CSIR- National Chemical Laboratory

ANNUAL REPORT 2019 - 20

सीएसआईआर- राष्ट्रीय रासायनिक प्रयोगशाला

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद

वार्षिक प्रतिवेदन 2019-20

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सीएसआईआर - राष्ट्रीय रासायनिक प्रयोगशाला

CSIR-National Chemical Laboratory

With Best Compliments from...

Prof. Ashwini Kumar Nangia
Director

CSIR-National Chemical Laboratory

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की कलम से...

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सीएसआईआर. राष्ट्रीय रासायनिक प्रयोगशाला

सीएसआईआर-राष्ट्रीय रासायनिक प्रयोगशाला (सीएसआईआर-एनसीएल), पुणे में आपका स्वागत एवं अभिवादन। वर्ष २०१९-२० के लिए प्रयोगशाला की वार्षिक रिपोर्ट प्रस्तुत करना मेरे लिए हर्ष का विषय है। यह रिपोर्ट मौलिक विज्ञान के क्षेत्रों में उपलब्धियों के साथ-साथ वर्ष के दौरान विकसित प्रक्रियाओं और प्रौद्योगिकियों का सारांश है।

सीएसआईआर-एनसीएल द्वारा प्रख्यात वैज्ञानिकों और संकाय सदस्यों के कई महत्वपूर्ण व्याख्यान आयोजित किए गए। पुणे के थर्मैक्स लिमिटेड के प्रबंध निदेशक और सीईओ श्री एम.एस. उन्नीकृष्णन द्वारा "Science and Technology only can save India" विषय पर सीएसआईआर स्थापना दिवस व्याख्यान दिया गया। "Role of Chemical Engineering in Nation Building" विषय पर रासायनिक प्रौद्योगिकी संस्थान के कुलपति प्रो. ए. बी. पंडित द्वारा सीएसआईआर -एनसीएल स्थापना दिवस व्याख्यान प्रस्तुत किया गया। मिशन शक्ति, डीआरडीओ, हैदराबाद के परियोजना निदेशक श्री यू. राजा बाबू ने "Technological Challenges: Missile and Space Defence" नामक विषय पर राष्ट्रीय विज्ञान दिवस व्याख्यान दिया। प्रो. अमिताभ चट्टोपाध्याय, SERB Distinguished Fellow, सीएसआईआर-कोशिकीय एवं आणविक जीव विज्ञान केंद्र, हैदराबाद द्वारा प्रो. जे. डब्ल्यू. मैकबैन स्मृति व्याख्यान "G Protein & coupled Receptors in the Context of the Membrane Bilayer: An Intimate Association with Cholesterol" विषय पर प्रस्तुत किया गया, जो कि एनसीएल-आरएफ वार्षिक छात्र सम्मेलन के एक हिस्से के रूप में आयोजित किया गया था।

प्रयोगशाला द्वारा विभिन्न कार्यशालाओं, सम्मेलनों और संगोष्ठियों का आयोजन किया गया जिनमें Electron Diffraction: PEDT based structure solutions for small crystals; Emerging Electron Crystallography Based Structure Solutions Using Transmission Electron Microscopy; वार्षिक छात्र सम्मेलन और "विज्ञान में महिला" इस विषय पर अर्धदिवसीय संगोष्ठी इत्यादि का समावेश है। स्मार्ट इंडिया हैकेथॉन हार्डवेयर संस्करण के ग्रैंड फिनाले 2019 का भी आयोजन किया गया।

प्रयोगशाला द्वारा राष्ट्रीय तथा अंतर्राष्ट्रीय स्तर के विशेषज्ञ समीक्षित जर्नल्स में ४५० से ज्यादा शोधपत्र प्रकाशित किए गए, जो कि वैज्ञानिक प्रकाशन के क्षेत्र में एक बडी उपलब्धि है। वर्ष के दौरान प्रयोगशाला ने ६७ भारतीय एवं ६८ विदेशी पेटेंट एकस्व दर्ज किए गए। सीएसआईआर-एनसीएल को ७३ भारतीय एवं १३५ विदेशी पेटेंट प्रदान किए गए। सीएसआईआर-एनसीएल के वैज्ञानिकों के मार्गदर्शन में ६८ शोध छात्रों ने पीएच.डी. पूर्ण की। इस प्रयोगशाला ने प्रौद्योगिकियों प्रक्रियाओं को प्रायोजित परियोजनाओं के द्वारा विकसित करने के अपने प्रयास को जारी रखा है। इनमें know & how for delivering actives (semiochemicals) और insecticides to plant surfaces to help spreading and retention; Integrated pest and pathogen management in agriculture using fungi and their metabolites; Miniaturized mixers and reactors devices called as GLFR devices; तथा Continuous Process for Production of Paracetamol का समावेश है।

सीएसआईआर-एनसीएल ने सिल्वर नैनोवायर्स के निरंतर बडे पैमाने पर उत्पादन के लिए सबसे सस्ती तकनीक विकसित की है, जिसका उद्घाटन सीएसआईआर के महानिदेशक डॉ. शेखर मांडे के द्वारा किया गया। मिशन प्रोजेक्ट "सतत विकास के लिए कैटलिसिस" के अंतर्गत डीएमई पायलट प्लांट का उद्घाटन माननीय केंद्रीय मंत्री डॉ. हर्षवर्धन द्वारा किया गया। राष्ट्रपति श्री राम नाथ कोविंद जी के द्वारा देश के पहले स्वदेशी उच्च तापमान फ्यूल सेल सिस्टम का अनावरण किया गया, जो सीएसआईआर-एनसीएल पुणे, सीएसआईआर- एनपीएल नई दिल्ली, सीएसआईआर सीईसीआरआई कराईकुडी और दो निजी कंपनियों के प्रयासों से विकसित किया गया।

सीएसआईआर- एनसीएल द्वारा पोहांग विज्ञान और प्रौद्योगिकी संस्थान कोरिया, पूना कॉलेज ऑफ फार्मेसी, पुणे; निरमा विश्वविद्यालय, अहमदाबाद; डेक्कन शुगर टेक्नोलॉजी एसोसिएशन (DSTA), पुणे; स्वामी रामानंद तीर्थ मराठवाडा विश्वविद्यालय (RTMUN), नांदेड; सशस्त्र बल मेडिकल कॉलेज (एएफएमसी), पुणे; भारतीय फार्माकोपिया आयोग; इंद्रशिल विश्वविद्यालय, गुजरात; और बिसलेरी इंटरनेशनल प्रा. लि. मुंबई के साथ समझौता ज्ञापन किया गया।

मैं सीएसआईआर-एनसीएल के अनुसंधान परिषद और प्रबंधन परिषद के साथ ही महानिदेशक, सीएसआईआर एवं सीएसआईआर मुख्यालय, नई दिल्ली के स्टाफ को उनके निरंतर समर्थन एवं सहयोग के लिए धन्यवाद देना चाहता हूं। मैं सीएसआईआर-एनसीएल के हितधारकों, वैज्ञानिकों, स्टाफ एवं विद्यार्थियों के प्रति अपनी कृतज्ञता प्रगट करता हूँ, जिनकी उत्कृष्ट उपलब्धियों को इस वार्षिक रिपोर्ट में सम्मिलित किया गया है।

अश्विनी कु. नांगिया

(अश्विनी कुमार नांगिया)

Message
From the Desk of
Director

Prof. Ashwini Kumar Nangia
CSIR- National Chemical Laboratory

Greetings to all and welcome to the CSIR-National Chemical Laboratory (CSIR-NCL), Pune. I take this opportunity to present the Annual Report of the Laboratory for the year 2019-20. The report summarizes the achievements in the areas of fundamental sciences as well as processes and technologies developed during the year.

CSIR-NCL organized several important talks delivered by eminent scientists and faculties. Shri M. S. Unnikrishnan, Managing Director & CEO of Thermax Limited, Pune, delivered the CSIR Foundation Day Lecture on "Science and Technology only can save India." CSIR-NCL Foundation Day Lecture was presented by Prof. A. B. Pandit, Vice-Chancellor, Institute of Chemical Technology, Mumbai, on the topic "Role of Chemical Engineering in Nation Building." Shri U. Raja Babu, Project Director, Mission Shakti, DRDO, Hyderabad, gave away the National Science Day lecture on a topic entitled "Technological Challenges: Missile and Space Defence." Prof. Amitabha Chattopadhyay, SERB Distinguished Fellow, CSIR-Centre for Cellular and Molecular Biology, Hyderabad, gave away Prof. J. W. McBain Memorial Lecture on "G Protein-coupled Receptors in the Context of the Membrane Bilayer: An Intimate Association with Cholesterol" as a part of NCL-RF Annual Students Conference.

The Laboratory hosted different workshops, conferences, and symposia, including a workshop on Electron Diffraction: PEDT based structure solutions for small crystals; workshop on Emerging Electron Crystallography Based Structure Solutions Using Transmission Electron Microscopy; Annual student's conference and a Half-day symposium on "Women in Science" etc. CSIR-NCL with ARAI and IISER Pune organized a Grand Finale of the Hardware Edition of Smart India Hackathon 2019.

The Laboratory has marked major achievements in scientific publications, having published more than 450 Research papers in national and international peer reviewed journals. CSIR-NCL has filed 67 Indian and 68 foreign patents during the year. 73 Indian and 135 foreign patents were granted for CSIR-NCL. 68 Research students have completed Ph.D. under the guidance of CSIR-NCL scientists.

The lab has continued to make efforts to develop the technologies/ processes through the sponsored projects. It included the know-how for delivering actives (semiochemicals) and insecticides to plant surfaces to help spreading and retention; Integrated pest and pathogen management in agriculture using fungi and their metabolites; Miniaturized mixers and reactors devices called as GLFR devices; and a Continuous Process for Production of Paracetamol.

CSIR-NCL has developed the most inexpensive technology for continuous large-scale production of silver nanowires which was inaugurated at the hands of Dr. Shekhar Mande, DG-CSIR. Hon'ble Union Minister Dr. Harsh Vardhan inaugurated the DME Pilot Plant under Mission Project "Catalysis for Sustainable Development." President Shri Ram Nath Kovind unveiled the country's first indigenous High-Temperature Fuel Cell System developed by the efforts of CSIR-NCL, Pune; CSIR-NPL, New Delhi & CSIR-CECRI, Karaikudi, and two private companies.

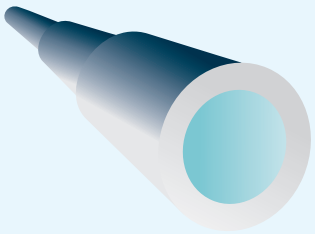
CSIR-NCL signed memorandum of understanding with the Pohang University of Science and Technology, Korea; Poona College of Pharmacy, Pune; Nirma University, Ahmedabad; Deccan Sugar Technology's Association (DSTA), Pune; Swami Ramanand Teerth Marathwada University, Nanded (SRTMUN), Nanded; Armed Force Medical College (AFMC), Pune; Indian Pharmacopoeia Commission; Indrashil University, Gujarat; and Bisleri International Pvt. Ltd., Mumbai.

I thank the Research Council and Management Council of CSIR-NCL as well as DG-CSIR and staff at CSIR HQ, New Delhi, for their constant support and cooperation. I acknowledge the role of stakeholders, the scientists, staff, and students of CSIR-NCL who made this outstanding achievement possible for inclusion in the Annual Report.

(Ashwini Kumar Nangia)

Vision, Mission, Guiding principles & Values

Vision



To be a globally recognized and respected R&D organization in the area of chemical sciences and engineering

To become an organization that will contribute significantly towards assisting the Indian chemical and related industries in transforming themselves into globally competitive organizations

To become an organization that will generate opportunities for wealth creation for the nation and, thereby, enhance the quality of life for its people

Mission

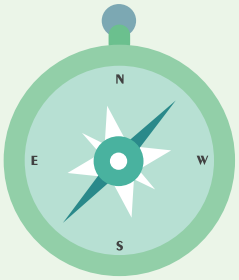
To carry out R&D in chemical and related sciences with a view to eventually deliver a product, process, intellectual property, tacit knowledge or service that can create wealth and provide other benefits to CSIR-NCL's stakeholders

To build and maintain a balance portfolio of scientific activities as well as R&D programs to enable CSIR-NCL to fulfill the demands of its stakeholders, present and future

To create and sustain specialized Knowledge Competencies and Resource Centers within CSIR-NCL which can provide support to all stakeholders of CSIR-NCL

To contribute to the creation of high quality Ph.D. students with competencies in the area of chemical, material, biological and engineering sciences

Values



To be deeply committed to the success of our stakeholders

To create and sustain a self - driven and self - managed learning organization with a high degree of internal and external transparency

To encourage a culture of collective and principle-centred leadership

To value the dignity of the individual and deal with people with a sense of fairness and without bias, prejudice or favour

To nurture the highest standards of integrity and ethical conduct

Organization Chart

Shri Narendra Modi
The Prime Minister of India
& President, CSIR

Dr. Harsh Vardhan
Union Minister for S&T
and Vice-President, CSIR

Dr. Shekhar C. Mande
Secretary, DSIR &
Director General, CSIR

Prof. Ashwini Kumar Nangia
DIRECTOR, CSIR-NCL

Management Council | **Research Council**

Scientific Divisions

- Chemical Engg. Process Dev.
- Catalysis & Inorganic Chemistry
- Organic Chemistry
- Physical & Materials Chemistry
- Polymer Science & Engineering
- Biochemical Sciences

Resource Centers

- Catalyst Pilot plant
- Center for Materials Characterization
- Central NMR Facility
- Digital Information & Knowledge Resource Center
- National Collection of Industrial Microorganisms
- NCL innovations

- Human Resource Management
- Intellectual Property Management
- Publication & Science Communication
- Research Planning & Audit
- Safety Management

- Engineering Services
- Glass Blowing

- Administration
- Finance & Accounts
- Stores & Purchase

Business Development

- Contract & Legal Support
- Public Relations & Events Management
- Management Information System

Research Areas

Catalysis

- Heterogeneous Catalysis
- Organometallic Chemistry
- Surface Science

Physical and Materials Chemistry

- Biomimetic Materials
- Materials for optoelectronics
- Magnetic and Gas storage
- Quantum electronic and structure theory
- Soft Matter: Theory and Simulation
- Synthesis of Materials including Nanomaterials

Chemical Engineering and Process Development

- Biochemical & Biological Engineering
- Energy and Environmental Engineering
- Industrial Catalysis and Catalytic Processes
- Industrial Flow Processes
- Mathematical & Computational Modeling
- Process Development and Scale-up
- Process Intensification and Engineering

Polymer Science and Engineering

- Advanced Polymeric Materials for Energy
- Healthcare, Water, Security and Strategic areas
- Biomass Chemistry and Technology
- Polymer Chemistry
- Polymer Engineering
- Polymer Physics
- Membrane Science and Technology
- Colloids, soft solids and metastable materials

Organic Chemistry

- Catalysis and new methods
- Chemical Biology
- Industrial Organic Chemistry
- Natural Product Chemistry
- Medicinal Chemistry
- Total Synthesis

Biochemical Sciences

- Enzymology and Microbiology
- Plant Molecular Biology
- Plant Tissue Culture
- Proteomics and Metabolomics
- Structure Biology

Research Council

Chairperson

Prof. Gautam R. Desiraju
Solid State & Structural Chemistry Unit
& Centre for Condensed Matter Theory,
Indian Institute of Science,
Bangalore

Internal Member

Prof. Ashwini Kumar Nangia
Director,
CSIR-National Chemical Laboratory,
Pune.

DG Nominee

Dr. Anjan Ray
Director,
CSIR-Indian Institute of Petroleum
P.O. IIP, Mohkampur
Dehradun – 248 005

Member Secretary

Mr. G. Prabhakaran

External Members

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President,
R&D and Business Development
India Glycols Limited
Noida-Greater Noida Expressway,
Subarea 2B, Sector 126
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Phase-2, ITBT Park, MIDC Hinjewadi,
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Director,
CSIR-National Institute of
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Industrial Estate, P.O. Pappanamcode
Thiruvananthapuram - 695019

Dr. S. Chandrasekhar
Director,
CSIR-Indian Institute of Chemical
Technology, Uppal Road, Tarnaka
Hyderabad - 500 007

Management council

Chairperson

Prof. Ashwini Kumar Nangia
Director,
CSIR-NCL, Pune

Members: CSIR-NCL

- **Dr. V. V. Panchanadikar**
- **Shri K. D. Deshpande**
- **Dr. G. J. Sanjayan**
- **Dr. S. Gurunath**
- **Dr. (Mrs.) Anuya Nisal**
- **Shri G. Prabhakaran**
- **Shri M. Sekar**

Sister Lab Director

- **Dr. Anjan Ray**
  CSIR-IIP, Dehradun

Member Secretary

- **Mrs. Pooja Kulkarni**
  Controller of Administration

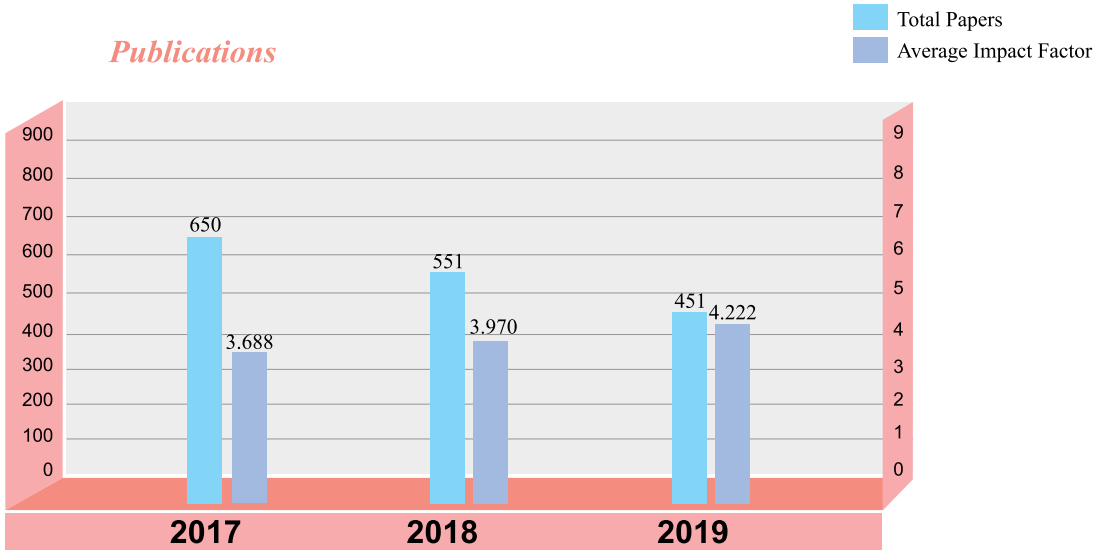
Performance Indicators

Performance Indicators

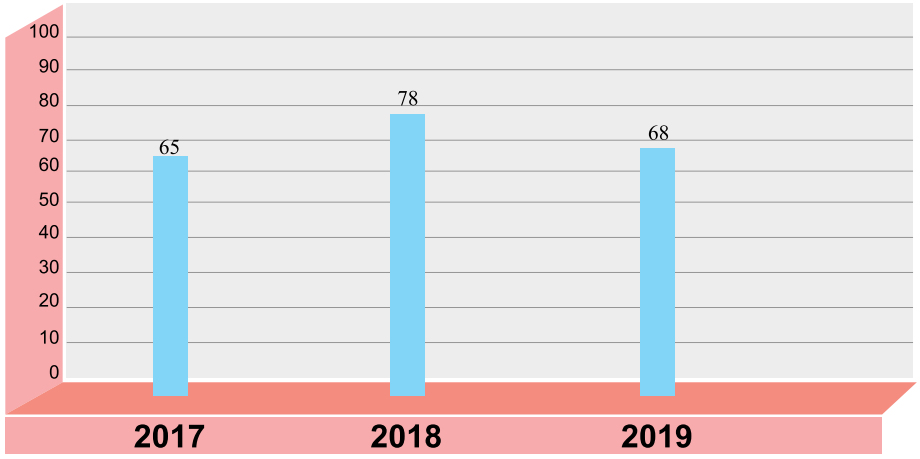
Science Performance Indicators

Research Output

Publications

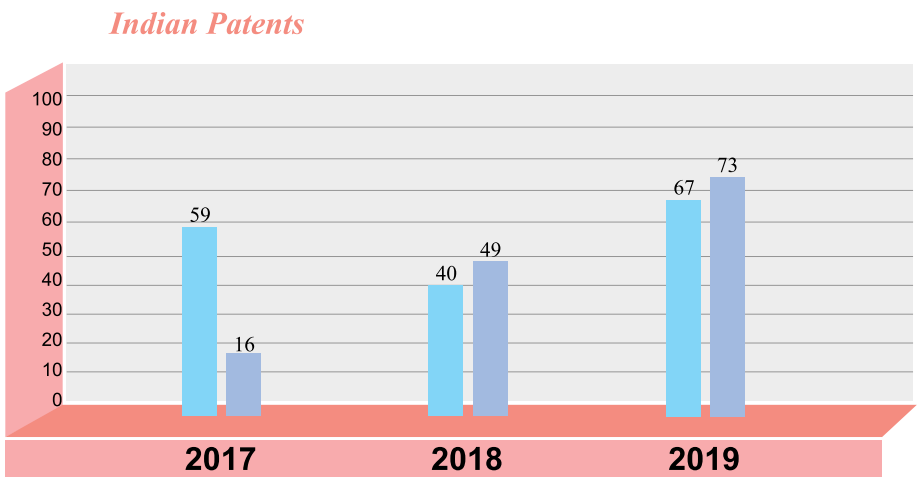


Ph.D. Theses

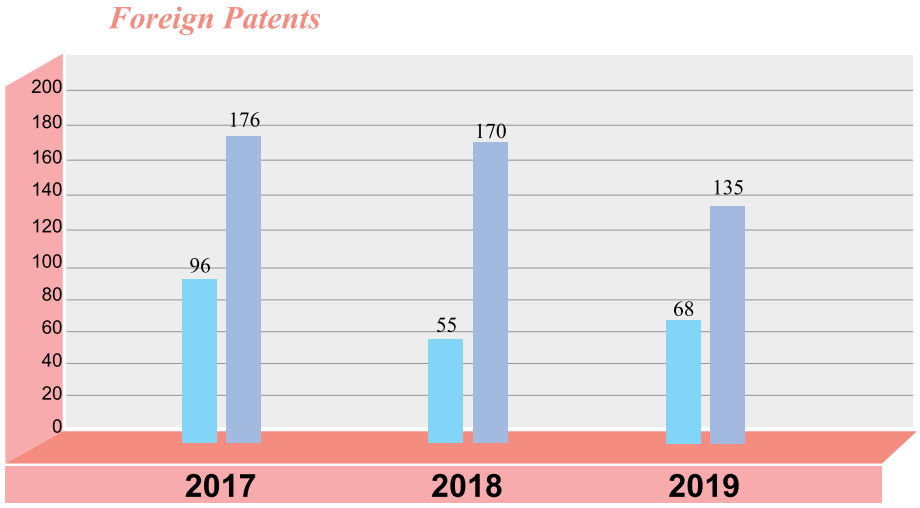


Technology Performance Indicators

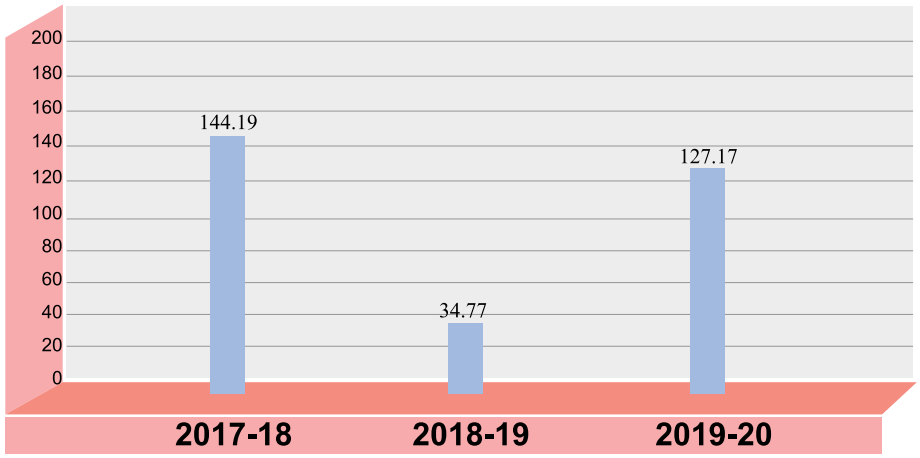
Indian Patents



Foreign Patents

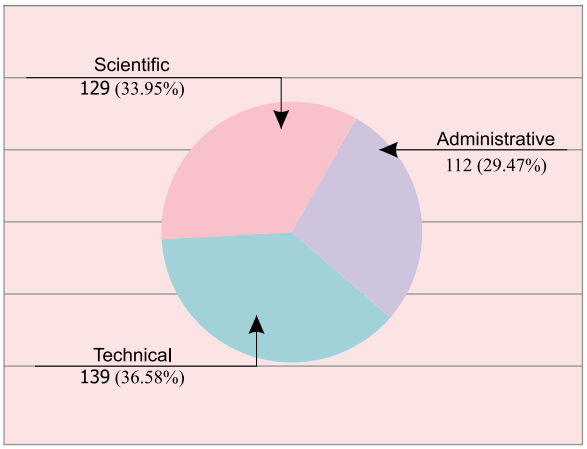


Premia/ Royalty Earnings

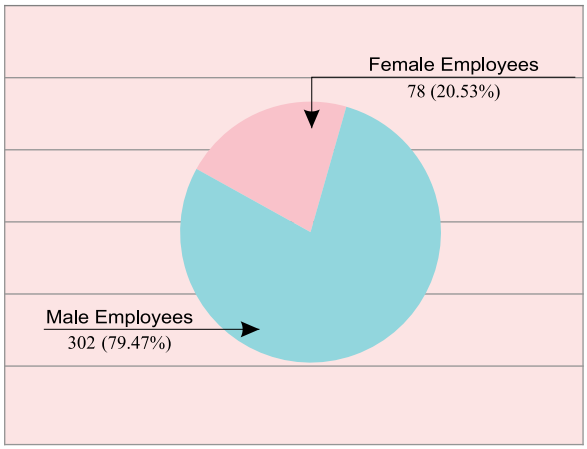


Human Resource Indicators

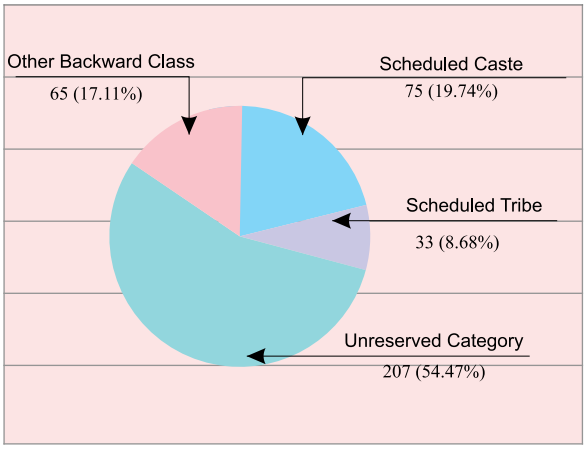
Total Staff: 380



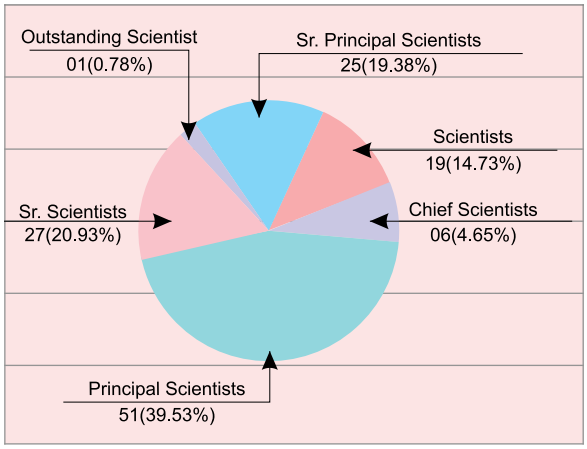
Male / Female Ratio



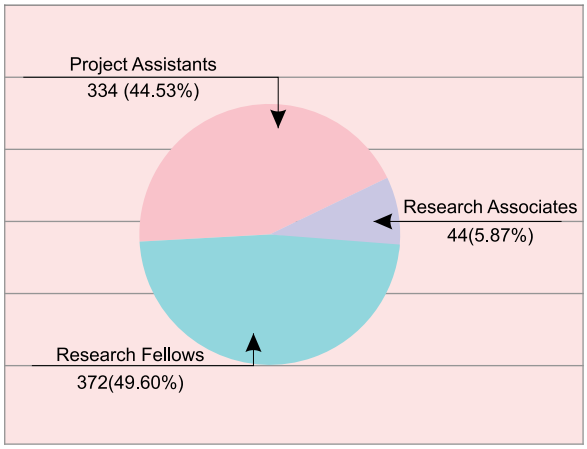
SC, ST, OBC & Others



Scientific Staff Distribution



Students and Project Staff



We welcome

Dr. Rakesh Shyamsundar Joshi
(08.05.2019)

Metabolic and Developmental Biochemistry, Agricultural Biotechnology, Structural Bioinformatics

- Assistant Professor, Savitribai Phule Pune University, Pune (2014-2019)
- Ph.D., Savitribai Phule Pune University, Pune (2010-2015)

Dr. Kiran S.
(23.05.2019)

Advanced Polymeric Biomaterials, Bio-renewable Polymers, Polymer Synthesis

- Post-Doctoral Fellow, Indian Institute of Space Science and Technology, Kerala (2015-2017)
- Post-Doctoral Research Fellow, University of Texas, USA (2014-2015)
- Ph.D., Sree Chitra Tirunal Institute for Biomedical Science and Technology, Kerala (2008-2013)

Dr. Mangesh Vetal
(29-05-2019)

Technology and IP marketing, Technology Assessment and Portfolio Analysis, and Open Innovation Programs

- Product Specialist, Agilent Technologies (2014-2019)
- Ph.D., Bioprocess technology, ICT Mumbai (2010-2014)

Dr. Nayaka G. P.
(30-05-2019)

Energy Storage and Conversion, Li-ion Batteries, E-Waste Management

- Post-Doctoral Research fellow at Kunming University of Science and Technology, Kunming, China (2017-2019).
- Ph.D., Kuvempu University, Karnataka, India (2013-2017)

We welcome

Dr. Vijayakumar Modepalli
(17.06.2019)

Technology Assessments, Strategy Recommendations, Technology Marketing

- Post-Doctoral Research Fellow, Ulsan National Institute of Science and Technology, South Korea (2016-2018)
- Ph.D., Ulsan National Institute of Science and Technology, South Korea (2011-2016)

Dr. Kirandeep Singh
(17.06.2019)

Functional Nanomaterials, Device Physics, Spintronics, 2D materials

- Post-Doctoral Research Fellow, Institute for Basic Science, Sungkyunkwan University, South Korea (2017-2019)
- Ph.D., Indian Institute of Technology Roorkee, India (2013-2017)

Dr. Vrushali Jadhav
(25-06-2019)

Homogenous & Heterogeneous Catalysis, Biomass to Biofuels, Carbohydrate Chemistry, Synthesis of Bioactive Natural Products, Synthetic Methodologies

- INSPIRE Faculty, CSIR-NCL, Pune (2013-2018)
- Post-Doctoral Research Fellow, University of Copenhagen, Denmark (2009-2011)
- Ph.D., University of Pune, Pune (2005-2010)

Dr. Sachin U. Nandanwar
(03-07-2019)

Heterogeneous Catalysis, Nanomaterials, Gas Processing

- Post-Doctoral Research Associate, University of Kansas, US (2018-2019)
- Post-Doctoral Research Associate, University of Wyoming, US (2017-2018)
- Post-Doctoral Research Associate, University of Idaho, US (2014-2016)
- Ph.D., S. V. National Institute of Technology, Surat (2010-2013)

We welcome

Dr. Satyam Naidu Vasireddy
(04-07-2019)

Process Intensification, Process Development and Scale-up of Chemical Processes, Kinetics of Chemical Reactions

- Post-Doctoral Research Associate, Hindustan Petroleum Corporation Ltd., Bangalore (2017-2019)
- Ph.D., IIT Madras, Chennai (2011-2017)

Dr. Santosh Kumar Meena
(30.07.2019)

Nanotechnology and Nanomaterials, Surfaces and interfaces, Metal-organic Frameworks, Bio-minerals, Kinetic modeling and process development

- Post-Doctoral Fellow, University of Sheffield, UK (2018-2019)
- Post-Doctoral Fellow, ENS Lyon, France (2017-2018)
- Post-Doctoral Fellow, University of California, USA (2016-2017)
- Ph.D., Johannes Gutenberg University of Mainz, Germany (2012-2016)

Dr. Niranjan Yeole
(08-08-2019)

Protection of IP, Administration of IP Portfolio, Technology and IP Strategy

- Sr. Research Scientist, PI Industries Ltd. (2017-2019)
- IP Analyst, Dolcera ITES, Hyderabad (2014-2017)
- Dr. D. S. Kothari Postdoctoral Fellow, University of Hyderabad, Hyderabad (2012-2014)
- Ph.D., North Maharashtra University, Jalgaon, (2008-2011)

Dr. Dinesh Sawant
(26-12-2019)

Organic Synthesis, Catalysis and Physical Organic Chemistry

- Assistant Professor (DST INSPIRE Faculty), IIT Dhanbad (2018-2019)
- Post-Doctoral Research Fellow, Leibniz-Institute for Catalysis, Germany (2017-2018)
- Post-Doctoral Research Fellow, Nagoya University, Japan (2016-2017)
- Post-Doctoral Research Fellow, King Abdullah University of Science and Technology, Saudi Arabia (2012-2016)
- Ph.D., ICT Mumbai, (2008-2012)

We welcome

Dr. Sudarsanam Putla
(12.02.2020)

Advanced Heterogeneous Catalysis, CO_2 Conversion, Biomass Valorization, Active Pharmaceutical Ingredients

- Marie Curie Post-Doctoral Fellow, Catholic University of Leuven, Belgium (2017–2019)
- Post-Doctoral Fellow, RMIT University, Australia (2014–2016)
- Ph.D., CSIR-IICT, Hyderabad (2009-2014)

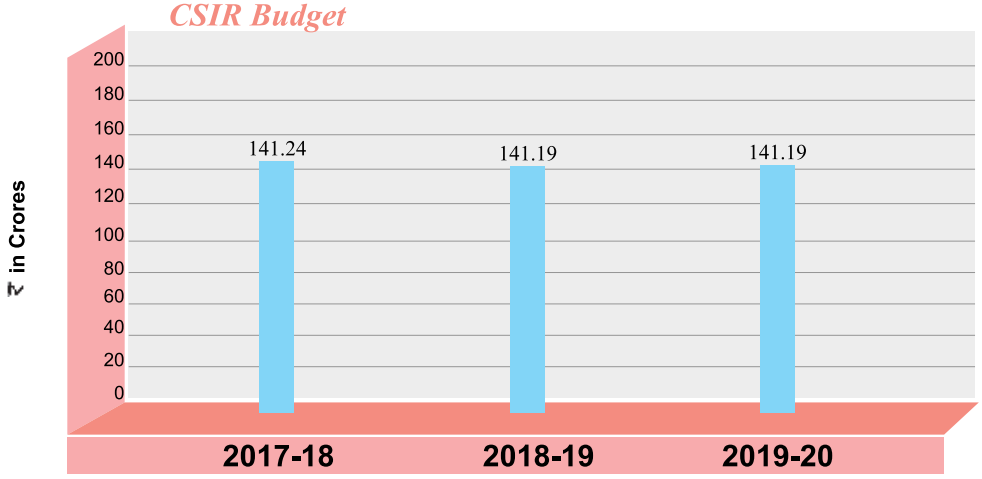
Dr. Chiranjit Chowdhury
(21-02-2020)

Bacterial Genetics and Molecular Microbiology, Synthetic Biology, Protein Biochemistry, Antimicrobial Agents and Chemotherapy

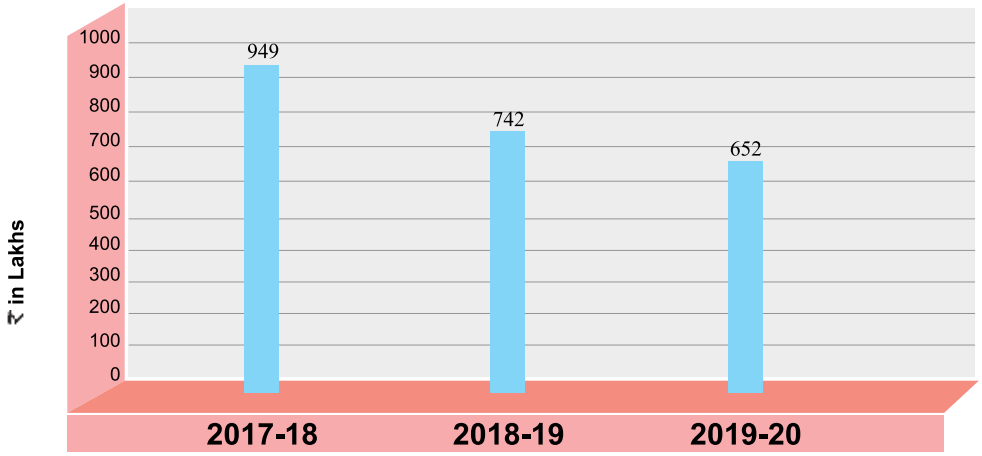
- Associate Professor & Ramanujan Fellow, Amity University, Noida (2018-2020)
- Assistant Scientist III, Iowa State University, USA (2017-2018)
- Post-Doctoral Research Associate, Iowa State University, USA (2012-2017)
- Post-Doctoral Research Associate, University of Notre Dame, USA (2011-2012)
- Research Associate, CSIR-Centre for Cellular and Molecular Biology, Hyderabad (2010-2011)
- Research Associate, IIT Kharagpur (2009-2010)
- Ph.D., Indian Institute of Technology, Kharagpur (2006-2009)

