रा सर्विसेज प्राइवेट लिमिटेड, बेंगलुरु द्वारा कार्यक्रम प्रायोजित किया गया था।

डॉ ए अजयघोष, निदेशक - सीएसआईआर-एनआईआईएसटी ने सेमिनार का उद्घाटन किया था, जिन्होंने अपनी प्रारंभिक टिप्पणी में उत्तेजित स्थिति में सामग्रियों के गुणों और प्रतिक्रियाओं पर निरंतर जांच के महत्व पर विस्तार से बताया। डॉ. ए. अजयघोष ने प्रतिष्ठित मेहमानों, वक्ताओं और कार्यक्रम के सभी प्रतिभागियों का स्वागत किया।

तकनीकी कार्यक्रम में कुछ पोस्टर के साथ 8 आमंत्रित व्याख्यान शामिल थे। संगोष्ठी का समापन सत्र, डॉ ए अजयघोष (निदेशक, सीएसआईआर-एनआईआईएसटी) की अध्यक्षता में हुआ और यह सत्र डॉ के. आर. गोपिदास (मुख्य वैज्ञानिक, सीएसआईआर-एनआईआईएसटी, तिरुवनंतपुरम) के सम्मान में समर्पित था, जो नवंबर 2017 में परिषद की सेवा से सेवानिवृत्त होने वाले थे। डॉ अजयघोष और अन्य प्रतिभागियों ने एक महान वैज्ञानिक, एक अद्भुत संरक्षक, एक व्यावहारिक शिक्षाविद् और एक समर्पित प्रशासक के रूप में डॉ गोपिदास की उत्कृष्टता और क्षमता को रेखांकित किया, जिन्होंने विज्ञान को न केवल एक करियर के रूप में, लेकिन जीवन के एक हिस्से के रूप में भी लेने के लिए एक पीढ़ी को प्रेरित किया था।

डॉ नारायणन उणिण के एन (सीएसआईआर-एनआईआईएसटी, तिरुवनंतपुरम) द्वारा प्रस्तावित धन्यवाद और राष्ट्रगान के साथ सत्र का औपचारिक समापन किया गया।

"डाइऑक्सीन विश्लेषण में उन्नत विश्लेषणात्मक समाधान" पर राष्ट्रीय कार्यशाला

सीएसआईआर- एनआईआईएसटी ने 5 जनवरी 2018 को एजिलेंट टेक्नोलॉजीज के सहयोग से "डाइऑक्सीन विश्लेषण में उन्नत विश्लेषणात्मक समाधान" पर एक दिवसीय कार्यशाला आयोजित की। एनआईआईएसटी ने भारत में पहली डाइऑक्सीन शोध प्रयोगशाला की स्थापना की और सतत् कार्बनिक प्रदूषकों पर देश के स्टॉकहोम सम्मेलन के दायित्वों के भाग के रूप में राष्ट्रीय कार्यान्वयन योजना (एनआईपी) तैयार करने में योगदान दिया। इसके बाद एनआईआईपी मूल्यांकन में उल्लिखित कमियों के लिए डाइऑक्सीन उत्सर्जन की सूची विकसित करने के लिए एनआईआईएसटी की सुविधाओं को मजबूत किया गया है। पर्यावरण और वन मंत्रालय (एमओईएफ) ने विभिन्न क्षेत्रों में पर्यावरण मंजूरी के लिए डाइऑक्सीन विश्लेषण करने के लिए एक रेफरल प्रयोगशाला के रूप में सीएसआईआर-एनआईआईएसटी की सिफारिश की है।

परीक्षण प्रयोगशालाओं, उद्योगों, नियामक निकायों, अनुसंधान संस्थानों और पर्यावरणविदों को डाइऑक्सीन विश्लेषण के नवीनतम रुझानों के बारे में ज्ञान प्रसार और जागरूकता पैदा करने के लिए कार्यशाला का आयोजन किया गया था। नमूनाकरण, नमूने की तैयारी और डाइऑक्सीन विश्लेषण में व्यावहारिक प्रशिक्षण का आयोजन भारत में पहली बार किया गया था।

कार्यशाला के दौरान नगर निगम द्वारा ठोस कचरे के खुले जलने से उत्पन्न डाइऑक्सीन उत्सर्जन पर सीएसआईआर-एनआईआईएसटी द्वारा किए गए अध्ययनों के नवीनतम निष्कर्षों पर प्रकाश डाला गया। सीएसआईआर-एनआईआईएसटी के निदेशक डॉ ए अजयघोष ने कार्यशाला का उद्घाटन किया और डॉ एस के भार्गव, सदस्य, विशेषज्ञ मूल्यांकन समिति, पर्यावरण तथा वन मंत्रालय कार्यक्रम में विशेष आमंत्रित थे।

डॉ. के पी प्रतीश, वैज्ञानिक - प्रभारी, डाइऑक्सीन प्रयोगशाला, श्री चंद्रशेखर कंदस्वामी, एजिलेंट टेक्नोलॉजीज और डॉ वान एसेन मार्क, एलसीटेक. जर्मनी ने जीसी-एमएस / एमएस का उपयोग करके खुला जलन अध्ययन, नमूना तैयारी के तरीकों और प्रमात्रीकरण के लिए अत्याधुनिक विश्लेषणात्मक पद्धतियों के बारे में प्रस्तुति दी। केंद्रीय और राज्य प्रदूषण नियंत्रण बोर्ड, सीएसआईआर-नीरी, आईआईटीआर, एनजीआरआई, निर्यात निरीक्षण परिषद (ईआईसी), स्पाइसेस बोर्ड, एफएसएसएआई, सीआईएफटी, केएसआरआईसी, कृषि विश्वविद्यालय, केईआईएल (फैक्ट), केएमएमएल, विम्ला लैब्स (हैदराबाद), सी लैब (कोच्चि), इंटरफील्ड लैब (कोच्चि), कुसाट आदि संगठनों से करीब 30 प्रतिभागियों ने कार्यशाला में भाग लिया।

लुमिनेसेन्स और इसके अनुप्रयोग (एनसीएलए-2018) पर राष्ट्रीय सम्मेलन

सीएसआईआर- राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान (एनआईआईएसटी) तथा लुमिनेसेन्स सोसाइटी ऑफ इंडिया के संयुक्त तत्वावधान में 14-16 फरवरी, 2018 के दौरान लुमिनेसेन्स और इसके अनुप्रयोग (एनसीएलए-2018) पर सीएसआईआर-एनआईआईएसटी, तिरुवनंतपुरम में राष्ट्रीय सम्मेलन आयोजित किया गया।

फोस्फोरस के क्षेत्र में हो रही विभिन्न घटनाओं व विकास पर चर्चा करने के लिए अकादमिक, शोधकर्ताओं और उद्योग के लिए एक इंटरैक्टिव मंच प्रदान करना एनसीएलए-2018 का उद्देश्य था। सम्मेलन का उद्देश्य युवा शोधकर्ताओं को इस क्षेत्र में सहयोगियों से मिलने के लिए और फोस्फोरस के विकास, निर्माण, इंजीनियरिंग और अनुप्रयोगों में आनेवाली चुनौतियों और मुद्दों पर चर्चा के लिए अवसर प्रदान करना था। सम्मेलन का उद्घाटन 14 फरवरी, 2018 को सीएसआईआर-एनआईआईएसटी, तिरुवनंतपुरम में डॉ आर पी राव, स्पेशलिटी फॉस्फर, यूएसए द्वारा किया गया।

