



संकल्प

Newsletter

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CSIR-IIP FOUNDATION DAY CELEBRATIONS, APRIL 14, 2016

On April 14, 2016, the Institute celebrated its 56th Foundation Day and also observed the 125th Birth Anniversary of the main architect of the Constitution of India, Bharat Ratna Dr Bhim Rao Ambedkar.



Dr V K Saraswat inaugurating the Foundation Day proceedings

The Chief Guest on this occasion was Padmabhushan Dr V K Saraswat, Member, NITI (National Institution for Transforming India) Ayog. Dr Saraswat chose the topic "Energy Security - A Challenge" for his Foundation Day Lecture. First of all, Dr Saraswat remembered the services of Dr. Ambedkar. Then, returning to his main topic, he said that commercialization of R&D was a challenge and underlined the need for indigenous products. He told that the wide gap between the demand and supply of energy, slated to increase further by 2031-32, is a great challenge. It is the percentage of the consumption of energy which defines and differentiates a developed nation from a developing one, he said. While we have to increase the production of energy, we also have to reduce carbon emissions. Renewable energy is the only solution to this problem. It is necessary to increase indigenous production. Besides this, protection of environment is equally necessary and for this, we need to work on advanced products. By way of some examples, he mentioned 'low-grade heat conversion', 'super-critical heat release technology', 'recovery of energy from waste heat' and 'clean coal technologies' as game-changers. Dr. Saraswat talked about 'multi-feed gasification technology' and said that India needs a paradigm shift for technology transformation. Dr. Saraswat talked of CO₂

A word from the Director...

In the recent times there has been a renewed emphasis on translational research leading to technology development and commercialization. Although, CSIR and its laboratories have been created to carry out such activities for developing the industry and the economic wealth of the nation, the need for implementing high science-based technologies has become the need of the hour.



I am extremely pleased to inform that three of our technologies have gone on stream in the last six months, two of these being of grassroots level. The Numaligarh Wax Plant and the Benzene Recovery Unit at Jamnagar have set a bench mark for others research institutes to follow.

This hat trick was announced in a press conference which was very well received by the press and the media. Our scientists and staff continue their efforts to bring many more technologies to both the Indian and foreign markets.

We celebrated our Foundation Day with none other than Dr V K Saraswat, Member, NITI Ayog. On my behalf and on behalf of my institute, I thank him for visiting us and for his kind words etched in our Visitors' Book. Future technologies have to be based on high science and we continue to excel in this endeavour by high-class research output reflected both in peer review journals as well as in conferences.

This has been a remarkable quarter to celebrate. This, of course, would not have been possible without the active involvement and confidence of our stakeholders, particularly oil and the petrochemical industries of our country. I, my staff and scientists thank you for the support.

• *Dr R A Vishwakarma*

capture and storage, which necessitate 'super-critical coal blend', 'coal gasification' and 'ultra super-critical carbon capture'.

The Chief Guest mentioned India's three-stage Nuclear Mission

as well, and said that thorium was a good alternative energy source. Besides these, he also stressed on bio-mass and bio-fuels (e.g., bio-diesel from micro-algae). The Chief Guest also mentioned the National Solar Mission. But, he said 'grid parity' was the ultimate solution to all the alternative sources. He also mentioned the Space Solar Energy, Hydrogen, Geo-thermal Energy and Methanol as alternative energy sources. We can get 17 trillion watts of energy by combining all these sources (through a grid).

Prior to this, the programme began with the lighting of the lamp by the Chief Guest and presentation of 'Saraswati Vandana' by the school-children of the Kendriya Vidyalaya, CSIR-IIP. Thereafter, the guests on the dais including the Chief Guest, Dr M O Garg, Scientist-H, Dr S M Nanoti, Chief Scientist, Dr D C Pandey, Chairman, Celebrations Committee and Mrs Sushila Singhal, Controller of Administration, besides the office-bearers of the SC/ST Workers Welfare' Association and others lit candles and offered floral respects to the portrait of Dr Ambedkar.