Financial Performance Indicators

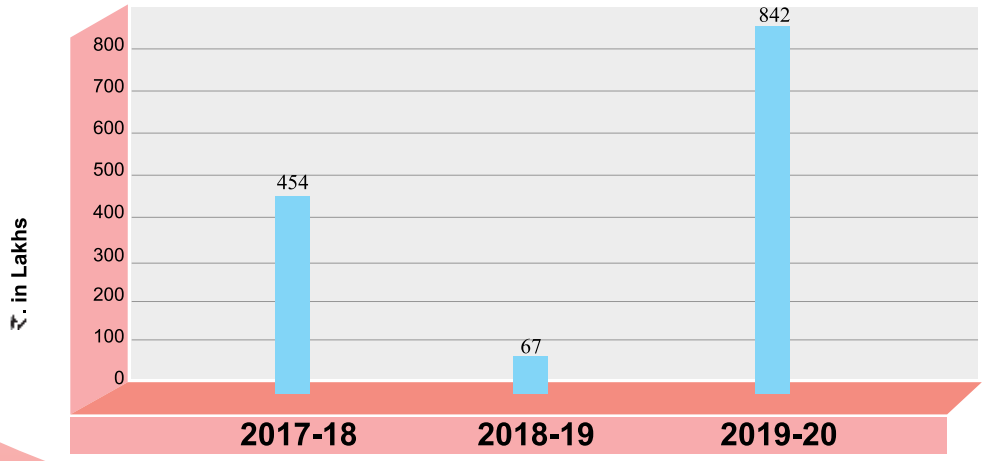
CSIR Budget



Laboratory reserve: Receipts

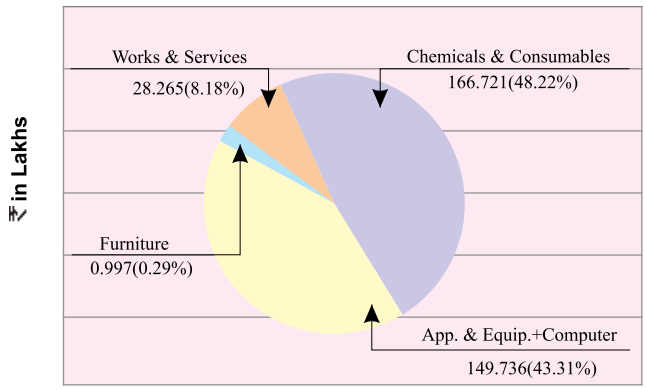


Laboratory reserve: Expenditure

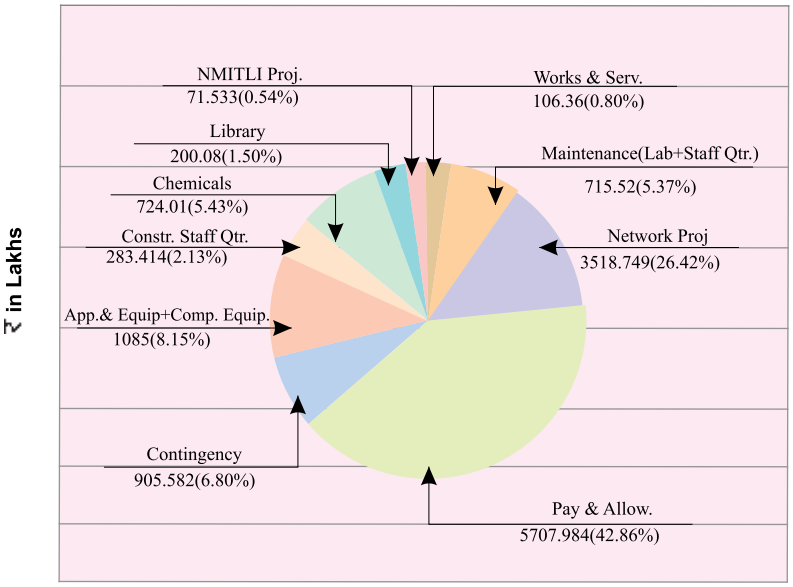


Financial Performance Indicators

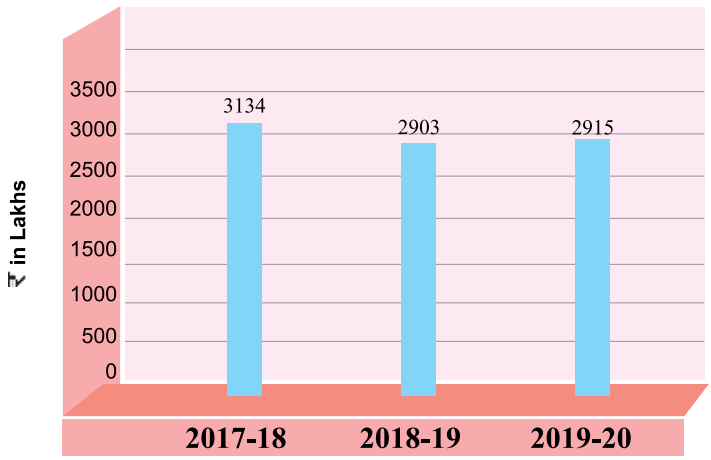
Laboratory reserve



CSIR and Network Projects



External Income

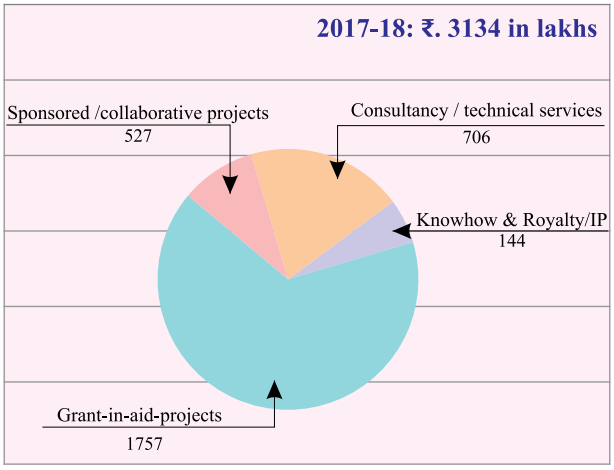


Financial Performance Indicators

Knowhow & Royalty/IP
Grant-in-aid-projects
Consultancy / technical services
Sponsored / collaborative projects
Government Sector
Indian Industry (Private)
Indian Industry (Public)
Foreign Sector

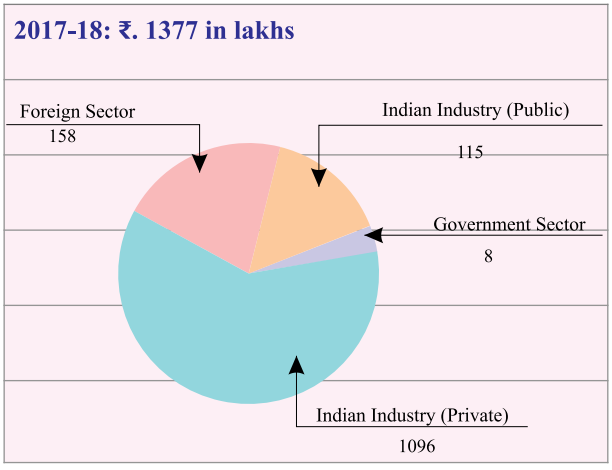
ECF by Source

2017-18: ₹. 3134 in lakhs

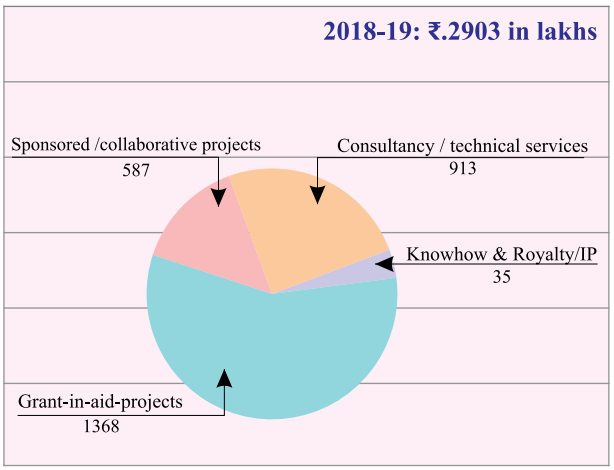


ECF from Industry

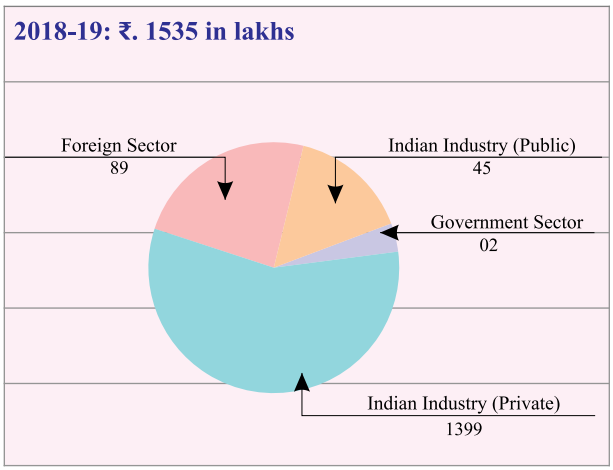
2017-18: ₹. 1377 in lakhs



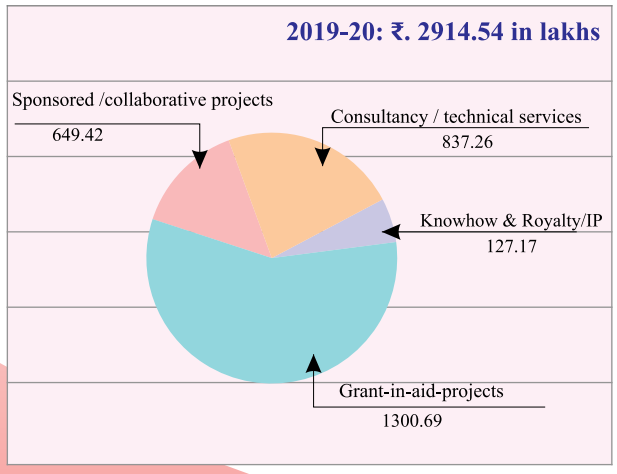
2018-19: ₹.2903 in lakhs



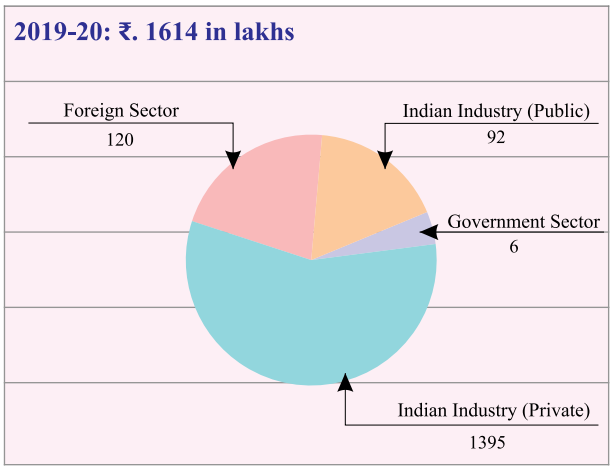
2018-19: ₹. 1535 in lakhs



2019-20: ₹. 2914.54 in lakhs



2019-20: ₹. 1614 in lakhs



Outputs & Outcomes

Category of Benefits	Benefit	Indicators	2017-18	2018-19	2019-20
Public and social goods	Generation of and dissemination of generic knowledge	Number of papers published (Calendar year)	650	551	451
		Number of invention disclosure (Calendar year)	102	93	62
		Number of patents filed in India (Calendar year)	59	40	67
		No of foreign patents filed ** (Calendar year)	96	55	68
		Number of PCT applications filed (Calendar year)	30	30	15
		No of US applications filed	51	51	35
	Highly trained man-power	Number of PhD students as on 31 March, 2019	404	443	372
		Number of PhDs produced (Calendar year)	65	78	68
		Number of NET/GATE qualified students joined (including DBT JRF)	127	90	12
	Science awareness, popularization etc.	Number of popular S&T articles published (in all languages)	1	4	6
		Number of national and regional workshops, seminars organized	7	4	4
	Pride and standing amongnations; National image	Number of international awards won	-	-	-
		Memberships of major international academies and learned societies	12	12	12
		Number of foreign patents granted** (Calendar year)	176	170	135
	Representation in global affairs	Official(s) in global/ -trans national organizations like the UN, WHO etc IUPAC (Cumulative years of office held) (Data given in no. of years)	8	8	8

1 Crore = 10 Million

Outputs & Outcomes

Category of Benefits	Benefit	Indicators	2017-18	2018-19	2019-20
Private goods	Research, consulting, teaching and analytical services	Total earnings from projects done for Indian & Foreign businesses/ industry (Rs in Crore) (Industrial ECF, excluding Grant-in-Aid)	31.34	15.35	16.14
	Continuing education	Total earnings from continuing education/ training programs (Rs in Crore)	NA	NA	NA
	Licensing and techno- logy transfer	Total earnings in the form of royalty, knowhow fees etc from Indian clients & contexts (Rs in Crore)	1.44	0.35	1.27
	Other tactical and strategic developments	Total earnings from patent related transaction (Rs in crore)	-	-	-
		No. of patents in new Licensing /assignment/ option arrangements	3	0	7
		No. of unique Licensing / assign- ment / option cases	2	0	4
		No. of Indian patents granted (Calendar year)	16	49	73
		No of foreign patents granted** (Calendar year)	176	170	135
	Contributions to projects involving valuable opportunities in the form of technology options	Money inflow from NMITLI projects and other similar strategic projects (Rs in Crore)	-	5.40	5.40
		Money inflow from Technology Mission & GIA projects (other than NMITLI) projects (Rs in Crore)	-	13.38	13.01
Intellectual assets and reputation	Quality, reputation and standing of scientific man-power	No. of Indian patents granted (Calendar year)	16	49	73
		No. of foreign patents granted** (Calendar year)	176	170	135
		Number of scientists who are members of editorial boards of international peer-reviewed journals, covered by SCI	NA	NA	NA
		Number of PhDs granted where lab scientists were research guides	65	78	68
		Number of staff who are members of National academies (Cumulative)	32	32	33
		Number of Bhatnagar awardees (Cumulative)	16	17	17
		Number of Padma awardees (Cumulative)	6	6	6
	Lab's standing with industry	Total worth of projects with industry (only industry: both Indian & foreign) (excluding Grant-in-Aid) (Rs in Crore)	31.34	15.35	16.14

* - Individuals who are members of more than one academy have been counted only once

** - Foreign means all filings other than IN & WO 1 Crore = 10 Million







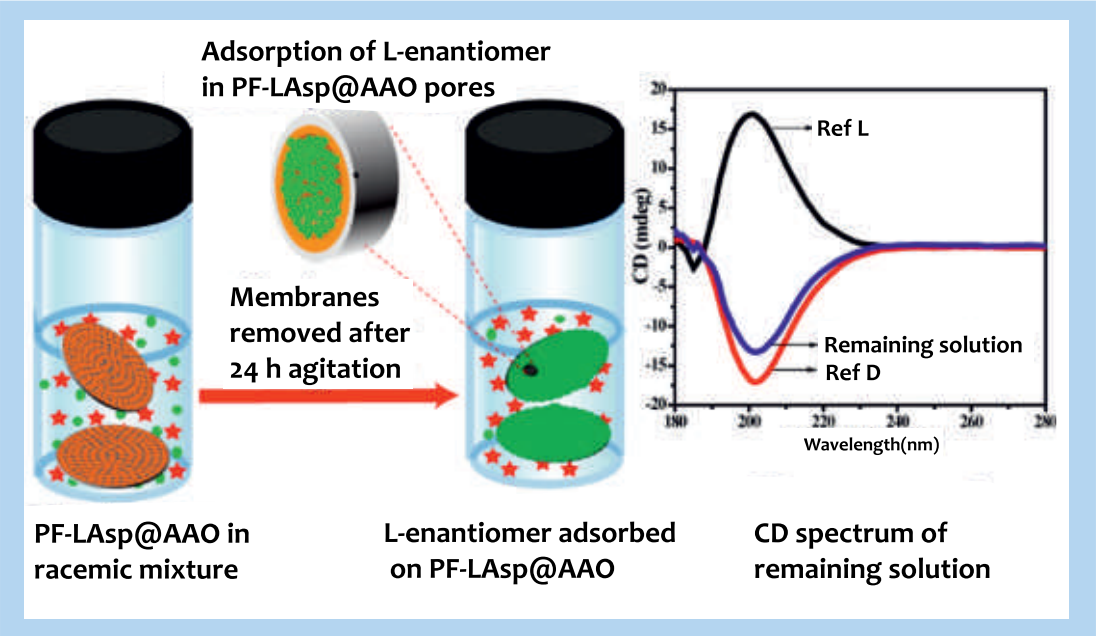

Research & Development

Research & Development

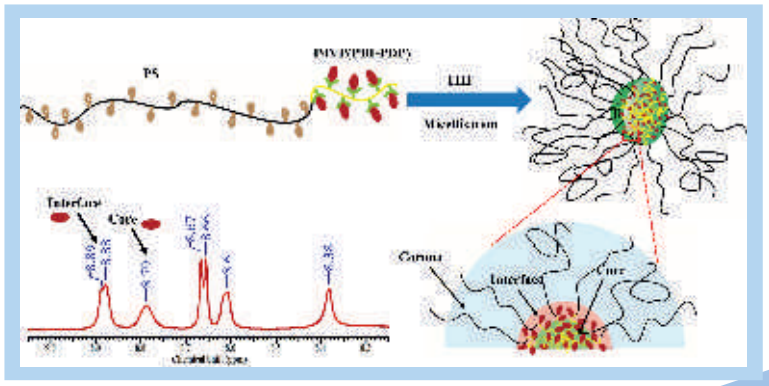
Asha S. K.
sk.asha@ncl.res.in

Polymer and soft material research

Enantio- selective separation using anodic aluminium oxide (AAO) membranes: Chiral anodic aluminium oxide membranes (AAO) prepared by coating protected D/L aspartic acid appended polyfluorene, successfully demonstrated enantioselective recognition and separation of a range of amino acids from their aqueous racemic mixture by simple filtration. Enantioselective separation was achieved by selective adsorption of one enantiomer into the chiral pores of the AAO membrane. A very high enantiomeric excess (ee %) of 95 % could be achieved for Glutamic acid in 24 h (*Anal. Chem.* **2020**, 92, 6850).



Self-assembly of bispentadecylphenol substituted perylenediimide: A ditopic molecular probe bispentadecylphenol substituted perylenediimide (PBI-PDP) was used to examine the molecular level self-assembly of PS-b-P4VP in THF. NMR experimental parameters measured for the small probe molecule provides detailed insights into the structure of the assemblies in solution as well as the interaction between the small molecule and the block copolymer. The dynamics and distribution of the PBI-PDP molecules within the assemblies in solution shows a dependence on the length of the P4VP block. Transmission electron microscopy was employed to study the evolution of morphologies in films prepared from the self-assembled structures in THF solutions (*ACS Appl. Polym. Mater.* **2020**, 2, 805).



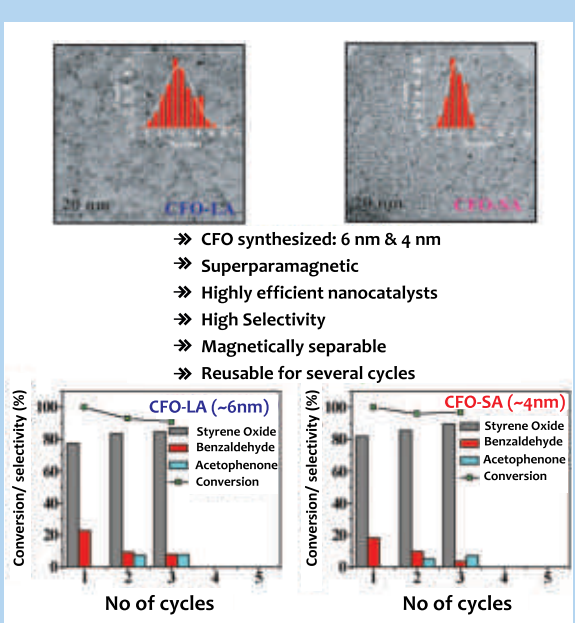
Advanced Materials

Nanostructured Materials

S. P. Mukherjee
sp.mukherjee@ncl.res.in

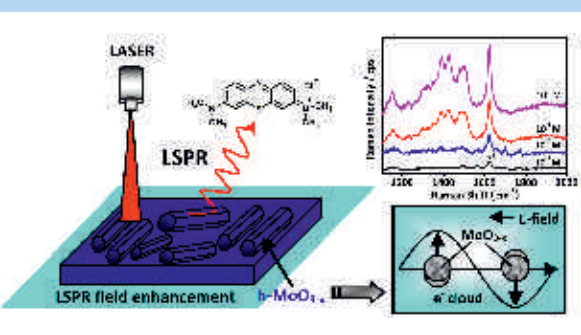
Size-controlled cobalt ferrite nanocrystals

Magnetically separable reusable nanocatalysts for selective oxidation of styrene: Superparamagnetic cobalt ferrite (CFO) nanocrystals (NCs) with sizes ~6 nm and ~4 nm were synthesized using a facile solvothermal method using fatty acids, lauric acid and stearic acid, as the capping agents. The synthesized nanocrystals were well characterized by XRD, FT-IR, XPS, SEM and TEM. The formation mechanism was explored and it was shown that the fatty acid was actually chemisorbed as a carboxylate onto the surface of CFO NCs. The experimental results specify that the size and size distribution of the CFO NCs were highly dependent on the length of fatty acid hydrophobic chain. Corresponding changes of the magnetic properties were investigated by measuring magnetization as a function of field and temperature, which suggest that the CFO NCs were super paramagnetic in nature. The catalytic properties for the oxidation of styrene in organic medium were examined by using the synthesized CFO NCs with sizes ~6 nm and ~4 nm. The synthesized CFO NCs, well dispersible in organic media, were demonstrated to be highly



catalytically active, reached 100% conversion of styrene in 12 h with ~77% and ~82% selectivity for styrene oxide respectively. The magnetic CFO nano catalysts were easily separated and recovered from the reaction medium by an external magnet, and reused for several cycles without loosing catalytic selectivity for styrene oxide (*ChemistrySelect* **2019**, 4, 6524).

Phase- and morphology-controlled synthesis of tunable plasmonic MoO_{3-x} nanomaterials: A simple surfactant-free hydrothermal strategy was proposed to fabricate crystalline h-MoO_{3-x} and α-MoO_{3-x} nanomaterials with tunable plasmonic properties. Herein, the crystal phase, morphology, and oxygen vacancy of MoO_{3-x} nanostructures were precisely controlled under suitable synthetic conditions. The plasmonic properties of the as-synthesized h-MoO_{3-x} and α-MoO_{3-x} micro-/nanostructures were controlled by adjusting the residual volume in the autoclaving chamber. In addition, the plasmonic MoO_{3-x} exhibited SERS activity with a detection limit as low as 1.0 × 10–9 M and the maximum enhancement factor (EF) up to 6.99 × 10^5 for h-MoO_{3-x}, while for α-MoO_{3-x}, the

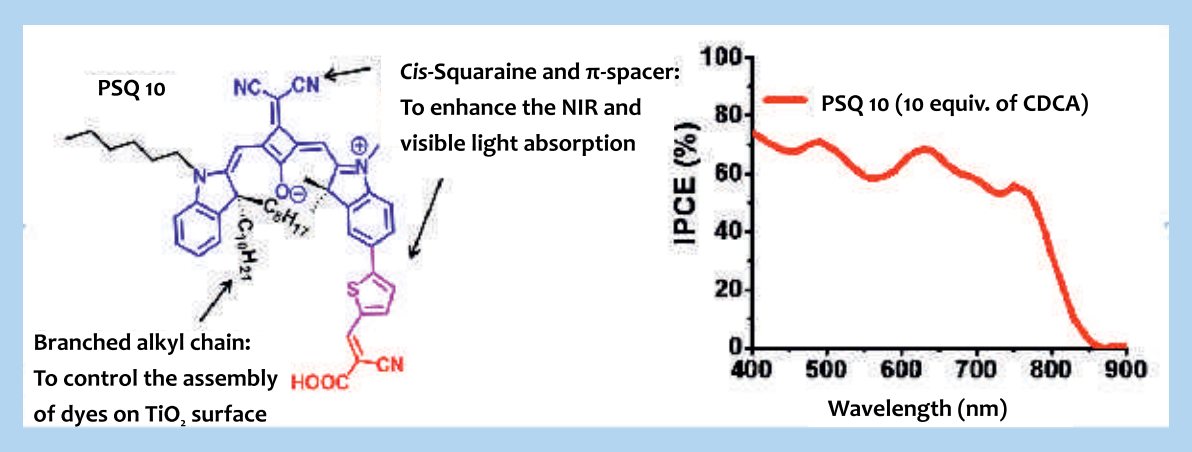


detection limit was 1.0 × 10^{-7} M with the corresponding EF up to 8.51 × 10^3, comparable with plasmonic noble metal nano materials without a "hot spot" (*J. Phys. Chem.* C **2020**, 124, 21082)

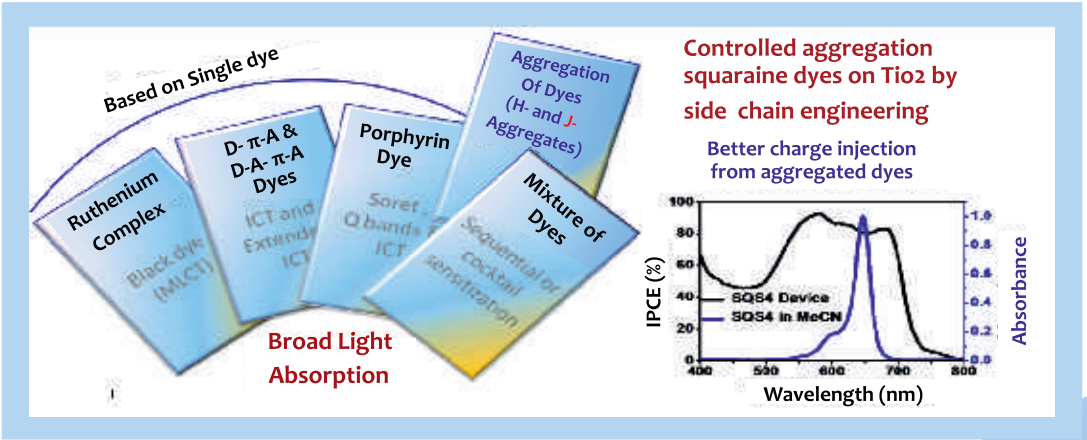
J. Nithyanandhan
j.nithyanandhan@ncl.res.in

Design and synthesis of far-red and NIR active squar- aine dyes for dye-sensitized solar cells

π extended *cis*-configured un symmetrical squaraine dyes for dye-sensitized solar cells: Far-red active π-extended *cis*-configured unsymmetrical squaraine dyes with carboxylic acid and cycnoacetic acid as anchoring groups with controlled aggregation and panchromatic light absorption by including the steric and electronic factors were engineered, synthesized, and tested as a light absorbing material for dye-sensitized solar cells. The presence of sp^3 -C (out-of-plane) and N-alkyl (in-plane) groups played an important role in modulating the assembly of the dyes on the TiO_2 electrode. The *cis*-squaraine unit helped to extend the conjugation in the NIR region besides enhancing the visible transition and the incident photon-to-current conversion efficiency profile that showed the importance of anchoring groups for the panchromatic response. Dye PSQ10 showed solar-to-electric conversion with an onset of 850 nm with the device performance of 7.0% (V_{oc} = 0.581 V, J_{sc} = 17.06 mA/cm^2 , FF = 70%) (*ACS Appl. Energy Mater.* **2019**, 2, 8464).



Alkyl group wrapped unsymmetrical squaraine dyes for dye-sensitized solar cells: Squaraines are far-red active zwitterionic dyes, have high molar extinction coefficient along with unique aggregation properties due to the larger dipole moment associated with it. A series of unsymmetrical squaraine dyes with systematic variation of alkyl groups at sp^3-C and N-atoms of indoline unit that was away from the



anchoring group is designed to control the dye-dyeinteractions on the TiO_2 surface. The branched alkyl groups help to modulate the self-assembly of sensitizers on the TiO_2 surface besides passivating the surface that helps to avoid the charge recombination processes. Dye SQS4 has achieved highest efficiency of 7.1% (Voc = 715 mV, Jsc = 13.05 mA/cm2) with coadsorbent chenodeoxycholic acid using iodine (I-/I3-) electrolyte compared to its analogs (*ACS Appl. Mater. Inter.* **2020**, *12*, 2555).

Arup Kumar Rath
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Quantum dots

Mutually passivated quantum dot ink: Tunable band gap colloidal quantum dots (QDs) is a potential building block to harvest the wide energy solar spectrum. We reported a joint passivation strategy using thiol and halometallate ligand was developed to prepare the QD ink. The mutually passivated QDs show a 50% reduction in shell thickness, reduced trap density and improved monodispersity in its solid films. These improvements lead to a four-time increase in carrier mobility and doubling of the diffusion length, which enables the carrier extraction from a much thicker absorbing layer. The photovoltaic devices showed a high efficiency of 10.3% and reduced hysteresis effect. The improvement in surface passivation leads to reduced oxygen doping and improved ambient stability of the solar cells (*ACS Appl. Mater. Inter.* **2019**, *11*, 26100).

Reduction of trap and polydispersity in quantum dot films: Control over surface passivation is a key to manage the optoelectronic properties in low dimensional nano materials due to their high surface to volume ratio. Tunable band gap quantum dots (QDs) are a potential building block for the development of optoelectronic devices like solar cells, photodetectors, and light-emitting diodes. Here we introduced a surface passivation strategy where the QDs are mutually passivated by organic ligand 3-methyl mercapto propionate and inorganic halometallate ligands to develop conducting QD ink. The mutually passivated quantum dots (MPQDs) showed significant improvement in optoelectronic properties in maintaining the trap free energy band gap and size monodispersity. The photovoltaic performance of MPQDs showed a 33% average increase in power conversion efficiency over the conventional halometallate passivation, to attain 9.6% PCE in MPQD solar cells. The improvements in photovoltaic parameters are corroborated by the reduction in density of intermediate trap states, increase in depletion width and diffusion length in MPQD based solar cells (*ACS Appl. Energy Mater.* **2020**, *3*, 8903).

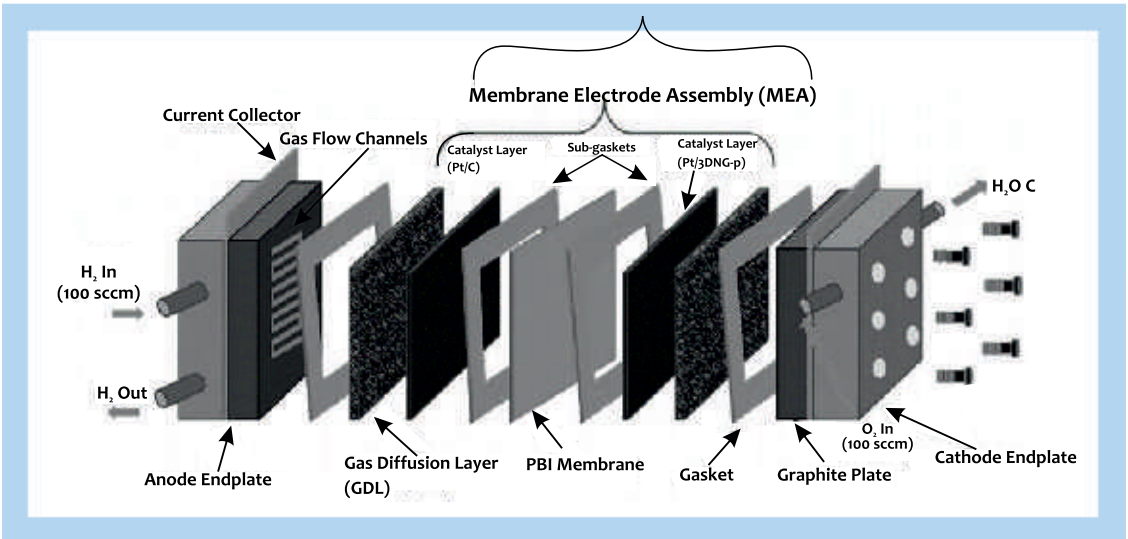
Inorganic ligands for quantum dot solar cell: We found out a solution phase ligand exchange strategy using alkali metal halides as a substitution for the organic counterpart to facilitate solution phase ligand exchange using all inorganic halometallate ligands. Considering the limited solubility of the alkali halides in organic solvents a two-stage ligand-exchanged process was developed to help remove the excess ligands, preserve the electronic purity and allow the formation of highly passivated QD films from solution phase deposition. A two-fold increase in solar cell performance is shown with the help of the modified ligand exchange approach. The solar cell properties are further analysed through detailed characterizations of the QD solar cells (*J. Mater. Sci.-Mater. El.* **2019**, 522, 16234).

K. Sreekumar
k.sreekumar@ncl.res.in

Advanced materials for energy conversion and storage

Development of non-aqueous rechargeable zinc-metal polymer battery: We demonstrated the preparation and characterization of non-aqueous zinc-ion conducting gel polymer electrolyte (GPE) using a facile UV-assisted polymerization technique. The as-synthesized GPE membrane exhibited good ionic conductivity at room temperature (10^{-3} S cm^{-1}) and high electrochemical stability (>2.4 V *vs.* $Zn|Zn^{2+}$) along with excellent mechanical strength. The GPE prepared with optimum Zn^{2+}-salt concentration offered stable solid electrolyte interphase (SEI) layer over the Zn electrode, thereby facilitating the plating/stripping of Zn in a Zn|Zn symmetric cell with a low overpotential of 300 mV for more than 200 h. The electrochemical performance of the GPE was further investigated in zinc-metal battery (ZMB) full-cell using $VOPO_4$ as the cathode and metallic zinc as the anode ($VOPO_4||Zn$). The resulting ZMB cell delivered a high average voltage of 1.2 V and a specific discharge capacity of 78 mAh g^{-1} (*Small* **2020**, 16, 2002528).

Electrocatalyst for polymer electrolyte membrane fuel cells: Effective utilization of platinum (Pt) is one of the critical parameters for enhancing the performance of the polymer electrolyte membrane fuel cells (PEMFCs). In line with this, we designed nitrogen-doped 3D graphene (3DNG) as the supporting material for Pt. The 3DNG support exhibits better accessibility, invariable size distribution, and high electrochemical surface area for Pt nanoparticles compared to the other conventional carbon supports (*viz.* Vulcan carbon (VC) and nitrogen-doped graphene (NRG)). This was further validated by the mass activity and specific activity comparison, which followed the trend: Pt/3DNG > Pt/VC > Pt/ NRG. We also demonstrated the electrochemical performance of Pt/3DNG as the cathode in a high-temperature PEMFC (HT-PEMFC). For analyzing the performance of Pt/3DNG in HT-PEMFC, we utilized the concept of *in-situ* generation of the proton conducting-ionomer by UV-light induced free-radical polymerization over the electrodes. The *in-situ* generated proton conducting ionomer has the potential to replace the conventionally used Nafion ionomer for electrode fabrication. Moreover, the membrane electrode assembly having the *in-situ* generated ionomer delivers a power density of 982 mW cm^{-2}, which is higher compared to that of the Nafion ionomer-based counterpart, highlighting the advantage of the proposed strategy (*Adv. Sustainable Syst.* **2020**, 2000125).



Advanced Materials

Materials for Energy

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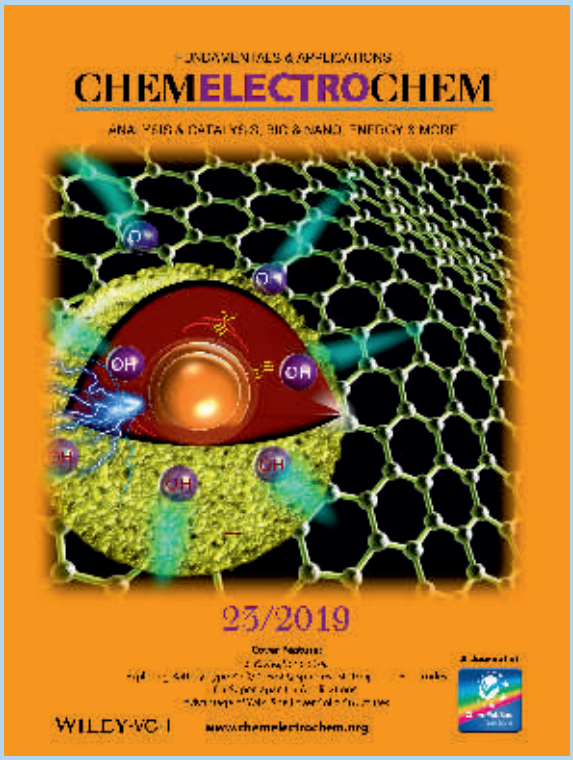
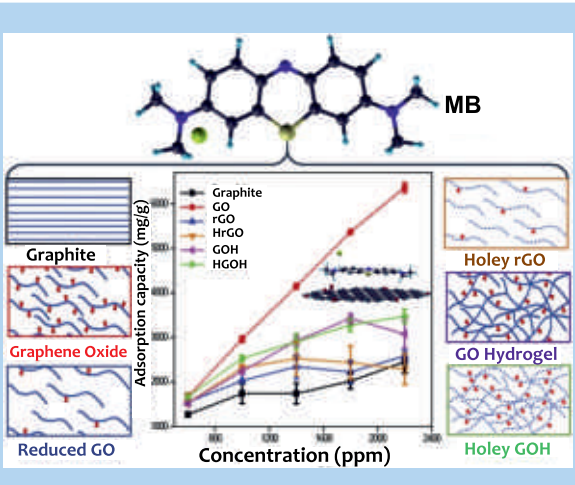
Rational designing of advanced functional nano-structured materials

Rational design and development of $ZnO/ZnFe_2O_4$ spheres-3D graphene: In spite of its excellent capacitance making it highly promising for energy storage applications, $ZnO/ZnFe_2O_4$ composite suffers with poor capacitance retention due to its strong volumetric variations during operation. We demonstrated a rationale design of a binder-free electrode with a porous yolk–shell $ZnO/ZnFe_2O_4$ composite matrixed inside a 3D network of graphene, grown on Ni foam. The design exhibited a four-fold increase in its specific capacitance, (1334 F g^{-1} at 0.5 A g^{-1}, specific capacity of 370.5 mAh g^{-1}) in contrast to solid metal oxide counterpart $ZnO/ZnFe_2O_4$ electrodes (309 F g^{-1} (85.8 mAh g^{-1}) at 0.5 A g^{-1}). The availability of free space in yolk–shell design accommodated the volume expansions to retain the capacitance up to 80 % beyond 5000 cycles at a current density of 1 A g^{-1} (*ChemElectroChem* **2019**, 6, 5819).



Unravelling the distinct surface interactions of modified graphene nanostructures with adsorbents: Nanoscopic modifications leading to multi-dimensional graphene structures are known to significantly influence their candidature for several applications including catalysis, energy storage, molecular sensing and environmental remediation. Our lab tries to identify the key trajectories that connect the structural qualification with the application. For instance, various physico-chemically Modified Graphene Nanostructures (MGNs) such as 2D Graphite, Graphene Oxide (GO), reduced GO (rGO), holey rGO, and 3D GO hydrogel and Holey GO hydrogel are investigated using an exclusive real time *in-situ* UV visible spectral setup. Detailed analysis of various experimental and computational data suggested a complex dependency of various factors such as surface oxygen, morphology, nanoporosity etc. Electrostatics and H bonding are the two dominant forces driving the adsorption on the best performing GO (*J. Hazard. Mater.* **2020**, *388*, 121755).