डॉ ए अजयघोष, निदेशक, सीएसआईआर-एनआईआईएसटी ने समारोह की अध्यक्षता की। अपने उद्घाटन भाषण में डॉ राव ने डायग्नोस्टिक्स, इमेजिंग जैसे चिकित्सा अनुप्रयोगों के क्षेत्रों में फोस्फोरस के महत्व पर प्रकाश डाला। उन्होंने आगे बताया कि हालांकि मौलिक सिद्धांतों और नयी और कुशल फॉस्फर सामग्री के विकास पर दुनिया भर में बहुत ध्यान केंद्रित अनुसंधान किया गया है, तो भी, वास्तविक क्षेत्र के अनुप्रयोगों के लिए उपकरणों के अहसास के प्रयासों पर अभी भी कमी है। जैसा कि राजस्व उत्पादन के मामले में यह क्षेत्र अत्यधिक चुनौतीपरक है, इन सामग्रियों के आधार पर कई घटक निर्माण का कार्य, आईपीआर के साथ बहुराष्ट्रीय कंपनियों द्वारा ध्यानपूर्वक संरक्षित हैं।

डॉ. ए. अजयघोष, निदेशक, सीएसआईआर-एनआईआईएसटी, तिरुवनंतपुरम ने अपने उद्घाटन संबोधन में रसायन विज्ञान, भौतिकी, इंजीनियरिंग, जीवविज्ञान जैसी शाखाओं से इनपुट के साथ लुमेनसेंट सामग्री के विकास के लिए अंतर्विषयी दृष्टिकोण अपनाने की आवश्यकता पर प्रकाश डाला। उन्होंने अपने भाषण में बताया कि लुमेनसेंट सामग्री का क्षेत्र अत्यधिक चुनौतीपूर्ण है और ठोस अवस्था प्रकाश जैसे क्षेत्रों में त्वरित गति पर विकास हो रहा है। उन्होंने इस क्षेत्र में कार्य कर रहे शोधकर्ताओं से मौलिक समझ पर ध्यान देकर डिवाइस निर्माण के इंजीनियरिंग सिद्धांतों को एकीकृत करने का आह्वान किया। उन्होंने प्रतिनिधियों से इंजीनियरिंग सहित विज्ञान की विभिन्न शाखाओं के विशेषज्ञों को शामिल करके एक अंतर्विषयी दृष्टिकोण को अपनाने के लिए आह्वान किया।

डॉ आर पी राव, स्पेशलिटी फॉस्फर, यूएसए ने मूल व्याख्यान दिया। अपने व्याख्यान के दौरान, डॉ राव ने चिकित्सा अनुप्रयोगों में लुमेनसेंट सामग्री द्वारा निभाई गई भूमिका पर प्रकाश डाला। यद्यपि लुमेनसेंट सामग्री के आधार

पर बड़ी संख्या में डिवाइस मौजूद हैं, डिवाइस निर्माण तकनीक दुनिया भर में बहुराष्ट्रीय कंपनियों द्वारा आईपीआरएस पर एकाधिक जोड़ों द्वारा ध्यानपूर्वक संरक्षित है। मौलिक ज्ञान का वास्तविक उपकरणों में रूपान्तर एक बड़ी चुनौती है, इसलिए उन्होंने उपकरणों के विकास के लिए विकास के शुरुआती चरणों में रसायन विज्ञान, जीवविज्ञान, इंजीनियरिंग और भौतिकी जैसे विभिन्न शाखाओं से विशेषज्ञों को शामिल करके एक अंतर्विषयी दृष्टिकोण को अपनाने की सिफारिश की।

तकनीकी सत्रों में विषय से संबंधित विभिन्न क्षेत्रों से प्रतिष्ठित विशेषज्ञों और सहयोगियों के आमंत्रित व्याख्यान शामिल थे। प्रत्येक सत्र में मुख्य व्याख्यान के बाद चयनित योगदान पत्रों की मौखिक प्रस्तुतियाँ भी थीं। लगभग 12 तकनीकी सत्र में पूर्ण, आमंत्रित और योगदान श्रेणियों में, 40 से अधिक आमंत्रित शोध पत्र प्रस्तुत किए गए थे। अन्य योगदान पत्र पोस्टर प्रस्तुतियों में थे। पोस्टर सत्रों में प्रस्तुत तीन योगदान पत्र को सर्वश्रेष्ठ पोस्टर प्रेजेंटेशन पुरस्कारों के लिए चुने गए थे और उन्हें प्रमाण पत्र के साथ नकद पुरस्कार से सम्मानित किया गया था। सम्मेलन में लगभग 200 पंजीकृत प्रतिनिधियों ने भाग लिया।

सम्मेलन बोर्ड ऑफ रिसर्च इन न्यूक्लियर साइंसेज (बीआरएनएस), डीएई, केरल स्टेट काउंसिल फॉर साइंस, टेक्नोलॉजी एंड एनवायरनमेंट (केएससीएसटीई), वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद (सीएसआईआर) द्वारा प्रायोजित था और कई अन्य निजी उद्योगों / संगठनों द्वारा समर्थित था।



उद्घाटन सत्र



डॉ ए अजयघोष, निदेशक, सीएसआईआर-एनआईआईएसटी अध्यक्षीय भाषण देते हुए



मुख्य व्याख्यान देते हुए डॉ आर पी राव, स्पेशलिटी फॉस्फर, यूएसए

आर एंड डी उद्योग बैठक

उद्योगों के साथ साझेदारी को बढ़ाने और मजबूत करने के लिए 23 फरवरी 2018 को सीएसआईआर-एनआईआईएसटी, तिरुवनंतपुरम में दूसरी आर एंड डी उद्योग बैठक आयोजित की गई। श्री टी के जोस, आईएएस, अपर मुख्य सचिव (स्थानीय स्वशासन विभाग), केरल सरकार ने आर एंड डी उद्योग बैठक का उद्घाटन किया। डॉ एम बीना, आईएएस, प्रबंध निदेशक, केएसआईडीसी, पद्मश्री हरीन्द्र नायर, संस्थापक एवं प्रबंध निदेशक, पंकजकस्तूरी और डॉ राम चंद, मुख्य कार्यकारी अधिकारी, सैक्सिन लाइफ साइंसेज प्रा. लिमिटेड उक्त अवसर पर उपस्थित थे।

श्री टी.के. जोस, आईएएस, अपर मुख्य सचिव (स्थानीय स्वशासन विभाग), केरल सरकार ने अपने उद्घाटन संबोधन में सामाजिक समस्याओं को हल करने के लिए अकादमिक संस्थानों, अनुसंधान संस्थानों, उद्योगों और सरकारी संगठनों को एक साथ जोड़ कर काम करने की आवश्यकता पर बताया। उन्होंने अपने संबोधन में देश के आर्थिक विकास के लिए उद्योगों में वैज्ञानिक हस्तक्षेप की आवश्यकता पर बल दिया। उन्होंने केरल राज्य के लिए विशिष्ट कई क्षेत्रों का उल्लेख किया जैसे कृषि उत्पादों, आयुर्वेद, दवा, पर्यावरण, जैव प्रौद्योगिकी, जिनमें मूल्यवर्धन, उत्पादकता में वृद्धि, विदेशी आयात को कम करने और निर्यात और लागत प्रभावशीलता को बढ़ाने के लिए वैज्ञानिकों की भागीदारी की आवश्यकता है। उन्होंने एनआईआईएसटी जैसे वैज्ञानिक संगठनों से सस्ती दवा, सभी के लिए आवास, स्वच्छ और हरे समाज जैसे सरकार की सामाजिक रूप से प्रासंगिक परियोजनाओं में भाग लेने के लिए कहा। केरल सरकार के साथ भागीदारी में हर साल कोचीन और कोषिकोड जैसे केरल के अन्य स्थानों में समान कार्यशालाओं को व्यवस्थित करने के लिए उन्होंने सीएसआईआर-एनआईआईएसटी से आग्रह किया।

डॉ एम बीना, आईएएस, प्रबंध निदेशक, केएसआईडीसी ने अपने संबोधन में कहा कि आर एंड डी उद्योग बैठक ऐसा एक मंच है, जहां उद्योग की समस्याओं और सामाजिक जरूरतों की पहचान की जा सकती है और नवाचार के लिए अवसरों के रूप में चर्चा की जा सकती है। उन्होंने प्रस्तुत किया कि अनुसंधान संस्थानों द्वारा विकसित प्रौद्योगिकियों का उपयोगी उत्पादों में रूपांतरण के लिए केएसआईडीसी अनुसंधान प्रयोगशाला और उद्योगों के बीच एक सेतु का कार्य करेगा। उद्योग क्षेत्र की उत्पादकता में सुधार के लिए और शिक्षित युवाओं के लिए नौकरियां पैदा करने के लिए अनुसंधान संगठनों के साथ काम करने के अवसर का लाभ उठाने के लिए उन्होंने राज्य के युवा उद्यमियों को आमंत्रित किया।