Dr M O Garg, Scientist-H, remembered Dr Ambedkar by saying that he had created the Constitution of India in the absence of a previous legacy. That we miss him today and remember him, itself underlines his importance. In the light of the Institute's Foundation Day, Dr Garg mentioned the technologies transferred by the Institute to the industries. Dr Garg extended a warm welcome to the Chief Guest and said that he has once been the chief of the DRDO, and is presently with the NITI Ayog as a member. Dr S M Nanoti, Chief Scientist, introduced the Chief Guest and talked about his role in the development of the Agni Missiles.

The Chief Guest also distributed the prizes of a quiz competition to the winners and runners-up; these included Ms Jayati Trivedi, Mr Aditya, Mr Rajkumar Yadav and Mr Nishant Ayangar, while Mr Raghuvir Singh, Mr Jitendra Kumar, Mr Pawan Kumar and Mr Adnaan Ali Khan, were runners-up.

Dr Saraswat also planted a coffee plant on the occasion in the



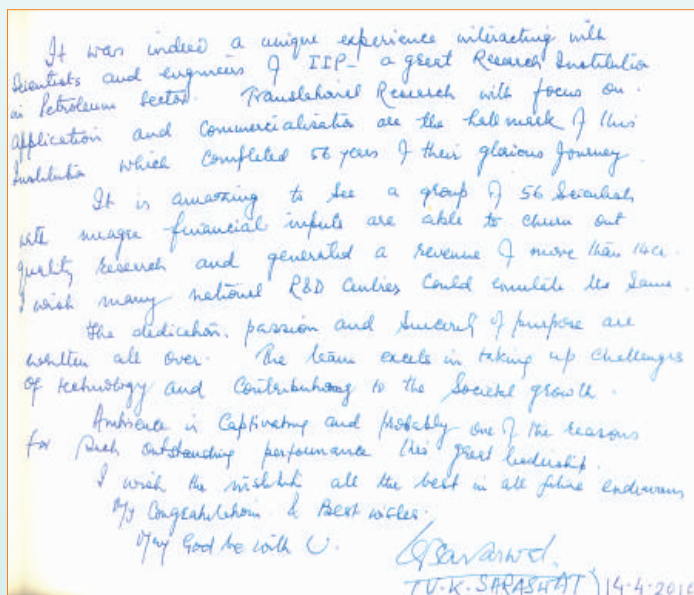
Dr V K Saraswat planting a coffee-plant in the Institute's campus



Dr Saraswat inaugurating the TEM Laboratory

premises of the Institute and inaugurated a new T.E.M laboratory.

In the end, Mrs Sushila Singhal, CoA, proposed a vote of thanks. Mr M C Ratori, Sr Hindi Officer, compered the programme.



Dr V K Saraswat's comments in the CSIR-IIP's Visitors' Book

- The 125th Birth Anniversary of Dr Bhim Rao Ambedkar Celebrated, April 14, 2016

The 125th Birth Anniversary of the main architect of the Constitution of India, Bharat Ratna Dr Bhim Rao Ambedkar, was celebrated in the Institute along with the Foundation Day.

The office-bearers of the SC/ST Workers' Welfare Association also spoke on the persona and the creativity of Dr Ambedkar. Mr Satish Kumar, Secretary, spoke about Dr Ambedkar's role in the making of the Contitution of India while Mr Hakim Singh, Vice-President and Mr Yograj, Member, spoke on Dr Ambedkar's life.



Floral tributes to Dr Ambedkar by DR V K Saraswat



Prime Minister Inaugurating the NRL Wax Plant (File Photo)

PRESS CONFERENCE ON THE INSTITUTE'S RECENT ACHIEVEMENTS, JUNE 20, 2016

The Institute organized a press conference on June 20, 2016 on its recent achievements. The media persons were apprised of the commercialization and commissioning of three of its path-breaking technologies in a single year, two of them being



Dr Ram A Vishwakarma, Director, CSIR-IIP, addressing the press conference. Dr M O Garg, Scientist-H and Mr Ajit Sapre, Group President, R&T, Reliance Industries Ltd., share the dais

grassroots units. A stellar record for any research organization, this CSIR-IIP feat has set a landmark for the others to follow.