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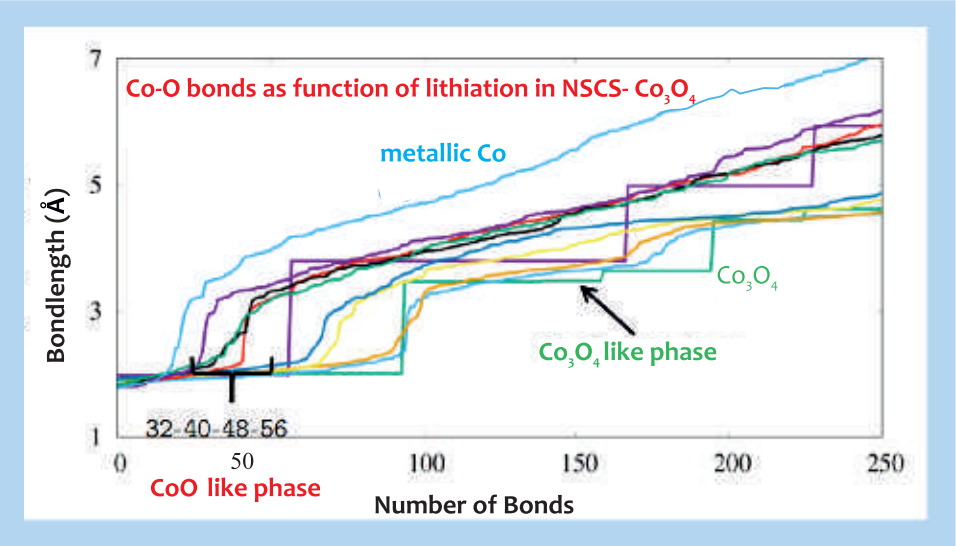
Understanding structural phase transitions in an electrode material upon doping: Conversion type anode materials are being studied for Li-ion batteries (LIBs) for their potentially higher capacities over current graphite based anodes. This work describes development of high capacity and stable anode from a nanocomposite of N and S co-doped carbon spheres (NSCS) with Co_3O_4 (NSCS-Co_3O_4). Detailed DFT based calculations have revealed role of doped support in controlling the volume expansion upon lithiation as well as how it help in maintaining the functionality of the electrode (*Nanoscale Adv.* **2020**, 2, 2914).



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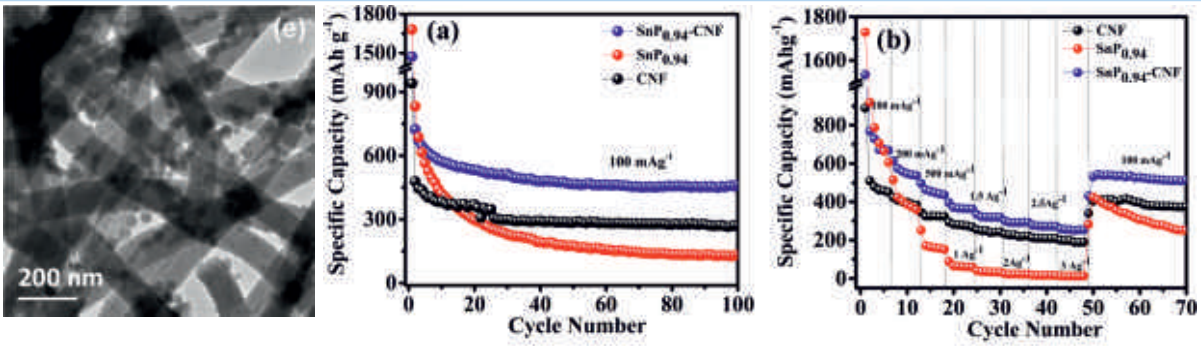
Rechargeable batteries and flexible supercapacitors
Anode materials for lithium-ion batteries (LIBs): LiBs have occupied a primary position in fulfilling energy storage requirements in the electronic applications. Especially anode materials are more important to increase energy density as well as power density of LIBs. We have synthesized an excellent conversion-

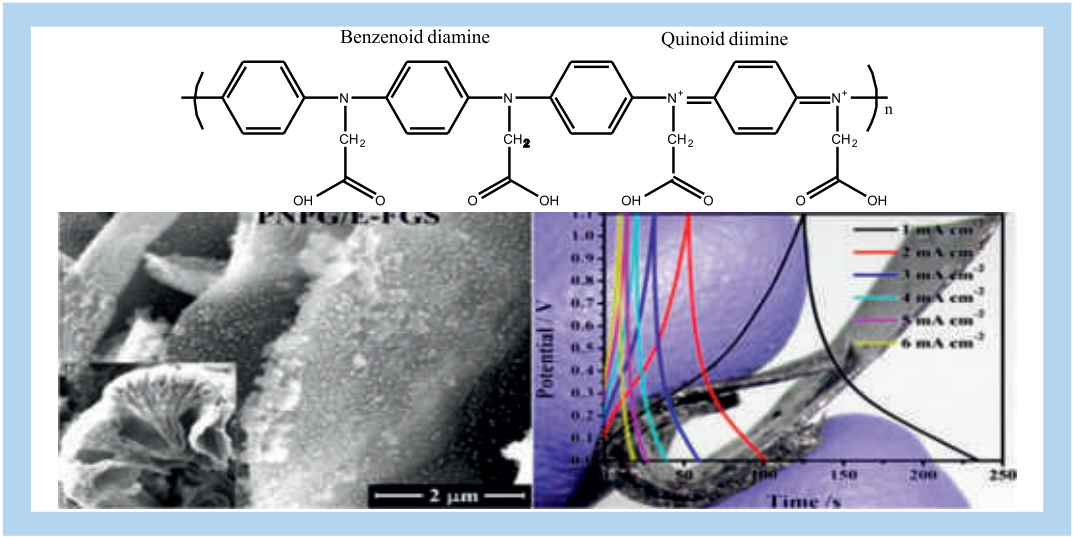


(a) (b) (c)

SnP0.94 nano-particles encapsulated in carbon nanofibers (a) SEM, (b) Cycle life study (c) Rate capability

-cum-alloying anode material for LIB with high energy density, longer cycle life and superior rate capability. We have developed high energy anode electrospun nanofibers of tin phosphide (SnP0.94) nanoparticles encapsulated in a carbon matrix. A capacity as high as 750 mAh g-1 has been achieved at a current density of 100 mA g-1 with acceptable cyclic stability, rate performance (*Energ. Fuel.* **2020**, 34, 7648).

High energy flexible supercapacitor: Compact devices such as bendable displays, implantable, wireless medical contrivances require improvements in replacing conventional capacitors by mechanically flexible electrochemical supercapacitors. We have fabricated flexible FGS substrate by electrochemical exfoliation. It was later used for electropolymerization of Poly(N-phenylglycine) (PNPG), an original pseudocapacitive conjugative conducting polymer on its surface. A flexible solid-state symmetrical supercapacitor was further fabricated using PNPG/E-FGS electrodes, exhibiting an excellent specific energy and power density (*ACS Sustain. Chem. Eng.* **2020**, *8*, 6433).



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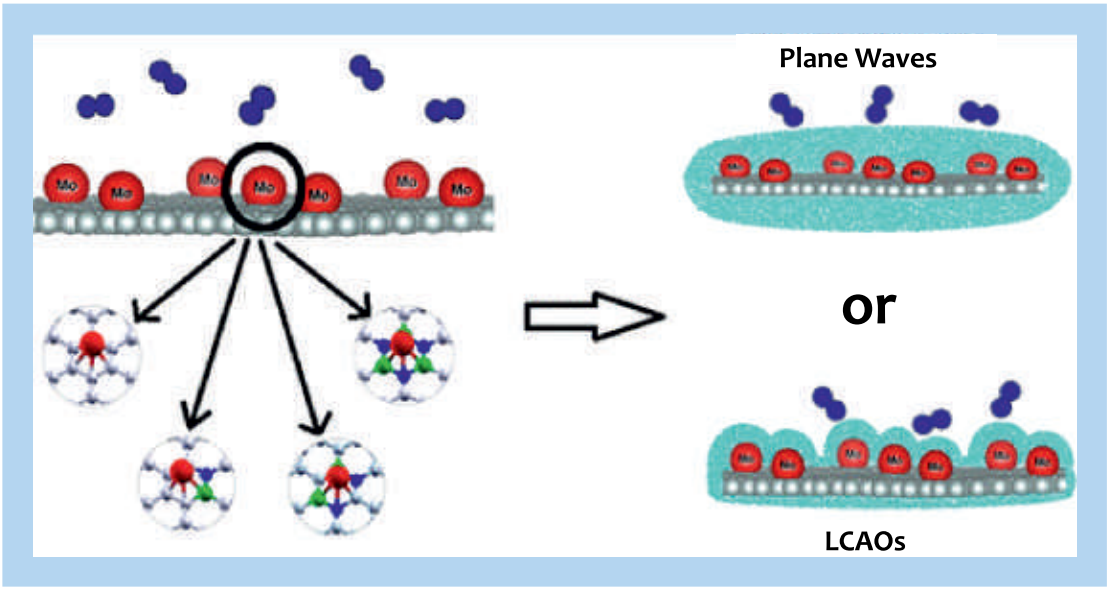
Materials for energy and environment

Dinitrogen activation using single atom catalysts: A case study of dinitrogen (N_2) activation on Mo anchored graphene has been made by employing periodic and finite models of graphene to understand the contributing factors of catalysis on such systems. The study has brought out the connotation of regulating atomic composition of graphene substrate for dinitrogen activation, also unveiled the relative insignificance of varying the size and edge effects of the substrate. These features are highlighted through an analysis of red shift in the N–N stretching frequency, charge transfer to dinitrogen from the catalytic system, and structural and electronic characteristics of the catalytic system. The total and projected density of states plots revealed hybridization between the metal d orbitals and the p orbitals of carbon and nitrogen in the valence band. On the other hand, the frontier molecular orbital analysis also depicted a strong chemisorption of dinitrogen with the metal–graphene supports on account of direct hybridization between the d orbitals of the supported metal atom and the p orbitals of dinitrogen. The Bader and Löwdin charge distribution on the adsorbed dinitrogen in periodic and finite models shows the preeminence of local site over the surface activity (*J. Phys. Chem. C* **2019**, 123, 27492).



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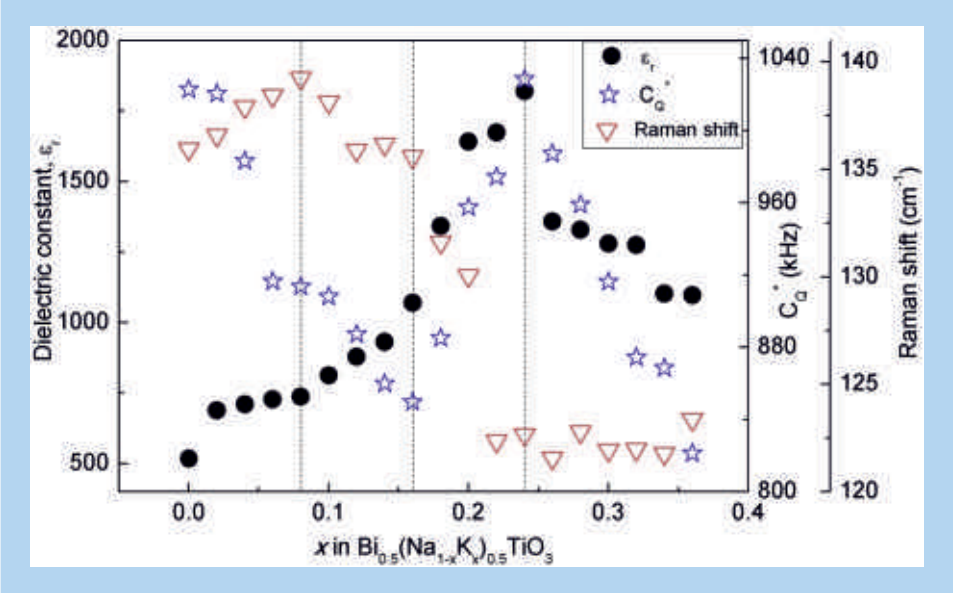
Raman and ^{23}Na solid-state NMR studies on the lead-free ferroelectrics: The local structural changes, due to the substitution of the smaller Na^+ by the larger K^+ ion, in the lead-free piezoelectric ceramic compositions were studied using Raman and ^{23}Na solid-state NMR spectroscopy. Different close compositions in the solid solution series $Bi_{0.5}(Na_{1-x}K_x)_{0.5}TiO_3$ ($0 \le x \le 0.36$, $\Delta x=0.02$) were studied in the morphotropic phase boundary (MPB) region arising from the different crystal structures of the end members $Bi_{0.5}Na_{0.5}TiO_3$ and $Bi_{0.5}K_{0.5}TiO_3$. The close correlations between the Raman and NMR parameters with the performance parameters of the system were observed as shown in the figure, suggesting the role of the local structural changes in determining these parameters. Raman and ^{23}Na NMR studies showed that the onset of the MPB region is at x=0.16 and the MPB region corresponds to

0.16 ≤ x ≤ 0.24 where better performance parameters were observed (*Mater. Res. Bull.* **2019**, *118*, 110506).



Materials for Environmental and Healthcare Applications

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Pharmaceutical materials

Polymorphs and multicomponent crystals Novel crystalline polymorphs of entresto: Entresto is the supramolecular complex of trisodium sacubitril valsartan hemi pentahydrate in crystalline form. It is the combination drug which contains 1:1 molar ratio of two APIs valsartan and sacubitril. Although various pharmaceutical companies have reported many solid forms of Entresto, the significant concerns lie with the cocrystal drug are hygroscopicity and stability. These twin issues were affecting the physicochemical properties of the drug to a great extent. We have developed five novel polymorphs, two of which showed greater stability and less hygroscopicity compared to the innovator solid form of the Entresto (Indian patent filed: 201911001837).

Novel crystalline polymorphs of GBT440: GBT-440 (Voxelotor) is the first hemoglobin oxygen-affinity modulator developed by Global Blood Therapeutics Inc. It is the first drug approved by the US FDA and European Medicines Agency for the treatment of sickle cell anaemia disease and hence research on screening of its novel solid forms having enhanced physicochemical properties conveys a lot of significance. Polymorph screening of Voxelotor yielded six conformational polymorphs and one hydrate. The developed novel polymorphs may have improved physicochemical properties (Indian patent filed: 202011009038).

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Microbial production of poly-gamma-glutamic acid (γ-PGA): The poly-gamma-glutamic acid is a high valued polymer for high-end applications. Glucose, L-glutamic acid and citric acid are required for its production. Since, the shelf life of tomatoes is short; a large number of wastes are generated. Thus, tomato waste has the potential to serve as a complete medium thereby substituting conventional production medium for PGA. A novel γ- PGA producing strain was reported that can valorize the tomato waste to γ- PGA (Indian patent filed: 202011024273).

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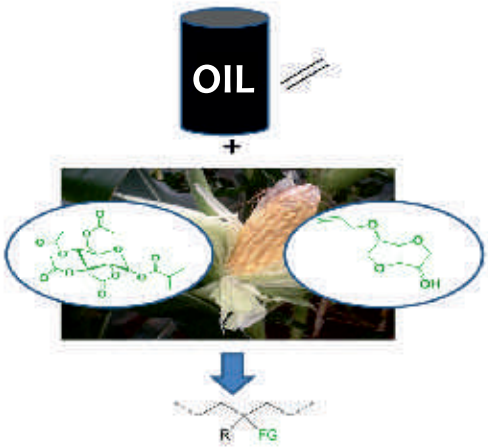
Olefin polymerization: We have designed the catalysts for ethylene polymerization to ultrahigh molecular weight polyethylene. In addition, we have prepared functional group tolerant catalyst and have demonstrated insertion copolymerization of various functional olefins. The scope of this reaction has been broadened to the insertion copolymerization of ethylene with sugar derived monomers. Our investigations establish the convergence of petroleum feed-stocks with renewable feed-stocks to produce functional polyethylene (*Prog. Polym. Sci.* **2020**, *109*, 101290; *Chem-Asian J.* **2020**, *15*, 398; *ChemPlusChem* **2020**, *85*, 1200; *Eur. Polym. J.* **2020**, *134*, 109775).



Renewing Polyethylene

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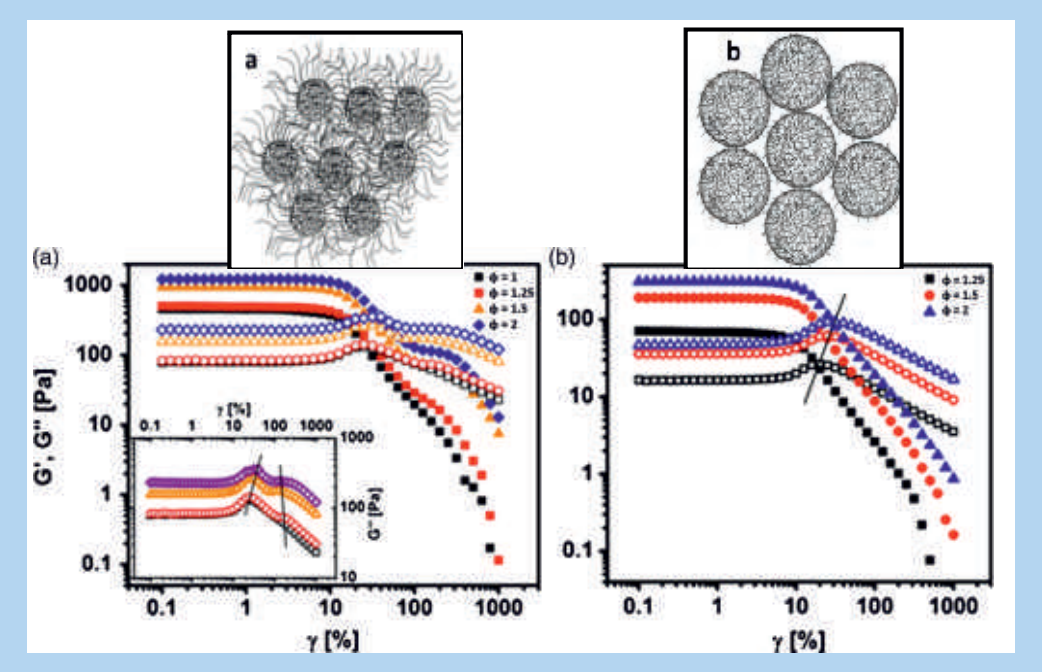
Thermosensitive microgels

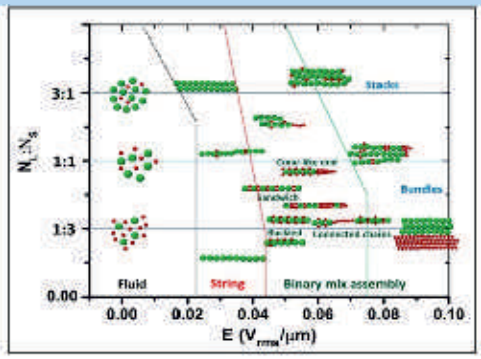
Role of particle morphology in the yielding behavior of densethermosensitive microgel suspensions: Yielding in dense thermosensitive microgel suspensions of poly(N-isopropylacrylamide) with two different particle morphologies core–shell (CS) and homogeneous (HS) particles were studied. The particles with uniform crosslinking density showed hard sphere like behavior with the loss modulus (G″) exhibiting a single peak due to cage breaking while CS type particles showed double yielding at different strains similar to that seen in attractive colloidal glasses. Current study suggests that interpenetration of polymer chains at high concentrations in CS particles sets in an attractive like potential leading to double yielding phenomena in an otherwise purely repulsive system (*J. Appl. Polym. Sci.* **2020**, *137*, 48625).

Advanced Materials

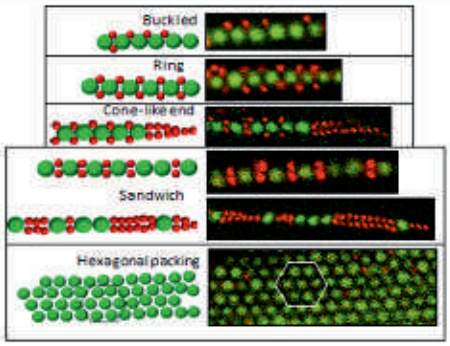
Polymers



Alternating electric-field-induced assembly of binary mixtures of soft repulsive ionic microgel colloids: An external alternating electric field was used to study the assembly of a binary mixture of poly(N-isopropylacrylamide-co-acrylic acid) microgels in their swollen form at hydrodynamic size ratio 2:1 under deprotonated state. Strings with different types of co-assembly structures such as buckled, ring, flame and sandwich were observed at low and intermediate field strengths at ratio 1:3, 1:1. At high field strength, aggregation of strings and a phase separation into individual aggregates of strings from both big and small microgels have been observed. At higher ratio 3:1, the string formation is mostly dominated by big particles. Our current study also confirms that in a binary co-assembly, not only big microgels interpenetrate but also big and small microgels interpenetrate to some extent due to soft repulsive nature of the microgel particles (*J. Colloid Interf. Sci.* **2019**, 544, 88).



Phase behaviour of binary ionic microgels



2D CLSM image (Right) and schematic of corresponding structures (Left)

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Blends of polyesteramide of neem oil as an active nanomaterial for tissue regeneration: We have synthesized neem oil based polyesteramide and blended with biocompatible polymers. Nanofiber mat of the blend immobilized with bioactive agent (chlorohexidine (CH)) for tissue regeneration was also fabricated. The developed nanomaterial was non-toxic with good mechanical strength with sustainable drug release capacity. The *in vivo* wound healing studies recorded high tissue regeneration efficiency i.e. up to 95 % without any inflammatory actions as compared to the commercial wound healing cream (povidoneiodine) (77%). We considered that this new nanomaterial is more efficient for tissue regeneration. Because of its nanoform it is more bioactive due to larger surface area. Further it is non-toxic, biodegradable with controlled release of bioactive agent thereby limiting the frequency to change the dressing material and thus reducing the cost, which is one of the important aspects for the commercial application (*ACS Appl. Bio Mater.* **2019,** 2, 3341).

In vivo wound healing studies

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Applications of NMR spectroscopy

NMR investi- gation of silk fibroin-sodium dodecyl sulphate gelation mechanism: Silk Fibroin (SF) gels find applications in controlled drug release, repair and regeneration of damaged tissues etc. In presence of surfactants SF gelation is accelerated and occurs within hours instead of several days. NMR investigations of the underlying mechanism revealed the presence of hot spots on the SF chain where surfactant molecules bind preferentially. This brings SF chain motifs which have a propensity to form beta-sheet structures closer thereby accelerating the sol-gel phase transition (*Langmuir* **2019,** 35, 14870).

NMR investigation of donor-acceptor interactions in a charge-transfer liquid: A solvent free charge transfer liquid involving dialkoxynaphthalene donor and a naphthalene diimide acceptor shows unprecedented stability retaining characteristic features even at elevated temperatures. NMR techniques were employed to understand the underlying intermolecular interactions leading to efficient charge transfer. Donor-acceptor stacking arrangement, thermal stability and interaction constant were determined by NMR thus giving significant insights into factors enhancing charge transfer efficiency in the neat liquid (*Chem. Commun.* **2019,** 55, 9371).

NMR investigation of self-assembly of substituted perylenediimide and PS-*b*-P4VP copolymer: Complexes between PS-*b*-P4VP copolymer with varying fractions of P4VP and 3-pentadecylphenol substituted perylenediimide (PBI-PDP) were examined by NMR. Interestingly, self-assembled structures in the solid phase are not fully disrupted when the complexes are dissolved. Structure and dynamics of the micelles were investigated by employing the ligand as a probe

to understand the correlation between P4VP block size and micelle properties. These insights are useful in developing strategies for manipulating the self-assembly behavior so as to tailor copolymer morphologies to suit various applications ranging from drug delivery to soft lithography and more (*ACS Appl. Polym. Mater.* **2020**, 2, 805).

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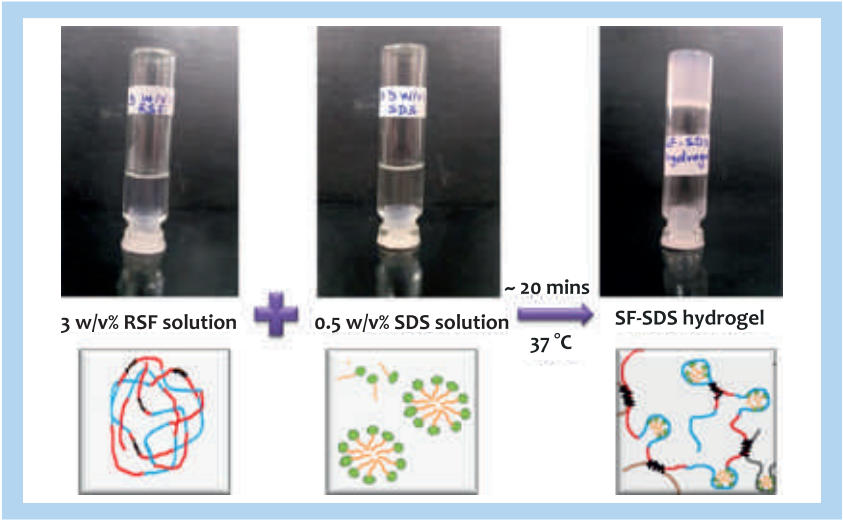
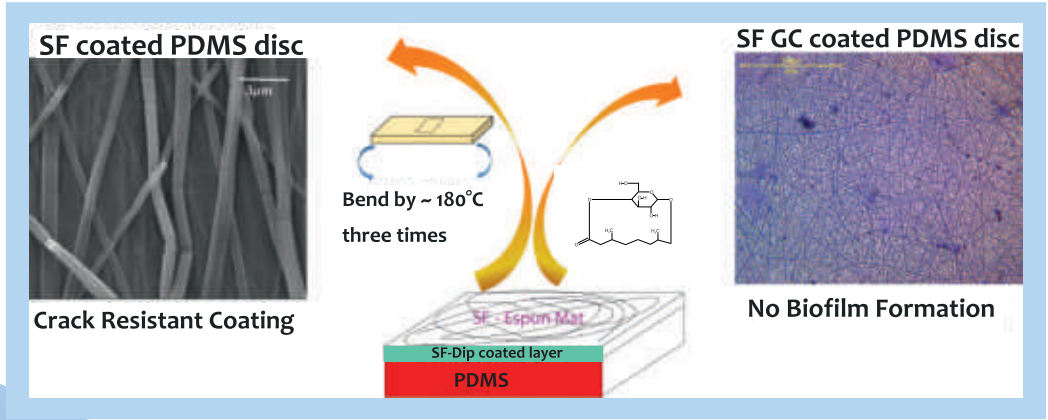
Silk–based materials for biomedical applications

Silk fibroin-surfactant hydrogels: Silk Fibroin hydrogels have promising applications in tissue regeneration. We have prepared novel silk fibroin hydrogels by blending them with a biosurfactant sophorolipid. Sophorolipids have interesting properties such as antibacterial, antifungal and anticancer activity, that they impart to these hydrogels. We have used a model surfactant sodium dodecyl sulphate to provide a mechanistic understanding of gelation of silk fibroin using surfactants (*Langmuir* **2019**, 35, 14870).



Silk fibroin coatings for breast implants: Silicone breast implants exhibit a failure rate of 15-20% in patients. We have developed a novel patent-protected processing protocol to prepare silk fibroin coatings on silicones. These coatings have excellent adhesion to silicones and are crack-resistant. The coatings were also functionalized with anti-quorum sensing inhibitory molecule glycomonoterpene (*ACS Appl. Bio Mater.* **2019**, 2, 675).



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Nanocellulose reinforced advanced composite mate-rials for energy applications

Nanocellulose reinforced flexible composite nanogenerators with enhanced sensing properties: Surface fluorinated nanocellulose crystals (FNC) were incorporated into polyvinylidene fluoride and electrospun into composite nanofibers. Incorporation of only 2 wt% surface fluorinated FNC in PVDF resulted in a significant enhancement in pressure sensitivity with very low detectable pressure limit of 10 Pa and sensitivity up to 18 mV/ kPa. When PENGs were mounted on a vacuum pump for transduction of mechanical vibrations into electrical energy, 2FNC/PVDF composite devices manifested ~3.8 times enhanced voltage output over neat PVDF (ACS Appl. Polym. Mater. 2020, 2, 2550).

Enhancing thermomechanical and chemical stability of polymer electrolyte membranes using polydopa - mine coated nanocellulose: Polydopamine coated nanocellulose (PNC) led to 200% improvement in storage modulus of Nafion at 90°C. The proton conductivity of the 3 wt% PNC composite membrane at 90°C and 100% RH (~125 mS/cm) was slightly higher than Nafion membrane (~94 mS/cm) at similar conditions. Free radical scavenging properties of polydopamine also helped to significantly enhance the chemical stability of Nafion, which was ascertained by accelerated degradation tests conducted in Fenton's reagent at 70°C over 40 days (ACS Appl. Energy Mater. **2020**, 3, 1988).

Agriculture, Food and Nutrition

Crop Protection

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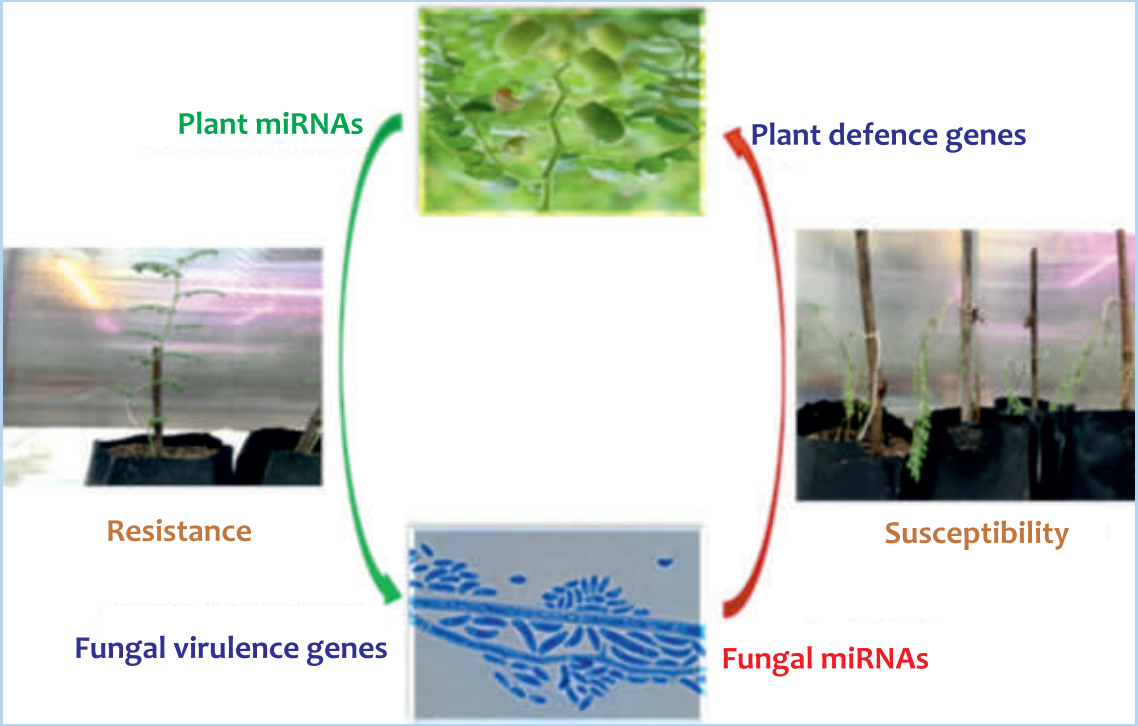
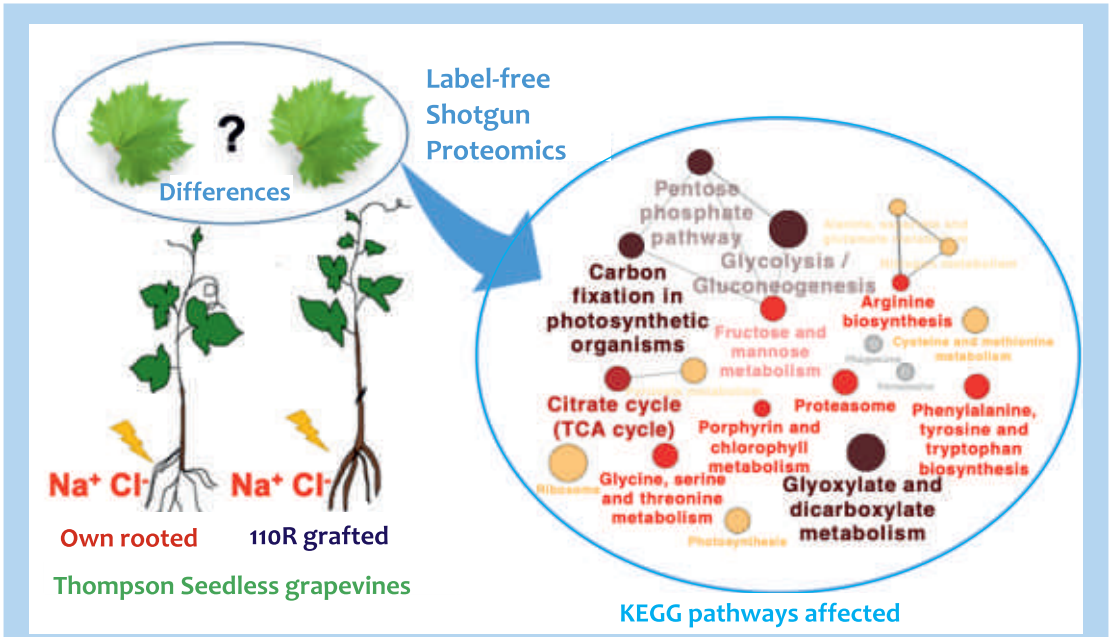
MicroRNA-mediated trans-kingdom gene regulation in fungi and their host plants: MicroRNAs (miRNAs) regulate gene expression by repressing or degrading target gene transcripts. To elucidate their roles in plant-pathogen interaction, we predicted 262 fungal miRNAs from 13 fungi, and identified their 649 target genes in their host plants. Plant miRNAs were found to target fungal virulence genes, while fungal miRNAs targeted plant resistance genes, corroborating miRNA-mediated trans-kingdom gene regulation in plant-pathogen interactions. Transgenic plants expressing miRNAs that target fungal virulence genes could be highly resistant to fungal pathogens (*Genomics* **2020**, *112*, 3021).



MicroRNA mediated trans-kingdom gene regulation in plant-fungus interaction

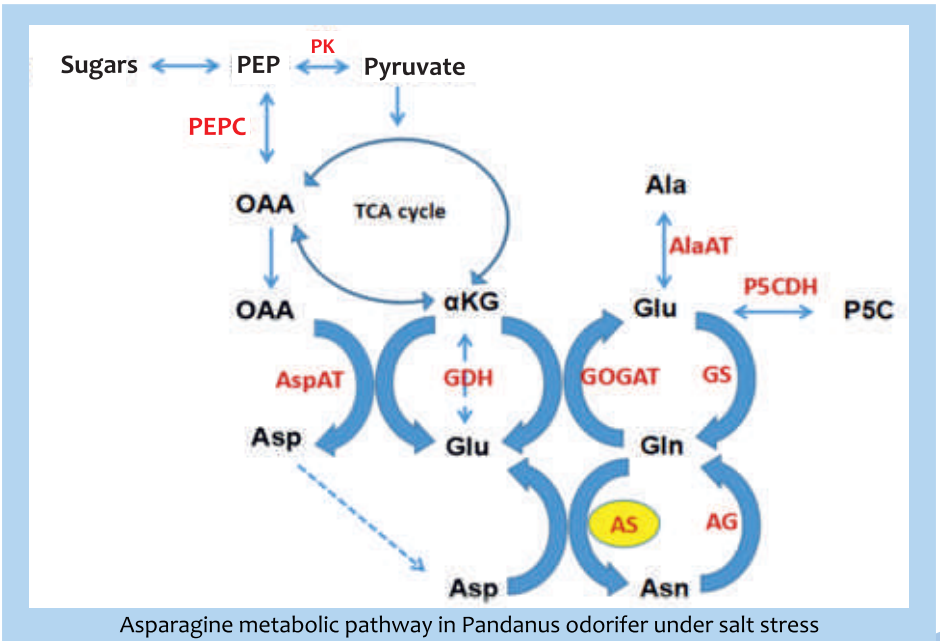
New putative fungicide targets to control the wheat-spot blotch pathogen: The fungus *Bipolaris sorokiniana* causes severe diseases in wheat, barley, and other cereals. The fungicide propiconazole is widely used to control the pathogen in fields. However, the fungus can become resistant to the fungicide due to its indiscriminate use. We treated the pathogen with sub-lethal doses of propiconazole and analyzed its gene expression to predict how the pathogen can possibly develop resistance to the fungicide. This revealed novel fungicide targets, which could be explored to develop new fungicides and plant protection strategies (*Funct. Integr. Genomics* **19**, 3, 453).

Identification of salinity-stress responsive proteins in grapes: Thompson Seedless, a popular table grape variety, is sensitive to soil salinity. Therefore, it is frequently grafted onto salinity tolerant wild rootstocks. Rising soil salinity is a growing concern, which causes heavy yield losses in grapes. We identified 2793 proteins using label-free shotgun proteomics, of which 246 were involved in photosynthesis, amino acid metabolism, chlorophyll biosynthesis, etc. The genes encoding these proteins could be used to develop new salt-tolerant grape varieties to secure income for farmers (*J. Proteome. Res.* **19**, 2, 583).



Salinity-stress responsive proteins identified in grapes

The role of Asparagine synthetase in salinity tolerance: *Pandanus odorifer*, commonly called Kewda, is a highly salt-tolerant plant growing naturally along the sea coasts. We performed integrative omics and enzyme activity analyses to better understand the mechanistic basis of salinity tolerance in the species. The Asparagine synthetase gene was overexpressed, accumulating extremely high levels of Asparagine, which is a known as osmolyte. The Na^+/H^+ antiporter were also overexpressed, facilitating compart mentalization of Na^+ into vacuoles. These genes could be transferred to salt-susceptible species to facilitate their cultivation on saline soils (*Sci. Rep.* **2019**, 9, 932).



Asparagine metabolic pathway in Pandanus odorifer under salt stress

Agriculture, Food and Nutrition

Crop Protection

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Molecular investigation of Coleopteran specific α-Amylase inhibitors from Amaranthaceae members: We have characterized three previously unidentified knottin-type α-Amylase inhibitors (α-AIs) from various Amaranthaceae plants. Recombinant α-AIs showed selective inhibition of coleopteran recombinant insect α-amylases. Interaction analysis of these inhibitors illustrated that the reactive site of inhibitors makes several non-covalent interactions with the substrate-binding pocket of coleopteran α-amylases. The selectivity of these inhibitors against coleopteran α-amylases highlights their potential in storage grain pest control (*Int. J. Biol. Macromol.* **2020**, *163*, 1444).

Functional Food and Nutrition

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Molecular understanding of tuber development pathway in potato

Epigenetic regulation of tuber development in potato: Polycomb repressive complex (PRC) proteins regulate developmental transitions in plants. In this project, we investigated the role of two PRC proteins, StMSI1 and StBMI1 in potato develo- pment. StMSI1-overe-xpression and StBMI1-1-antisense (RNAi) lines produced enhanced levels of miR156 accompanied by the formation of aerial stolons and tubers from above-ground axillary nodes in potato. We demonstrated that MSI1and BMI1regulate aerial tuber formation in potato under short-day photoperiodic conditions (*Plant Physiol.* **2020,** *182*, 185; *J. Exp. Bot.* **2020**, DOI: 10.1093/jxb/eraa468).

Molecular factors governing tuberization process in potato: Tuber formation in potato is a dynamic process, which involves the integration of multiple molecular and biochemical signals with environmental cues. StBEL5 (BEL1-LIKE transcription factor), StSP6A (Flowering Locus T ortholog) and StCDF1 (CYCLING DOF FACTOR1) factors function as crucial molecular signals of potato development. The BEL-KNOX heterodimer regulates key tuberization genes through tandem TGAC core motifs in their promoter sequences. Although StCDF1 functions as a positive regulator of tuber development, the upstream regulators of its gene expression were unknown. Using promoter reporter transgenic potato lines and yeast1-hybrid (Y1H) assays, we showed that StBEL5 regulates StCDF1 through tandem TGAC core motifs in potato (*J. Plant Physiol.* **2020**, *241*, 153014; *Int. J. Dev. Biol.* **2020**, *64*, 133).