पद्मश्री हरीन्द्र नायर, संस्थापक एवं प्रबंध निदेशक, पंकजकस्तूरी व्यवसाय समूह ने अपने मूल व्याख्यान में देश भर में आयुर्वेद और आयुर्वेदिक उत्पादों के प्रचार और लोकप्रियता की आवश्यकता पर बल दिया और वांछना की कि आयुर्वेदिक दवा और हर्बल उत्पादों के सत्यापन में वैज्ञानिक अनुसंधान संगठनों को एक महत्वपूर्ण भूमिका निभानी चाहिए।

डॉ राम चंद, मुख्य कार्यकारी अधिकारी, सैक्सिन लाइफ साइंसेस प्रा. लिमिटेड ने भविष्य अनुसंधान के कुछ क्षेत्रों, विशेष रूप से स्वास्थ्य और दवा खोज के क्षेत्रों में प्रकाश डाला। उन्होंने अपने भाषण में विशिष्ट समस्याओं को हल करने के लिए पश्चिमी देशों से उद्योग और अकादमिक सहयोग की आवश्यकता पर बल दिया। उन्होंने यह भी कामना की कि वैज्ञानिक संगठनों को देश में महत्वपूर्ण और कुशल जनशक्ति की कमी को संबोधित करना चाहिए।

डॉ ए अजयघोष, निदेशक, सीएसआईआर-एनआईआईएसटी ने अपने अध्यक्षीय भाषण में सीएसआईआर की गतिविधियों के बारे में बताया और समाज की सेवा के लिए सीएसआईआर के साथ उपलब्ध प्रौद्योगिकियों को सूचित किया। उन्होंने आश्वासन दिया कि उद्योगों के साथ जुड़े रहने के लिए आर एंड डी-उद्योग बैठक हर साल आयोजित की जाएगी, जो एनआईआईएसटी में उपलब्ध ज्ञान का उद्योग के उत्पादों और सेवाओं में रूपांतरण के लिए महत्वपूर्ण है। उन्होंने यह भी उल्लेख किया कि एनआईआईएसटी सामाजिक जरूरतों के प्रति काम करेगा और उद्योगों की समस्याओं के समाधान के लिए प्रयास करेगा। डॉ सी एस भट्ट, वरिष्ठ प्रधान वैज्ञानिक और प्रमुख, आरपीबीडी ने धन्यवाद प्रस्ताव दिया।

उद्घाटन सत्र के बाद प्रत्येक प्रभाग यानि, कृषि प्रसंस्करण तथा प्रौद्योगिकी प्रभाग, माइक्रोबियल प्रक्रिया तथा प्रौद्योगिकी प्रभाग, रसायन विज्ञान तथा प्रौद्योगिकी प्रभाग, सामग्री विज्ञान तथा प्रौद्योगिकी प्रभाग और पर्यावरण प्रौद्योगिकी प्रभाग के प्रतिनिधियों द्वारा अपने संबंधित प्रभाग की विशेषज्ञता, सुविधाओं और अनुसंधान उन्नति पर प्रकाश डालते हुये तकनीकी प्रस्तुतियां दी गयीं। श्री प्रवीण राज, वरिष्ठ वैज्ञानिक, रिसर्च प्लानिंग एंड बिजनेस डेवलपमेंट प्रभाग ने एनआईआईएसटी के साथ व्यवसाय करने की आसानी पर प्रकाश डाला। एनआईआईएसटी के विभिन्न प्रभागों का दौरा और वहाँ उपलब्ध सुविधाओं का अवलोकन करने के लिए उद्योग प्रतिभागियों को प्रोत्साहित किया गया। ट्रांस्लेशनल अनुसंधान पर ध्यान केंद्रित करने के लिए और उद्योग आवश्यकताओं के लिए आर एंड डी कार्यक्रमों को ट्यून करने के लिए वैज्ञानिकों, प्रौद्योगिकीविदों और उद्योग प्रतिनिधियों के साथ एक से एक इंटरैक्शन थे। बैठक के भाग के रूप में सीएसआईआर-एनआईआईएसटी में विकसित उत्पादों / प्रौद्योगिकियों / प्रक्रियाओं की एक प्रदर्शनी भी व्यवस्थित की गई थी। पारस्परिक हित के मुद्दों की पहचान करने और गठबंधन बनाने के लिए सूक्ष्म, लघु और मध्यम उद्यमों सहित विभिन्न क्षेत्रों के साथ से अधिक उद्योगों ने आर एंड डी उद्योग की बैठक में भाग लिया। दौरा किये उद्योगों में से कुछ हमारे मौजूदा ग्राहक थे और अधिकांश नए प्रतिभागी थे।

कार्यक्रम में एक पैनल चर्चा भी थी। समापन समारोह के साथ कार्यक्रम समाप्त हुआ जिसमें एनआईआईएसटी और केएमएमएल, चवरा के बीच तथा एथमिक बायोटेक प्राइवेट लिमिटेड के साथ कुछ समझौते निष्पादित किए गए थे और कुछ व्यापार सौदे भी उभर गए।



आर एंड डी-उद्योग बैठक के विभिन्न दृश्य

सतर्कता और निविदा प्रक्रिया पर कार्यशाला

सीएसआईआर - मानव संसाधन विकास केंद्र, गाजियाबाद (सीएसआईआर-एचआरडीसी) के सहयोग से संस्थान के ज्ञान संसाधन केंद्र ने वैज्ञानिक और तकनीकी स्टाफ को सतर्कता और निविदा प्रक्रिया पर जानकारी प्रदान करने के लिए 26 फरवरी 2018 को 'सतर्कता और निविदा प्रक्रिया' पर एक दिवसीय कार्यशाला का आयोजन किया।

श्री साजन पीटर, आईएएस (सेवानिवृत्त), पूर्व मुख्य सचिव, सतर्कता और सांस्कृतिक कार्य, ने कार्यशाला का उद्घाटन किया, जबकि सीएसआईआर-एचआरडीसी के प्रमुख डॉ मनु मनुसेना ने सत्र की अध्यक्षता की। श्री राकेश कुमार शर्मा, वरिष्ठ उप सचिव (सेवानिवृत्त), सीएसआईआर ने सतर्कता, आचरण नियमावली, दायित्व और अनुपालन; सामान्य अनियमितताओं और "क्या करें और क्या न करें" के पहलुओं के बारे में एक सिंहावलोकन



दिया। श्री एम दुलप कुमार, भंडार व क्रय नियंत्रक, एनआईआईएसटी ने निविदा प्रक्रिया के सतर्कता परिप्रेक्ष्य पर व्याख्यान दिया, इस्पात मंत्रालय के पूर्व निदेशक श्री समेंद्रनाथ ने सार्वजनिक खरीद और वर्क्स और सेवाओं पर सीवीसी के दिशानिर्देशों पर व्याख्या दी। प्रतिभागियों को कार्यशाला से बहुत फायदा हुआ और संकाय और सीएसआईआर-एचआरडीसी के प्रति धन्यवाद के साथ कार्यशाला समाप्त हुई।

तकनीकी कार्मिक के लिए योग्यता विकास कार्यक्रम

सीएसआईआर-एनआईआईएसटी के समूह II और समूह III तकनीकी कार्मिकों के लिए 26-27 फरवरी 2018 के दौरान सीएसआईआर - मानव संसाधन विकास केंद्र, गाजियाबाद (सीएसआईआर-एचआरडीसी) द्वारा प्रशिक्षण कार्यक्रम आयोजित किया गया था। सीएसआईआर विजन, मिशन और लक्ष्यों, एर एंड टी कार्मिक के लिए सतर्कता दृष्टिकोण, दैनिक कार्यों में आईटी टूल्स, योजना और आयोजन कौशल, प्रभावी पारस्परिक कौशल, टीम बिल्डिंग और ग्रुप डायनेमिक्स, सेवा संबंधी मामले, कार्यस्थल पर आत्म प्रभावशीलता जैसे विभिन्न विषयों पर प्रशिक्षण दिया गया था। डॉ मनु सक्सेना, प्रमुख, सीएसआईआर-एचआरडीसी गाजियाबाद, श्री