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Dephytinizing *Sacchromyces cerevisiae* probiotics: Cell-bound phytase producing *Sacchromyces Cerevisiae* evaluated using statistical media optimization with MGYP media and got the enhanced activity up to four fold. The process has been scaled-up to 10-L fermenter with increased productivity of 6.4 IU/DCG/h. *S. cerevisiae* has also exhibited the probiotic properties like tolerance to artificial gastric juice conditions, hydrophobicity, autoaggregation, coaggregation, and BSH activity. *S. cerevisiae* phytase enzyme has totally dephytinized the phytate content in functional foods and feed ragi, soya, chickpea, and animal feed. Therefore, *S. cerevisiae* can be exploited to use as aprobiotic for non-ruminant animals and humans (*Probiotics Antimicrob. Proteins* **2019**, *11*, 2).

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Conservation of an endangered medicinal plant from the Western Ghats in India: An efficient in vitro propagation protocol along with phytochemical profiling was developed for C. media to provide a sustainable solution. Callus cultures were induced from seedling and wild leaf tissues using the most effective Murashige and Skoog's (MS) medium with 2,4-dichlorophenoxyacetic acid (2,4-D; 2 µM) and sucrose (3%). Somatic embryos were acquired on MS medium with 1 µM 6-Benzylaminopurine (BAP) and 1 µM 2,4-D. Conversion into plantlets was attained only from tissue culture-derived seedling leaf (TCDSL) explant. We suggested enhanced production of selected metabolites with *in vitro* propagation and $AgNO_3$, alleviating the problem of unavailability of planting materials. Thus, the current study might offer potential ways for the conservation of such RED enlisted species as *C. media* (*J. Plant Growth Regul.* **2020**, doi.org/10.1007/s00344-020-10173-6).

Generation of novelties in the genus Ocimum as a result of natural hybridization: An interspecific natural cross led to the development of two hybrids in Ocimum. GC–MS of hybrids indicated phenylpro panoid and terpene-rich novel chemotypes. Enriched metabolite diversity may have potential application in the various fields. The present study explored the two interspecific *Ocimum* hybrids originating through a serendipitous natural cross between *O. kilimandscharicum* and *O. basilicum*. These two novel *Ocimum* hybrids exhibited intermediate morphological features of two parental species. Inter simple sequence repeats analysis and DNA barcoding with the plastid non-coding *trnH-psbA* intergenic spacer region reaffirmed unambiguous parental identification and differentiation of these natural hybrids from other available *Ocimum* species (*Ind. Crops Prod.* **2020**, *15*, 112859).

Agriculture, Food and Nutrition

Microbial diversity and bioprospecting

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Metagenome guided discovery of potent microbes for mitigation of polluted environments

Metagenomics based resistome in Soda lake: Metagenome sequencing showed diverse proteobacteria, firmicutes and bacteriodetes from years 2013, 2016 and 2018 data. Phylum euryarchaeota was stable and known to play key role in biogeochemical cycles of the lake. Results also revealed the abundance of genes related to antibiotic resistance and toxic compounds indicating polluted lake. Multidrug resistant efflux pumps, beta-lactamase, and fluoroquinolones, conferring resistance to cadmium, zinc, cobalt, and arsenic were also detected. The findings of the study could be a baseline for implementing strategies for conservation of the precious Lonar Lake ecosystem (*Ecol. Indic.* **2020**, *110*, 105827).

Metagenomics of Ganges river: It is the first metagenomic study of microbial communities in confluence stretch of Ganges and Yamuna Rivers (India). Yamuna River had transient effect on taxonomic and functional diversity at immediate downstream of Ganges. Variations in functional profiles (and not the taxonomic diversity) at the confluence were driven by Yamuna River. Pre-confluence (Ganges) and farther downstream of confluence profiles were similar. Archaeal diversity is reported for the first time using MinION sequencing (*Sci. Total Environ.* **2019**, *674*, 288).

Thermophiles for hydrocarbon degradation: Mixed PAHs were degraded by pure and mixed culture of thermophilic and thermo-tolerant bacteria. Higher degradation was achieved at 50°C by Aeribacillus and mixed culture. Crude oil was used as a substrate to study the degradation of PAHs. The PAHs degrading strains produce surfactin, a lipopeptide type of biosurfactant (*Sci. Total Environ.* **2019**, *679*, 52).

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Microbial technologies

A thermo stable biosurfactant and its applications: A novel thermo stable biosurfactants, 1-Pentanonacontene ($C_{95}H_{190}$) a fatty alkene and 3-Hydroxy-16-methylheptadecanoic acid ($C_{18}H_{36}O_3$) were isolated from a marine isolate Bacillus SGD-AC-13. Biosurfactants were produced using 1% yeast extract in tap water as production medium at 24 h in flask and 12 h in the bioreactor. Crude biosurfactant reduced the surface tension of distilled water to 31.32 ± 0.93 mN/m with CMC value of 0.3 mg/ml. Cell-free supernatant showed excellent emulsification and oil displacement activity with stability up to 160 °C, pH 6–12 and 50 g/L NaCl conc. Biosurfactants were characterized using FTIR, TLC, HPLC LC–MS and NMR spectroscopy. Cell-free supernatant reduced the contact angle of a distilled water droplet from 117° to 52.28° and of 2% pesticide from 78.77° to 73.42° while 750 µg/ml of crude biosurfactant reduced from 66.06° to 56.33° for 2% pesticide and recovered 35% ULO and 12% HWCO from the contaminated sand. It is the first report of thermostable fatty alkene as a biosurfactant and is structurally different from previously reported, having potential application in agriculture, oil recovery and bioremediation (*J. Hazard. Mater.* **2019,** *380*, 120868).

Molecular networking and whole-genome analysis: Molecular networking coupled with genome analysis led to ease in identification of urdamycin E and a novel natural derivative urdamycin V, purified from Streptomyces sp. OA293. Urdamycin E (Urd E) induced apoptosis and autophagy in cancer cell lines. Urd E exerted anticancer action through inactivation of the mTOR complex by preventing phosphorylation at Ser 2448 and Ser 2481 of mTORC1 and mTORC2, respectively. Significant reduction in phosphorylation of the major downstream regulators of both mTORC1 (p70s6k and 4e-bp1) and mTORC2 (Akt) were observed, thus further confirming complete inhibition of the mTOR pathway. Urd E presents itself as a novel mTOR inhibitor that employs a novel mechanism in mTOR

pathway inhibition (*ACS Chem. Biol.* **2020**, *15*, 780).

Bioactivities and molecular networking-based elucidation of metabolites: This study highlights the cultivable diversity and bioactivities of Actinobacteria associate with the Unkeshwar hot springs, India. Potent strains were evaluated for their biosynthetic potentials and metabolite analysis was performed using effective replication molecular networking tools. A total of 86 acti no bacterial strains were isolated and grouped into 21 distinct genera, based on 16S rRNA gene sequence analysis. The extracts were subjected to MS/MS-guided molecular networking analysis to effectively delineate the secondary metabolites. Structurally diverse compounds including the polyketides 22-dehydroxymethyl-kijanolideand Abyssomicin-I were detected in the extracts. Brevianamide F was detected in the extract of Micromonospora, which has mostly found in fungal species. Other compounds such as cyclic tripeptides, Cyclo(L-Pro-D-Ile) and Cyclo (D-Pro-L-Phe), were also identified in this strain. We explored the diversity of Actinobacteria and evaluated their bioactive potential from the Unkeshwar hot springs (*RSC Adv.* **2019,** 9, 9850).

Energy and Environment

Conventional energy coupled with CO_2 capture, storage and utilization

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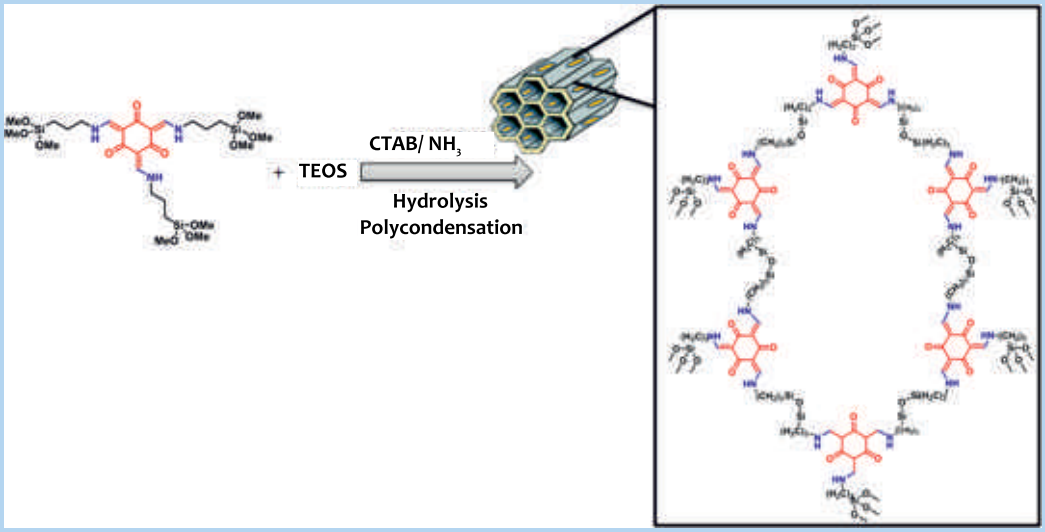
Co_2 utilization to value added products

Co_2 hydrogenation to formate on Pd supported on N-incorporated periodic mesoporous organosilica (PMO): N-incorporated hybrid PMO was synthesized and utilized as a platform for stabilizing well dispersed and easily accessible Pd nanoparticles (Pd-NPMO) without using any stabilizing agents or expensive dendrimers (Scheme 1 and Fig. 1). Further, this bifunctional hybrid catalyst has been demonstrated to heterogeneously catalyze aqueous phase CO_2 hydrogenation (CO_2/H_2 ratio 1:3) for the direct synthesis of formate under 4 MPa pressure and at 100°C. To validate the superior performance of Pd-NPMO catalyst, we compared the activity with Pd-SBA-15 catalysts and the results showed a ten-fold increase in turnover frequency of 108 h^{-1} using Pd on NPMO which envisaged the crucial role of nitrogen sites in this catalyst to boost the CO_2 valorization to formate (Fig. 2) (*ACS Sustain. Chem. Eng.* **2020**, *8*, 14765).



Scheme 1: The surfactant directed synthesis of N-containing periodic mesoporous organosilica (NPMO)

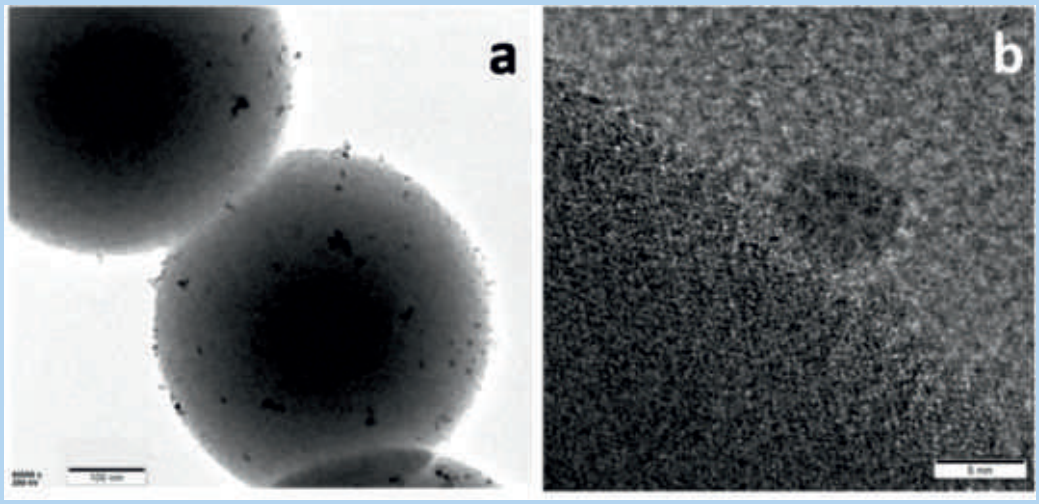


Fig. 1: (a) High Resolution TEM image (scale 100 nm) (b) Magnified HR-TEM image (scale 5 nm)

Conventional energy coupled with CO_2 capture, storage and utilization

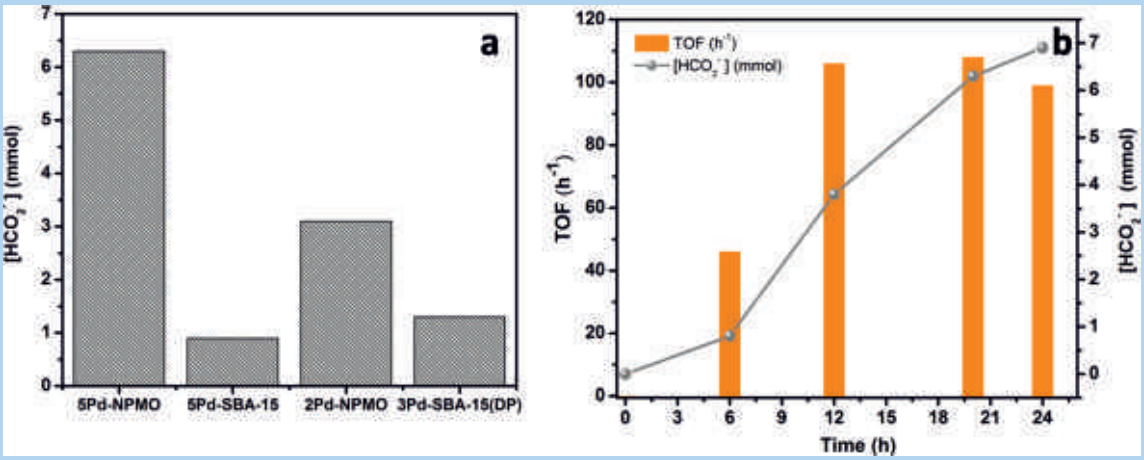


Fig. 2: Screening of CO_2 reduction to formate on various Pd catalysts
(b) Time course of hydrogenation to formic acid catalyzed by 5Pd-NPMO

Renewable & alternative energy technologies

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Solar energy to chemical energy conversion

Enhanced solar hydrogen production by electronic integration of material components: Renewable and clean energy sources are and will be the norm of the planet earth to minimize disasters. Our work on material integration with thin film approach demonstrates an enhanced solar hydrogen generation in direct sunlight, compared to the conventional powder based suspension method. Au-Pd/rGO/TiO_2 exhibits 43 times higher hydrogen yield in thin film form (21.50 mmol/h.g) compared to powder form (0.50 mmol/h.g) (Fig. 1). Electronic integration has been demonstrated for improved hydrogen production (*ACS Appl. Mater. Inter.* **2019**, *11*, 32869).

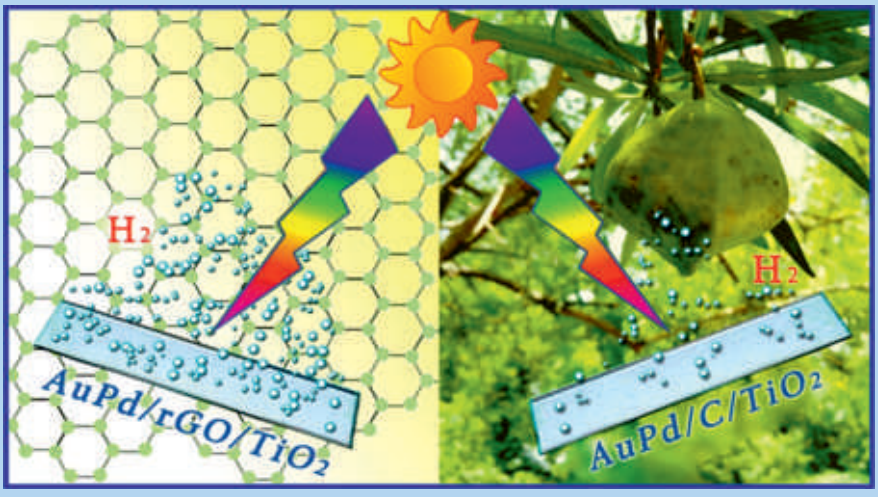

Fig. 1: Layered reduced graphene oxide material is shown to integrate efficiently

Energy and Environment

Renewable & alternative energy technologies

New plasmonic 2D-multifunctional MoS_2/MoO_{3-x}/RGO for solar hydrogen generation: Solar hydrogen generation was demonstrated with visible and near IR photons available in the sunlight has been demonstrated with MoS_2/MoO_{3-x}/RGO. A combination of new, exotic and plasmonic 2D MoO_{3-x} (Fig. 2) with another 2D graphene oxide and integrated with MoS_2 was prepared by a simple oxidative disproportionation of MoS_2+RGO. Oxygen from RGO was utilized in-situ to form plasmonic 2D MoO_{3-x}, which absorbs light in visible and NIR regions (*J. Phys. Chem. C* **2019,** *123*, 21685).

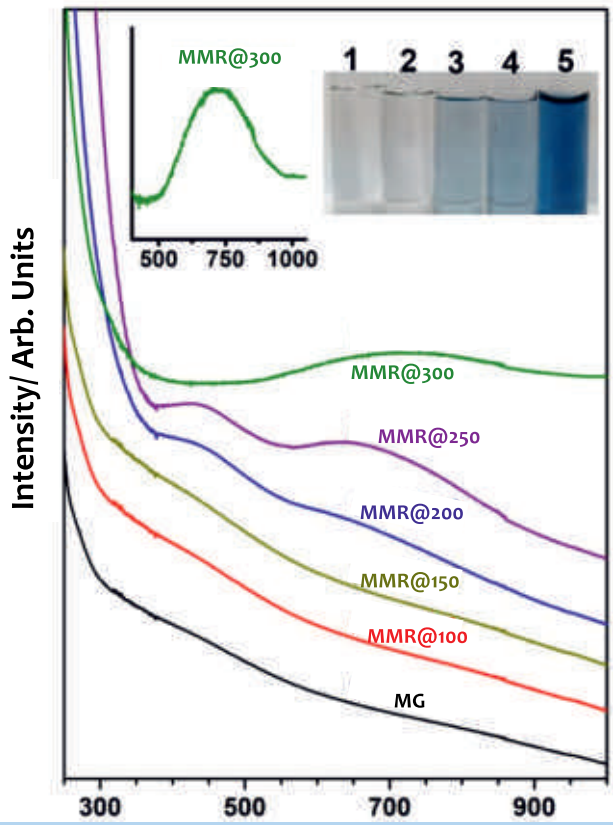

Fig. 2: UV-visible absorption spectra of MoS_2-GO (MG) and MoS_2/MoO_{3-x}/RGO (MMR) composites calcined at different temperatures in inert atmosphere

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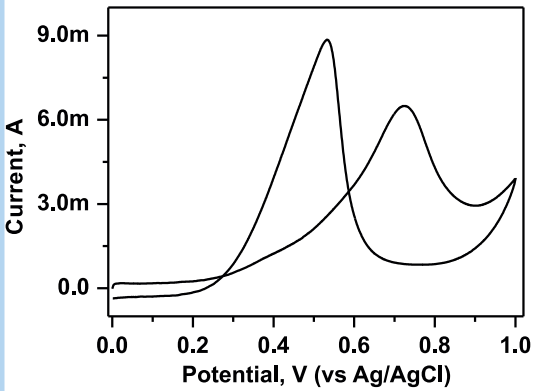
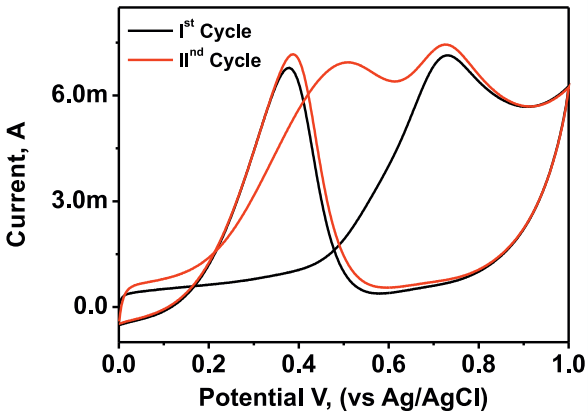
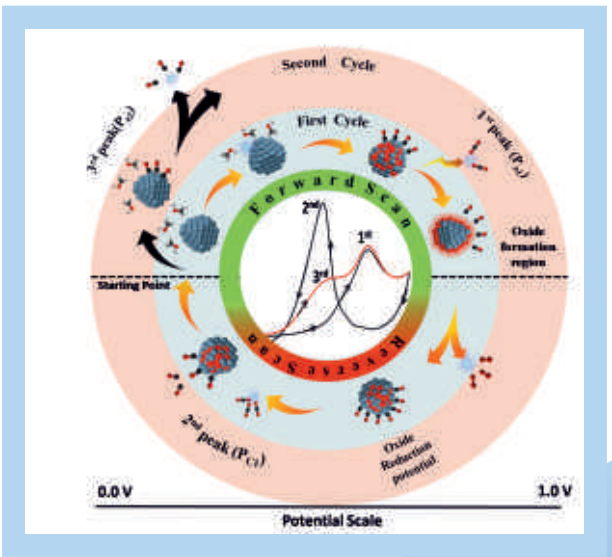
Mechanistic aspects of methanol electro-oxidation reaction (MOR) through cyclic voltammetry

Re-investigation of CV response of MOR in acidic medium: The identification of an electro-catalyst material which is commercially viable with consistent performance continues to be a great challenge mainly due to our limited understanding of the exact MOR mechanism. We have embarked upon a program to gain deeper insights into this process through a series of systematic CV experiments. Our analysis clearly suggested that the peak during the cathodic scan (P_{c1}) in CV for MOR belongs mainly to electro-oxidation of carbon monoxide (CO) species which is not truly adsorbed on electrode surface and hence has a less possibility to poison the electrode surface. An additional peak was observed in the anodic scan at higher scan rates and our results suggest that this peak is associated with surface confined electrochemical processes related to the oxidative desorption of left over CO. The frequently used I_f/I_b criteria are not appropriate to evaluate the electro-catalyst performance in MOR (*Energy Technol.* **2020**, *8*, 1900955).





Proposed mechanism for MOR: Based on all experimental data we had proposed a mechanism for MOR. As we start the CV from o V, during the first anodic scan methanol oxidizes to CO at P_{a1}, part of which gets oxidised to CO_2 at $P_{a1'}$. Majority of the remnant un-oxidised CO stays in solution phase while a small part resides adsorbed on the electrode surface. This adsorbed CO along with the CO present in the solution oxidizes at P_{c1} during cathodic scan. This left over CO gets reductively adsorbed on the electrode surface which ultimately oxidatively desorbs at P_{a2}. Though the presence of this left over CO was not discussed clearly in the literature, our results explain its presence successfully (*Energy Technol.* **2020**, *8*, 1900955).



Energy and Environment

Renewable & alternative energy technologies

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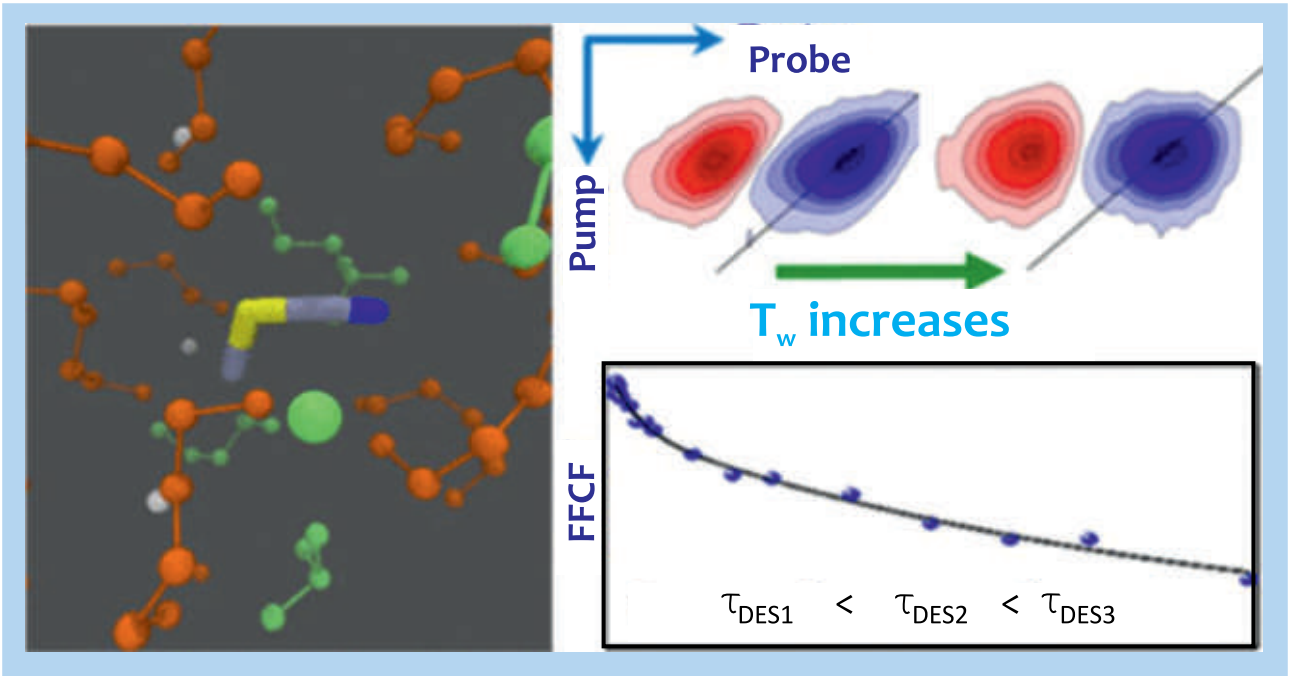
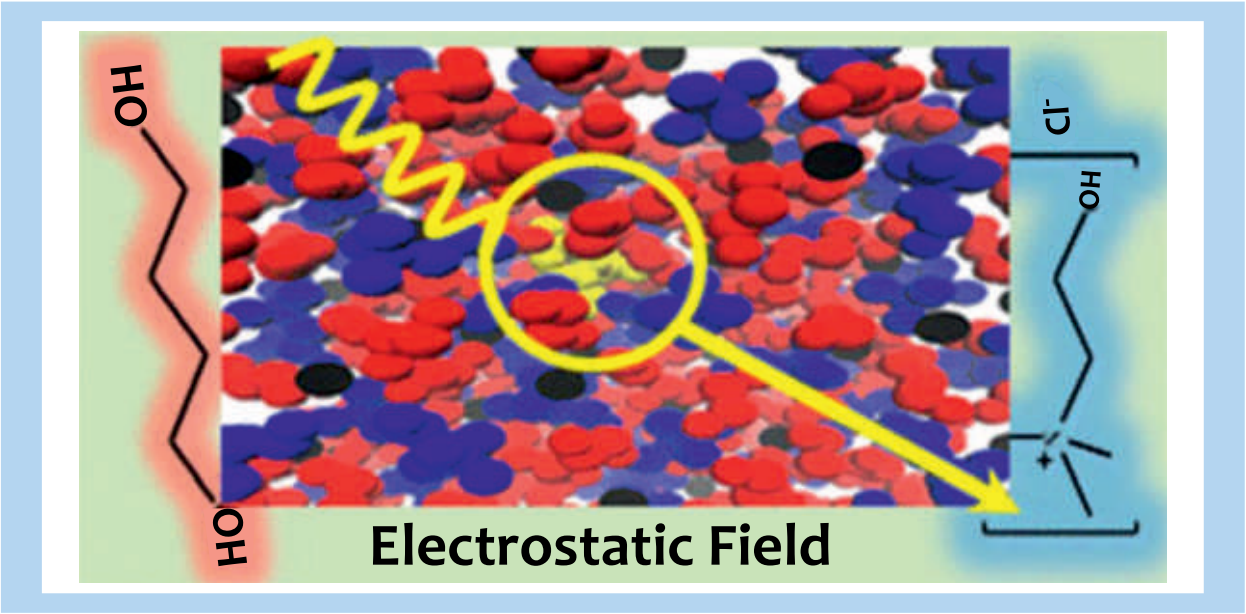
Deep eutectic solvents

Hydrocarbon chain-length dependence of alcohol based eutectic solvents: Deep eutectic solvents (DESs) have gained popularity in recent years as an environmentally benign, inexpensive alternative to organic solvents for diverse applications in chemistry and biology. Among them, alcohol-based DESs serve as useful media in various applications due to their significantly low viscosity as compared to other DESs. Despite their importance as media, little is known how their solvation dynamics change as a function of the hydrocarbon chain length of the alcohol constituent. In order to obtain insights into the chain-length dependence of the solvation dynamics, we have performed two-dimensional infrared spectroscopy on three alcohol-based DESs by systematically varying the hydrocarbon chain length. The results reveal that the solvent dynamics slows down monotonically with an increase in the chain length. This increase in the dynamic timescales also shows a strong correlation with the concomitant increase in the viscosity of DESs. In addition, we have performed molecular dynamics simulations to compare with the experimental results, thereby testing the capacity of simulations to determine the amplitudes and timescales of the structural fluctuations on fast timescales under thermalequilibrium conditions (*J. Phys. Chem. B* **2019**, *123*, 9355).



Electrostatic manifestation of micro-heterogeneous solvation structures in deep-eutectic solvents: We have showed that the electrostatic field, which can be estimated both from infrared experiments and theory, can act as a unified concept to report on the microscopic heterogeneous solvation of deep eutectic solvents. We reported the residue-specific distribution, orientation, and hydrogen bonding in deep eutectic solvents constituting of choline chloride and alcohols of varying chain-lengths using a fluorophore containing the carbonyl moiety as the solute and the electrostatic field as a descriptor of the solvation structure of the deep eutectic solvents. We observed that an increase in alcohol chain-length not only affects the alcohol's propensity to form hydrogen bond to the solute but also alters the spatial

arrangement of choline cations around the solute, thereby leading to microheterogeneity in the solvation structure. Moreover, to extend our electrostatic field based strategy to other deep eutectic solvents, we report an emission spectroscopy based method. We showed that this method can be applied, in general, to all deep eutectic solvents, irrespective of their constituents. Overall, this work integrates experiments with molecular dynamics simulations to provide insights into the heterogeneous DES solvation (*J. Phys. Chem. B* **2020**, *124*, 3709).



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Design and development of scalable high performing catalytic material and technology for clean hydrogen production: Hydrogen is produced via reforming the fossil fuels which is highly carbon emitting, energy inefficient, and unclean process. Solar driven water electrolysis is a zero-emission alternate that is currently hindered by its strong reliance on noble metal-basedcatalysis. We have developed the advanced catalysts (HER/OER) and a prototype to demonstrate the technology with cutting edge features such as inexpensive non-noble metal catalysts, state-of-the-art AEM technology, lower operational potentials (<3V), 'in-toto' green process with solar source, high H_2 output with high scalability, and on-site large scale production for better safety. H_2 production of up to 240 litres (with 100 cm^2 cell) is sustainable for several hundred hours (Indian Patent Filed: 202011001811).

NCL's AAEM stack (100 cm^2) developed & Dedicated performance evaluation facility

Energy and Environment

Renewable & alternative energy technologies

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Synthesis of new dyes and their application for dye sensitised solar cells

Synthesis of the dyes as a photocatalyst for water splitting using DFT: We have reported two descriptors, namely, charge injection efficiency and electron hole separation using a combination of density functional theory based calculations and experiments that can be used for in silico design of new and efficient dye-sensitized-semiconductor composites as catalysts for hydrogen evolution reaction. Three azo-based dyes were synthesised, namely 4-(2-Hydroxy-naphthalen-1-ylazo)-benzoic acid (4ABBN), (E)-4-((8-hydroxy-quinolin-5-yl)diazenyl) benzoic acid (4AB8HQ) and ((E)-3-((8-hydroxyquinolin-5-yl)diazenyl) benzoic acid (3AB8HQ). Amongst them, the interactions of 3AB8HQ and 4ABBN have already been studied. Here we summarize the main results. For both these two dyes we found that they bind strongly with ZnO through the COOH anchoring group. The H+/H_2 reduction potential lies below the conduction band, thereby suggesting that these are good candidates asDSS catalyst for H_2 production. Similarly, many composites of oligothiophenes with ZnO were synthesised and showed that they can produce hydrogen (*ChemCatChem* **2019,** *11*, 6460).

Synthesis of N-alkyl-3-methylpyridinium halides as ionic liquid crystals: The thermotropic phase behaviour of ionic liquids and ionic liquid crystals based on novel N-alkyl-3-methylpyridinium halides, trihalides and dichloroiodates was experimentally studied by polarized optical spectroscopy (POM) and differential scanning calorimetry (DSC) as well as by molecular dynamics simulation. We have synthesized a series of 1-alkyl-3-methylpyridinium halides, trihalides and dichloroiodate compounds [CnMP][X] with n = 12, 14, and 16 and the anion X being Cl^-, Br^-, I^-, Br_3^-, ICl_2^-, and I_3^-, in order to have a set of systems with a varying ratio between the cationic volume and the anionic volume. The thermotropic phase behaviour was then studied by DSC and POM, where the phase and transition temperatures of the ILs are determined. Finally, it is worth mentioning that there was quantitative agreement between simulations and experiments (*Soft Matter* **2020**, *16*, 411).

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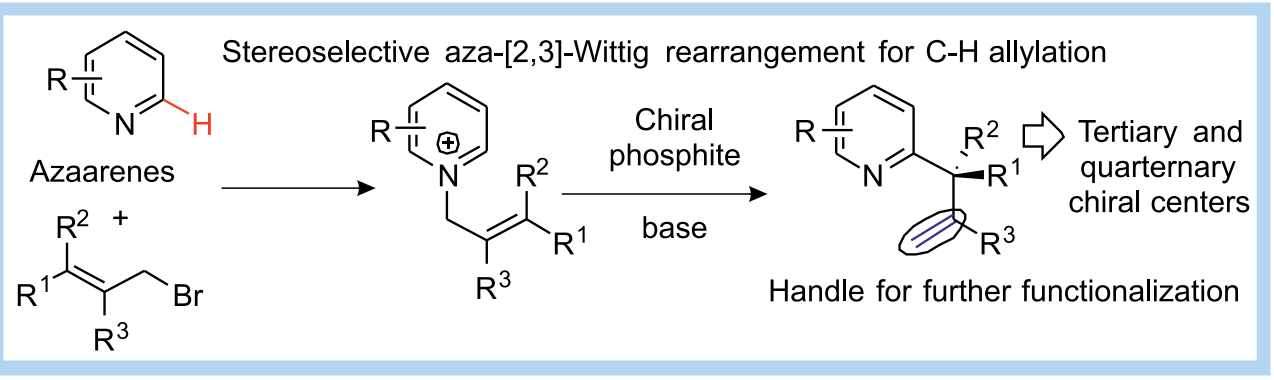
Phosphite catalyzed enantioselective [2,3]-aza-Wittig rearrangement: A phosphite-mediated [2,3]-aza-Wittig rearrangement has been developed for the regio- and enantioselective allylic alkylation of six-membered heteroaromatic compounds (azaarenes). The nucleophilic phosphite adducts of N-allyl salts undergo a stereoselective base-mediated aza-Wittig rearrangement and dissociation of the chiral phosphite for overall C–H functionalization of azaarenes. This method provides efficient access to tertiary and quaternary chiral centers in isoquinoline, quinoline, and pyridine systems, tolerating a broad variety of substituents on both the allyl part and azaarenes. Catalysis with chiral phosphites is also demonstrated with synthetically useful yields and enantioselectivities (*Angew. Chem. Int Edit.* **2019**, *58*, 14104).



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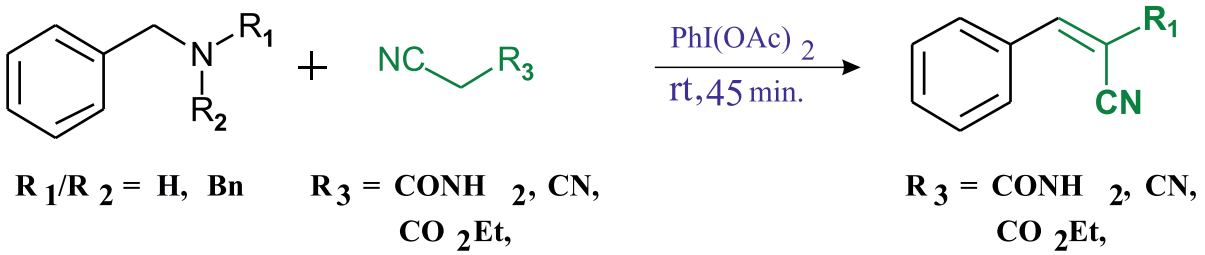
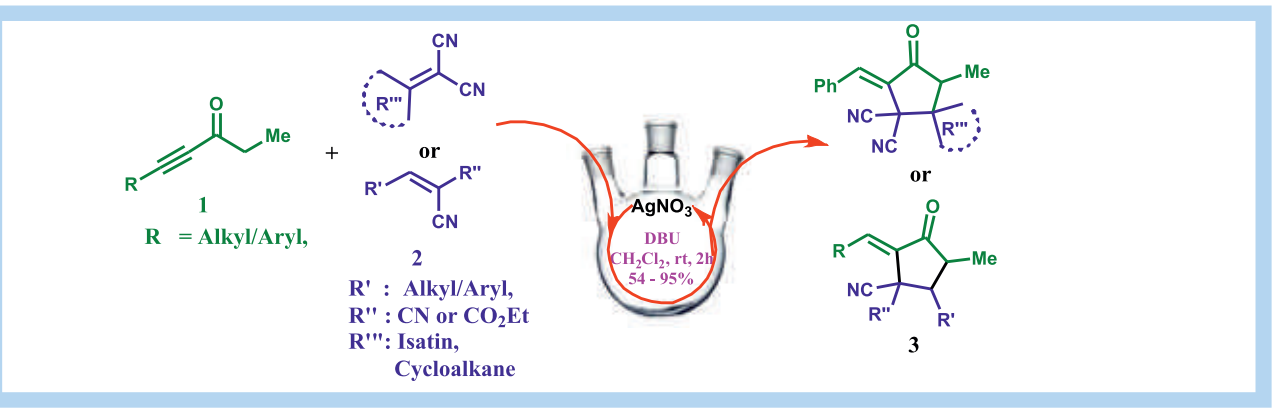
Methods on metal and metal free organic transformation and synthesis of bioactive molecules

Oxidative olefination of benzylamine with an active methylene compound mediated by hypervalent iodine (III): Hypervalent iodine-mediated oxidative olefination of amines with an active methylene compound provides a rapid gateway towards the formation of electrophilic alkenes under mild reaction conditions in good to excellent yields. This is an efficient protocol for the preparation of substituted electrophilic alkenes (*Eur. J. Org. Chem.* **2019**, 6232; *J. Org. Chem.* **2019**, *84*, 4, 2039).

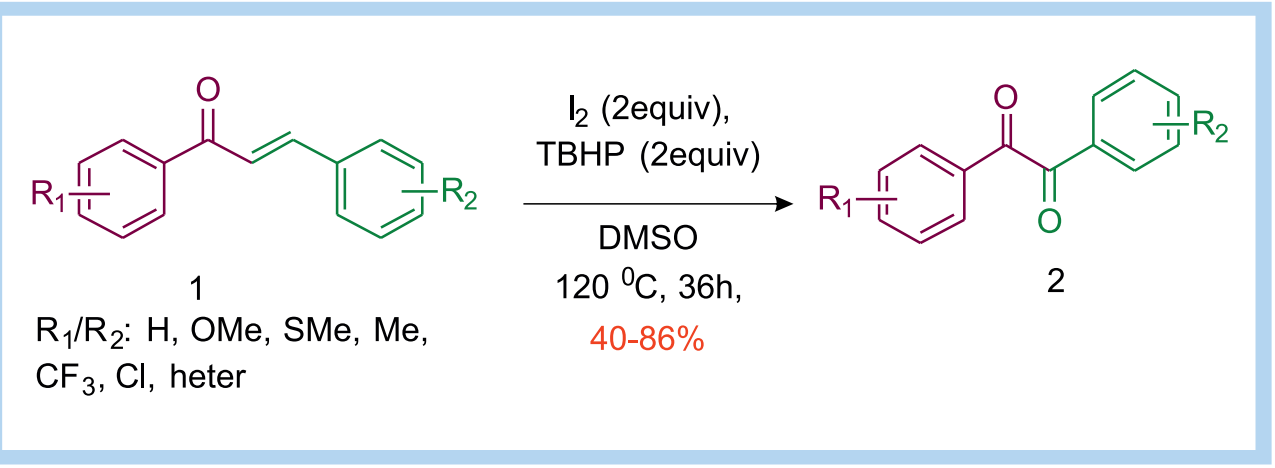


R_1/R_2 = H, Bn R_3 = $CONH_2$, CN, CO_2Et, R_3 = $CONH_2$, CN, CO_2Et,

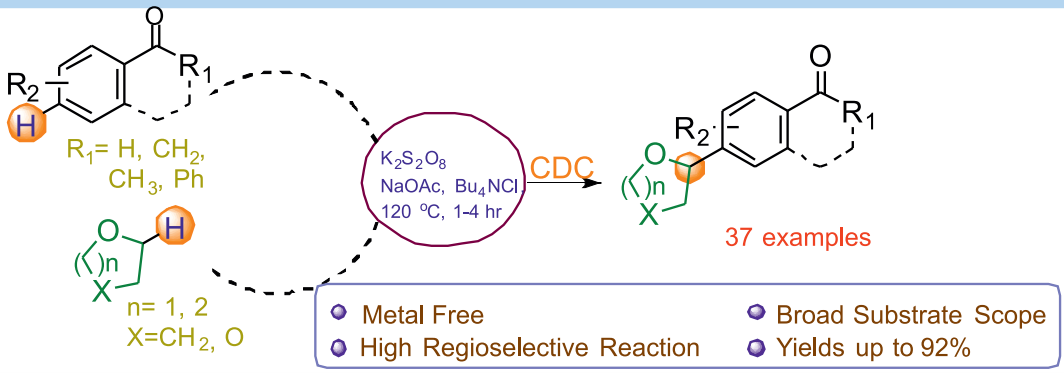
$AgNO_3$ catalysed intramolecular cyclization: An efficient $AgNO_3$-catalysed method has been developed for the synthesis of functionalized cyclopentanones and spiro-cyclopentanones through intramolecular cyclization between ynones and cyanoacrylate /aryl/alkylidene malononitrile using DBU as a base. Easy availability of starting materials and mild reaction conditions make this protocol more feasible over previously reported methods. The functionalized cyclopentanones and spiro-cyclopentanones were synthesized in good to excellent yields with a broad substrate scope (*Asian J. Org. Chem.* **2019**, *8*, 1907).



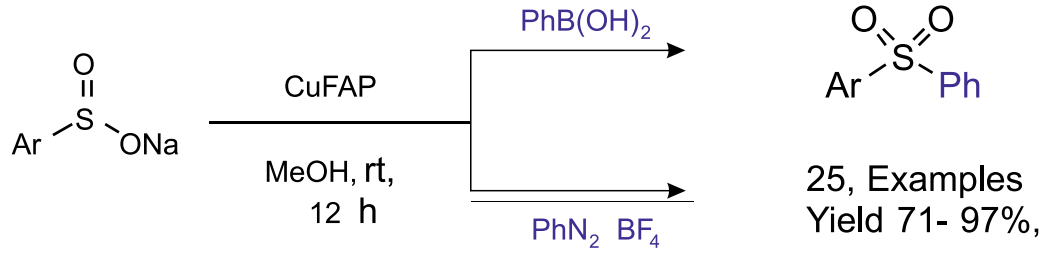
Iodine-mediated oxidative rearrangement of α, β-unsaturated diaryl ketones: A metal-free oxidative rearrangement was explored for the synthesis of 1,2-diaryl diketones by utilizing α,β-unsaturated diaryl ketones and I_2/TBHP in good to high yields. The reaction proceeds via oxidative aryl migration, followed by C–C bond cleavage. A simple and high-yielding protocol was developed for the synthesis of a wide range of 1, 2-diaryl diketones, which are the backbone for a variety of medicinally important molecules (*ACS Omega* **2019**, *4*, 9636).



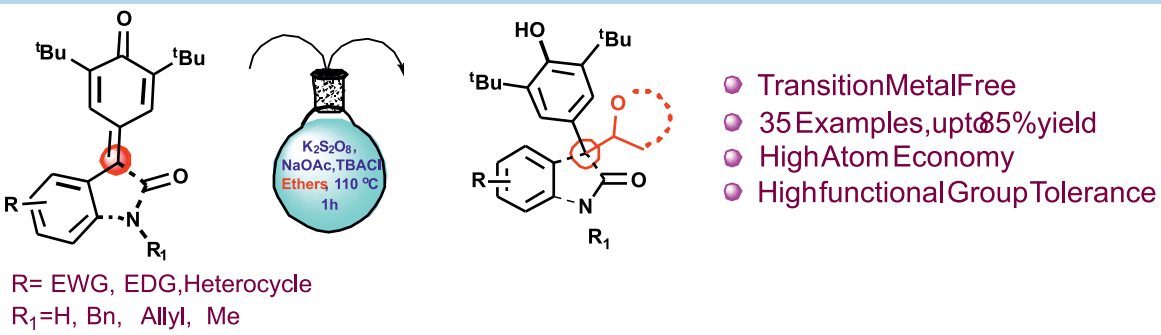
Metal-free regioselective cross dehydrogenative coupling of cyclic ethers and aryl carbonyls: A highly regioselective, efficient, and metal-free oxidative cross dehydrogenative coupling (CDC) of aryl carbonyls with cyclic ethers has been developed. This method offers easy access to substituted α-arylated cyclic ethers with a high functional group tolerance in good to excellent yields. The regioselectivity of this CDC reaction was confirmed by density functional theory (DFT)-based calculations (*J. Org. Chem.* **2019**, *84*, 2039).



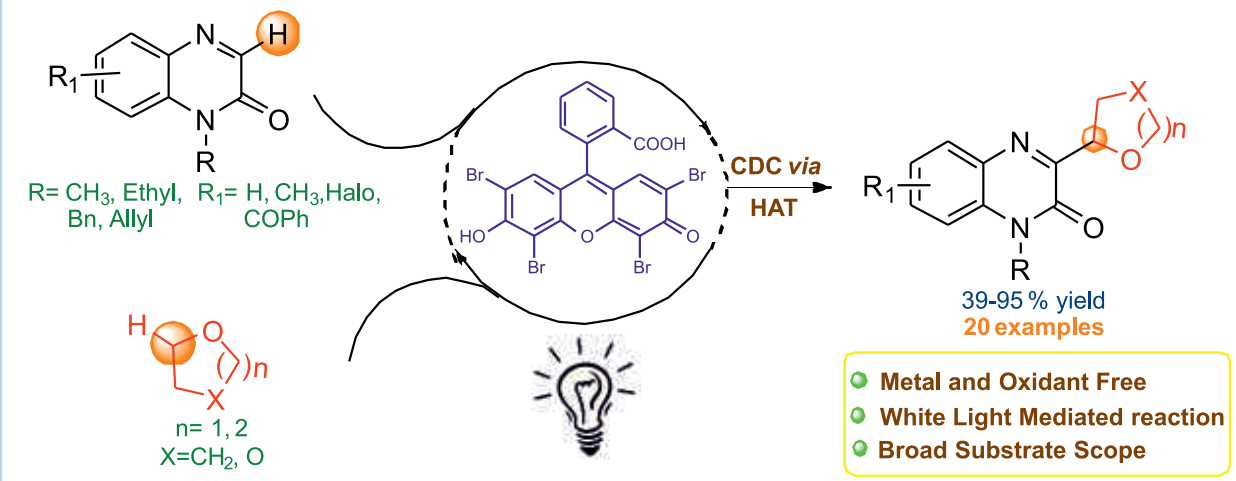
An efficient heterogeneous copper fluorapatite (CuFAP)-catalysed oxidative synthesis of diaryl sulfone under mild ligand-and base-free conditions: A simple, eco-friendly and efficient method for the synthesis of unsymmetrical diaryl sulfones using heterogeneous copper fluorapatite (CuFAP)-catalysed coupling of aryl sulfonic acid and phenyl boronic acid has been developed with good to excellent yields without use of any ligand, base or co-catalyst. Broad substrate scope and gram scale operations are the important features of this method (*New J. Chem.* **2019**, *43*, 1632).



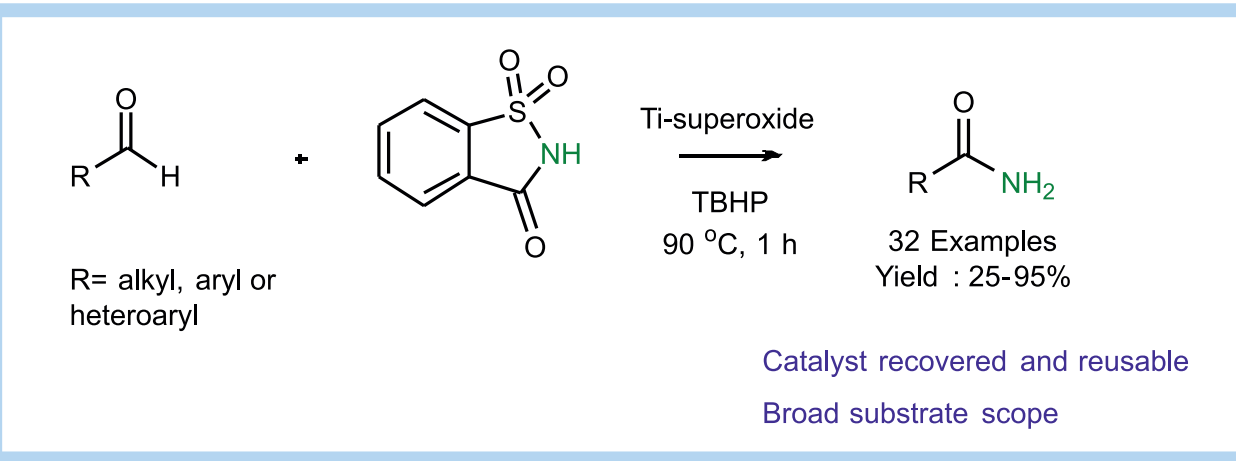
Metal-free, radical 1, 6-conjugated addition of cyclic ethers with para-quinone methides (p-QMs): An efficient method for metal-free C–C bond formation between p-quinone methides (p-QMs) and cyclic ethers via a radical pathway to afford substituted diarylmethanes and triarylmethanes or to effect the α-alkylation of the cyclic ethers has been developed. Also, the synthesis of 3,3′-disubstituted oxindoles with stereogenic quaternary carbon centers was successfully achieved under mild reaction conditions (*Org. Biomol. Chem.* **2019**, *17*, 3239).



Highly efficient cross dehydrogenative coupling reaction between quinoxalin-2 (1 H)-ones and ethers: The efficient and metal free, white light mediated 3C alkylation of quinoxalin-2(1H)-ones via a cross dehydrogenative coupling reaction with cyclic ethers using eosin Y as a photocatalyst is described. This reaction has broad substrate scope and strong functional group tolerance with good to excellent yields (*New J. Chem.* **2019**, *43*, 7403).



Ti-superoxide catalyzed oxidative amidation of aldehydes with saccharin as nitrogen source: synthesis of primary amides: Heterogeneous catalytic system using Ti-superoxide and saccharin with TBHP has been developed which catalyzes oxidative amidation of aldehyde to produce primary amides. It tolerates a wide range of substrates with different functional groups (RSC Adv. **2020**, *10*, 724).



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Total synthesis of bioactive natural products

Chemoselective ring closure of 4-(3-Methyl-2-oxo-2,5-dihydro-1H-pyrrol-1-yl)butanal: An alkaloid has been completed via regioselective reduction of methylmaleimide and acid catalyzed enolization of 4-(3-methyl-2-oxo-2,5-dihydro-1H-pyrrol-1-yl)butanal followed by chemoselective intramolecular dehydrative cyclization as the key steps. It is noteworthy that the analogues model system with an additional β-methyl group followed alternate chemoselective intermolecular aldol condensation pathway (*ACS Omega* **2020**, 5, 859).

Indole-based subincanadine alkaloids and their biogenetic congeners: The tryptamine-derived polycyclic bridged bioactive indole alkaloids subincanadines A-G were isolated by Ohsaki and coworkers from the bark of the Brazilian medicinal plant Aspidospermasubincanum. Kobayashi proposed that subincanadines D-F could be biosynthetically resulting from stemmadenine via two different pathways and, furthermore, that the subincanadines A-C could be biogenetically resulting from subincanadines D and E. Kam and coworkers, in their focussed efforts, isolated five indole alkaloids from Malaysian Kopsiaarborea species, namely valparicine, apparicine, arboridinine, arborisidine, and arbornamine in combination with subincanadine E. On the basis of structural features, it has been proposed and proved in some examples that subincanadine E is a biogenetic precursor of these five different bioactive indole alkaloids bearing complex structural architectures. All important information on isolation, characterization, bioactivity, probable biogenetic pathways, and more specifically racemic and enantioselective total synthesis of subincanadine alkaloids and their biogenetic congeners are summarized in the present chapter (*Alkaloids* **2020**, *83*, 187).

Regioselective oxidation of indoles to 2-oxindoles: Facile regioselective oxidation of indoles to 2-oxindoles promoted by sulfuric acid adsorbed on silica gel was reported. The present oxidation strategy is also employed to accomplish total synthesis of natural products donaxaridine and donaxarine. On the basis of analytical and spectral data it is evidenced that the donaxarine stays in equilibrium with its hydrated ring opened form. The structural features essential for such type of oxidation and plausible mechanism are discussed in brief (*Org. Biomol. Chem.* **2019**, *17*, 6671).

Stereoselective synthesis of subincanadine alkaloids framework: Starting from N-tosyl tryptamine and (S)-acetoxysuccinic anhydride, facile synthesis of (–)-indolizinoindolone was demonstrated as a basic structural outline of bioactive subincanadine alkaloids. Regioselective Grignard reaction with (S)-acetoxysuccinimide, stereoselective intramolecular cyclization to form (–)-indolizinoindolone skeleton and $TiCl_4$ induced condensation with acetaldehyde for stereo- selective generation of exocyclic carboncarbon double bond were the key features (*Indian J. Chem.* **2019**, *58B*, 669).

Healthcare

Chemical Biology

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Molecular parasitology and drug discovery for infectious diseases

Demystifying role of hexuronic acid in *Toxoplasma gondii* invasion into host cells: *Toxoplasma gondii* is a ubiquitous eukaryotic pathogen responsible for toxoplasmosis in humans and animals. This parasite actively invades susceptible host cells, a process which is mediated by specific receptor–ligand interactions. Here, we have reported an unnatural 2,4-disulfated D-glucuronic acid (Di-S-GlcA), a hexuronic acid composed of heparin/heparan sulfate, as a potential carbohydrate ligand that can selectively bind to *T. gondii* parasites and strongly inhibits parasite entry into host cells (*Org. Biomol. Chem.* **2019**, *17*, 4535).

Developing mitochondrial cox3 gene based diagnosis of *Babesia gibsoni* infection in dogs: A PCR assay using mitochondrial cytochrome oxidase subunit III (cox3) gene for molecular detection of *Babesia gibsoni* infection in dogs has been developed in this study. Samples were analyzed from three geographical locations of Satara, Wai and Pune in Maharashtra state of India. The analytical sensitivity of cox3 PCR was evaluated as 0.000003% parasitaemia or 09 parasites in 100 µl of blood and was also very specific, with no cross activity with other haemoprotozoa and rickettsia (*Exp. Parasitol.* **2019**, 206, 107771).

Driving drug discovery for human pathogens through intensive chemogenomic data integration: A chemo-genomics approach for neglected tropical diseases drug discovery has been developed which helps in identifying drug targets and advancing drug repositioning. The TDR targets database (http://tdrtargets.org) has been designed and developed as an online resource to facilitate the rapid identification and prioritization of molecular targets for drug development. This resource facilitates connections between genes and small molecules, yielding insight into whether particular proteins may be druggable, effectively allowing the navigation of chemical space in a genomics context (*Nucleic Acids Res.* **2020**, *48*, D992).

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Structural bioinformatics approach to screen anti-SARS-CoV-2 molecules

Discovery of potential multi-target-directed ligands by targeting host-specific SARS-CoV-2 structurally conserved main protease: SARS-CoV-2 infection has resulted in the current COVID-19 pandemic. The main protease (M^{Pro}) plays a critical role in viral replication and maturation, thus can serve as the primary drug target. Upon virtual screening, we identified several natural molecules strongly binding to M^{Pro}, human angiotensin-converting enzyme 2 (hACE-2), and RNA dependent RNA polymerase (RdRp). We anticipate that our approach for identification of multi-target-directed ligand will provide new avenues for drug discovery against SARS-CoV-2 infection (*J. Biomol. Struct. Dyn.* **2020**, 1).

Rationale based selection and prioritization of antiviral drugs for COVID-19 management: To select and prioritize approved antiviral drugs and drug combinations for COVID-19, 61 antiviral drugs having proven safety profile in humans were subjected to virtual screening for binding to hACE-2, RdRp and M^{Pro}. Ledipasvir and Daclatasvir and their approved marketed combination with Sofosbuvir emerged as leading candidate drugs/drug combinations for SARS-CoV-2. The present work brings back attention to the potential usefulness of approved antiviral drugs/drug combinations (*ChemRxiv*, **2020**).

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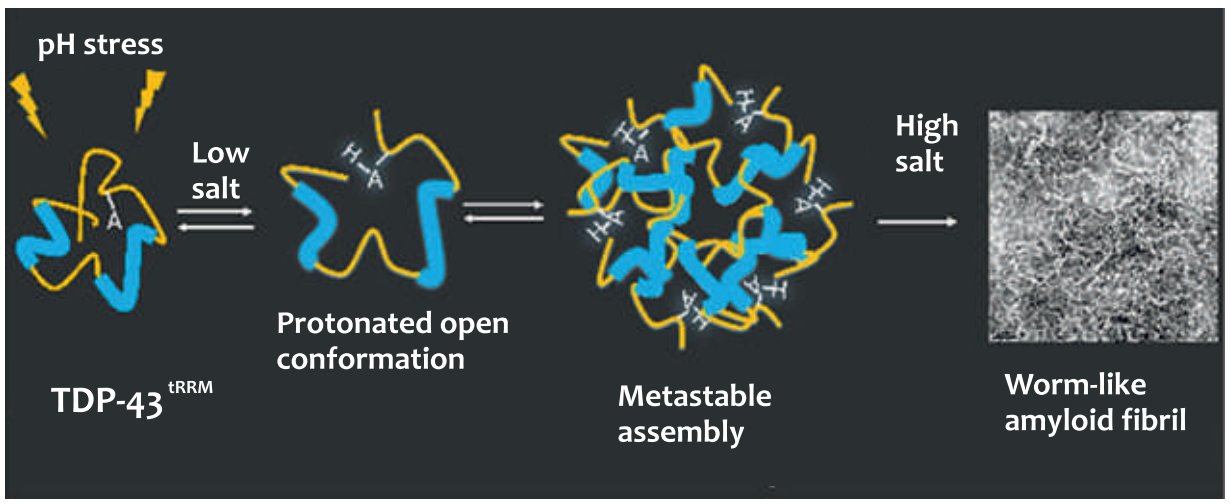
Stress sensing during neurodegenerative diseases: TDP-43 is a vital protein which forms abnormal aggregates in the cytosol of neurons when exposed to various environmental stresses, in many neurodegenerative diseases including ALS. However, the nature of early structural changes upon stress-sensing and the consequent steps during the course of aggregation are not well understood. In this study, we showed that stress-sensing by TDP-43 during neurodegeneration occurs by coupling of protonation-deprotonation equilibria with assembly of proteins into metastable assemblies that lead to the formation of amyloid-like aggregates (*Biochemistry-US* **2020**, 59, 315).



Healthcare

Synthesis of API

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Synthesis of sitagliptin: The number of diabetic patients in India is increasing and requires immediate attention. We have developed a highly enantioselective and atom economic synthesis of sitagliptin, a potent DPP-4 inhibitor. Chiral FerroLANE ligands in presence of rhodium, catalyze asymmetric hydrogenation of enamine to yield sitagliptin with an unprecedented enantioselectivity of 98%. The asymmetric hydrogenation has been scaled to 5g batch and the final product is isolated as a phosphate salt with >99% ee (*Asian J. Org. Chem.* **2020**, 9, 189; Patent No: WO 2020/121321A1).

Mathematical modeling and Big data analytics

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Modeling long-range lipid effects in cell signaling pathways

Cholesterol and sphingomyelin effects in caveolin-1 mediated membrane curvature: The caveolin-1 (cav-1) protein is an integral component of caveolae and is essential for cell trafficking and mechano-sensing. We have modeled in molecular detail the interactions between cav-1 and complex bilayers using a series of coarse-grain simulations, focusing on lipid clustering and membrane curvature. Our results suggest that cav-1 binding induces concentration-dependent curvature effects and clustering in complex membranes. Overall, our work is an important step in understanding themolecular basis of curvature and lipid clustering in complex cellular membranes (*J. Phys. Chem. B* **2020**, 124, 5177).

Role of cholesterol-mediated effects in GPCR heterodimers: The organization of GPCRs into dimers and oligomers allows a larger repertoire of downstream signaling events. We have explored the effect of membrane cholesterol on the adenosine$_{2A}$ and dopamine D_3 receptors using coarse-grain molecular dynamics simulations. We showed that cholesterol modulates the relative population of co-existing heterodimer conformations. These results constitute one of the first examples of modulation of GPCR hetero-dimerization by cholesterol, and could prove to be useful in designing better therapeutic strategies (*Chem. Phys. Lipids* **2020**, 227, 104852).

Sustainable Chemical Processes/ Technologies

Process intensification and engineering, Process separations, and Process modeling

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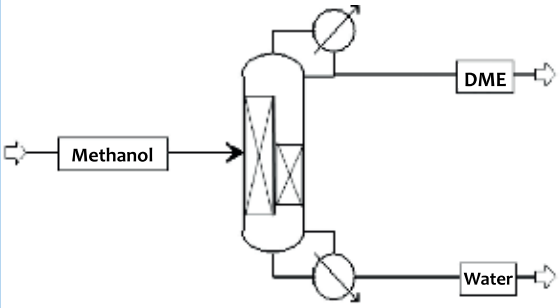
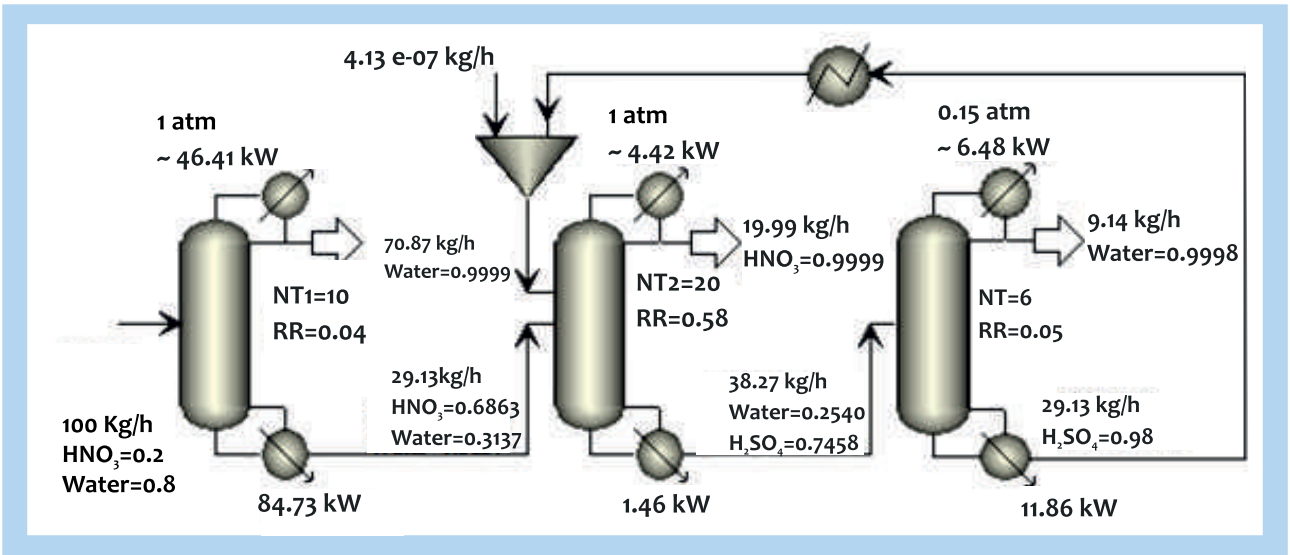
Advanced distillation technologies

Intensified reactive distillation configurations for production of dimethyl ether: The combustion properties of dimethyl ether (DME) are similar to the conventional fuels; hence it is being used as a promising green energy source. The conventional method of DME production by methanol dehydration is highly energy consuming due to the use of a series of distillation columns. In this study, an energy efficient reactive distillation configuration is proposed for DME production which leads to higher methanol conversion with less energy requirement as compared to reported configurations (*Chem. Eng. Process.* **2020**, *149*, 107824).



Extractive distillation configuration for nitric acid dehydration using sulfuric acid: Processes utilizing concentrated nitric acid usually lead to an effluent of dilute nitric acid, typically in the range of 15–20 mass% nitric acid, which needs to be concentrated and recycled back to the process. But the concentration of nitric acid by a conventional distillation process is difficult due to the formation of a maximum boiling azeotrope with water. This work reports an optimized extractive distillation configuration for dehydration of nitric acid using sulfuric acid as a solvent. Detailed parametric analysis of an extractive distillation configuration for the dehydration of nitric acid using sulfuric acid as a solvent is not available in the open literature (*Ind. Eng. Chem. Res.* **2020**, 59, 6183).



Experimental vapor-liquid phase equilibrium analysis of the binary systems of aniline: Experimental phase equilibrium data, specifically for vapor and liquid phases, i.e., VLE data, is must to understand equilibrium compositions under different operating conditions. For separation equipment such as distillation, this data is very critical, and it is very important to know the presence of any non-ideal

Sustainable Chemical Processes/ Technologies

Process intensification and engineering, Process separations, and Process modeling

behavior such as azeotrope formation or a close-boiling nature, which poses a challenge in purification using a conventional distillation column. For mixtures of aniline with xylene isomers, no such VLE data is reported in the literature except for aniline+p-xylene and aniline+m-xylene. This work reports the vapor–liquid phase equilibrium study for four binary systems of aniline with xylene isomers as the T–x,y data at atmospheric pressure (*J. Chem. Eng. Data* **2020**, 65, 2619).

Experimental analysis of vapour-liquid phase equilibria for binary systems of diethyl carbonate: We reported an experimental isobaric VLE analysis for binary systems, DEC + methyl acetate, DEC+ethyl acetate, DEC+ isopropyl acetate, DEC + n-butyl acetate, DEC + isoamyl acetate at local atmospheric pressure of 95 kPa. Interaction parameters were determined for various activity coefficient models which can be used for mathematical modelling and designing various unit operations and processes involving mixtures of DEC and esters (*J. Chem. Thermodyn.* **2020**, *150*, 106189).

Catalysis

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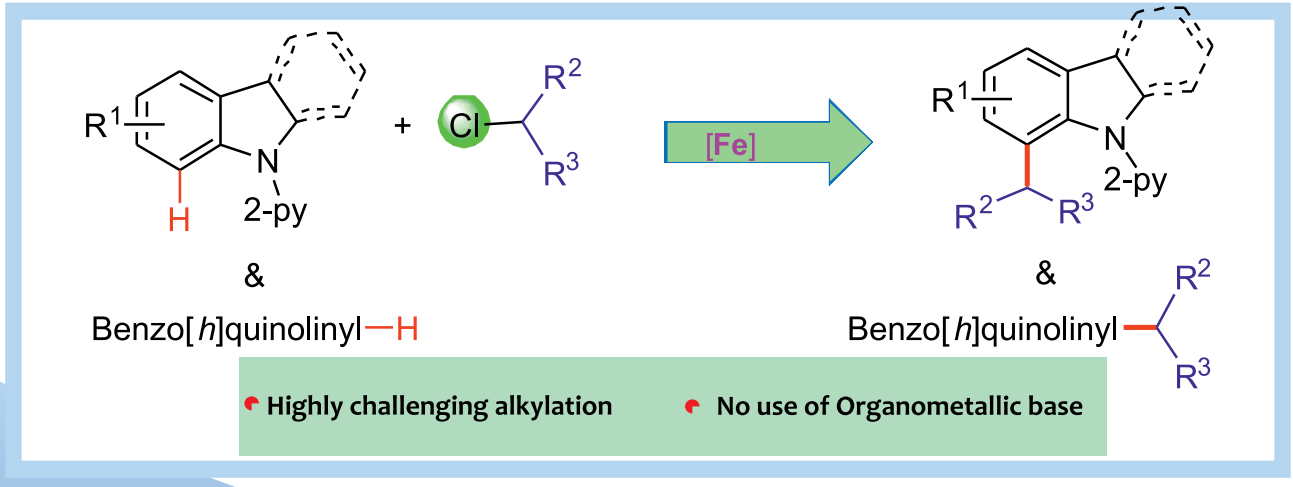
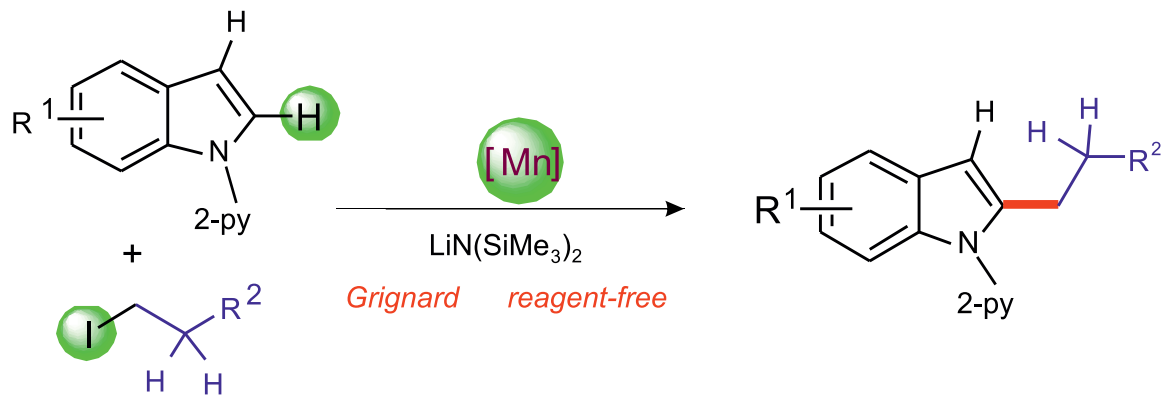
Organometallic chemistry and homogeneous catalysis

Iron-catalyzed C(sp^2)H alkylation with unactivated alkyl chlorides through chelation-assistance: Regio-selective CH bond alkylation of indolines and benzo[*h*] quinoline with a wide range of unactivated and high-demand primary and secondary alkyl chlorides is accomplished using a low-cost iron catalyst. This reaction tolerates diverse functionalities, such as C(sp^2)Cl, fluoro, alkenyl, silyl, ether, thioether, pyrrolyl and carbazolyl groups including cyclic, acyclic alkyls as well as alkyl bearing fatty-alcohol and polycyclicsteroid moieties. The demonstrated iron-catalyzed protocol proceeded either *via* a five-membered or a six-membered metallacycles. Intriguingly, the C-7 alkylated indolines can be readily functionalized into free-*NH* indolines/indoles, and Tryptamine derivatives. Detailed mechanistic investigation highlights the participation of an active Fe(I) catalyst, and involvement of a halogen-atom transfer process *via* single-electron-based mechanism. Deuterium labeling and kinetics analysis indicate that the CH metalation of indoline as the probable turnover-limiting step. Overall, the experimental and theoretical studies supported Fe(I)/Fe(III) pathway for the alkylation reaction comprising the two-step one-electron oxidative addition of alkyl chloride (*ACS Catal.* **2020**, *10*, 7312).



$MnBr_2$-catalyzed direct and site-selective alkylation of indoles and benzo[*h*]quinoline: Manganese-catalyzed regioselective CH alkylation of indoles and benzo[*h*]quinoline with a variety of unactivated alkyl iodides was demonstrated. Unlike other Mn-catalyzed CH functionalization, this protocol does not require a Grignard reagent base, and employs a simple and inexpensive $MnBr_2$ as catalyst. This method tolerates diverse functionalities, including fluoro, chloro, bromo, iodo, alkenyl, alkynyl, pyrrolyl and carbazolyl groups. The alkylation proceeds through a single-electron transfer pathway comprising reversible CH manganesation, and involving an alkyl-radical intermediate (*Org.Lett.***2020**, *22*, 4643).



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Surface science and heterogeneous catalysis

Reverse water-gas shift reaction (RWGS) for Co_2 activation: Mo_2C was demonstrated to be an attractive catalyst for CO_2 reduction to CO with H_2 via RWGS reaction. 1:3 = CO_2:H_2 was found to be the optimum for highly active and selective towards CO at 723 K at ambient pressure with Mo_2C. Basicity, redox property and high catalytic activity observed with Mo_2C around 700 K correlates well and indicate a strong synergy among them towards CO_2 activation (*Dalton T.* **2019**, *48*, 12199).

Styrene to styrene oxide with molecular oxygen: We attempted to exploit the nanoscience to make a catalytic process sustainable. Catalytic styrene epoxidation with O_2 was attempted on spinel Co_3O_4 with two different morphologies, namely, nanorods made by solvothermal and hydrothermal methods, and nanocubes. Although all three surfaces were found to be active for selective epoxidation of styrene with O_2 in liquid phase, the correlation between catalytic activity and morphology reveals the nanocube exhibiting the highest activity and demonstrates the structure sensitive nature (*Dalton T.***2019**, *48*, 4574).

Sustainable Chemical Processes/ Technologies

Catalysis

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Modified deposition precipitation method for Pd supported SBA-15 nanomaterials and its improved catalysis: Modified deposition precipitation (DP) method is used for supporting small Pd nanoparticles on SBA-15 silica system (Scheme). A comprehensive size dependent CO oxidation activity has been demonstrated for Pd-SBA-15 catalysts with Pd NPs of varying sizes such as 1-2, 4-6 and 7-10 nm (Fig. 1). Pd-S-N catalyst prepared by modified DP method (reduced at 400 °C) demonstrated CO oxidation activity with lower light off temperature (50 °C), clearly one of the best reported for a Pd-silica system (Fig. 2) (*App. Catal. B.* **2020**,272,118934).

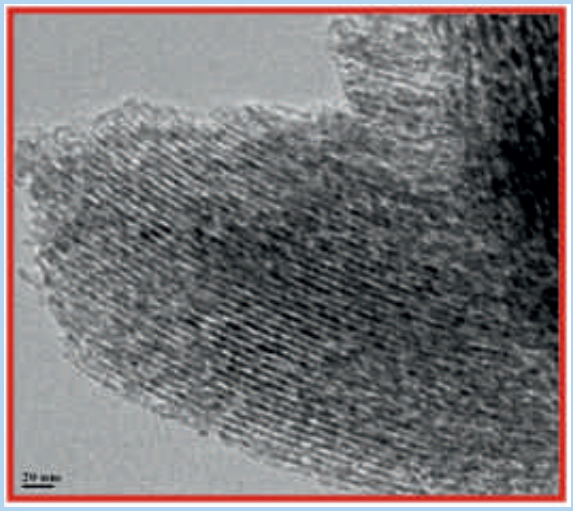
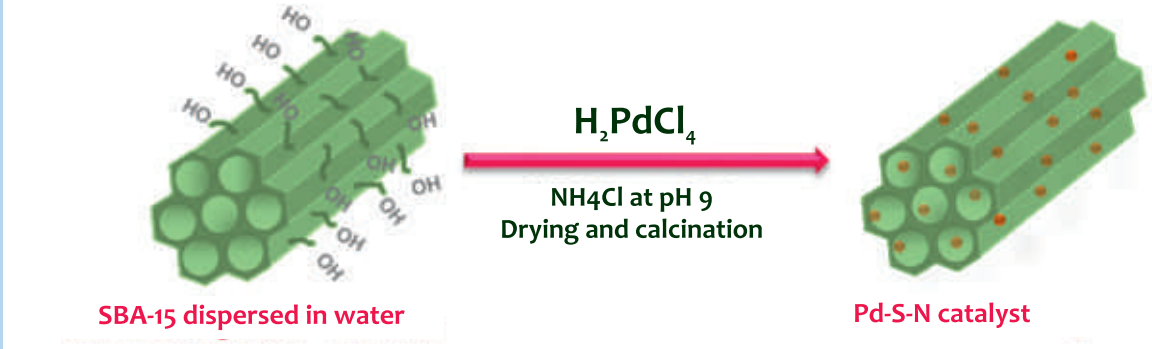


Fig.1: HRTEM image of Pd-S-N nanocatalyst



Schematic showing the modified deposition precipitation method for synthesizing Pd- SBA-15 nanocatalyst

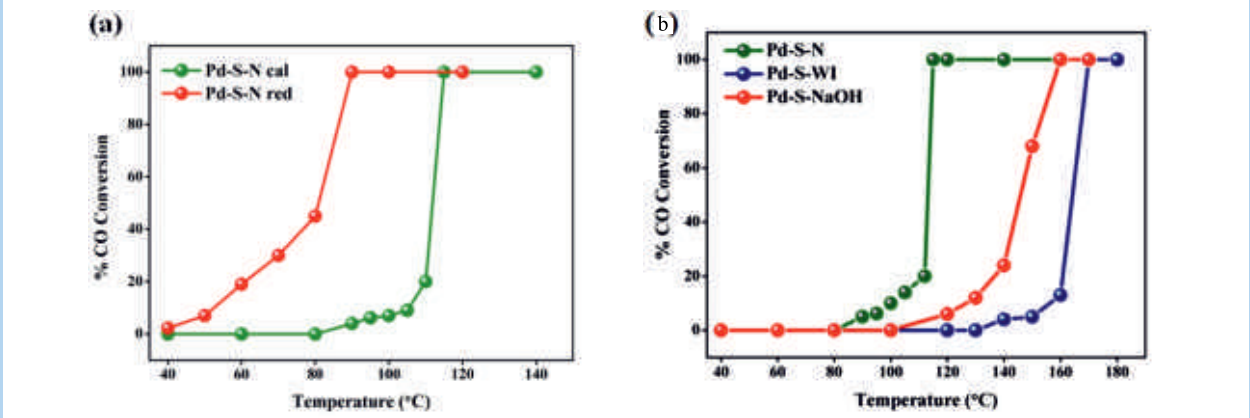


Fig.2: (a) Catalytic activity comparison of Pd-S-N (modified DP method) with Pd-S-WI (wet impregnation) and Pd-S-NaOH (normal DP method) (b) Catalytic activity of Pd-S-N calcined and

Sustainable Chemical Processes/ Technologies

Catalysis

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Catalytic transformation of renewable feed-stock's

Xylose to levulinicacid: Sulfonated H-β zeolite was successfully prepared and used for the synthesis of furanic compounds especially furfural and furfuryl alcohol from D-xylose in one step using isopropanol as alcohol media. It was found that the total acid amount was increased with increase in sulfur loading which confirmed that sulfonic acid group (SO_3–H) was successfully grafted onto zeolite structure. 3 wt% H-β–SO_3–H catalyst with optimized reaction parameters of 150°C, 7 h, and 25wt% catalyst loading was tuned to get the highest furanic compound yield of 88.5% that include furfural-76.8% and furfuryl alcohol-11.7% (*Biomass Bioenerg.***2020**, *139*,105646).