समेंद्रनाथ, पूर्व निदेशक, इस्पात मंत्रालय, भारत सरकार, श्री राकेश कुमार शर्मा, वरिष्ठ उप सचिव (सेवानिवृत्त), सीएसआईआर और डॉ आलोक गोयल, वरिष्ठ तकनीकी अधिकारी, सीएसआईआर-एचआरडीसी योग्यता विकास कार्यक्रम के संकाय थे।

राष्ट्रीय विज्ञान दिवस -2018

28 फरवरी, 2018 को सीएसआईआर-एनआईआईएसटी में राष्ट्रीय विज्ञान दिवस मनाया गया। सीएसआईआर-एनआईआईएसटी के निदेशक डॉ ए अजयघोष ने स्वागत भाषण दिया और दिन के मुख्य अतिथि का परिचय दिया। मुख्य अतिथि प्रो.वी नागराज, अध्यक्ष, जवाहरलाल नेहरू सेंटर फॉर एडवांस्ड साइंटिफिक रिसर्च, बैंगलुरु ने "पुनरुत्थानशील दवा प्रतिरोधी क्षयरोग का मुकाबला कैसे करें" विषय पर राष्ट्रीय विज्ञान दिवस व्याख्यान दिया। उन्होंने जोर दिया कि क्षयरोग के इलाज के लिए नई दवाओं पर खोज वैज्ञानिकों के लिए एक गंभीर चुनौती है। इसका मुख्य कारण यह है कि ट्यूबरक्लोसिस बैक्टीरिया एक प्रबल रोगजनक है, जिससे शोधकर्ताओं को



प्रभावी दवाओं का विकास करना मुश्किल हो जाता है। हालांकि, दुनिया भर में ट्यूबरक्लोसिस का मुकाबला करने का एकमात्र तरीका टीका और नई दवा रणनीति के माध्यम से होगा। डॉ लक्ष्मी वर्मा आर, अध्यक्ष, अकादमिक कार्यक्रम समिति ने धन्यवाद प्रस्ताव दिया।

EVENTS AND CELEBRATIONS

National Technology Day – 2017



National Technology Day is celebrated every year on May 11 to commemorate the history of India's technological innovations and excellence. The day holds significance as India successfully tested nuclear bombs in Pokhran on May 11, 1998.

CSIR-NIIST celebrated the National Technology Day on May 11, 2017. Dr. A. Ajayaghosh, Director, CSIR-NIIST delivered the welcome address and introduced the Chief Guest of the day Prof. M.M. Sharma, Former Director, Institute of Chemical Technology, Mumbai. Prof. Sharma delivered the Technology day lecture on "The Critical Role of Innovation to Trigger Rapid Economic Growth". He emphasized the need for strong fundamental research linking to the industrial applications. While emphasizing the importance of Innovation, he said that innovative ideas can be born from good science, which can turn to Innovations, technologies for the benefit of mankind which influence the economic growth directly. While citing some technologies which have changed the

fundamentals of business such as Ball Pen, Helicopter, Transistor, CD's, DNA, Vaccines, Antibiotics, Mobile phones, Anaesthetic agent etc., the veteran of chemical engineering manifested that the innovations cannot be scheduled, which requires enough time to mature and many of the innovations had taken years for this process. He also pointed out that Innovation is tough to manage and easy to stifle and innovator is often harassed because Creativity thrives on Instinct, Uncertainty, Freedom and Iconoclasm while management demands Consensus, Control, Certainty, and the Status quo. Half of the great innovations in the world came from great insights, the other half happened by accident and none of them on a schedule and no one predictable path to successful innovation. Patience is a mandatory condition if innovation is to thrive. While congratulating the achievements of NIIST, Prof. Sharma emphasized that a fertile relationship between Science and Engineering is required for Innovation. The mistakes are common, not because people or firms are incompetent but because they are continuously dancing on the edge of knowledge.



A scene from Technology day celebrations



Prof. M.M. Sharma, Former Director, Institute of Chemical Technology, Mumbai delivering the Technology day lecture

The ability to learn from failure is critical to making progress and in India a very important factor affecting Innovations is total lack of ownership of failures. Dr. A. Sundaresan, Head, RPBD proposed the vote of thanks.

Workshop on 'Prospects in Agroprocessing'



Shri Biju Prabhakar, Director of Agriculture Development & Farmer's Welfare inaugurating the workshop

A one day R & D symposium on "Prospects in Agroprocessing" was inaugurated by Shri Biju Prabhakar, Director of Agriculture Development & Farmer's Welfare on 23rd May, 2017 at CSIR-NIIST. He stressed the scope of new ventures in the primary processing of produce of the region and complimented the efforts of CSIR NIIST in developing and popularizing such technologies. He singled out the Refrigeration Adsorption Dehumidified Drier (RADD) developed by the institute and its great potential and informed that the state government is going to install 14 of such units for the benefit of the farmers.

Dr. A. Ajayaghosh, Director CSIR NIIST assured the industry that, the institute is refocusing its efforts in solving industrial problems and urged the industry to make use of the vast expertise and infrastructure available with the institute.

Presentations were made by the industry representatives from A.K. Flavours & Aromatics Cochin, M/ Brahmins Food Products, M/s. PCPCL Palakkad, Spices Board, FSSAI and KINFRA. A presentation was also done by the institute on how technologies are developed at bench scale and then taken it to pilot plant and commercial level. Some of the ventures set up by the institute on turnkey basis were highlighted during the presentation from the institute.

World Environment day



World Environment Day

The world Environment day was celebrated on 5 June, 2017 at CSIR-NIIST, Thiruvananthapuram by planting of saplings within the campus of CSIR-NIIST. Jawaharlal Nehru Tropical Botanic Garden and Research Institute has provided medicinal plants and various other tree saplings. Director, CSIR-NIIST in his address to the staff and students on the World Environment day stressed the importance of planting and maintenance of greenery within the campus. He also thanked JNTBGRI for providing the saplings. The saplings were planted by the staff and students of CSIR-NIIST. Saplings were also distributed among staff and students of CSIR-NIIST.

Jigyasa 2017 - Scientist-Students Connect Programme

The Council of Scientific and Industrial Research (CSIR) in collaboration with Kendriya Vidyalaya Sangathan (KVS) has launched a wide ranging Scientist-Students Connect programme at National Institute for Interdisciplinary Science and Technology (NIIST). The programme named "Jigyasa" in full stream with KVS is expected to connect about 350 KVS schools targeting 75,000 students and nearly 1,000 teachers with CSIR labs across



'Team Jigyasa-2017' at the valedictory function, at CSIR-NIIST auditorium on 16th June 2017



the country. A one week “Jigyasa” programme has been conducted at CSIR-NIIST from 12th to 16th June 2017 was inaugurated by the Director CSIR-NIIST Dr. A. Ajayaghosh. Around 85 KVS students and teachers from six KV schools in Thiruvananthapuram city attended this programme. Jigyasa at CSIR-NIIST was coordinated by Dr. C. H. Suresh, Principal Scientist, and Dr. R. Luxmi Varma, Sr. Principal Scientist & Head, Chemical Sciences and Technology Division. This programme consisted of basic lab experiments, popular science lectures, science quiz, science film, laboratory visit, and interaction with scientists and research scholars. Scientists including Dr. Manoj Raama Varma, Dr. U. S. Hareesh, Dr. K. K. Maiti, Dr B Krishnakumar, Dr. T.P.D. Rajan, Dr. V. Karunakaran, Dr. L. Ravishankar, Dr. K. Yoosaf, Dr. P. Nisha, and Dr. P. Binod took part. The idea of connecting scientists and research scholars of CSIR institutes with a large pool of science students and teachers in the country is a highly inspirational one for the science education sector in the country. Definitely, a successful and long term conduct of the programme will lead to massive improvement in our education system and it will empower the students, teachers and even parents to lead a path for achieving ambitious goals in a scientific career.