Wheat straw to ethyl levulinate: Ethyl levulinate, biofuel additive can blend up to 20% with biodiesel to improve its fuel properties. There are reports on use of homogeneous catalysts (H_2SO_4, ionic liquid) for synthesis of ethyl levulinate from raw biomass like wheat straw. This work is a successful attempt to use heterogeneous micro-meso acidic H-USY for direct one step conversion of wheat straw to ethyl levulinate with higher yield of 24.5 wt%, which is probably the highest so far (*Micropor.Mesopor. Mat.***2020**, *306*, 110474).

Epoxidation of karanjaoil methyl ester: The synthesis, characterization and catalytic performance of a conceptually simple, novel NbOx-SiO_2 catalyst are reported. The niobium(V)-silica catalyst was prepared starting from cheap and viable reactants, by alkaline deposition of $NH_4Nb(C_2O_4)_2{\cdot}H_2O$ in the presence of fructose as a stabilizer and subsequent calcination. The NbOx-SiO_2 solid (0.95 Nb wt.%) was tested in the liquid-phase epoxidation with aqueous hydrogen peroxide of methyl oleate, as a model substrate. It was then tested in the epoxidation of a mixture of methyl esters obtained by transesterification with methanol and purification of karanja oil, extracted from the autochthonous Indian variety of *Millettiapinnata* tree. The catalyst showed a promising performance in terms of methyl oleate conversion up to 75% and selectivity to epoxide up to 82% (*Catalysts* **2019**, 9, 344).

Glucose to ethyl levulinate: The study highlighted the catalytic synthesis of ethyl levulinate from glucose over synergetic combination of zeolite H-USY and Lewis acidic catalysts such as Sn-beta, TiO_2, ZrO_2, and SnO_2. The synergetic combination of H-USY with SnO_2 showed higher ethyl levulinate yield than the combination with other Lewis acidic catalysts. Highest ethyl levulinate yield of 81% from glucose (50 g/L) at 180 °C in 3 h was achieved over the optimal combination of 95% H-USY and 5% SnO_2 having strong/weak acidity and B/L ratios of 1.30 and 0.75, respectively. The study was further extended for establishing the proposed reaction mechanism without the formation of 5-hydroxymethyl furfural, levulinic acid, and formic acid which makes the overall process clean and green (*Energ.Fuel.***2019**, *33*, 2319).

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Valorization of plaster of paris (POP) in biomedical waste: The eco-friendly and rapid disintegration of biomedical POP waste was done by treating with ammonium bicarbonate solution (20% w/v ABC) to form non-hazardous products like ammonium sulphate and calcium carbonate in the form of sludge. The ammonium sulphate $(NH_4)_2SO_4$ is generally used in agriculture as a chemical fertilizer and calcium carbonate ($CaCO_3$) as an additive in the construction sector making this process cost-effective and value-addition. Interestingly, 20% ABC solution also had significant antibiofilm, antimicrobial activity against fungi, yeast and bacterial strains probably due to its high pH-driven osmotic effect. Therefore, 20% ABC solution finds dual eco-friendly application in disinfection of used POP, especially arising from biomedical waste from patients (*Int. J. Environ. Sci. TE.***2019**, *16*, 2475).

Sustainable Chemical Processes/ Technologies

Catalysis

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Catalyst development for fine/bulk chemicals

Pd based solid acid catalysts for hydrogenation of various functionalities: Palladium supported on various solid acid supports were prepared and used for hydrogenation of various industrially important substrates. Hydrogenation of nitro aromatics, different C=N groups, aromatics, acetophenones and many industrially important substrates. The catalysts have shown very high efficiency for hydrogenation under ambient conditions for nitroaromatics, acetophenones as well as several important substrates and under milder conditions for aromatics, imines. With only 1% Pd loading catalysts have shown very high efficiency for recycle without Pd leaching (Patent:US2015239821A1).

Process for the manufacture of nitrobenzene using solid acid catalyst: A solid acid catalyst was developed for the liquid phase nitration of benzene using commercial nitric acid (65-70%) as nitrating agent without using any sulfuric acid in the process. The catalyst showed excellent catalytic activity for mono nitration (100% selectivity) of benzene at ~90-95 °C. The water formed during the reaction is removed azeotro pically with benzene. Hence no additional solvent is needed for removal of water from the reaction system. Preliminary results showed almost 65-70% HNO_3 conversion with recovery of unreacted HNO_3(*Appl. Catal. A* **2019**,574, 105; Patent: WO2019111280A1).

Oxidative dehydrogenation of ethyl lactate to ethyl pyruvate: Pyruvates are important intermediates for various bioactive and pharmaceutical molecules. A simple liquid phase route for oxidative dehydro-genation of ethyl lactate to synthesis ethyl pyruvate using aq. tert-butyl hydroperoxideas oxidant was developed using very simple, cheap and recyclable heterogeneous catalyst with 98% yield of ethyl pyruvate (98% conversion, 100% selectivity). Catalyst was recyclable with no deactivation as well as no polymerisation of pyruvates leading to high yield of ethyl pyruvate (*Appl. Catal. A* **2019**, *587*, 117246, Patent: US2018141892A1).

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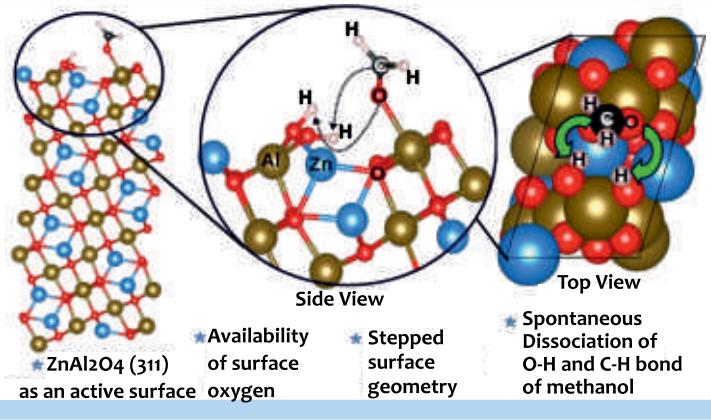
Understanding how a catalyst works: Density Functional theory based computation is employed to unravel the potential of a mix metal oxide as a catalyst for MeOH adsorption and activation. DFT based computation is employed to understand the atomistic level details and the electronic structure of a catalyst which indeed explains why the performance of this catalyst is far better than the existing once. The results reported here opens up a new class of catalyst for research (*Appl.Surf.Sci.***2020**, 534, 147449).



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Fabrication of mesoporous carbon supported Ni-Mo catalyst for the enhanced conversion of glucose to ethylene glycol: Ethylene glycol is an interesting polymer precursor to prepare polyethylene terephthalate (PET) and it is manufactured from petroleum-derived ethylene and propylene oxides. It is vital to find an alternative and sustainable route for their manufacture. The spherical shaped mesoporous-carbon was prepared and relatively low cost metals were impregnated. The direct conversion of concentrated aqueous glucose to ethylene glycol was studied in a batch reactor. The high hydrogenation activity of Ni and the medium to strong acidity of molybdenum oxide helped in obtaining a significantly high yield of ethylene glycol (63.2%) with complete glucose conversion under moderate reaction conditions. The catalyst was found to be reusable (*New J. Chem.* **2020**, *44*, 15965).

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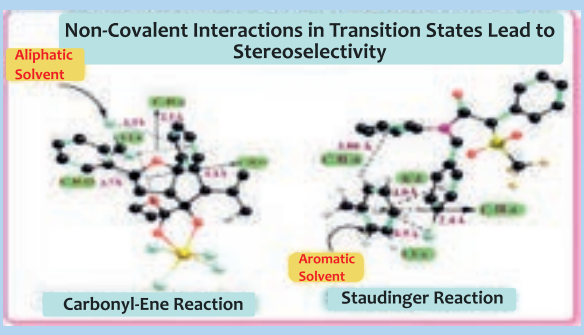
Computational studies on substrate-solvent interactions: Non-covalent interactions have been identified as important contributing factors in determining selectivity in organic transformations. The current computational study with density functional theory (DFT) identifies two important transformations where this is the case: the intramolecular carbonyl-ene reaction and the Staudinger [2+2] cycloaddition reaction. Calculations indicate that the diastereomeric ratio (dr) would be 95.0:5.0 for the formation of tricyclic tetrahydrofuran diastereomers *via the* intramolecular carbonylene reaction, and 94.0:6.0 for the formation of the triflonesdiastereomers *via* the Staudinger [2+2] cycloaddition reaction, which corroborates with experiment. In both the cases, the calculations indicate that non-inclusion of explicit solvent molecules would lead to only a small difference between the competing transition states, which leads to the conclusion that solvent-substrate non-covalent interactions are the major cause for diastereo-selectivity in both the cases considered (*Phys. Chem. A* **2020**, *124*, 8019).



Sustainable Chemical Processes/ Technologies

Catalysis

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Valorization of agri (crop) and plastic waste into valuable chemicals

Dehydration and oxidation of sugars and their derivatives: India specific glucose dehydration into 5-hdyroxymethyl furfural (HMF) and fructose into furfural was carried out with proprietary catalyst. Reactions with higher substrate concen- tration (>10wt%), milder reaction conditions and use of variety of substrates along with recyclability of catalyst are some of the important aspects of the methodology developed. Further, furans obtained were oxidized again with the proprietary and commercially available catalysts to obtain acids. For e.g. HMF was oxidized in presence of air or oxygen below 15 bar pressure to obtain 2,5-furan dicarboxylic acid (FDCA) with >90% yield. It is important to note that crude HMF with a purity of 50% can also be effectively oxidized to FDCA, which finds use in PET analogous PEF manufacture. The economics of the methodology has been done and it is observed that the system is very much comparable or better than reported by several industries (Patent filed: India/202011034406).

Depolymerization of plastic into chemicals: A unique catalytic system was developed to recycle and reuse the plastic waste generated, by which recyclable catalyst can be used to obtain monomers back from the polymer. This way, monomers obtained in quantitative yield, can be reused for the polymerization to food grade polymer. Possibility of recycle of colored plastic and mixture of plastics is one of the key aspects of this work (Indian Patent filed: 202011007863).

Sakya Singha Sen
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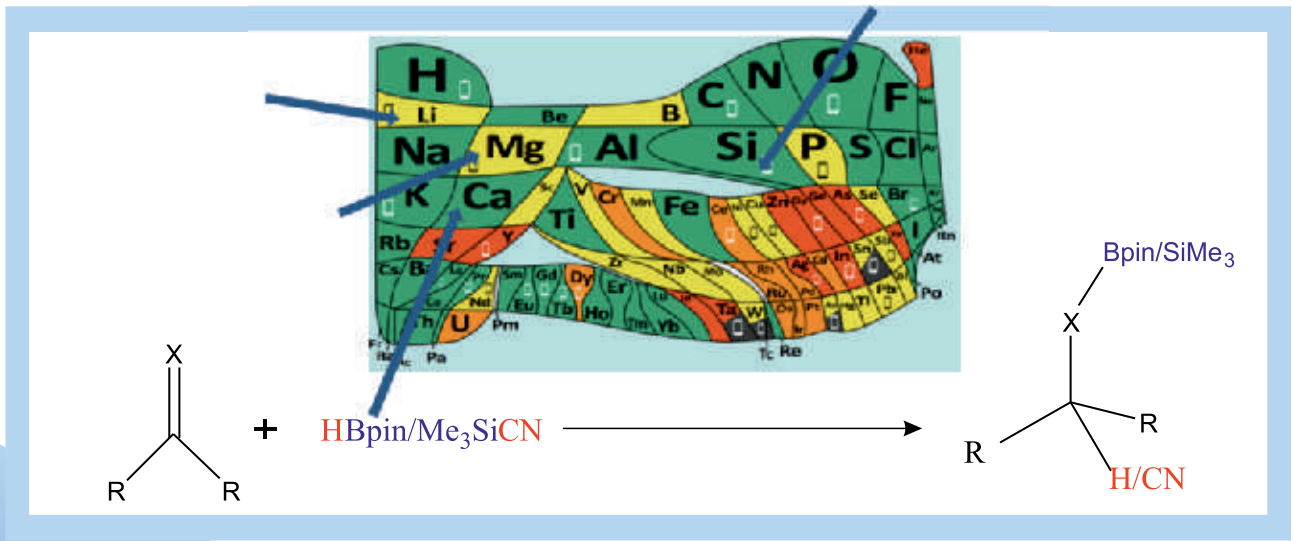
Main group compounds as surrogates for precious metals: We prepared several main group compounds based on lithium, magnesium and calcium. We utilized them as catalysts for important organic transformation like hydroboration of alkenes and alkynes. Such transformation was known only with precious transition metals and we were able to replace them with cheap and green main-group elements. We have also prepared a novel silicon compound known as silylene for activating small molecules, which is considered as the first step of any catalytic cycle (*Chem.Commun.***2019**, 55, 11711; *Chem.-Asian J.***2020**, 15, 820).



Sustainable Chemical Processes/ Technologies

Catalysis

Sudarsanam Putla
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Advances in heterogeneous catalysis for biomass conversion and fuel cell applications

Towards lignin-derived chemicals using atom-efficient catalytic routes: This review provides a concise account of the recent advances in lignocellulose fractionation/lignin depolymerization processes towards lignin-derived monomers. Subsequently, numerous potential atom-efficient catalytic routes for upgrading lignin monomers into drop-in chemicals and new polymer building blocks were discussed (*Trends Chem*.**2020**, 2, 898).

TiO_2-based water-tolerant acid catalysis for bio-derived fuels and chemicals: Recent progress toward TiO_2-based water-tolerant acid catalysis for biomass conversion, with a focus on hydrothermal stability of TiO_2, its acidity, and catalysts' synthesis methods were discussed. Various biomass conversions over TiO_2-based catalysts, where water-tolerant acid sites or acid-redox dual sites show a significant catalytic effect were highlighted. Structure–activity relationships based on water-tolerant Lewis acidity of TiO_2 were studied. It provides valuable information for developing efficient water-tolerant solid acid catalysts not only for biomass valorization but also for other challenging reactions in the aqueous medium (*ACS Catal*.**2020**,*10*, 9555).

Supported bimetallic catalysts for oxygen reduction and formic acid oxidation reactions: We reported the synthesis of highly efficient carbon-supported palladium–nickel electrocatalysts for both oxygen reduction reaction and formic acid oxidation reactions. The homogeneous dispersion of smaller palladium–nickel alloy nanoparticles over the carbon support, downshift of Pd d-band center, as well as the synergistic metal-support effect were the key for efficient electrocatalysis (ACS Appl. Energy Mater.**2020**,*3*,9285).

Functionalized magnetic nanosized catalysts for biodiesel synthesis: The preparation methods, structural and performance control, and protection and functionalization of magnetic nanoparticles as well as the consequent catalytic effects in the synthesis of biodiesel (mainly long-chain fatty acid methyl esters) were reported. In addition, various representative reaction mechanisms are discussed, emphasizing the existing challenges and prospects of industrialization (*Green Chem*.**2020**,22, 2977).

Vrushali Jadhav
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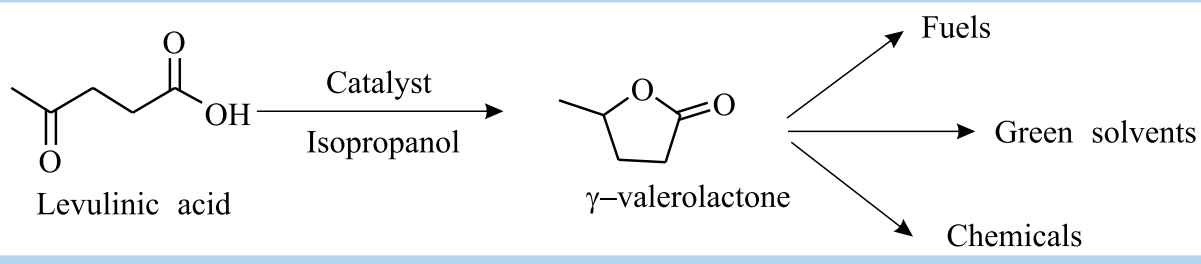
Efficient synthesis of γ-valerolactone: The synthesis of γ-valerolactone was reported using biomass derived levulinic acid by catalytic transfer hydrogenation in isopropanol solvent as a hydrogen donor. A new hafnium based carbonaceous catalyst was prepared, well characterized and the catalytic activity was evaluated for synthesis of γ-valerolactone. 100 % conversion of levulinic acid afforded γ-valerolactone in an excellent yield of 96% with more than 99% selectivity. The catalytic method developed is simple, efficient and economical (*CatalLett*. **2020**, *150*, 2038).



Sustainable Chemical Processes/ Technologies

Catalysis

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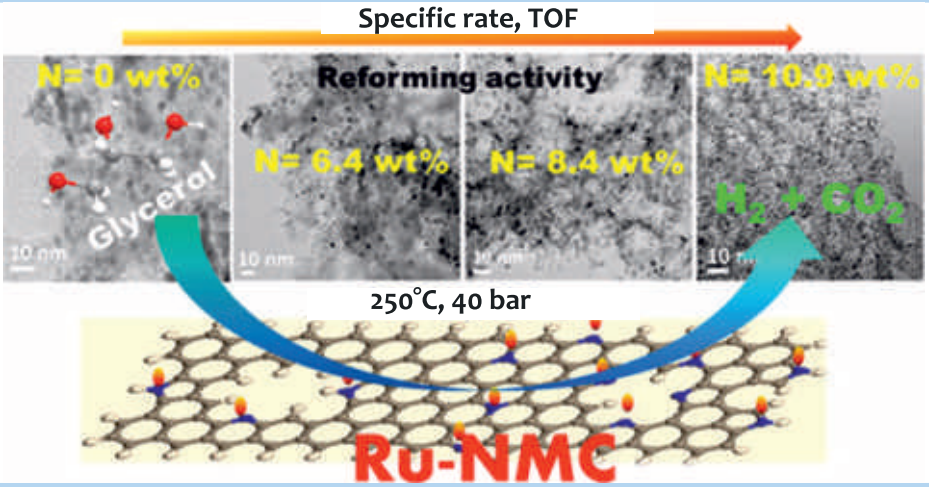
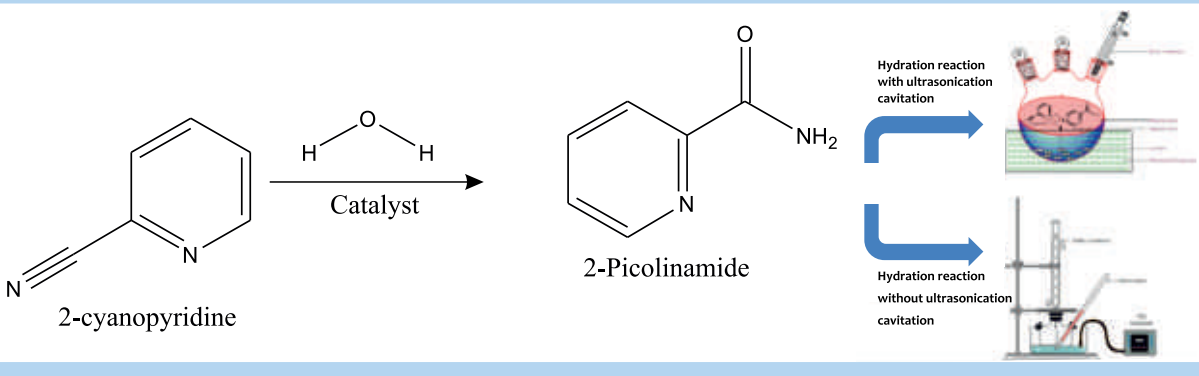
Heterogeneous catalysts

Aqueous phase reforming of glycerol over Ru-NMC catalysts: A series of highly stable Ru-supported catalysts with controlled metal nanoparticle sizes have been prepared via incipient wetness impregnation method. These catalysts were used for aqueous phase reforming of glycerol to produce hydrogen. Nitrogen doped mesoporous carbon (NMC) were utilized as supports and found to have strong influence on catalytic performance of the catalysts. Incorporation of nitrogen in the carbon framework significantly enhanced the catalytic activity compared to Ru on nitrogen free supports (*ACS Catal.* **2020**, *10*, 2489).



Phase transfer ceria-supported nanocatalyst for nitrile hydration reaction: The present study elaborates the catalytic effect of rare-earth metal oxides (Sm_2O_3 and La_2O_3) over ceria as a support phase transfer catalyst. The synthesized catalysts were subjected to different characterization techniques, such as field-emission scanning electron microscopy, high-resolution transmission electron microscopy, powder X-ray diffraction, N_2 adsorption–desorption (BET surface analysis), temperature-programmed desorption study (NH_3/CO_2-TPD), Fourier transform infrared, Raman analysis, and X-ray photoelectron spectroscopy to get better insights into the catalytic activity of the catalysts for hydration of nitrile (*ACS Omega* **2019**, *4*, 16037).



Sustainable Chemical Processes/ Technologies

Mathematical & computational modeling

Kavita Joshi
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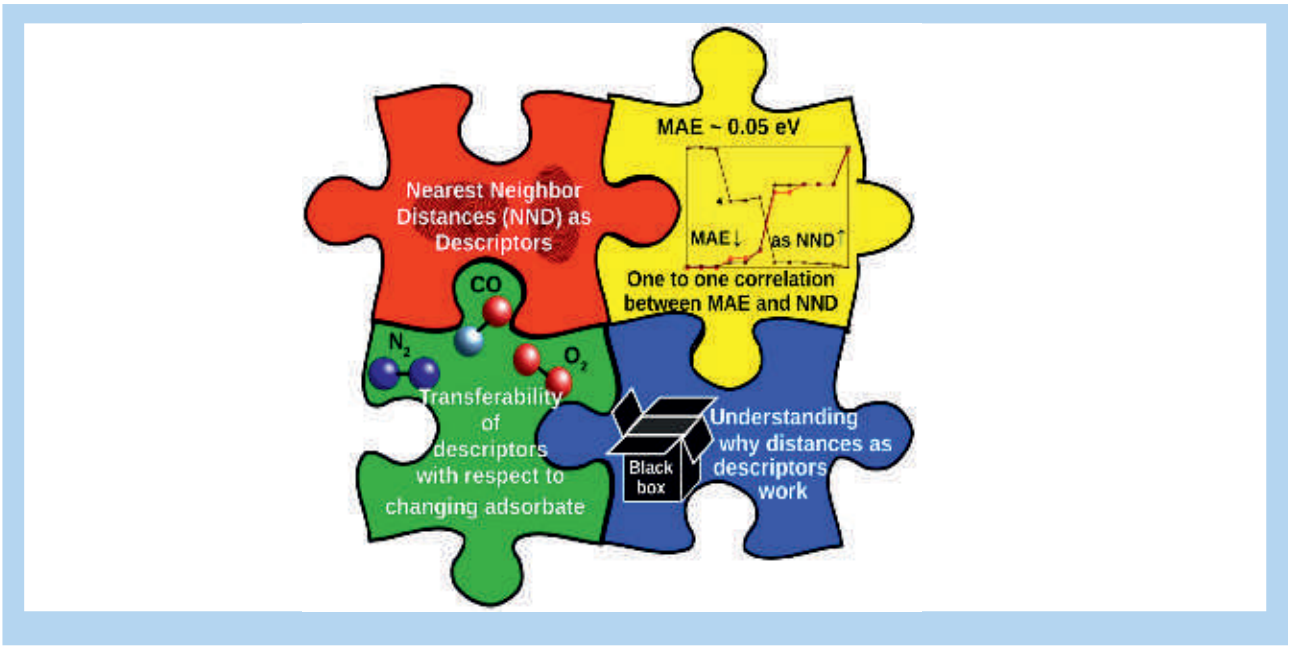
ML black box with simple DFT based descriptors to predict cluster–adsorbate interaction energy: We have applied a machine learning based model to predict DFT energies. The most crucial part of any model is to understand why it works. This work explains why these descriptors work. Further, the simplicity of the descriptors allow us to generalize it to more complex systems, thus predicting DFT energies for systems with ML based model (*New J. Chem.* **2020**, 44, 8545).



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Relativistic coupled cluster: Z-vector relativistic four component coupled cluster method was used to compute to nuclear magnetic quadrupole moment (MQM) of HgH^{201} scalar-pseudoscalar nucleus-electron interaction constant (Ws), the effective electric field (Eeff) experienced by the unpaired electron, and the nuclear magnetic quadrupole moment-electron interaction constant (WM) in the open-shell ground electronic state of HgF, the role of electron correlation in the hyperfine structure of alkali metals and alkaline earth metal mono positive ions in their ground electronic configuration was studied. Our studies revealed that for the precise calculation of the wave function near nuclear region corecorrelating function plays a significant role. We have studied the effect of electroncorrelation in the computed properties of CdH and that of the P, T-odd parameters for monohydrides i.e. ZnH, CdH, and HgH. The study revealed that HgF can be a possible candidate for the search of new physics beyond standard model (*Phys. Rev. A* **2019**, 99,032503; **2020**,101, 032505; *J. Chem. Phys.* **2019**, 150, 084304).

Sustainable Chemical Processes/ Technologies

Chemical Engineering Science

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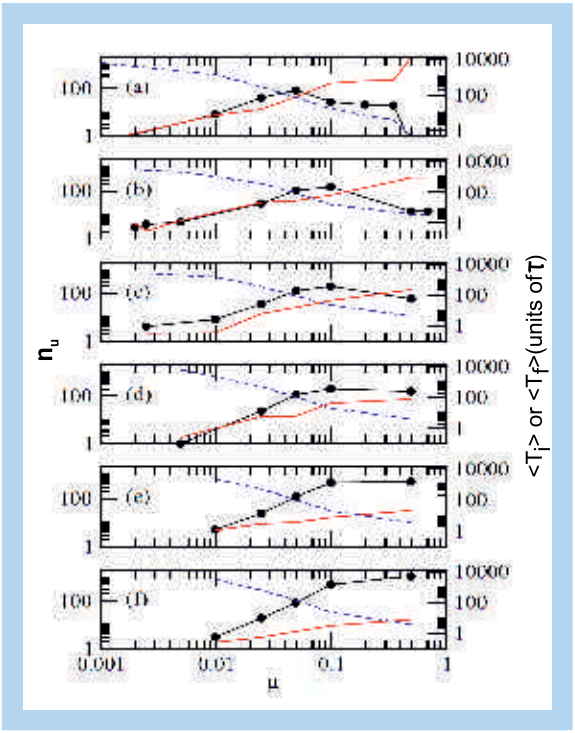
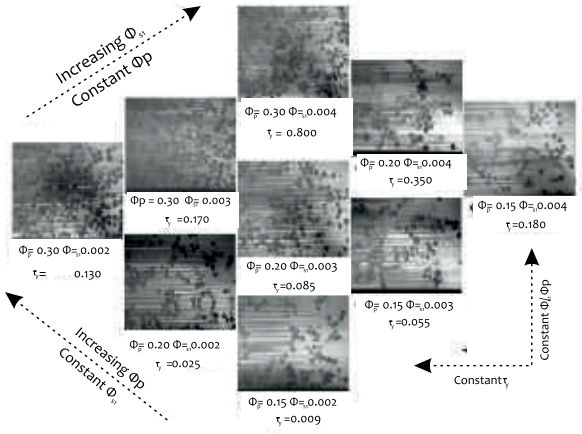
Structure and flow of suspensions

Friction mediated flow and jamming in a multi-orifice silo: The inherent tendency of particulate materials to clog while flowing through a narrow orifice of a silo can be reversed by including a second orifice in the same silo. The mean duration of clogging ($<t_j>$ and flowing ($<t_f>$), respectively, decrease and increase with increasing inter-particle friction coefficient (μ) while the frequency (n_u) of unclogging instances of the first orifice exhibits a nonmonotonic behavior comprising an increase followed by a decrease with increasing inter-particle friction coefficient. On either side of the maximum the system moving progressively towards a permanently clogged or a permanently flowing state. The results are of significance in optimal designing of silos for industries handling particulate materials (*Phys. Rev. E* **2019**, *100*, 012901).



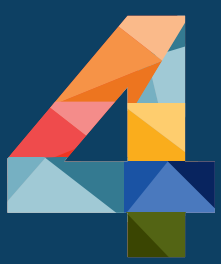
Micro structure and yielding of capillary force induced gel: The suspension of particles in a liquid undergoes gelation upon the addition of a small content of second, wetting liquid which forms liquid bridges between particles leading to a sample spanning network. The rheology of this gel primarily exhibits a yield stress (T_y) at low shear rates followed by a linear variation of shear stress at high shear rates. The yield stress increases rapidly with secondary liquid content (φ_{sl}) followed by saturation while a monotonic increase is observed with increasing particle concentration (φ_p). X-ray tomogr- aphy images showed increased local compactness with increased liquid content and increased spatial homogeneity with increased particle fractions. The outcome of the work is of significance in designing novel, porous materials (*Rheol.Acta.***2020**, 59, 291).



MoU's

MoU's

Resource Centers



Resource Centers

Catalyst Pilot Plant

Catalyst Pilot Plant (CPP) is well equipped with all the catalyst scale-up facilities such as wide range of batch reactors from 250mL to 50L capacity to perform step wise scale up from gm level to 4kg/batch level. CPP is also well equipped with downstream processing units such as filtration; centrifugation; drying; calcinations and extrusion of the heterogeneous catalyst up to 1kg level. These wide ranges of reactors are also suitable for translating batch process from laboratory scale to pilot plant scale. CPP also houses micro-fixed bed reactors for the performance evaluation of the catalysts in various chemical reactions of academic and industrial importance.

Some of the recent projects include development of zeolites, mixed oxides, micro-meso composites etc for its exploitation in Industrial relevance application as well as in the area of conversion of renewable feedstocks such as raw biomass, C6/C5 sugars to value added chemicals, methanol to olefin, etherification of ethylene glycol/2-ethoxymethanol etc.

Central NMR Facility

This Resource Center provides NMR support to all the scientific activities of the laboratory. The scientists associated with this Resource Center also carry out research activities on application of solution state and solid state NMR spectroscopy in diverse areas of chemical, biological and materials sciences. The facility maintains and operates eight NMR spectrometers operating at 200, 300, three at 400, two at 500 and 700 MHz. Bruker AV300 is a wide bore spectrometer dedicated to solid state NMR while the standard bore Bruker AV500 and JEOL ECX 400 spectrometers are equipped with solid state accessories. The new 500 MHz wide bore spectrometer is a dedicated solid-state NMR spectrometer with high power diffusion for liquid state. The 700 MHz spectrometer is equipped with accessories for solution state and solid state NMR. The recently procured 400 MHz standard bore spectrometer is equipped with a reaction monitoring system. Although, the primary users of this facility are from the research community within the laboratory, the facility is open to researchers in other educational institutions and industries. Apart from technical support, the facility also plays an integral part in the basic and applied research activities of the Laboratory.

During the current year, the NMR facility analyzed samples in solution state and solid state including from industries, other R&D and academic institutes generating an ECF of about ₹ 51 lakhs.

Resource Centers

Centre for Materials Characterization

Centre for Materials Characterization (CMC) is a central facility for routine and advanced characterization of materials. The centre caters to the requirements of entire research community at CSIR-NCL as well as the industrial and academic clients including our sister concerns on payment basis. The centre is equipped with various instruments, such as Single Crystal and powder X-ray diffracto- meters (SCXRD/XRD), Scanning electron microscopes (SEM/e-SEM), Transmission electron microscope (TEM), X-ray photo-electron spectroscope (XPS), High Resolution Mass Spectrometer (HRMS), Maldi-TOF MS, Triple TOF LC-MS, SQUID magnetometer, Raman Spectrometer, Vibrating Sample Magnetometer, etc that are used for R & D projects of the institute.

During the year, 13217 samples were analysed of which about 10% percent comprised of industrial samples. This generated some amount of ECF for the laboratory. The activity has generated an ECF of about ₹. 90 Lakh for year.

Digital Information Resource Center

Digital Information Resource Center (DIRC) is continuously in the process of visualizing, anticipating and defining ICT needs of the lab and setting up its efficient and reliable infrastructure to improve the operational efficiency, convenience, speed & security. While managing IT infrastructure, center takes care of planning, installation, operation as well as maintenance of necessary hardware, software as well as human ware of all the IT assets.

DIRC has maintained two data centers consisting of more than two hundred server/storage and network devices as well as essential non-IT infrastructure consisting of high end UPS, PAC, VESDA, surveillance, fire detection, access control systems, etc. located at DIRC. It maintained DATA CENTER, located at the newly constructed 'Convergence' building, while ensuring its 24x7 availability for the computational scientists in the lab and four 'Visitor management system (VMS) kiosk' machines and two Barcode visitor's slip readers, installed at the reception. DIRC maintained latest version of server grade 'Trend Micro' antivirus software, in order to provide virus-free network environment in the lab. It has maintained more than 40 Aadhar enabled biometric attendance system readers in the lab for marking of central attendance of all the regular NCL staff members.

National Collection of Industrial Microorganisms

NCIM Resource Centre (established in 1951) is a one of the oldest microbial collection of India. Activities are dedicated to the isolation, identification, collection, preservation, and distribution of authentic strains to industries and academia for R&D purpose. It also caters allied services in microbial technology sector. NCIM external cash flow mainly comes from private sector. NCIM is pivotal in cataloguing and preserving Indian microbial diversity.

It has generated the cash flow of ₹ 470 lakhs through supply of 9700 microbial strains. Around 150 microbial

strains were lyophilized for their long-term preservation. Nearly 25 new microbial strains were received for deposition. Around 400 cultures have been identified through identification service. Certificate of analysis (COA) microbial cultures is also sent along with cultures. Latest catalogue of microbial strains is available in the form of friendly and online version. Updated deposit forms, and sequencing and miscellaneous forms as per global standards are available in online portal of NCIM and also listed on Analyti CSIR portal.

Knowledge Resource Centre

Knowledge Resource Center (Library) has subscribed to many resources in electronic format so that users get wider access to online contents. Through CSIR-NKRC consortia users are provided access to wide range of ejournals from different publishers. During the year users were provided access to more than 700 ejournals from major publishers such as ACS, AIP, APS, Elsevier, IEEE, Royal Society of Chemistry, Springer/Springer-Nature and Wiley. Users were also provided access to various databases such as ithenticate plagiarism software, Grammarly software, Web of Science database, Sci-Finder database, Orbit Intelligence database and Derwent Innovations database.

During the year more than 50 books, 71 thesis and 65 hindi books were added in the library collection. Library holds 54590 books, 80373 bound volumes, 3000 ebooks, 4400 reports, 2400 thesis and 1733 standards. It has spent more than 2 Crores and 40 lakhs for the renewal of print and electronic journals during 2019-2020. Library catalogue of all these resources can be accessed from https://opac.ncl.res.in.

CSIR-NCL Digital repository (https://dspace.ncl.res.in) is mainly used for uploading thesis submitted by students of CSIR-NCL. The repository contains all the theses available in CSIR-NCL library from the year 1936 which is one of the good online resources. The repository also contains other collection such as old reports which are available in digital format and are available to only registered users of CSIR-NCL.

Library provides Inter Library Loan facilities to users for the documents which are not available in CSIR-NCL library. During the year 438 journal articles, 27 Indian/ International standards, 18 theses, 77 ebooks, 23 reports and 41 patents were provided to users on ILL requests. Library has also provided Document Delivery Services to other libraries such as other CSIR libraries, DRDO labs, DAE labs, IITs. IISERs, DST labs and other universities. Library has implemented Koha; an open source library automation system 100% with RFID support.

Several events were organized by Library for the benefits of users from CSIR-NCL during the year.

Session	Date
Orbit/ Questel Database Training Session	May 3, 2019
Web of Science and Endnote Training Session	May 23, 2019
iThenticate Plagiarism Software Training Session	May 28, 2019
Grammarly Software Training Session	June 17, 2019
Derwent Innovations Training Session	July 29, 2019
Understanding research integrity, ethics & plagiarism; Wiley Author Workshop	October 15, 2019

S & T Support Services

S & T Support Services

Engineering Services Unit

'Engineering Services Unit' plays major role in the laboratory functioning, while providing basic engineering facilities as well as new erections, installations and maintenance related to Civil, Electrical, Mechanical Engineering, Communication system as well as Glass blowing.

The Civil Engineering section is responsible for buildings and plants erections, roads revamping, colony maintenance, drainage cleaning system etc. The section also runs and maintains water treatment plant for providing drinking water to the laboratory. It also runs garbage management plant for proper disposal of waste while producing good amount of manure.

The Electrical Engineering section is responsible for providing electrical power supply received to lab from MSEDCL. The section also takes care of the entire laboratory and colony lighting as well as all the roadside lights. It also maintains electrical substations, distribution systems, solar power systems, diesel generators, etc.

The Mechanical Engineering section takes care of distribution systems related to water, air, gas, vacuum, including water pumps, compressors, vacuum pumps, gas piping systems, fume hoods etc., related to their procurement, installation as well as routine maintenance. The central workshop facility is used for various machinery work related to turning, fitting, welding, fabrication, etc. The carpentry dept. takes care of laboratory furniture repairs. This section also manages outsourcing of liquid nitrogen for the laboratory requirements. The 'Refrigeration and air conditioning' section takes care of procurement, installation as well as repairs of all sorts of comfort as well as precision ACs.

Publication and Science Communication Unit

Publication and Science Communication (PSC) Unit is a channel that communicates between the laboratory and its stakeholders. It uses the facilities like web, print, electronic and social media. It takes care of the video conference facility, external and internal websites; prepares annual reports and brochures. It communicates the impact making work from laboratory in the form of R&D features, prepares and issues press releases and also coordinates the videos for its stakeholders. It supports to organize conferences and various events at the lab. The unit participates in the exhibitions and organizes the interviews with scientists with scientists on request of the reporters.

PSC coordinated/ participated in following exhibitions during the year:

- 5th edition of India International Science Festival (IISF) 2019, Kolkata (5-8 November, 2019)
- 107thsession of Indian Science Congress, Banglore (January 3-7, 2020)
- Kutuhal- An exhibition on Healthcare Systems, Pune (February 7-10, 2020)
- 4th Innovation Festival at National Science Centre, Mumbai (March 5-7, 2020)

Skill Development Program

CSIR- NCL has embarked on implementing CSIR's Skill Integrative initiative and started its skill development courses. One of the goals of the program is to expose students to career options available and to enhance their chances of employability. It aims to create opportunities, space and scope for the development of the talents of the youth and to expand more of those sectors which have already been put under skill development for the last so many years and also to identify new areas for skill development.

During the last year, CSIR-NCL has conducted 22 skill development programs and trained 156 candidates and generated the ECF of ₹ ~12 Lakh. Additionally, CSIR-NCL also provides accommodations to the course participants on a nominal charge basis at its premises to make their training comfortable and affordable.

Following Skill Development programs were conducted at CSIR-NCL during the year

Course Name & Duration

- **Certificate course in Patents** (6 - 10 May 2019)
- **Embedded systems** (3 - 21 June 2019)
- **Advanced training in ARM controllers** (3 - 21 June 2019)
- **Lab VIEW basics and applications** (3 - 21 June 2019)
- **Microbial Identification by biochemical, genetic and genomic techniques** (18 - 28 June 2019)
- **Xray Crystalography** (10 June - 5 July 2019)
- **Raman spectroscopic measurements** (17 - 21 June 2019)
- **Training on HPLC and LCMS** (22 - 26 July 2019)
- **Training on GC and GC-MS** (8 - 12 July 2019)
- **Polymer Characterization by DSC, TGA, FTIR and UV-VIS spectroscopy** (22 - 26 July 2019)
- **Advanced techniques in organic synthesis** (19 August 28 September 2019)
- **Embedded Systems** (26 June - 16 July 2019)
- **Advance Training on ARM Controllers** (26 June - 16 July 2019)
- **Basic training in Electron Microscopy and Techniques** (19 - 30 August 2019)
- **Polymer Characterisation by DSC, TGA, FTIR and UV-Vis pectrophotometer** (20 - 24 January 2020)
- **Embedded Systems** (12 December 2019 - 1 January 2020)
- **Lab VIEW basics and applications** (12 December 2019 - 1 January 2020)
- **Training on GC and GC-MS** (10 - 14 February 2020)
- **Controlled Release of Active Molecules** (3 - 7 February 2020)
- **Training on HPLC and LCMS** (3 - 7 February 2020)
- **Advanced training in mass spectrometry-based quantitative proteomics** (9 - 13 December 2019)
- **Synthetic Organic Chemistry** (3 February - 27 March 2020)

वित्त एवं लेखा

1.	**निधि की उपयोगिता**	
	सीएसआईआर अनुदान राशि	
	परियोजनाएँ	**(₹ लाख में)**
	नेटवर्क (सी/एफ सहित)	3518.749
	गैर-नेटवर्क	17162.843
	NMITLI परियोजनाएँ	71.533
	ईएमआर एवं वैज्ञानिक पूल	45.131
	प्रयोगशाला आरक्षित निधि	841.506
	बाहरी वित्तपोषित परियोजनाएँ	1703.092
	विविध जमा राशि	500.414
	बाहरी निकायों की ओर से भुगतान	0.000
	प्रायोजित सम्मेलनों/संगोष्ठियों हेतु अमानत	15.171
	कुल	**23858.439**
2.	**प्रयोगशाला आरक्षित निधि**	**(₹ लाख में)**
	वर्ष के दौरान अतिरिक्त निधि (सीएसआईआर के अलावा) के निवेश पर अर्जित ब्याज के माध्यम से प्रयोगशाला आरक्षित निधि का अर्जन	212.925
	अन्य लेखाशीर्षों से	439.235
	कुल	**652.160**
3.	**31.3.2020 को अतिरिक्त निधि का निवेश (₹ लाख में)**	**3999.000**
4.	**आपत्ति-पुस्तिका मदों का निपटारा**	
	वर्ष के दौरान किए गए समायोजन	**(₹ लाख में)**
	निजी	2449.112
	यात्रा भत्ता /छुट्टी यात्रा रियायत	33.075
	स्थानीय	23.187
	कुल	**2505.374**
	कुल मदें	427
5.	**निम्न लिखित प्रकार के वाउचर तैयार किए गए**	
	भुगतान	14980
	प्राप्त राशि	4403
	टी.ई.	296
	कुल	**19679**

1.	**Funds Utilization**	
	CSIR Grant	
	Projects	**(₹ in lakh)**
	Network (including C/F)	3518.749
	Non – network	17162.843
	NMITLI Projects	71.533
	EMR & Scientist Pool	45.131
	Laboratory Reserve	841.506
	Externally Funded Projects	1703.092
	Misc. Deposits	500.414
	Payment on behalf of outside bodies	0.000
	Deposits for Sponsored conf. / seminars	15.171
	Total	**23858.439**
2.	**Generation of Lab Reserve**	**(₹ in lakh)**
	Through earning of interest on investment of surplus funds (other than CSIR) during the year	212.925
	From other heads	439.235
	Total	**652.160**
3.	**Investment of surplus funds as on 31.3.2020 (₹ in lakh)**	3999.000
4.	**Clearance of OB items**	
	Adj. made during the year	**(₹ in lakh)**
	Private	2449.112
	TA/LTC	33.075
	Local	23.187
	Total	**2505.374**
	No. of items	427
5.	**Following types of vouchers were generated**	
	Payment	14980
	Receipt	4403
	TE	296
	Total	**19679**

Stores & Purchase

भंडार एवं क्रय

उपलब्धियां

मद	संख्या		मूल्य (₹. करोड में)	
	2018-19	2019-20	2018-19	2019-20
कुल प्राप्त एवं निष्पादित मांगपत्र	5983	1721	70.17	92.22
कुल दिए गए ऑर्डर (आयातित)	205	53	35.99	12.15
कुल दिए गए ऑर्डर (स्वदेशी: ऑनलाइन आरसी ऑर्डर सहित)	1212	1356	7.81	23.00
स्थानीय और जेम खरीद (ऑनलाइन आरसी ऑर्डर सहित)	3761	2541 और 631	14.94	2.82 और 1.97
वित्तीय वर्ष **2019-20** के दौरान समायोजित बकाया शेष	294	157	15.51	37.55
वित्तीय वर्ष **2019-20** के दौरान सीमा शुल्क से छूट प्राप्त राशि का उपयोग	-	52	1.57	0.85

Stores & Purchase

Accomplishments

Item	Numbers		Value (Rs. In Crores)	
	2018-19	2019-20	2018-19	2019-20
Total indents received and Processed	5983	1721	70.17	92.22
Total order placed (imported)	205	53	35.99	12.15
Total orders placed (indigenous including on line RC orders)	1212	1356	7.81	23.00
Local purchases & Gem purchases	3761	2541 & 631	14.94	2.82 & 1.97
O.Bs adjusted during the financial year	294	157	15.51	37.55
Utilization of Custom Duty Exemption	-	52	1.57	0.85

CSIR-Jigyasa

The CSIR-Jigyasa is a Student Scientist Connect program initiated by CSIR with Kendriya Vidyalaya Sangathan. The scope of the program is to extend the classroom learning by focusing on well-planned research laboratory based learning. The program was inspired by Prime Minister Narendra Modi's vision of a new India and "Scientific Social Responsibility (SSR)" of scientific community and institutions. As part of the program, science outreach activities for school students are conducted in the laboratory. The program has now extended its reach to Jawahar Navodaya Vidyalaya, and other State Board and CBSE board schools.

Different programs were organized benefitting 2,901 students and 259 teachers as follow:

- **Popular Talks:** 11 popular talks were conducted, attended by more than 1100 students and 72 teachers from Kendriya Vidyalayas, Navoday Vidyalayas, State government schools and other schools from across India.

- **Teachers Training Workshop:** A Teachers Training Workshop for high school science teachers was conducted during August 29-30, 2019. This workshop was attended by 36 teachers from Kendriya Vidyalayas, State Government schools as well as other schools.

- **Workshop for High School Students:** Two day's training workshop was organized for science students from grade IX to XII during September 16-17, 2019, in which a total of 900 students and 90 teachers attended from several Kendriya Vidyalaya school.

- **IYPT event:** To mark the International Year of Periodic Table as declared by UNESCO, Jigyasa had organized a one day program on December 21st, 2019. This event was attended by over 455 students and 45 teachers.

- **Nano Jatha Event:** One day program on Nanotechnology organized for the students of Kendriya Vidyalaya School on 12th December 2019 by Jigyasa was well received. The program included an interactive talk followed by exhibition and live demonstrations on different topics of Nanotechnology. This event was attended by a total of 160 students along with 9 teachers from the KVS.

- **Women's Day Celebration:** Jigyasa celebrated International Women's Day on March 9, 2020 by organizing a half day symposium on the topic 'Women in Science' at the Hutatma Balveer Shirishkumar High School, which was attended by over 200 students and 7 teachers from the same school.

JIGYASA

Human Resource Management

The Human Resource Management (HRM) department coordinates the process of a short term Training Program for postgraduate students. These students are inducted throughout the year for a period of 6 months.

Short Term Project Training: In the year, 151 students pursuing the courses like M.Sc., M.Pharm, B.E., M.E., B.Tech., M.Tech, at various colleges, universities and Indian institutes including IITs, IISERs, and NITs completed their Summer/Winter Projects at CSIR-NCL as part of their dissertation / project training.

IAS Officers visit: The department also organized training program to IAS officers from the *Lal Bahadur Shastri National Academy of Administration* (*LBSNAA*), Uttarakhand. The full day training was attended by 15 officers.

Institutional visits: 18 institutional visits were coordinated mainly of students pursuing professional courses in chemical sciences, medical sciences, agricultural sciences, engineering sciences, besides basic and applied sciences from postgraduate colleges located across India. A total of 918 students and teachers visited CSIR-NCL this year for institutional visits. Out of which 841 were students and 62 teachers.

Human Resource


गशाळांना २०२२चे लक्ष्य
ज्या प्रमाणे १९४२ ते १९४७ या काळात देशाला स्वतंत्र करण्यासाठी देशभर जनआंदोलन उभारले गेले, त्याच प्रमाणे २०१७ ते २०२२ या काळात देशातील मूलभूत समस्यांचे निराकरण करण्यासाठी संकल्प करण्यात आला आहे.
- डॉ. हर्ष वर्धन, केंद्रीय विज्ञान तंत्रज्ञान व आरोग्यमंत्री
वाटीसाठी संशोधन संस्थांबरोबर करणार काम
एनसीएलची होणार
प्रतिकारक उसाच्या चाचण्या
आईआईपीआईडी दुनिया में चौथे नंबर की संस्था
जिक प्रश्नांवर उपाय
ज्ञान आणि तंत्रज्ञान मंत्री डॉ. हर्षवर्धन
न्यू इंडिया का निर्माण करने के लिए वैज्ञानिकों
एनसीएल में आयोजित कार्यक्रम में केंद्रीय विज्ञान व तकनीकी मंत्री ने कहा :
राष्ट्रीय रसायनिक प्रयोगशाला में हिंदी समारोह संपन्न
कार्यालय में हिंदी के प्रयोग को बढ़ावा देने के लिए विभिन्न हिंदी प्रतियोगिताएं आयोजित की गईं
वैज्ञानिक
एन.आर.
पुणे,
नेशनल
वैज्ञानिक डॉ. बी.
आर. राव राष्ट्री
केमिकल
(एलपीजी) सहयोगी इंधन आणि स्वयंपाकाच्या गॅससाठी
इथर ची (डीएमई) निर्मिती करण्यात डायमिथिल
प्रयोगशाळेतील (एनसीएल) संशोधकांना यश आले
आहे. एनसीएल मधील उत्प्रेरक विभागातील
टी. राजा यांच्या नेतृत्वाखालील संशोधकां
कामगिरी केली आहे.

Annexures

Annexures

Patents Granted

Foreign

Title	Inventor(s)	Country: Patent No.
A Generic Method For The Preparation Of Ultra Small Size (2-3 nm) Transition Metal Nanoparticles	Bhagavatula L V Prasad; Jhumur Seth	GB: 2882550 DE: 2882550 EP: 2882550
A Method For The Synthesis Of Norepinephrine Alkaloids And Its Analogs As Antimalarial Agents	Asish K Bhattacharya; Eswarkumar Aratikatla; Kumkum Srivastava; AshanManhas	US: 10519098
A New Catalytic Approach To Quinoline Derivatives	EkambaramBalaraman; Siba Prasad Midya; GarimaJaiswal	US: 10227355
A Novel Nano-Heterojunction Synthesis Of Catalyst Free Vertically Aligned CNTs On SiNW Arrays	Manjusha Vilas Shelke	KR: 101954381
A Process For Fractionating Sugarcane Bagasse Into High Alpha-Cellulose Pulp, Xylan And Lignin	AnjanikumarJyotiprasad Varma	BR: P10817084-3
A Remote Computing Environment Method, System And Apparatus For Molecular Investigation By Email Platform	M Karthikeyan; Deepak Pandit; Renu Vyas; SanketBapat	US: 10467068
A Short Route To Enantioselective Syntheses Of Antideppressant 1-Aminotetralins Such As (+)-Sertraline And Tametraline Employing ProlineCatalyzedMannich Reaction Of Acetaldehyde	V Venkatarama Subramanian; RupaliKalshetti; ArumugamSudalaiq	US: 10266481
ABPBI Copolymer Membranes For HT-PEMFC Application / ABPBI Copolymers	U K Kharul; KurungotSreekumar; HarshalDilipChaudhari; VinayaBhagwatGhodake	JP: 6463760
An Improved Process For Liquid Phase Nitration Of Aromatics Using Solid Acid Catalyst	Shubhangi B Umbarkar; Mohan K Dongare; Ankush V Biradar; Atul B Kulal; Trupti V Kotbagi; Ashvini R Bhosale; Macchindra G Chandgude	GB: 3003553 DE: 3003553 EP: 3003553
Bioactive Oil Based PolyesteramideNanofibers For Wounds Healing	G V N Rathna	US: 10195158
Blend Membranes Based On PBI And Polyionic Liquids	U K Kharul; SreekumarKurungot; Anita SanwarmalRewar; HarshalDilipChaudhari	JP: 6523306
Catalytic Hydrogenation Of Co_2 To Methanolby Single-Siteru(Ii)- Pincer-Typecatalysts	EkambaramBalaraman; Vinod GokulkrishnaLandge; Siba Prasad Midya; Manoj Kumar Sahoo; GarimaJaiswal	US: 10449529

Patents Granted

Foreign

Title	Inventor(s)	Country: Patent No.
Design Synthesis And Pharmacological Evaluation Of EGFR Inhibitors (Flavone)	Pradeep Kumar Tripathi; JigneshKantilal Parikh; EeshwaraiahBegari	FR: 3253750 EP: 3253750 DE: 3253750 US: 10221165
Design, Synthesis And Pharmacological Evaluation Of EGFR Inhibitors (Benzimidazole)	Pradeep Kumar Tripathi; JigneshKantilal Parikh; EeshwaraiahBegari	FR: 3221309 GB: 3221309 DE: 3221309 CH: 3221309 EP: 3221309
Detection Of Explosive Materials By Para-Aminobenzoic Acid Sensitized $LaF_3:Tb^{3+}$ Nanoparticles	MeitramNirajLuwang; Debasish Ghosh	FR: 3194936 EP: 3194936 DE: 3194936 GB: 3194936
Development Of NMR Chemical Shift Fingerprints And Applications	M Karthikeyan; Renu Vyas; Pattuparambil R Rajamohanan	US: 10216910
Elastic Macroporous Scaffolds With Tunable Pore Size From Covalent Self-Assembly Of Nano And Microparticles	GuruswamyKumaraswamy; Raja Rajamanickam; SayamSengupta	EP: 2945656 FR: 2945656 GB: 2945656 DE: 2945656
Enantiospecific Synthesis Of Pheromones	D Srinivasa Reddy	US: 10221122
Engineering Of Organic Molecules For Terahertz (<10THZ) Tagging Applications	Ashootosh V Ambade; Nitin BapuraoBasutkar; BalaPesala; Kavita Joshi; KawareVaibhavVilasrao; Shaumik Ray; Jyotirmayee Dash	US: 10464929 EP: 3094621 DE: 3094621 GB: 3094621 FR: 3094621 IT: 3094621 ES: 3094621
High Aspect Ratio Nanoscale Multifunctional Material	SreekumarKurungot; BeenaBalan; UlhasKharul; Vijayamohanan Pillai	US: 10501317
Insertion Copolymerization Of Functional Olefins CatalyzedPd-Phosphinesulfonate Acetonitrile Complex	Samir H Chikkali; SahajiRajaramGaikwad	US: 10266621
Magnetically Separable Fe-Catalyst On Nitrogen Doped Graphene For Efficient Conversion Of Alcohols To Carbonyl Compounds With Liberation Of Molecular Hydrogen	EkambaramBalaraman; Dinesh Jagadeesan; EkambaramBalaraman; Dinesh Jagadeesan	US: 10335775
Method For Producing Oxazoline From Glycerol Using Solid Acid Catalyst	C V Rode; Rajan Pandya; Sharda E Kondawar	US: 10385029 EP: 3191456 CH: 3191456 DE: 3191456
Method For The Preparation Of Biofuels From Glycerol	DharbhaSrinivas; Lakshmi Saikia; Paul Ratnasamy	PH: 1/2010/502068
Method For Treating Vitiligo	D Srinivasa Reddy; Rajesh S Gokhale	DE: 3394054 CH: 3394054 FR: 3394054

Patents Granted

Foreign

Title	Inventor(s)	Country: Patent No.
		BE: 3394054 EP: 3394054 GB: 3394054 JP: 6586528 US: 10246449
Modified Cyclodextrin Coated Magnetite Nanoparticles For Targeted Delivery Of Hydrophobic Anticancer Agents	P A Joy; JayaprabhaKunnothNaduvilidam	US: 10456363
N C-Chelate Four-Coordinate Organoborons With Full Colour Tunability	Nitin T Patil	US: 10301330
N-Doped Porous Carbon Derived From Graphitic C_3N_4-MOF Composite As An Efficient Non-Platinum Electrocatalyst	SreekumarKurungot	US: 10170770
New Bisphenols Containing Pendant Clickable Maleimide Group And Polymers Therefrom	Prakash P Wadgaonkar; Sachin Suresh Kuhire; Samadhan Suresh Nagane	US: 10239865
New Difunctional Monomers Containing Clickable Pendant Furyl Group And Polymers Therefrom	Prakash P Wadgaonkar; KavitaGarg; Deepshikha Chatterjee	US: 10294209 EP: 3233816 FR: 3233816 DE: 3233816
New Fully Bio-Based Bisphenol Containing Furyl As A Clickable Pendent Functional Group And Polymers Therefrom	Prakash P Wadgaonkar; Sachin Suresh Kuhire; Samadhan Suresh Nagane	DE: 3119750 FR: 3119750 EP: 3119750
New Reagent For Selective Detection Of Cysteine And Histidine In Pure Aqueous Environment And In Human Blood Plasma	Amitava Das; SamitChattopadhyay; Upendar Reddy Gandra; HrideshAgarwalla	EP: 3160971 NL: 3160971 GB: 3160971 DE: 3160971
New Reagent For Specific Detection Of Cysteine In Physiological Condition As Well As By Using Modified Silica Coated Test Strip	Amitava Das	NL: 3328869 GB: 3328869 DE: 3328869 EP: 3328869
New Strategy To Synthesize High Surface Area Nitrogen Doped Single Walled Carbon Nanohorns For Enhanced Oxygen Reduction Electrocatalyst	SreekumarKurungot; SreekuttanMaraveeduUnni; SarathRamadas	US: 10218006
Nitrite Reductase (NIRBD) As Novel Anti-Tubercular Drug Target	Dhiman Sarkar	FR: 2961847 EP: 2961847 GB: 2961847
Novel Analogues Of Benzenecarbothioccyclopenta [C] Pyrrole-1,3-Dione and Synthesis Thereof	DumbalaSrinivasa Reddy; Satish Chandra Philkhana; GorakhnathRajaramJachak; VidyaBhausahebGunjal	US: 10239836
Novel Angiotensin II Type 2 Receptor (AT_2) Agonists For Improvement Of Neurological Disorders	G J Sanjayan	US: 10385096
Omniphilic Sponge	GuruswamyKumaraswamy	US: 10487190

Patents Granted

Foreign

Title	Inventor(s)	Country: Patent No.
	SavitaKiranShingote; LalitaSanjib Roy	
Synthesis Of Dimethyl Carbonate (DMC) From Methanol And Methyl Carbamate/Urea Using Mixed Metal Oxides Of Rare Earth Metals Calcined At High Temperature As Catalysts	Vivek V Ranade; AshutoshAnantKelkar; Vilas HariRane; Anil KisanKinage; SavitaKiranShingote; LalitaSanjib Roy	US: 10336681
Synthesis Of Dimethyl Carbonate (DMC) From Methanol And Urea In Presence Of Stripping With Inert Gas	VivekVinayakRanade; AshutoshAnantKelkar; Vilas HariRane; Anil KisanKinage; SavitaKiranShingote; LalitaSanjib Roy	JP: 6559067 IT: 2917172 DE: 2917172 NL: 2917172 ES: 2917172 EP: 2917172
Synthesis Of Functionalized Carbon Microspheres And Their Catalyst Activity In C-C And C-N Bond Formation Reactions	Shubhangi B Umbarkar; Ankush V Biradar; Mohan K Dongare	US: 10195599
Synthesis Of Furfuryl Ethyl Ether Using MesoporousZr-Incorporated SBA-15 Catalyst	Chandrashekhar V Rode	US: 10428038
Synthesis Of Indazole Derivatives And Uses Thereof	D Srinivasa Reddy; ChaitanyaSaxena; KashinathKomirishetty	CN: ZL201480048261.9 JP: 6474808
Synthesis Of Tamiflu Employing Stereospecific Amidoalkylation Protocol And Ramberg-Backlund Reaction	SubhashPratapraoChavan; Prakash NarsingChavan	JP: 6474392
Synthesis, Gas Separation And Fluorescence Properties In A Polybenzimidazole Based Poly(Ionic Liquid)s With Pyrene And AnthraceneFluorophore	UlhasKharul; SayaliVinayakShaligram; Prakash PurushottamWadgaonkar	US: 10266654
Transformed WithaniaSomnifera Plants With Improved Secondary Metabolite Content	B M Khan; Neha Gupta; ParthSanjaykumar Patel; Poonam Sharma; Shuchishweta Vinay Kendurkar	EP: 3049431 GB: 3049431 DE: 3049431
Use Of Proton Conducting FNPA Metallogel As Solid Electrolyte For Realizable Dry And Intermediate Temperature H_2-O_2 Fuel Cell Operation	SreekumarKurungot; Rahul Banerjee; HarshithaBarikeAiyappa; SubhadeepSaha; PritishWadge	DE: 3180814 DK: 3180814 EP: 3180814
Vortex Diodes As Reactors And Effluent Treatment Devices	Vivek V Ranade; Amol A Kulkarni; Vinay M Bhandari	BE: 2766314 PL: 2766314 NL: 2766314 FR: 2766314 DE: 2766314 EP: 2766314
Water Splitting Activity Of Layered Oxides In Mo_3(ZnO)M	R Nandini Devi; Soumya B Narendranath	US: 10307734
Yarn Supercapacitors	K Krishnamoorthy	US: 10395853

Patents Granted

Indian

Title	Inventor(s)	Patent No.
Long-Chain Amines: Synthesis And Uses Thereof	D Srinivasa Reddy	328261
One Step Cost-Effective Facile Microwave Synthesis Of Green Luminescent Graphene Quantum Dots - Silica Composite From Paper Precursor	Pankaj Poddar; Subha Sadhu	328156
New Fully Bio-Based Bisphenol Containing Furyl As A Clickable Pendent Functional Group And Polymers Therefrom	Prakash P Wadgaonkar; Sachin Suresh Kuhire; Samadhan Suresh Nagane	327841
Process For C_2-Substituted Acryl Aldehydes	Venkata Ramana Chepuri; Chandrababu Naidu Kona	327755
New Method For The Preparation Of R-Enantiomer Of Calcium Channel Blocker Bepridil	M Muthukrishnan; Mujahid Mohammad	327580
Novel Uracil And 5-Fluorouracil Conjugated Ruthenium(II) Polypyridyl Complexes As Cellular DNA Imaging Agents	Amitava Das; Samit Chattopadhyay; Vadde Ramu; Nandaraj Taye	327590
Synthesis Of Dimethyl Carbonate (DMC) From Methanol And Urea Using Hydrotalcites As A Catalyst	Vivek V Ranade; Ashutosh Anant Kelkar; Vilas Hari Rane; Anil Kisan Kinage; Savita Kiran Shingote; Lalita Sanjib Roy	327539
Methodology For Continuous Flow Manufacturing Of Nanocrystalline Materials	Venkata Ravi Kumar Darbha; Lakhsmi Vara Prasad Bhagavatula; Amol Arvind Kulkarni	326811
Transition-Metal-Free Regioselective C–H Bond Acetoxylation Of Indoles	Benudhar Punji; Vineeta Soni	326584
Iso-DNA For G-Rich Functional Oligomers	Vaijayanti Anil Kumar; Anita D Gunjal; Moneesha Fernandes	324959
Process For The Preparation Of Pseudo Indoxyl Derivatives And Studied Their Optical Properties	Chepuri V Ramana; Yogesh Mansukhabhai Goriya	323949
Solomonamides Analogues And Synthesis Thereof	Dumabala Srinivasa Reddy; Kashinath Kormirishetty; Vasudevan Natrajan	323962
Acidic Ionic Liquids Catalyzed Depolymerization Of Lignin	Paresh Laxmikant Dhepe; Ashutosh Anant Kelkar; Babasaheb Mansub Matsagar; Sandip Kumar Singh	323865
Method For Producing The Catalyst And Solvent Free Synthesis Of Glycerol Carbonate Using The Catalyst	C V Rode; Sharda Eknath Kondawar	323589
Synthesis Of Novel Antihistaminic Drug	S P Chavan; Pradeep Bhaskarrao Lasonkar	323155
Copper Catalyzed Carbonylation Of Halides With Cyanide: New Process For The Production Of Carboxylic Acid Derivatives	Arumugam Sudalai; Pragati Kishore Prasad	322407
Sila Amino Acids	Srinivasa Reddy; Remya Ramesh	321781
Ambient Oxidation Of Benzene To Phenol By Photocatalysis On $Au/Ti_{0.98}V_{0.02}O_2$	Chinnakonda Subramanian Gopinath; Perumal Devaraji	320954

Patents Granted

Indian

Title	Inventor(s)	Patent No.
Synthesis Of Tamiflu Employing Stereospecific Amidoalkylation Protocol And Ramberg-Backlund Reaction	Subhash Prataprao Chavan; Prakash Narsing Chavan	319972
Use Of Proton Conducting Fnpa Metallogel As Solid Electrolyte For Realizable Dry And Intermediate Temperature H_2-O_2 Fuel Cell Operation	Sreekumar Kurungot; Rahul Banerjee; Harshitha Barike Aiyappa; Subhadeep Saha; Pritish Wadge	320046
A Mild And General Process For The Synthesis Of Aryl Sulfones	Santosh B Mhaske; Virat Pandya	319717
Asymmetric Membranes Based On BUPBI	U K Kharul; Deepti Gangaram; Harshal Dilip Chaudhari	319643
A Nucleotide Sequence Encoding Two Geranyl Pyrophosphate Synthases From 'Alphonso' Mango	Vidya S Gupta	319361
New Method For The Synthesis Of (R)-Phenoxybenzamine Hydrochloride Employing Aziridine Ring Opening As A Key Step	M Muthukrishnan; Muthukumarasamy Karthikeyan; Velayudham Ramadoss; Viswanadh Nalla	318887
Synthesis Of New C-11 Substituted 12- Oxo Bile Acid Derivatives	Pore Vandana Sudhir; Jaisingh Manohar Divse; Chaitanya Rajendra Charolkar	318742
Single Step Process For Conversion Of Furfural To Tetrahydrofuran	Chandrashekhar Vasant Rode; Narayan Shamrao Biradar; Amol Mahalingappa Hengne	318101
Synthesis Of Glycidol From Glycerol And Dimethyl Carbonate Using Ionic Liquid As A Catalyst	A A Kelkar; Vilas Hari Rane; Swapna Mugutrao Gade; Mudassir Khursheed Munshi	318126
Utilization Of Long-Chain Branched (LCB) Polypropylene In Extrusion Film Casting Or Extrusion Coating Processes	Kalyani Suresh Chikhalikar; Ashish Kishore Lele; Harshwardhan Vinayak Pol; Kishor Shankar Jadhav; Sunil Janardan Mahajan; Zubair Ahmad	318020
A New Process For The Synthesis Of (R)-Selegiline And (S)-Benzphetamine	Arumugam Sudalai; Soumen Dey	317208
Resorcinol For Anchoring Sensitizer Dyes Onto Oxide Semiconductors For Dye Sensitized Solar Applications	Amitava Das; Hirendra Nath Ghosh; Tanmay Banerjee	317116
New Strategy To Synthesize High Surface Area Nitrogen Doped Single Walled Carbon Nanohorns For Enhanced Oxygen Reduction Electrocatalyst	Sreekumar Kurungot; Sreekuttan Maraveedu Unni; Sarath Ramadas	316990
Sila Analogs Of Oxazolidine Derivatives	D Srinivasa Reddy; Seetharam Singh Balamkundu; Remya Ramesh	316587
Superparamagnetic Iron Oxide Nanoparticles Encapsulated With Antifungal Drug Amphotericin	Pattayil Alias Joy; Jayaprabha Kunnoth Naduvilidam	316105
Novel And Green Protocol For The Allylic Oxidation	S P Chavan; Pradeep Bhaskarrao Lasonkar	315830

Patents Granted

Indian

Title	Inventor(s)	Patent No.
Corrugated Silica Nanospheres For Metal Free Epoxidation Of Olefins And Process Thereof	Ankush V Biradar; Shubhangi B Umbarkar; Prakash Chandra; Mohan K Dongare	315709
Library Of Spiroannulated Nucleosides	Ramana Venkata Chepuri ; Mangesh Pandurang Dushing	315432
Synthesis Of Tricyclic Compounds And Uses Thereof	Dumbala Srinivasa Reddy; Kashinath Komirishetty; Prakash Daulat Jadhav	315343
Metal Catalysed Synthesis Of Novel Benzofuran Derivatives Useful As Anti-Inflammatories	Chepuri V Ramana; Yadagiri Kommagalla; Kolluru Srinivas	315096
A New Organocatalytic Process For The Total Synthesis Of Stagonolide E And (-)-(6R,11R,14R)-Colletallol	Soumen Dey; Varun Rawat; Arumugam Sudalai	314811
Peribysin E Analogues Synthesis And Uses Thereof	Srinivasa Reddy; Kishor Laxman Handore	314711
Method For Producing Oxazoline From Glycerol Using Solid Acid Catalyst	C V Rode; Rajan Pandya; Sharda E Kondawar	314473
New Process For The Synthesis Of Methyl 3-EPI-Shikimate And Oseltamivir	Argumugam Sudalai; Varun Rawat; Soumen Dey	314403
An Improved Process For The Preparation Of Membrane Electrode Assemblies (MEAS)	Vijayamohanan Kunju Krishna; Ulhas Kanhaiyalal Kharul; Sreekumar Kurungot; Harshal Dilip Chaudhari; Sreekuttan Maraveedu Unni; Bipinlal Unni; Husain Noman Kagalwala	314348
Porous Co_3O_4 Nanorods For Photoelectrochemical Water Splitting	P A Joy; Vijayamohanan K Pillai; Ramasundar Rani Mohan; Debgupta Joyashish	313822
Synthesis Of Disuphonic Acids Starting From Cashew Nut Shell Liquid: Crosslinking Catalysts For Silane Functionalized Polyolefins	Prakash P Wadgaonkar; Bhimrao D Sarwade; Bhausaheb Vilas Tawade	313504
Comb-Coil Supramolecular Crosslinked Polymer	Asha Syamakumari; Rekha Narayan	313228
Silicon-Based Fungicides And/ Or Herbicides	D Srinivasa Reddy; Gorakhnath Rajaram Jachak; Remya Ramesh; Santosh Genba Tupe; Mukund Vinayak Deshpande	312955
Catalyst For Asymmetric Transfer Hydrogenation Of Ketones And Imines	A A Kelkar; Sudhindra Hanamant Deshpande; Savita Kiran Shingote; Vaishali Sarjerao Shende	312705
ABPBI Copolymer Membranes For HT-PEMFC Application / ABPBI Copolymers	U K Kharul; Kurungot Sreekumar; Harshal Dilip Chaudhari; Vinaya Bhagwat Ghodake	312562
New Reagent For Specific Detection Of Cr(III) In Pure Aqueous Medium	Amitava Das; Firoj Ali; Sukdeb Saha	310998
Sila Analogs Of DEET Towards Potential Insect Repellents	Srinivasa Reddy; Remya Ramesh; Seetharam Singh Balamkundu	310730

Patents Granted

Indian

Title	Inventor(s)	Patent No.
A New Process For The Production For The Production Of 3-Substituted Phthalides	Santosh Rekula Reddy; Chaitahanya Kiran Indukuru Naga; A Sudalai	310532
A Process For The Transition- Metal-Free N-Arylation Of Tertiary Amines	Akkattu T Biju; Sachin Suresh Bhojgude; Trinadh Kaicharla	310297
Surfactant-Copolymer Complexes As Delivery Devices For Targeted Delivery Of Hydrophobic Compounds	Guruswamy Kumaraswamy; Edakkal Venugopal	310155
Perylenebisimidepolyester Blend Films For Photovoltaic Applications	Asha Syama Kumari; Nisha Simon Kumari	309706
One Step Preparation Of Indinavir Intermediate 2,2-Dimethyl-3a,8a-Dihydro-8h-Indeno[1,2-D][1,3]Dioxole And Its Related Derivatives	Chepuri V Ramana; Ravindra Suresh Phatake	309510
Development Of Tricycle Structure Of Substituted Sugar Drived 1, 2, 3 Triazol Derivativesa (Small-Molecule Library) For Screening Against Various Cancer Cell Lines And Other Related Targets	Pradeep Kumar; Anand Harbindu; Brijesh Sharma	309724
Nanoporous Graphene Through Chemically Assisted Chipping Of Graphene Quantum Dots And Its Conversion To Efficient Oxygen Reduction Electrocatalyst Through Nitrogen Doping	Sreekumar Kurungot; Thangavelu Palaniselvam	308588
In Situ PH Control Using Hydrogel	Mugdha Gadgil	307912
Blend Membranes Based On PBI And Polyionic Liquids	U K Kharul; Sreekumar Kurungot; Anita Sanwarmal Rewar; Harshal Dilip Chaudhari	307714
N-Doped Porous Carbon Derived From Graphitic C_3N_4-MOF Composite As An Efficient Non-Platinum Electrocatalyst	Sreekumar Kurungot	307037
New Process For The Preparation Of An Antiepileptic Drug Levetiracetam In High Optical Purity	Murugan Muthukrishnan; Mohammad Mujahid; Prashant Pramod Mujumdar	306977
An Efficient Catalytic Process For A-Acyloxy Ketones And Esters From Alkenes	A Sudalai; Rambabu Reddi; Pushpa Malekar	306994
Ready Access To Both Enantiomers Of An Highly Attractive Sex Pheromone Of The Long-Tailed Mealybug	D Srinivasa Reddy	306201
Cu-Mediated One Pot Production Of O-Cyanocinnamonitrile Derivatives	Brijbhushan Ahuja; Reddy Santosh Rekula ; Arumugam Sudalai	306210
Process For Producing Furan	Darbha Srinivas; Bhogeswararao Seemala	306101
A Generic Method For The Preparation Of Ultra Small Size (2-3 Nm) Transition Metal Nanoparticles	Bhagavatula L V Prasad; Jhumur Seth	306007

Patents Granted

Indian

Title	Inventor(s)	Patent No.
Synthesis, Gas Separation And Fluorescence Properties In A Polybenzimidazole Based Poly(Ionic Liquid)s With Pyrene And Anthracene Fluorophore	Ulhas Kharul; Sayali Vinayak Shaligram; Prakash Purushottam Wadgaonkar	305862
A Novel Nano-Heterojunction Synthesis Of Catalyst Free Vertically Aligned CNTS On Sinw Arrays	Manjusha Vilas Shelke	305836
Metal Assisted Alignment Of Electron Transport Units That Exhibits High Electron Carrier Mobility	Kothandam Krishnamoorthy; Arulraj Arulkashmir; Bhan Prakash Jain	305722
N-Heterocyclic Carbene-Mediated Oxidative Esterification Of Aldehydes With Alcohols Under Aerobic Condition	Arumugam Sudalai; Chaithanya Kiran Indukuru Naga; Santhosh Reddy Rekula; Komal Lalwani	305690
A Facile, Chromatography-Free And Multi-Gram-Scale Synthesis Of Pillar[5]Quinone By The Hypervalent Iodine Oxidation Of 1,4-Dimethoxypillar[5] Arene	Kilingaru I Shivakumar; Gangadhar J Sanjayan	305704
Surface Induced Disassembly Of Nano Containers	K Krishnamoorthy	305579

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Academy of Scientific & Innovative Research: 66

Author	Title	Guide(s)
Bahadur, Vir	Acyl Transfer Reactions in Molecular Crystals, Cocrystals and Associated Studies	Shashidhar, M. S. & Gonnade, Rajesh G.
Kamble, Rohit	Asymmetric Synthesis of Bioactive Molecules *via* Two Stereocentred Hydrolytic Kinetic Resolution and Synthetic Methodologies Involving Formation of C-O, C-S Bonds	Kumaraswamy, Guruswamy
Ghotekar, Ganesh S.	Asymmetric synthesis of biologically important compounds and devlopment of synthetically useful C-C and C-O bond forming reactions via transition metal free conditions	Muthukrishnan, M.
Oak, Pranjali	Biochemical and molecular analysis of spongy tissue disorder in Mango (*Mangifera indica*cv. Alphonso)	Gupta, Vidya S. & Giri, Ashok P.
Sanghi, Smrati	Biochemical and molecular characterization of polyunsaturated fatty acids producing microbes	Kadoo, Narendra
Chaudhuri, Krishnaroop	Blends of Ultra-High olecular Weight Polyethylene and High-Density Polyethylene: Dissolution, Rheology, and Modeling	Lele, Ashish K. & Pol, Harshawardhan V.
Indrapal Kharbal	Boron Carbon Nitride (BCN): Synthesis and Study as an Electrode Material for Energy Storage Devices	Shelke, Manjusha V.
Burate, Pralhad	Carbon-Carbon Bond Forming Reactions Using Organocatalysts	Kinage, Anil K.
Mote, Nilesh	Classical Bidentate Versus Supramolecular Ligands in Ethylene Polymerization	Chikkali, Samir H.
Rajput, Vijay Bhagchand	Comparative structural and functional studies of acid ceramidase-like proteins using biophysical and computational techniques	Karthikeyan, M.
Sinha, Noopur	Computational Approaches and Drug Discovery in Target Based Therapy	Sarkar, Ram Rup
Kadam, A. L.	Design & tactics for total synthesis of D2 receptor agonist quinagolide & development and application of on-water oxidation of furan in collection synthesis of bioactive natural products	Chavan, S. P.
More, Namita.	Design synthesis and biological evaluation of novel heterocycles and their encapsulation in drug delivery system	Gajbhiye, J. M.