One Day Industry -Institute Workshop on "Utilization of Rare Earths and Beach Sand Minerals"

Rare Earths and beach sand minerals continue to play a dominant role in the Indian mining industry by virtue of their importance to advanced applications. CSIR-NIIST organised a one day Industry-Institute Workshop on "Utilisation of Rare Earths and Beach Sand Minerals" on June 27, 2017 jointly with Rare Earths Association of India (REAI). The workshop was aimed at providing a common platform for the researchers in the Institute and the mineral Industries to discuss the latest developments in the mineral mining/ processing including the issue related to pollution abatement.

The workshop was inaugurated by Shri. D. Singh, Chairman and Managing Director of Indian Rare Earths Limited (IREL) and President of REAI. He called on the researchers and mineral industries to identify areas of common interest for translational research. In presidential address, Dr. A. Ajayaghosh, Director, CSIR-NIIST invited mineral industries

to collaborate with research institutions for the issues of the industries for which scientific and technological interventions are required. Dr. A. D. Damodaran, Former Director, CSIR-NIIST delivered a special lecture on the saga of development of mineral activity at CSIR-NIIST and its translation from laboratory to industries through many of the pilot plant trials. Dr. M. L. P. Reddy, Secretary, REAI and Chief Scientist (Retd.) CSIR-NIIST welcomed the gathering. Dr. K. Harikrishna Bhat, convener of the workshop proposed the vote of thanks. Invited lectures were delivered by Shri. Antony Francis, Kerala Minerals and Metals Ltd., (KMML), Shri. C. Swamydas, W Minerals, Dr. K. Johnson, Travancore Titanium Products Ltd. (TTPL) and Dr. K. Harikrishna Bhat, CSIR-NIIST on issues related to beach sand mining, titanium pigment production and preparation of synthetic rutile. The workshop was attended by scientists from CSIR-NIIST, VSSC and IREL.



Dr. A. D. Damodaran, Former Director, CSIR-NIIST delivering special lecture

OBSERVANCE OF HINDI WEEK

Hindi Week was celebrated in the Institute during 11-14th September 2017. The formal inaugural function of the Hindi week was held on 11th September 2017 at 10.00 AM. Dr. P. Prabhakar Rao Chairman, Organizing Committee welcomed everyone present in the function. In his welcome speech, he presented a brief information on the relevance of organizing Hindi Day and Hindi Week in Central Government Offices and urged the participants to use the official language Hindi in their official work and contribute their best in implementing the official language policy of the Government. Dr. A. Ajayaghosh, Director, CSIR-NIIST presided over the inaugural session. In his presidential address, he said that Hindi is a rich language and it is a link between India's national and cultural unity. As far as its use in official work is concerned, we have to make such a decision in our mind and have to accept it as our duty and that no resolution will be required for its use in government functioning. Today India has emerged as a world power. We should connect the Hindi language



Dr. P. Prabhakar Rao, Chairman, Hindi Week Celebration Committee welcoming the participants

with Science & Technology and Information Technology, so that benefits of these areas will reach the common man. He urged the participants to do their official work originally in Hindi and also to take a firm determination to do official work in Hindi as much as possible in order to fulfill the official language requirements. He congratulated all officers and employees for their efforts in promoting Official Language Hindi and appreciated their contributions and later declared the formal inauguration of the Hindi Week -2017.



Mr. Dulip Kumar, Controller of Stores & Purchase, giving presentation on Stress Management



Dr. Sanjib Banerjee giving presentation on "Useful polymers in daily life".

Immediately after the inauguration, Mr. Dulip Kumar, Controller of Stores & Purchase gave a presentation on "Stress Management" in Hindi. In his presentation, he elucidated different forms and different stages of stress, its management, and gave information on the simplest,



Dr. A. Ajayaghosh, Director delivering the Presidential address

most affordable available techniques for a stress-free life. He urged the participants to accept life and its problems as an opportunity.

The second presentation was given by Dr. Sanjib Banerjee, Ramanujan Fellow on "useful polymers in daily life". In his presentation, he explained in detail about the importance of certain polymers, their chemical composition and their impact on human health. The topics of both presentations being extremely important in the present perspective, the participants took full advantage and appreciated the speakers. The inaugural session ended with vote of thanks by Smt. S. Sobhana, AO.

The following competitions were organized throughout the whole week for staff of the Institute, including project staff, research students etc.

- 1) Hindi Online Quiz (September 11 to September 13)
- 2) Hindi Quiz (12 September 2017)
- 3) Hindi Antakshari (September 13, 2017)
- 4) Hindi debate (September 14, 2017)

14 September 2017 was celebrated as Hindi Day and the closing ceremony and prize distribution was organized on the same day at 4.00 pm. Dr. P. Prabhakar Rao, Chairman, Hindi Week Organizing Committee presided over the function. Dr. S.R. Jayashree, Assistant Professor, Department of Hindi, MG College, Thiruvananthapuram was the chief guest. Dr. P. Nishy, Head, KRC and Member, Organizing Committee delivered welcome address and introduced the Chief guest to the participants. The Chief Guest, gave a very interesting lecture on the rationale of making Hindi as the official language and the role of government employees in the progress of the official language. Director – In Charge Dr. A. Sundaresan distributed prizes to successful participants of various competitions.

CSIR-NIIST Science Outreach Programme

CSIR-National Institute for Interdisciplinary Science and Technology (NIIST), Trivandrum organised one day Science Outreach Programme for students and public on September 18, 2017 as a precursor event of the India International Science Festival (IISF-2017), the third of its kind, jointly organised by the Ministry of Science and Technology and the Ministry of Earth Sciences in association with VIBHA (VijnanaBharati). The outreach program aims to create awareness of the R&D activities of CSIR-NIIST to the public and to inculcate a scientific temper among the young minds as the development of our Nation at any phase is linked with advance in science and innovation.

The Science outreach programme was inaugurated by Prof. K. Girish Kumar, Professor, Cochin University of Science and Technology, Kochi. In his inaugural address he highlighted the importance of Effective

Communication and popularisation of science. Science publication should be simple and easy to understand for the common man. In the presidential address, Dr. A. Ajayaghosh, Director, CSIR-NIIST, Trivandrum emphasised the need make the public aware about the importance of science in human life. Though science takes a backseat many times, it is integral and essential for the growth of mankind.

About 150 school and college students and teachers attended the programme comprising popular science lectures, interaction of students with scientists, open house laboratory visits, exhibition of technologies. Dr. U.S. Hareesh, Senior Scientist, CSIR-NIIST delivered the talk on “Popular Advancements in Materials Science: A few Case Studies” and Dr. B. Krishnakumar, Senior Scientist, CSIR-NIIST talked on “Waste Resource Factories”. The programme had also a video show on various activities of CSIR-NIIST.

8th East Asia Symposium on Functional Dyes and Advanced Materials (EAS8)

The “8th East Asia Symposium on Functional Dyes and Advanced Materials” (EAS8) was held at CSIR-NIIST, Thiruvananthapuram, India during 20-22 September 2017. EAS8 belongs to the series of biennial symposia previously organized in Japan (2003, 2009, 2015), Taipei (2005), Korea (2007), and China (2011, 2013) and for the first time it is being organized in India, as part of the Platinum Jubilee celebrations of CSIR. CSIR-NIIST has been continuously engaged in developing such novel dyes and inks and EAS8 offered an excellent platform for productive interactions among young researchers, students and entrepreneurs.

EAS8 witnessed three days of exciting and inspiring program of the highest scientific caliber. With approximately 300 participants from India, Japan, Korea, Singapore, Australia, Taiwan and Switzerland, the symposium showcased one of the largest in the series and the first one hosted outside the East Asian countries. The event was flagged off on 19th September 2017, via a pre-symposium workshop for students on “How to Effectively Communicate your Research – Starting from Manuscript Writing to Acceptance and Promotion”. The workshop

was offered by American Chemical Society and more than 80 students actively participated in the workshop. Dr. R. Luxmi Varma, Head CSTD and Chairperson APC welcomed the gathering and Dr. A. Ajayaghosh, Director - CSIR-NIIST, inaugurated the workshop. Dr. Varma,



Pre-symposium workshop (EAS8-2017)
September 19, 2017

during her welcome address, spoke about the objectives of any scientific communication to accurately and clearly disseminate and communicate new scientific knowledge. In the inaugural address, Dr. Ajayaghosh pointed out the significance of “the art of effective scientific communication”, that was further elaborated by Dr. Deeksha Gupta (Managing Editor, ACS Omega) and

her team during the two-hour interactive session. All the attendees were given participation certificates.

The symposium started on 20th September 2017 with a colorful opening ceremony. Dr. A. Ajayaghosh opened the symposium with a welcome address and Dr. Suresh Das (Executive Vice President, KSCSTE, Govt. of Kerala) presided over the function. Prof. Hiroyuki Nakazumi (Osaka Prefecture University, Japan) elaborated on the context and dimensions of the symposium. Directors of three sister institutes - Dr. S. Chandrasekhar (Director, CSIR-IICT, Hyderabad), Dr. Vijayamohan K. Pillai (Director, CSIR-CECRI, Karaikudi) and Dr. B. Chandrasekaran (Director, CSIR-CLRI, Chennai) were the guests of honor. Dr. S. Chandrasekhar delivered the inaugural address, and Dr. Pillai and Dr. Chandrasekaran unveiled the book of abstracts. The opening ceremony came to a close with vote of thanks proposed by Dr. K. N. Narayanan Unni (CSIR-NIIST, Thiruvananthapuram and Convener, EAS8). The inaugural plenary lecture was given by Prof. G. D. Yadav (Vice Chancellor and R. T. Modi Distinguished Professor, ICT, Mumbai) and was chaired by Dr. Suresh Das. The advancement made in the field of functional materials derived from biomass using solid acid / base catalysts was discussed in detail by Prof. Yadav. The lecture stressed on the significance of green and sustainable chemistry for the realization of value added products from cheap and renewable ecofriendly sources. The symposium featured



exhibition stalls from different sponsors and vendors and was inaugurated by Dr. B. Chandrasekaran.

The technical program included 6 plenary lectures, 16 invited lectures, 6 young scientist lectures and 4 invited lectures from industries, along with two poster sessions and a flash talk session for students. In total, 130 posters were presented by the student participants over the first two days of the symposium. Seven best posters were selected for ACS Omega best poster awards (3 prizes) and EAS8 best poster awards (4 prizes). Three best flash talk presenters were bestowed with RSC best talk awards. The awardees were conferred the prizes during the concluding session of the symposium. Dr. Der-Gun Chou announced the 9th symposium in the EAS series to be held in Taiwan in 2019. The symposium came to a close after the concluding remarks by the Chairs of the symposium (Dr. Ajayaghosh and Prof. Nakazumi) and a vote of thanks proposed by Dr. Vijayakumar C. Nair (Co-convener, EAS8, CSIR-NIIST, Thiruvananthapuram).

CSIR Foundation Day - 2017

The CSIR Foundation Day was celebrated in CSIR-NIIST on September 26, 2017. Dr. A. Sundaresan, Chief Scientist and Head, RPBD, CSIR-NIIST delivered the welcome address and introduced the Chief Guest of the day. The CSIR Foundation Day Lecture was delivered by the chief guest, Dr. N. Purnachandra Rao, Director, National Centre for Earth Science Studies, Thiruvananthapuram on the topic "Earthquakes and Tsunamis in the Indian subcontinent - How prepared are we?". He described how the earthquakes and Tsunami occurs and what are major causalities happened. He depicted the earthquake prone areas in India and what are the normal warning signals we get when the earthquake and tsunami occurs. He described the methods for prediction of tsunami occurrences and how the large causalities can



be mitigated. He told after the tsunami in December, 2004, India had taken major steps in installing tsunami warning systems and monitoring them. Dr. Luxmi Varma, Chairperson, Academic Programme Committee proposed the vote of thanks. Around three hundred students from various educational institutions had visited CSIR-NIIST as part of open day.

NIIST Foundation Day - 2017



CSIR-NIIST celebrated the NIIST Foundation Day on October 6, 2017. Dr. A. Ajayaghosh, Director, CSIR-NIIST delivered the welcome address and introduced the Chief Guest of the day. The NIIST Foundation Day Lecture was delivered by the chief guest Dr.Kuncheria P. Isaac, Vice Chancellor, APJ Abdul Kalam Technological University, Thiruvananthapuram. He emphasised the need for



enhancing the quality of higher education in the state. The Annual Report of CSIR-NIIST for the year 2016-17 was released by the Chief Guest and received by Dr. A. Sundaresan, Chief Scientist and Head, RPBD, CSIR-NIIST. Dr. R. Luxmi Varma, Chairperson, Academic Programme committee proposed the vote of thanks.

Observance of Vigilance Week-2017



In CSIR- NIIST, Thiruvananthapuram, Vigilance Awareness week-2017 started on 30th October 2017 with Vigilance Pledge. In the Inaugural function of the Vigilance Awareness Week, Director briefed this year's theme "My vision- Corruption free India" and also the activities proposed to be conducted during the week long celebration. He read out the pledge in both Hindi and English and advised the staff members to take e-pledge also by visiting CVC's site. On 31st October, a Workshop on TA/DA/ LTC, Conduct Rules and do's and Don'ts was held in order to create awareness on Vigilance among staff and Research students. Followed by this a quiz was held on the above topics.

On 1st November, elocution competition was held separately for staff members and students on the topic "Is corruption co-existing with developmental activities" ?

On 3rd November Panel Discussion on this year's theme- My vision- corruption free India was held. The Panels views on "How to make India corruption free" are summarized as follows :-

1. Digitally enabled governance has helped in improving the transparency in the system, which in turn has helped in reducing the corruption in the public dealing departments of Government.
2. One of the reasons for corruption is absolute Power, Hence distribution of more power at various hierarchical level from highest author to the level of local council level to ensure the participation of Citizen will help in reducing the corruption.
3. Funding to political parties should be transparent.
4. Establishment of Special courts for dealing with cases involved by politicians will lead to reducing the corruption in the system.
5. Corruption has almost become like a culture in the society now. Hence quality education is a must to get rid of this.
6. Strengthening the implementation of RTI, Lokpal and Lokayukta, will enable a corruption free country.

7. The common men should get his basic needs like food, hospital, and education from the government system so that corruption in such basic amenity can be reduced and the general public will not be suffered to meet his basic needs.
8. Empowering women and stoppage of many bad practices like dowry etc. will also help to reduce corruption.
9. Implementation of law and ensuring punishment to the guilty is also necessary to reduce the corruption.
10. A vigilant and watchful police system (as in the case of Singapore) surely help to reduce the corruption

Debate on the topic “Whether Implementation of digitalization has reduced corruption” was held on 6th November morning. Both the teams, for and against having an in-depth knowledge on the theme debated well, which was appreciated by the audience. Audience

were also given opportunity to express their views on the topic.

To create awareness on vigilance and anti- corruption among staff and public who visited the Instt. during the week, slogans and famous quotes on vigilance anti- corruption were displayed through the display system kept at various places of the Institute. A hand book on “How to make India Corruption free” has been displayed in the Institute’s intranet portal for the benefit of all.

The valedictory function and distribution of prizes to the winners of various competitions were held on 6th November afternoon with Dr. ShaikDarvesh Sahib, IPS and ADGP, Vigilance & Anti- Corruption Bureau as the Chief Guest. In his valedictory address, quoting various incidents that came across his career, he urged the participants to be honest in all their official and personal dealings and also inculcate these habits to their next generation so that our Country will emerge corruption free.