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Author	Title	Guide(s)
Marathe, Yogesh	Design, Synthesis and Crystallization Behaviour of New Borassus incorporated Poly(lactic acid) Composites and Nanocomposites	Badiger, Monohar V.
Yeware, Amar	Development of new dormancy model in the *Mycobactteriium* sp. for the novel drug screening program	Sarkar, Dhiman
Dwivedi, Pravin kumar	Development of nanostructured metal oxide-carbon composites for rechargeable li-ion battery	Shelke, Manjusha V.
Acharya, Sayantan	Diffusion through crowded environment: An MD simulation study	Bhattacharyya, Sarika M.
Rana, Jagannath	Earth-Abundant Metal Catalyzed C-N Bond Activation of Amides and Alkylation Reactions using Alcohols	Balaraman, E.
Deb, Pranab	Electrostatics and dynamics in molecular functions: A spectroscopic approach	Bagchi, Sayan
Mondal, Sourik	Encapsulated Nanocatalysts and Single Atom Alloy Catalysts: A Synthesis, Characterization and Catalytic Study	Nandini Devi, R.
Gupta, Sharad	Exploring Metal Oxide Nanostructures for CO_2 Hydrogenation	Prabhakaran, Vinod C. & Jagadeesan, D
Gogoi, Pranjal	Hydrogen production through the aqueous phase and steam reforming of bio-based oxygenated hydrocarbons	Raja T. & Satyanarayana, C.V.V.
Kokane, Reshma	Hydrogenation of Various Functional Groups Using Pd/MgF_2 as Catalyst Under Ambient Conditions	Umbarkar, Shubhangi B.
Navale, G. R.	Improved production of epi-cedrol and santalene by fusion protein expression: Stability study and cyclization mechanism of epi-cendrol biosynthesis	Dharne, Mahesh S.
Reddy, Srikanth T.	Improving Device Performance of PbS Quantum Dot Solar Cells Using Inorganic Hole Transport Layers	Rath, Arup K. & Late, Dattatray J.
Kashid, Somnath	Investigation of hydrogen bonding interactions and dynamics of carbonyls using ultrafast infrared spectroscopy and molecular dynamics simulation	Bagchi, Sayan
Shaikh, Samir	Investigation of Molecular Conformation of Aromatic Sulfonamide and Sulfoester Derivatives and Effect of Substituents on π-Stacking Interactions	Gonnade, Rajesh G.
Patil, Sucheta	Investigation of the molecular response of grapevine to salt stress through transcriptomics and proteomics approaches	Gupta, Vidya S.

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Author	Title	Guide(s)
Jain, Preeti	Investigations on Cobalt based catalysts for Energy Applications	Prabhakaran, Vinod C.
Rajput, Bhausaheb S.	Isohexide and plant oil based renewable and degradable polymers	Chikkali, Samir H.
Patil, Harshal	Isolation, biotransformation, chemical modification and bioactivity studies of terpenoids from plant sources	Thulasiram, H. V.
Ayasha, Nadeema	Layered double hydroxides and their derived functional nanomaterials for sustainable energy applications	Kurungot, Sreekumar
Khayum, Abdul M.	Macroscopic architecture of covalent organic frameworks for storage and purification	Kharul, Ulhas K.
Mohan S	Magnetic, Magnetostrictive and Magnetodielectric Properties of $CoFe_2O_4$- $BaTiO_3$ Multiferroic Composites	Joy, P.A.
Goudappagouda	Modulation of Ground and Excited State Properties of Donor Acceptor Organic Small Molecules Towards Lighting, Light-harvesting and Electronic Applications	Sukumaran, Santhosh Babu
Vrushali Ravindra Hande	Molecular Dynamics Study of Context Dependent Structural and Dynamical Properties of Water in Heterogenous Environments and Water Mediated Self- Assembly Processes	Bhattacharyya, Sarika, & Chakrabarty, Suman
Kumawat, Amit.	Molecular thermodynamic view of bimolecular signaling: Allostery and protein-protein interaction	Vanka, Kumar
Ram, Farsa	Nanocellulose Reinforced Polymer Composites for Energy Applications	Shanmuganatha N, Kadhiravan
Jadhav, Rupali	New π-conjugated materials for optoelectronic applications	Wadgaonkar, Prakash P.
Mukherjee, Subrata	N-Heterocyclic Carbene-Catalyzed Selective Synthesis of Functionalized Lactones and Related Chemistry	Marelli, Udaya K. & Biju, A.T.
Das, Tamal Kanti	N-Heterocyclic Carbene-Catalyzed Umpolung of Aldimines for the Synthesis of Nitrogen Heterocycles and Related Chemistry	Marelli, Udaya K. & Biju, A.T.
Thosar, Aniket	PEM fuel cells: Analytical modelling and experimental validation	Gadgil, Chetan
Gadgil, Bhagyashri Thorat	PHBV Blends: Preparation, Fabrication and Characterization of Bulk and Nanomaterials for Biomedical Application	Rathna, GVN

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Author	Title	Guide(s)
Mawlankar, Rahul	Polyphasic systematics of marine bacteria and their alpha-glucosidase inhibitor activity	Dastager, Syed
Biswas, Bipul	Preparation of colloidal chains and studies of their structure and dynamics	Kumaraswamy, Guruswamy
Vishwanathgouda Maralingannavar	Probing CHO cell metabolism using adaptation to nutrient limitation: Insights on metabolic trade-offs	Gadgil, Mugdha
Shukla, Chinmay	Process Intensification of Multistep Synthesis Involving Diazonium Salts	Kulkarni, Amol & Ranade, Vivek
Jadhav, P.M.	Reactor Design and Process Intensification of Energetic materials	Kulkarni, Amol & Pandey, Raj K.
Sharma, Aakash	Relating the properties of cellulose fibers to structure	Kumaraswamy, Guruswamy
Ghosh, Deepanjan	Structural and Biochemical Investigation of Tat components	Rao, Koteswar V. & Ramasamy, Suresh K.
Shibin T.	Structural and lectrochemical characterisation of transition metal doped perovskite related structure ABO3- (A =Ca/Sr/Ba; B=Fe/Si/In)	Devi, Nandini
Sandholu, Anandsukeerthi	Structural and functional studies on novel oxidoreductases specific to steroids and isoprenoids reduction	Kulkarni, Kiran
Agrawal S. B.	Studies of conformational and functional transitions of N-acetyl galactosamine binding lectins from Bauhinia purpurea and Wisteria floribunda	Kulkarni, Mahes h
Pandey, Ramendra	Studies on humidification of PEM fuel cells	Kharul, Ulhas
Dadwal, Arun	Studies on the Effect of Surfactant, Base fluid and Particle Size on the Thermal Conductivity of Magnetite Nanofluids	Joy, P.A.
Gunjal, Vidya	Studies toward bioactive macrocyclic peptides: Teixobactin, pseudoxylallemycin B, arthroamide and fusaristatin C	Reddy, Srinivas a
Deshmukh, Satej	Synthesis of imine, phosphinite ligands and applications in catalysis	Chikkali, Samir H.
Giram, Prabhanjan	Synthesis of PLGA polymers to combat cancer and fabrication of nanofibres for transdermal drug discovery	Garnaik, Baijayantimala
Mohite, Kavita	Synthesis of Poly (L-Lactide) using Zinc-Aleuritic acid Complex and Chitosan as Nanocarriers for Drug Delivery in Burn wound and Cancer	Garnaik, Baijayantimala

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Author	Title	Guide(s)
Rathod, Jayant B.	Synthetic explorations into carbon-carbon and carbon-nitrogen bond forming reactions	Kumar, Pradeep
Dhaware, Vinita	Synthetic Polypeptides and Biopolymers: Synthesis, Self-assembly and Cellular Interactions	Nisal, Anuya & Sen Gupta, Sayam
Kawale, Sanket	Synthetic Studies Towards Quinagolide, Tamiflu, Vinyl Glycine and Brivaracetam	Chavan, Subhash P.
Mullapui Venkannababu	Total Synthesis of (+)-Petromyroxol, (–)-*iso*-etromyroxol, Xylarinol B and Studies Toward the Total Synthesis of Diocollettines A	Ramana, C.V.
Pandya, Virat	Transition-metal-free access to biologically important scaffolds via novel C–C and C–X bond formations using aryne chemistry	Mhaske, Santos h B.
Menon, Sneha	Triggers for protein conformational changes and self-assembly probed with fully atomistic computer simulations	Vaval, Nayana
Pal, Sayan	Understanding flow of solids in continuous flow reactors	Kulkarni, Amol

Savitribai Phule Pune University: 2

Author	Title	Guide(s)
Suresha, P. R.	Polymeric flocculants: Synthesis, characterization and applications	Badiger, Manohar
Torris, Arun A.T.	Hydrogels from biomimetic resources: Synthesis, characterization and applications	Badiger, Manohar

Customers

Indian Customers

- K K Nag Pvt. Ltd.
- Centaur Pharmaceuticals Pvt. Ltd.
- Biocon Ltd.
- BASF India Ltd.
- Atul Limited
- Amar Equipments Pvt. Ltd.
- Alps Chemical Pvt. Ltd.
- Ahammune BioSciences Pvt. Ltd.
- Pidilite Industries Ltd.
- Pheromones Biotech LLP
- Module Innovations Pvt. Ltd.
- Greenvention Biotech Pvt. Ltd.
- KPIT Technologies Limited
- Shantani Proteome Analytics Pvt. Ltd.
- Jemby Chem Ltd.
- Vivira Process Technologies Pvt. Ltd.
- Ventri Biologicals
- Unilever Industries Pvt. Ltd.
- Thermax Ltd
- Tatva Chintan Pharmachem P. Ltd.
- Colourtex Industries Pvt. Ltd.
- Clearsynth Labs Ltd.
- Aarti Industries Ltd.
- Shell Technology Centre
- Mallak Specialties Pvt. Ltd.

Foreign Customers

- Solvay Speciality Polymers, Italy

Publicly Funded

- Indian Oil Corporation Ltd.
- Mangalore Refinery and Petrochemicals Ltd. (MRPL)

Awards/ Recognitions

Name	Award
Prof. Ashwini Kumar Nangia	J. C. Bose Fellowship
Dr. Bhushan Chaudhari	A Fellow of the Maharashtra Academy of Sciences
Dr. Sakya Singha Sen	Merck Young Scientist Award 2019
	An Early Career Advisory Board Member (EACB) of the journal ACS Catalysis
Dr. B. L. V. Prasad	MRSI-ICSC Materials Science Annual Prize' 2020
	Prof. C. N. R. Rao National Prize for Chemical Research
Dr. Guruswamy Kumaraswamy	A Fellow of the Indian National Academy of Engineering (INAE), New Delhi
Dr. Syed Dastager	A member of Board of the Editors of a Journal 'Microbiological Research'

Awards

Outreach Programme

This is the science outreach activity of CSIR- NCL and faculty from Indian Institute of Science, Education and research, Pune. The objective is to boost the excitement of science and technology among school children. Following talks were organized during the year.

Topic	Speaker
The story of how life originated on Earth	Dr. Sudha Rajamani , IISER-Pune
Evolutionary Biology: Then and Now	Dr. Sutirth Dey, IISER-Pune
Matrix of Multicellular Life: How cell adhesion regulates cell function	Dr. Nagaraj Balasubramanian , IISER-Pune
Himalaya weathering and global CO_2 cycle	Dr. Gyana Ranjan Tripathy,
Smashing protons- Big Bang, Higgs & dark matter!	Dr. Seema Sharma, IISER-Pune
Our unseen neighbours: A look at the microbial world	Dr. Nishad Matange, IISER-Pune
Foundations of Animal Developmente Little Pulsar	Dr. Girish Ratnaparkhi, IISER-Pune
"Twinkle Twinkle Little Pulsar	Dr. Raman Athreya, IISER-Pune
International Year of Periodic Table: From Democritus to Mendeleev's World	Dr. Sakya Sen, CSIR-NCL
The story of Hawaii's ecosystems and why we should learn it	Dr. Anand Krishnan, IISER-Pune

CSIR-NCL Dateline

Date	Event
July 8 – 12, 2019	Smart India Hackathon- Hardware Edition by CSIR-NCL, IISER & ARAI
July 29 – August 1, 2019	Symposium on Indo – German collaboration in Research and Innovation
September 9, 2019	Inauguration of the DME Pilot Plant under Mission Project "Catalysis for Sustainable Development" at the hands of Union Minister, Dr. Harsh Vardhan
September 19, 2019	Visit of a team of 15 European Journalists to CSIR-NCL as a part of a familiarization program
September 24, 2019	CSIR foundation day Lecture by Shri M. S. Unnikrishnan, Thermax Limited, Pune on "Science and Technology only can save India".
October 10, 2019	Distinguished public lecture by Dr. Jagannath V. Dixit on "Simple Diet plan to manage Obesity"
October 30, 2019	Curtain Raiser Outreach Program of IISF 2019: A special talk by Dr. Yogesh Shouche, NCCS, Pune on "Search for life in Space: Microbiological perspective"
November 28-29, 2019	Annual Students Conference 2019
Januray 6, 2020	CSIR-NCL Foundation Day Lecture by Prof. A. B. Pandit, Institute of Chemical Technology, Mumbai on "Role of Chemical Engineering in Nation Building"
Januray 31, 2020	Inauguration of the pilot plant for continuous flow manufacture of Silver Nanowires at the hands of Dr. Shekhar Mande, Director General, CSIR
February 12, 2020	A workshop on " Emerging Electron Crystallography Based Structure Solutions Using Transmission Electron Microscopy
February 28, 2020	National Science Day Lecture by Shri U. Raja Babu, DRDO, Hyderabad on "Technological Challenges: Missile and Space Defence"
March 9, 2020	A half-day symposium on "Women in Science" on the occasion of International Women's Day

CSIR-NCL Dateline





हिन्दी पखवाड़ा

राष्ट्रीय रासायनिक प्रयोगशाला (सीएसआईआर-एनसीएल) में हिन्दी पखवाड़ा समारोह का आयोजन

राष्ट्रीय रासायनिक प्रयोगशाला (सीएसआईआर-एनसीएल) में दिनांक १६ से ३० सितंबर, २०१९ के दौरान हिन्दी पखवाड़ा समारोह आयोजित किया गया। हिन्दी-पखवाड़े के अंतर्गत राजभाषा हिन्दी के प्रयोग को बढावा देने की दृष्टि से विभिन्न हिन्दी प्रतियोगिताएं, हिन्दी संबंधी गतिविधियों का आयोजन किया गया, जिनमें स्टाफ एवं शोध छात्रों ने बडी संख्या में उत्साहपूर्वक प्रतिभाग लिया।

हिन्दी पखवाड़े के दौरान १६ सितंबर, २०१९ को नगरस्तर पर हिंदी परिचर्चा प्रतियोगिता, १७ सितंबर, २०१९ को हिन्दी शुद्धलेखन प्रतियोगिता, १९ सितंबर, २०१९ को हिन्दी काव्यपाठ प्रतियोगिता, २० सितंबर, २०१९ को सामान्य ज्ञान प्रतियोगिता, २३ सितंबर, २०१९ को लेखक एवं घोषवाक्य पहचान प्रतियोगिता, २४ सितंबर, २०१९ को हिन्दी निबंध लेखन प्रतियोगिता एवं २५ सितंबर, २०१९ को हिंदी वैज्ञानिक संगोष्ठी का आयोजन किया गया जिसमें कुल १७ शोधपत्र प्रस्तुत किये गए।

दिनांक २५/९/२०१९ को आयोजित एक दिवसीय वैज्ञानिक हिन्दी संगोष्ठी में प्रमुख अतिथि के रूप में डॉ. एस. के. सिंह, प्रमुख वैज्ञानिक (आघारकर अनुसंधान संस्थान, पुणे); कार्यकारी निदेशक डॉ. एस. पी. चव्हाण, संगोष्ठी के संयोजक डॉ. राजेश गोन्नाडे (वरिष्ठ प्रधान वैज्ञानिक), तथा सचिव तथा हिंदी अधिकारी डॉ. स्वाति चढ्ढा उपस्थित थे। स्वागत भाषण डॉ. स्वाति चढ्ढा ने एवं संगोष्ठी की प्रस्तावना डॉ. राजेश गोन्नाडे ने प्रस्तुत की। डॉ. एस. के. सिंह ने इस अवसर पर प्रसन्नता व्यक्त करते हुए कहा कि एक राष्ट्र, एक ध्वज के साथ-साथ एक भाषा का

हिन्दी पखवाड़ा

विधान होना भी आज की सबसे महत्वपूर्ण आवश्यकता है । अपने देश में सभी भाषाएं फले-फूले, किंतु अपनी राजभाषा हिन्दी को सही अर्थो में अपनाना अत्यंत जरूरी है। कार्यकारी निदेशक डॉ. एस. पी. चव्हाण ने इस आयोजन पर प्रसन्नता व्यक्त करते हुए कहा कि वैज्ञानिकों के कार्य को जन-जन तक पहुँचाना अत्यंत जरूरी है और यह जनभाषा हिन्दी के माध्यम से ही संभव हो सकता है । संगोष्ठी का आयोजन तीन तकनीकी सत्रों में किया गया, जिसमें कुल १७ शोध पत्र प्रस्तुत किए गए, तकनीकी सत्रों की अध्यक्षता डॉ. सी. वी. रमना, (वरिष्ठ प्रधान वैज्ञानिक), डॉ. डी. एस. रेड्डी (वरिष्ठ प्रधान वैज्ञानिक) तथा डॉ. आशीष भट्टाचार्य (प्रधान वैज्ञानिक) ने की। आभार प्रदर्शन डॉ. स्वाति चढ्ढा ने किया।

दिनांक ३० सितंबर, २०१९ को 'एनसीएल आलोक' पत्रिका का लोकार्पण तथा हिन्दी पखवाड़ा पुरस्कार वितरण समारोह आयोजित किया गया। इस अवसर पर मुख्य् अतिथि के रूप में डीआरडीओ के आयुध एवं समाघात अभियांत्रिकी महानिदेशालय के निदेशक-प्रशासन डॉ. हिमांशु शेखर, तथा अध्यक्ष के रूप में डॉ. एस. पी. चव्हाण (प्रभारी निदेशक), हिन्दी पखवाड़ा आयोजन समिति के अध्यक्ष डॉ. राजेश गोन्नाडे (वरिष्ठ प्रधान वैज्ञानिक), प्रशासन अधिकारी श्रीमती पूजा कुलकर्णी तथा हिन्दी अधिकारी डॉ. (श्रीमती) स्वाति चढ्ढा उपस्थित थे।

इस अवसर पर मुख्य अतिथि डॉ. हिमांशु शेखर ने अपने संबोधन में कहा कि ''हम सभी भारतीयों को इस भाषा के प्रचार-प्रसार में अपना योगदान देने की आवश्यकता है ताकि शिक्षा, रोजगार और प्रशासन के क्षेत्र में इस भाषा को अच्छी तरह से लागू किया जा सकें। वैज्ञानिक जानकारियों को हम सभी को न केवल हिन्दी बल्कि सभी भारतीय भाषाओं में लाने की आवश्यकता है।'' उन्होंने एनसीएल द्वारा राजभाषा पत्रिका ''एनसीएल आलोक'' के प्रकाशन पर प्रसन्नता व्यक्त करते हुए कहा कि 'विभिन्न प्रकार के वैज्ञानिक एवं तकनीकी लेखों को जन मानस की सरल भाषा में प्रस्तुत किया जाना एक बहुत बडी उपलब्धि है, इससे निश्चय ही हिन्दी भाषा का प्रचार-प्रसार होगा एवं विज्ञान के क्षेत्र में भी इस भाषा का उपयोग बढेगा।'

तत्पश्चात डॉ. राजेश गोन्नाडे ने हिन्दी पखवाड़े के दौरान आयोजित कार्यक्रमों की जानकारी दी। कार्यक्रम के अध्यक्ष तथा प्रभारी निदेशक डॉ. एस. पी. चव्हाण ने अपने संबोधन में कहा कि 'हिन्दी हमारे राष्ट्र की भाषा है, हमारे देश की पहचान है। हमारे एनसीएल में हिन्दी भाषा का प्रशासन तथा अन्य सभी क्षेत्रों में संतोषजनक प्रयोग हो रहा है। हिन्दी पत्रिका का प्रकाशन, वेबसाईट का द्विभाषीकरण तथा हिन्दी माध्यम से संगोष्ठियों का आयोजन हमारी हिन्दी भाषा के प्रति निष्ठा का प्रमाण है।'

तत्पश्चात विभिन्न प्रतियोगिताओं के विजेताओं तथा सरकारी कामकाज में राजभाषा हिन्दी का उल्लेखनीय प्रयोग करने वाले अधिकारियों/ कर्मचारियों को अध्यक्ष एवं मुख्य अतिथि के द्वारा पुरस्कृत किया गया। साथ ही विभिन्न प्रतियोगिताओं में आंतरिक निर्णायक की भूमिका निभाने वाले पदाधिकारियों को भी स्मृति चिन्ह देकर सम्मानित किया गया।

कार्यक्रम के अंत में वरिष्ठ तकनीकी अधिकारी डॉ. स्मिता मुले ने सभी के प्रति आभार व्यक्त किया। समारोह की कार्यवाही का संचालन हिन्दी अधिकारी डॉ. श्रीमती स्वाति चढ्ढा ने किया। इस संपूर्ण आयोजन में हिन्दी पखवाड़ा समिति के अध्यक्ष डॉ. राजेश गोन्नाडे तथा सदस्य डॉ. स्मिता मुले, डॉ. सचिन अगवने, श्री नवीन पवित्रन, श्री पुरुषोत्तमन ने महत्वपूर्ण भूमिका निभाई।

संयुक्त राजभाषा वैज्ञानिक संगोष्ठी

दिनांक ४ मार्च, २०२० को पुणे स्थित तीन वैज्ञानिक संस्थान राष्ट्रीय कोशिका विज्ञान केंद्र (एनसीसीएस), सीएसआईआर-राष्ट्रीय रासायनिक प्रयोगशाला (एनसीएल) तथा आघारकर अनुसंधान संस्थान (एआरआई) द्वारा सम्मिलित रूप से संयुक्त राजभाषा वैज्ञानिक संगोष्ठी का आयोजन राष्ट्रीय कोशिका विज्ञान केंद्र (एनसीसीएस) में किया गया।

राजभाषा हिन्दी को विज्ञान के क्षेत्र में प्रचार-प्रसार करने एवं उपयोग बढाने की दृष्टि से तीनों संस्थानों ने अपने सम्मिलित प्रयासों से इसे आयोजित किया। इस संगोष्ठी के उद्घाटन समारोह के मुख्य अतिथि के रूप में जानेमाने शिक्षाविद, मनोवैज्ञानिक, समाजशास्त्री, लेखक एवं संपादक तथा महात्मा गांधी अंतर्राष्ट्रीय हिंदी विश्वविद्यालय के पूर्व-कुलपति प्रो. गिरीश्वर मिश्र उपस्थित थे। उन्होंने अपने संबोधन में कहा कि 'हमें सतत विकास की संकल्पना को अपनाने की आवश्यकता है और विज्ञान से जुडे कार्य जनता के साथ-साथ नीति निर्धारकों तक पहुंचना भी अत्यंत जरूरी है, जो जनभाषा के माध्यम से ही संपन्न हो सकता है। इसके साथ-साथ ही हमारे प्राचीन ज्ञान-विज्ञान का महत्व समझ कर इन पर भी गहन अनुसंधान होना चाहिए और उसे आज के आधुनिक विज्ञान से जोडा जाना चाहिए।' मंच पर एनसीसीएस के निदेशक डॉ. मनोज भट, सीएसआईआर-एनसीएल के निदेशक प्रो. अश्विनी कुमार नांगिया, अघारकर अनुसंधान संस्थान के निदेशक डॉ. प्रशांत ढाकेफलकर तथा एनसीसीएस के पूर्व निदेशक पदमश्री डॉ. जी. सी. मिश्र मौजूद थे। इस मौके पर संगोष्ठीं की सारांश पुस्तिका का तथा सीएसआईआर-राष्ट्रीय रासायनिक प्रयोगशाला की हिन्दी पत्रिका 'एनसीएल आलोक' का भी विमोचन किया गया। इस सम्मेलन में सम्पूर्ण भारत के केन्द्रीय संस्थानों से वैज्ञानिक,शोधछात्र तथा प्रशासनिक प्रमुख/ हिन्दी अधिकारी उपस्थित थे। उद्घाटन कार्यक्रम का संचालन एवं आभार प्रदर्शन एनसीएल की हिन्दी अधिकारी डॉ. (श्रीमती) स्वाति चढ्ढा द्वारा किया गया।

इस संगोष्ठी के दौरान तीन तकनीकी सत्रों में वैज्ञानिकों/ शोधछात्रों द्वारा २० शोधपत्र हिन्दी भाषा में प्रस्तुत किए गए तथा संपूर्ण भारत तथा पुणे से कुल १२५ प्रतिभागियों ने हिस्सा लिया। सारांश पुस्तिका में कुल ४३ शोधपत्र प्रकाशित की गई। इस सम्मेलन में निम्नांकित विषयों पर चर्चा की गई।

- समग्र स्वास्थ्य
- जैवऊर्जा और जल संरक्षण
- जैव प्रौद्योगिकी
- जैव विविधता और पर्यावरण
- कौशल विकास और रोजगार निर्माण
- डिजिटल इंडिया
- मेक इन इंडिया
- औद्योगिक अनुसंधान

राजभाषा कार्यान्वयन रिपोर्ट

सीएसआईआर-एनसीएल की राजभाषा कार्यान्वयन संबंधी रिपोर्ट

भारत सरकार की राजभाषा नीति तथा राजभाषा संबंधी नियमों का अनुसरण करने की दृष्टि से सीएसआईआर-राष्ट्रीय रासायनिक प्रयोगशाला (एनसीएल), पुणे में प्रत्येक स्तर पर गहन प्रयास किए जाते हैं। सीएसआईआर-एनसीएल एक वैज्ञानिक प्रयोगशाला है, जहां अधिकांश कार्य वैज्ञानिक तथा तकनीकी स्वरूप का होता है तथा शेष प्रशासनिक कार्य अधिकांशत: हिन्दी भाषा में किया जाता है। इस प्रयोगशाला में किए जा रहे राजभाषा कार्यान्वयन संबंधी उल्लेखनीय प्रयास निम्नानुसार हैं।

- प्रत्येक तिमाही में एनसीएल की राजभाषा कार्यान्वयन समिति की तिमाही बैठक नियमित रूप से निदेशक महोदय की अध्यक्षता में आयोजित की जाती है एवं इन बैठकों में प्रयोगशाला में राजभाषा हिन्दी के प्रगामी प्रयोग तथा राजभाषा कार्यान्वयन संबंधी प्रयासों की समीक्षा की जाती है। इन बैठकों में प्रयोगशाला के प्रत्येक प्रभाग/अनुभाग प्रमुख सदस्य के रूप में उपस्थित रहते हैं।
- प्रत्येक छह महीने में हिन्दी गृहपत्रिका "एनसीएल-आलोक" का प्रकाशन नियमित रूप से किया जाता है। गृहपत्रिका प्रकाशन का मूल उद्देश्य हिन्दी भाषा में लिखे गए वैज्ञानिक लेखों का प्रचार-प्रसार तथा कर्मचारियों की हिन्दी में लेखन और अभिव्यक्ति क्षमता को प्रोत्साहित करना है।

संयुक्त राजभाषा वैज्ञानिक संगोष्ठी

तकनीकी सत्रों का संचालन श्री. रामेश्वर नेमा और श्रीमती मंजुषा तिवारी ने किया। तकनीकी सत्रों की अध्यक्षता तीनों संस्थाओं के वरिष्ठ वैज्ञानिकों डॉ. शुभांगी उबंरकर, डॉ. ललिता लिमये, डॉ. सुरेश गोखले, डॉ. संजय सिंह, डॉ. शैलजा सिंह, डॉ. ज्युडतिका राजवाडे द्वारा की गई।

समापन समारोह के मुख्य अतिथि के रूप में राष्ट्रीय कोशिका विज्ञान केन्द्र, पुणे के पूर्व-निदेशक पद्मश्री डॉ. ज्ञानचन्द्र मिश्र जी एवं अध्यक्ष के रूपमें डॉ. मनोज भट (निदेशक, एनसीसीएस) उपस्थित थे। इस अवसर पर मुख्य अतिथि डॉ. ज्ञानचन्द्र मिश्र ने कहा कि राजभाषा हिन्दी की सम्पदा विज्ञान के क्षेत्र में बढाए जाने और अंग्रेजी भाषा के सामने हिन्दी तथा अन्य क्षेत्रीय भाषाओंको कम महत्व देने की हम भारतीयों की गलत मानसिकता को बदलने की अत्यंत आवश्यकता है। इस अवसर पर डॉ. संजय सिंह, प्रमुख वैज्ञानिक, आघारकर अनुसंधान संस्थान ने एक दिवसीय संगोष्ठी की समीक्षा प्रस्तुत की। इस समापन कार्यक्रम का संचालन एवं आभार प्रदर्शन एनसीसीएस की वैज्ञानिक डॉ. शैलजा सिंह ने किया।

इस संगोष्ठी के आयोजन में डॉ. गिरधारी लाल, डॉ. शैलजा सिंह, डॉ एस. के.सिंह, डॉ. राजेश गोन्नाडे, डॉ. ज्योति राव, डॉ. गुरुदत्त वाघ, श्री विजय जिनराळकर, श्रीमती कीर्ति भोसले ने महत्वपूर्ण भूमिका निभाई। संगोष्ठी के समन्वयक के रूप में श्रीमती स्मिता खडकीकर, डॉ. स्वाति चढ्ढा तथा श्रीमती मंजुषा तिवारी ने कार्य किया।

राजभाषा कार्यान्वयन रिपोर्ट

सीएसआईआर-एनसीएल की राजभाषा कार्यान्वयन संबंधी रिपोर्ट

- एनसीएल में प्रतिवर्ष हिन्दी पखवाड़ा समारोह का भव्य आयोजन किया जाता है। इस अवसर पर स्टाफ के लिए विभिन्न हिन्दी प्रतियोगिताओं तथा कार्यक्रमों का आयोजन किया जाता है। हिन्दी पखवाड़ा के आरंभ में हिन्दी दिवस के अवसर पर प्रतिवर्ष प्रयोगशाला की अर्धवार्षिक गृहपत्रिका "एनसीएल-आलोक" का विमोचन भी किया जाता है।
- एनसीएल के स्टाफ को हिन्दी कार्य करने में आ रही समस्याओं का निदान करने तथा हिन्दी में कार्य करने हेतु प्रोत्साहित करने की दृष्टि से प्रत्येक तिमाही में नियमित रूप से हिन्दी कार्यशाला का आयोजन किया जाता है। इन कार्यशालाओं में स्टाफ को भारत सरकार की राजभाषा नीति की जानकारी देने के साथ-साथ अपना दैनंदिन सरकारी कार्य हिन्दी में करने तथा कंप्यूटर पर यूनिकोड प्रणाली के माध्यम से हिन्दी में काम करने का प्रशिक्षण दिया जाता है।
- एनसीएल में प्रतिवर्ष हिन्दी वैज्ञानिक संगोष्ठी का आयोजन किया जाता है, ताकि विज्ञान के क्षेत्र में राजभाषा हिन्दी की संपदा बढ सकें। संगोष्ठी के अवसर पर स्मारिका भी प्रकाशित की जाती है।
- हिन्दी कक्ष द्वारा प्रतिदिन हिन्दी सुविचार तथा अँग्रेजी शब्द के अर्थ का प्रेषण मेल द्वारा सभी कर्मचारियों को किया जाता है, ताकि कर्मचारियों में हिन्दी भाषा के प्रति रुचि उत्पन्न हो सकें।
- राजभाषा अधिनियम की धारा ३(३) के अंतर्गत जारी होने वाले सभी दस्तावेज द्विभाषी जारी किए जाते हैं।
- इस प्रयोगशाला में राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम में निर्धारित किए गए लक्ष्यों की प्राप्ति की ओर विशेष ध्यान दिया जाता है।
- केंद्र सरकार, राजभाषा नियम १९७६ (संघ के सरकारी प्रयोजनों के लिए प्रयोग) के नियम १० (४) के अंतर्गत इस प्रयोगशाला को ऐसे कार्यालयों के रूप में, जिसके ८० से अधिक कर्मचारी वृंद ने हिन्दी का कार्यसाधक ज्ञान प्राप्त कर लिया है, राजपत्र में अधिसूचित किया गया है।
- प्रयोगशाला के ९८ प्रतिशत कर्मचारियों को हिन्दी, हिन्दी टंकण एवं आशुलिपि का प्रशिक्षण दिया जा चुका है।
- प्रशासन अनुभाग के कुछ अधिकारियों / कर्मचारियों तथा वैज्ञानिक स्टाफ को कंप्यूटर पर हिन्दी में कार्य करने हेतु प्रशिक्षित किया गया है तथा शेष स्टाफ को प्रशिक्षित करने की प्रक्रिया जारी है।
- सभी मानक प्रपत्र, फार्म तथा आवेदन पत्र इत्यादि द्विभाषी रूप में तैयार किए गए हैं।
- वैबसाइट को द्विभाषी रूप में प्रदर्शित किया गया है।
- सभी कम्प्यूटरों में द्विभाषी रूप से कार्य करने की सुविधा उपलब्ध है।
- सभी साइनबोर्ड, नाम-पट्टों तथा रबर की मोहरों को द्विभाषी बनाया गया है।

राजभाषा कार्यान्वयन रिपोर्ट

सीएसआईआर-एनसीएल की राजभाषा कार्यान्वयन संबंधी रिपोर्ट

- प्रशिक्षण कार्यक्रमों में मिली-जुली भाषा का उपयोग किया जाता है।
- एनसीएल के निदेशक एवं हिन्दी अधिकारी नगर राजभाषा कार्यान्वयन समिति की बैठकों में नियमित रूप से भाग लेते हैं।
- एनसीएल की शीर्ष स्तर की प्रबंध परिषद की बैठकों की कार्यसूची द्विभाषी रूप में तैयार की जाती है और इन बैठकों में हिन्दी में भी चर्चा की जाती है।
- पुस्तकालय हेतु प्रतिवर्ष हिन्दी पुस्तकें खरीदी जाती हैं।
- एनसीएल में आयोजित होने वाले समारोहों, व्याख्यानों एवं संगोष्ठियों की रिपोर्ट हिन्दी एवं अँग्रेजी दोनों भाषाओं में सीएसआईआर-समाचार में प्रकाशनार्थ राष्ट्रीय विज्ञान संचार एवं सूचना स्त्रोत संस्थान (निसकेयर), नई दिल्ली को नियमित रूप से भेजी जाती है।
- सीएसआईआर मुख्यालय की मौलिक (विज्ञान) पुस्तक लेखन योजना, वैज्ञानिक कार्यों में हिन्दी पुरस्कार योजना तथा विज्ञान चिंतन लेखमाला आदि योजनाएँ इस प्रयोगशाला में लागू हैं।
- इसके अतिरिक्त प्रयोगशाला में आयोजित होने वाले विभिन्न वैज्ञानिक कार्यक्रमों तथा अन्य समारोहों का संचालन भी हिन्दी माध्यम से किया जाता है।
- इस प्रयोगशाला के वैज्ञानिक देश के विभिन्न संस्थानों में राजभाषा के माध्यम से आयोजित होने वाली संगोष्ठियों तथा विज्ञान सम्मेलनों में भाग लेकर हिन्दी भाषा में अपना शोध पत्र प्रस्तुत करते हैं।

राजभाषा कार्यान्वयन रिपोर्ट

सीएसआईआर-एनसीएल की राजभाषा कार्यान्वयन संबंधी रिपोर्ट

- प्रयोगशाला से जारी होने वाली सभी निविदा सूचनाएँ तथा विज्ञापन इत्यादि द्विभाषी रूप में प्रकाशित किए जाते हैं।
- विज्ञान शिक्षा के प्रति रुचि उत्पन्न करने तथा राजभाषा के माध्यम से विज्ञान के प्रचार-प्रसार के उद्देश्य से एनसीएल के वैज्ञानिकों द्वारा विभिन्न विद्यालयों तथा महाविद्यालयों के विद्यार्थियों के लिए विज्ञान संबंध व्याख्यान हिन्दी में देते है।
- एनसीएल के स्टाफ को हिन्दी में कार्य करने हेतु प्रोत्साहित करने की दृष्टिसे यहाँ विभिन्न राजभाषा प्रोत्साहन योजनाएँ लागू हैं।
- प्राप्त हिन्दी पत्रों के उत्तर अनिवार्य रूप से हिन्दी में ही दिये जाते हैं।
- क तथा ख क्षेत्रों को जाने वाले अधिकांश पत्रों के लिफाफों पर पते हिन्दी भाषा में लिखे जाते हैं।
- राजभाषा विभाग के वार्षिक कार्यक्रम तथा राजभाषा संबंधी निर्देशों से सभी विभाग/ प्रभाग प्रमुखों को अवगत कराया जाता है।
- हिन्दी काम-काज को बढावा देने तथा राजभाषा नीति के अनुपालन हेतु ९ अनुभागों को हिन्दी में कार्य करने के लिए निर्दिष्ट किया गया है।

...e edition of ...ackathon starts

...are edition of Smart India Hackathon (SIH) 2019 started on ... and will end on July ...

City-based CSIR-National Chemical Laboratory (CSIR-NCL) and Indian Institute of Science Education and Research (IISER) inaugurated the grand finale of SIH 2019 in the presence of chief guest Seetha Rama Krishna, Director of High Performance Computing, Asia Pacific and Japan, Intel at IISER.

Around 250 teams with six students in each team

Participation

- 250 teams with six students in each team from engineering colleges are participating.

from engineering colleges all across India are participating in this competition. These students will build practical hardware-based solutions on problem statements identified by nine union ministries and over 40 private sector industries.

This year hardware edition received mo... 20,000 ... in n... state... stake...

It will be held at 18 nodal centres across India. Around 25 teams will participate in Pune.

The teams are given problem themes such as waste management, clean water, renewable energy, robotics and drones, healthcare and biomedical devices and smart vehicles.

The 36-hour software edition was held between March 2 and 3 this year.

Chairman and ma... director of...

From left: Professor Ashw... Kumar Nangia, NCL director, felicitates MS Unnikrish... HT PHOTO

NCL sets up pilot plant to produce clean fuel that can replace diesel

77TH FOU... CELEB... DAY OF CSIR ... EMBER 24

Five-day hardware Smart India Hackath...

ST CORRESPONDENT
PUNE

...Prize

...dent receives national tech innovation award

Nalinee received the award for developing the technology for 'Non-Catalytic deep desulfurization process using hydrodynamic cavitation' at CSIR-NCL under the guidance of Vinay Bhandari.

This was at Chemical Engineering and Process Development Division.

A graduate in Petrochemical Engineering from the Dr Babasaheb Ambedkar Technological University in Lonere, her doctoral work is quite mainly focused on "Studies in sulfur removal processes for transportation fuels".

Previously, she received the ...RB-IGCW 2017 award at the ...ustrial Green Chemistry ...ld 2017' conference.

...and Initiatives for Sustainable Technologies and Institutions) has established three national awards with BIRAC (Biotechnology Industry Research Assistance Council) for innovative student projects in engineering, biotechnology, agriculture, pharmacy, material science and other applied technological domains.

The awards were given to 21 young researchers for innovations related to 42 categories this year.

SRISTI-GYTI awards celebrate the spirit of student innovation in all the fields of engineering, science, technology and design through extremely affordable/frugal solution or the ...

Nalinee Suryawanshi receives the award from Vice-President M Venkaiah Naidu, in the... Union Minister for Health & Family Welfare, Scie... Vardhan...

Notes

Notes

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ABOUT CSIR- NCL

CSIR-National Chemical Laboratory, Pune is a research, development and consulting organization with a focus on chemistry and chemical engineering.

'HINDI PAKHWARA' celebrated at CSIR-NCL

"The purpose of this laboratory is to advance knowledge and to apply chemical science for the good of the people"

Research

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