Swachhta Pakhwada

As per instructions received from Govt. of India/ CSIR, the Institute conducted extensive cleaning activities within the Laboratory and outside premises of the Institute. All R&D and Non- R&D divisions were requested to carry out cleaning activities and weeding out of unused/ obsolete items / files during Swachhta pakhwada. On 1st November 2017, the staff members took Swachhta Pledge.

As part of Swachhtapakhwada Quiz competition on “Cleanliness & hygiene” was held on 14th September 2017. Staff members actively participated in the Competition.

All Administrative Sections carried out weeding out of old files and 3 condemned vehicles have been disposed. Intensive cleaning was carried out to keep the laboratory and its surroundings clean and Swachhta Pakhwada was observed in its true spirit.



The safety committee requested all the scientific divisions of the institute to observe 14th November 2017 as cleaning day. In accordance with this, every division conducted their own cleaning process.

Fumigation and pest control measures were also undertaken.



Cleaning activities in the Campus

Chemistry and Physics at The Excited States



Dr. K. R. Gopidas, Chief Scientist, CSTD delivering the lecture

As part of the outreach activities of the Chemical Sciences and Technology Division, we organized a one-day national seminar on “Chemistry and Physics at the Excited States” on 24 November, 2017. The seminar witnessed a day of exciting and inspiring program of the highest scientific caliber. With approximately 200 participants from different parts of India, including students, scientists and industry delegates, the seminar showcased not only the scientific advancements but also presented the opportunities and challenges existing in this field of research. The event was sponsored by Laser Spectra Services Pvt. Ltd., Bengaluru.

The seminar was inaugurated by Dr. A. Ajayaghosh, Director - CSIR-NIIST, who, in his introductory remarks, elaborated on the significance of continued investigations on the excited state properties and reactions of materials. Dr. Ajayaghosh also welcomed the distinguished guests, speakers and all the participants to the program.

The technical program included 8 invited lectures along with a few posters.

The seminar came to a close with a concluding session, chaired by Dr. A. Ajayaghosh (Director, CSIR-NIIST) and was devoted in honour of Dr. K. R. Gopidas (Chief Scientist, CSIR-NIIST, Thiruvananthapuram), who was superannuating from Council service in November 2017. Dr. Ajayaghosh and others underlined the excellence and caliber of Dr. Gopidas as a great scientist, a wonderful mentor, an insightful academician and a dedicated administrator, who inspired and motivated a generation to take science not only as a career, but as a part of life also. The session was formally closed with the vote of thanks proposed by Dr. Narayanan Unni K. N. (CSIR-NIIST, Thiruvananthapuram) followed by the national anthem.

National Workshop on Advanced Analytical Solutions in Dioxin Analysis

CSIR- National Institute for Interdisciplinary Science & Technology conducted an one day workshop on "Advanced Analytical Solutions in Dioxin Analysis" in collaboration with Agilent Technologies on 5th January 2018. NIIST established the first dioxin research laboratory in India and contributed in preparing the National Implementation Plan (NIP) as a part of country's Stockholm convention obligations on POPs. Subsequently the facilities at NIIST have been strengthened for developing inventories of dioxin emission for gaps pointed out in NIP evaluation. Ministry of Environment & Forests (MoEF) has recommended CSIR- NIIST as a referral laboratory for carrying out dioxin analysis for environmental clearance in various sectors.

The workshop was organized for knowledge dissemination and creating awareness to testing laboratories, industries, regulatory bodies, research institutes and environmentalists in the latest trends in dioxin analysis. The hands-on training in sampling, sample preparation

and analysis of dioxins was conducted for the first time in India. The latest findings of the studies conducted by CSIR-NIIST on the emission of dioxins from open burning of municipal solid wastes were presented during the workshop. Dr. A. Ajayaghosh, Director, CSIR-NIIST inaugurated the workshop and Dr. S.K. Bhargava, Expert Appraisal Committee Member, Ministry of Environment & Forests was the special invitee to the programme.

Dr. K. P. Prathish, Scientist – in charge, Dioxin Laboratory, Mr. Chandrasekar Kandaswamy, Agilent Technologies and Dr. Van Essen Marc, LCTech, Germany presented the state of the art analytical methodologies for open burning studies, sample preparation methods and quantification using GC-MS/MS. About 30 participants from organisations such as Central and State Pollution Control Boards, CSIR-NEERI, IITR, NGRI, Export Inspection Council (EIC), Spices Board, FSSAI, CIFT, KSREC, Agricultural University, KEIL (FACT), KMML, Vimta Labs (Hyderabad), Sea Lab (Kochi), Interfield Lab (Kochi), CUSAT etc attended the workshop.

National Conference on Luminescence and its Applications (NCLA-2018)

National Conference on “Luminescence and its Applications “ (NCLA-2018) organized jointly by CSIR-National Institute for Interdisciplinary Science and Technology (NIIST) and Luminescence Society of India (LSI) was held during February 14-16, 2018 at CSIR-NIIST Thiruvananthapuram. NCLA-2018 was aimed at providing an interactive platform to the academia, researchers and the industry to discuss the various developments taking place in the area of phosphors. The conference was also intended to provide an opportunity for the young researchers to meet the peers in the field and discuss the challenges and issues in the development, fabrication, engineering and applications of phosphors.

The conference was inaugurated by Dr. R. P. Rao, Speciality Phosphors, USA, at CSIR-NIIST, Trivandrum on February 14, 2018. The function was presided over by Dr. A. Ajayaghosh, Director, CSIR-NIIST, Trivandrum.

In his inaugural address Dr. Rao highlighted the importance of phosphors in medical applications in areas such as diagnostics and imaging. He further informed that though there has been very focussed research on the fundamentals and the development of new and efficient phosphor materials worldwide, the efforts on realisation of devices for actual field applications still lacking. As the area is highly competitive in terms of revenue generation, many of the component fabrication based on these materials are closely guarded by multinational companies with IPRs.

Dr. A. Ajayaghosh, Director, CSIR-NIIST, Trivandrum in his presidential address highlighted the need of interdisciplinary approach for the development of luminescent materials with inputs from branches such as chemistry, physics, engineering and biology. He also emphasized that the area of luminescent materials is highly challenging and the developments are taking place at rapid rates in areas such as solid state lighting. He called upon the researchers in the area to devote attention on fundamental understanding and integrate engineering principles of device fabrication. He called upon the delegates to adopt an interdisciplinary approach comprising experts from different branches of science including engineering.

The key Note Lecture was delivered by Dr. R. P. Rao, Speciality Phosphors, USA. During his lecture, Dr. Rao highlighted the role played by luminescent materials in the medical applications. Though there exist a large number of devices based on luminescent materials, the device fabrication technology is closely guarded by multiple add on IPRs by MNCs worldwide. As the translation of fundamental knowledge to actual devices is a major challenge and hence he recommended adopting an interdisciplinary approach for the device development and engaging experts from different branches such as chemistry, biology, engineering and physics in the early stages of development.

The technical sessions included invited lectures from the distinguished experts and peers in various theme areas of the subject. The lead lectures in each session were followed by selected contributed papers in the oral presentations. There were about 12 technical sessions in which over 40 invited papers were presented in plenary, invited and contributed categories. The other contributed papers were in poster presentations. Three contributed papers presented in the poster sessions



Inaugural Session



Dr. A. Ajayaghosh, Director, CSIR-NIIST delivering the Presidential Address



Dr. R.P. Rao, Speciality Phosphors, USA, delivering the Keynote Lecture



were selected for the best poster presentation awards and were awarded cash prize with a certificate. About 200 registered delegates attended the conference.

The conference was sponsored by Board of Research In

Nuclear Sciences (BRNS), DAE, Kerala State Council for Science, Technology and Environment (KSCSTE), Council of Scientific & Industrial Research (CSIR), and supported by many other private industries/organisations.

R & D Industry meet

The second R&D Industry meet was held at CSIR-NIIST for enhancing and deepening partnership with Industry on 23rd February 2018. The R & D Industry meet was inaugurated by Shri T.K. Jose, IAS Additional Chief Secretary (Local Self Government Department), Govt. of Kerala in the esteemed presence of Dr. M. Beena, IAS Managing Director, KSIDC, Padmashree Hareendran Nair, Founder & MD, Pankajakasthuri, Dr. Ram Chand Chief Executive Officer, Saksin Lifesciences Pvt. Ltd.

Shri. T.K. Jose, IAS, Additional Chief Secretary (Local Self Government Department), Govt. of Kerala in his Inaugural address highlighted the need for linking academic institutions, research institutions, industries and government organizations to resolve societal problems. He emphasized the need for the scientific intervention in industries to achieve economic growth for the country. He mentioned many sectors specific to the state of Kerala such as Agri-products, Ayurveda, medicine, environment, bioTechnology which required scientist's involvement for value addition, productivity increase, reduce foreign import and enhance export and cost effectiveness etc. He asked scientific organizations like NIIST to take part in the government's socially-relevant projects in affordable medicine, housing-for-all, clean and green society etc. He wished CSIR-NIIST to organize similar workshops in other parts of Kerala like Cochin and Kozhikode every year in partnership with Kerala Government.

Dr. M. Beena, IAS Managing Director, KSIDC in her address cited that R&D and Industry meets are forums where the Industry problems and social needs can be identified and discussed as opportunities for innovation. She offered that the KSIDC can build a bridge between research laboratory and industry to translate technologies developed by the research institutes to useful products. She invited the young entrepreneurs of the state to take advantage of the opportunity to work with research organizations for

improving the productivity of industry sector and creating jobs for educated youths.

Padmashree Hareendran Nair, Founder & MD, Pankajakasthuri business group in his keynote address stressed the need for promoting and popularizing Ayurveda and ayurvedic products across the country and desired that scientific research organizations should play a pivotal role in the validation of Ayurvedic medicine and herbal products.

Dr. Ram Chand Chief Executive Officer, Saksin Lifesciences Pvt. Ltd. highlighted some of the areas of futuristic research specifically in the health and drug discovery sector. He emphasized the need for Industry and academia collaboration for solving specific problems as in the western countries. He also wished that scientific organizations should address the shortage of critical and skilled manpower in the country. The Director, CSIR-NIIST, Dr. A. Ajayaghosh in his presidential address briefed the activities of CSIR and cited the technologies available with CSIR to serve the society. He assured that R&D Industry meet would be organized every year to stay connected with Industries which is important for the translation of the knowledge available at NIIST to industry products and services. He also mentioned that NIIST would be working towards the societal needs and finding solutions to the problems of the industries. Dr. C. S. Bhat Sr. Pr. Scientist and Head, RPB proposed the vote of thanks.

The inaugural session was followed by technical presentations by the representatives of each division viz., Agro-processing and Technology division, Microbial process and Technology division, Chemical Sciences & Technology Division, Materials Science & Technology Division and Environmental Technology division highlighting the expertise, facilities and research advancement of their respective division. Mr. Praveen Raj, Sr. Scientist of Research Planning and Business

development division highlighted the ease of doing business with NIIST. The industry participants were encouraged to visit the divisions and facilities available at NIIST. There were one to one interactions with scientists, technologists and Industry representatives to focus on translational research and tune the R&D programmes to industry requirements. An exhibition of Products/ Technologies/ Processes developed in CSIR-NIIST also arranged as part of the meet. More than Sixty Industries from various sectors including Micro, Small & Medium

Enterprises took part in the R&D Industry meet to identify the issues of mutual interest and to forge alliances. Among the industries that visited few were our existing clients and majority were new participants.

The programme also had a panel discussion. The programme ended with a valedictory function in which a couple of agreements were executed between NIIST and KMML, Chavara and also with Athmic Biotech Private limited and a few business deals budded.



Various scenes from R.& D Industry meet

Workshop on Vigilance and Tendering Process

A one-day workshop was organised by the Knowledge Resource Centre, CSIR-NIIST in association with CSIR - Human Resource Development Centre, Ghaziabad (CSIR-HRDC) on 26th February 2018 on 'Vigilance and Tendering Process' for imparting the knowledge of vigilance and tendering process to Scientific and Technical Staff. Shri Sajen Peter IAS (Retd.), former Chief Secretary Vigilance and Cultural Affairs inaugurated the workshop while Dr Manu Saxena, Head, CSIR-HRDC chaired the session. Shri. Rakesh Kumar Sharma, Sr. Deputy Secretary(Retd.), CSIR gave an overview about a Facets of Vigilance, Conduct Rules, The Obligation and Compliance; Common Irregularities and Do's & Don'ts. Shri M. Dulip Kumar, Controller of Stores & Purchase, NIIST talked on



the Vigilance Perspective of Tendering Process, Shri. SamrendraNath, Former Director, Ministry of Steel explained on the CVC Guidelines on Public Procurement and Works & Services. The participants were greatly benefited by the workshop which ended with vote of thanks to Faculty and CSIR-HRDC.

Competency Development Programme for Technical Personnel

The training programme was organized by CSIR - Human Resource Development Centre, Ghaziabad (CSIR-HRDC) during 26th -27th February 2018 for the group II & Group III Technical Personals of CSIR-NIIST. Training was given on various topics such as CSIR Vision, Mission and Goals, Vigilance Perspectives for S&T Personnel, IT Tools in the day to day work, planning & organizing skills, effective

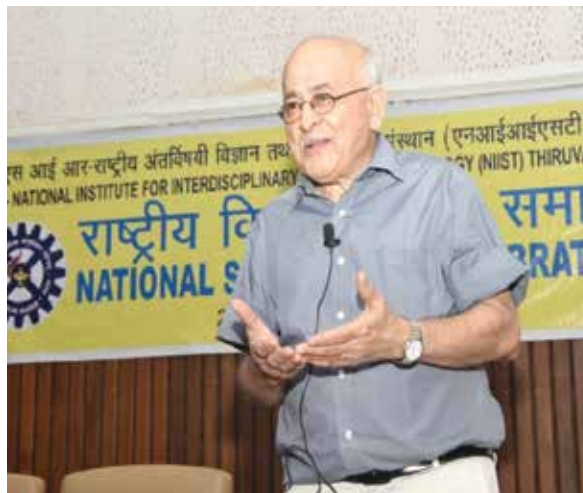


interpersonal skills, team building and group Dynamics, Service Matters and Self-Effectiveness at the workplace. Dr Manu Saxena, Head, CSIR-HRDC Ghaziabad; Shri SamrendraNath, Former Director, Ministry of Steel,

Govt. of India; Shri. Rakesh Kumar Sharma, Sr. Deputy Secretary(Retd.), CSIR and Dr AlokGoel, Sr. Technical Officer, CSIR-HRDC were the faculties for imparting the Competency Development Programme.

National Science Day Celebrations - 2018

The National Science Day was celebrated in CSIR-NIIST on February 28, 2018. Dr. A. Ajayaghosh, Director, CSIR-NIIST delivered the welcome address and introduced the Chief Guest of the day. The National Science Day Lecture was delivered by the chief guest, Prof. V. Nagaraja, President, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, on the topic "How to counter the resurgent drug-resistant tuberculosis". He emphasized that the research on newer drugs to treat tuberculosis is posing a serious challenge to scientists. This is primarily because the TB bacteria is a formidable pathogen making it tough for researchers to develop effective drugs. However, the only way to counter TB worldwide would be through a vaccine and new drug strategy. Dr.Luxmi Varma R, Chairperson, Academic Programme Committee proposed the vote of thanks.



Prof. V. Nagaraja, President, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, delivering Science day Lecture

नयी सुविधा / New Facility

X-ray Photoelectron Spectroscopy

**नया एनआईआईएसटी डिस्पेंसरी भवन / New NIIST dispensary building**



CSIR-NIIST

राष्ट्रीय अंतर्विषयी विज्ञान तथा प्रौद्योगिकी संस्थान
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)
तिरुवनंतपुरम

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