The first technology to be commercialized and commissioned by the CSIR-IIP during this year was the state-of-the-art grassroots Wax Plant at the Numaligarh Refinery in Assam. With the annual production of 50,000 tonnes of high quality wax, Numaligarh/BPCL has already captured 55% of the Indian market and also a substantial share of the world market, including that of Nepal and Kenya. This wax plant was dedicated to the nation on 5th February, 2016 by the Honourable Prime Minister of India, Shri Narendra Modi.

The second grassroots unit to go on-line during this year is the Benzene Recovery Unit at Reliance refinery in Jamnagar. The

first of its kind in the world, this unit recovers benzene from FCC gasoline. This unique technology produces benzene-free gasoline while simultaneously producing pure benzene. This is the first indigenous technology jointly developed by the CSIR-IIP & M/s Reliance (further details of this technology are in this issue).



Feed cutin ceremony at the BRU in the RIL refinery, Jamnagar

The third unit was successfully commissioned and the performance guarantee test-run conducted at the Indian Oil Corporation Refinery at Haldia. This unit uses an advanced technology to produce high-quality fuel oil from a process called visbreaking. Developed over a period of six years, carefully designed internals have been installed in the soaker drum of the Visbreaking Unit to eliminate back-mixing, thus providing low viscosity fuel oil along with higher yield of LPG gasoline and diesel.

Conducting the press conference, Dr Dinesh Chandra Pandey, Head, Technical Directorate, CSIR-IIP, initially welcomed all the invitees and gave a brief on the above technologies.

Dr Ram A Vishwakarma, Director, CSIR-IIP, Dehradun, highlighted the importance of all the three indigenous technologies. Dr M O Garg, Ex-Director, CSIR-IIP and Scientist-H,



CSIR-IIP-scientists commissioning the soaker internal technology at the Haldia refinery

gave a detailed technical description of all the three technologies and, for the benefit of the audience, explained the subject in simple language.

Dr Ajit Sapre, Group President, Research & Technology, Reliance Industries Limited (RIL), Jamnagar, underlined the importance of the technology jointly developed by the CSIR-IIP and the RIL, Jamnagar and said that the gasoline produced from this Benzene Recovery Unit would be practically benzene-free (with benzene content even less than the US gasoline specifications), and, therefore, fit for export. Besides this, the unit will also simultaneously produce high-market value benzene.

During the discussions, all the dignitaries on the dais replied to the queries of the media and told about the positive economic & societal impact of the technologies.

The Press Conference was also attended by the developer teams of all the three technologies. The conference closed with a thanks motion by Dr DC Pandey.

MoU's SIGNED

- Non-disclosure Agreement with M/s Bharat Petroleum Corporation Limited, Mumbai for Evaluation of Dewaxing Catalyst.
- MoU with M/s Bharat Petroleum Corporation Limited, Mumbai for Evaluation of Dewaxing Catalyst.
- Non-disclosure Agreement with M/s Renault-Nissan Technology & Business Centre India Private Limited, Kancheepuram for the Testing of the Combustion Catalyst

RESEARCH ACTIVITIES

Sponsored Projects Taken Up

- The Indian Consortium for Advanced Bio-jet Fuel Technologies (IC-ABFT)
- Selective oxidation of benzene to phenol with molecular oxygen over nano-structured catalyst

- Detailed evaluation studies on Eastern Offshore Asset Crude Oil
- Yeast lipid-based bio-refinery for production of fatty acid methyl esters as bio-diesel fuel and other value-added materials using low-cost renewable feedstocks
- Miscibility & compatibility (physico-chemical/performance) - test for lubricants
- Development of nano-catalysts for the preferential oxidation of carbon monoxide for practical use in PEM fuel cells
- NMR analysis of white oil samples
- Analysis of Cauvery composite Crude Oil and Madanam crude oil on nomination basis
- Testing of performance grade polymer modified bitumen

Sponsored Projects Completed

- Testing of Alpha Olefin C₂₀₊ Samples
- Evaluation of thermal stability characteristics of aviation fuel kerosene CEL-16 as per GOST specifications
- Studies on ISO HV-68 & VG-32 samples
- Short evaluation studies for benchmark pricing of crude oil sample from 98/2 Block of the East Coast
- Compatibility & stability studies on RJ crude oil-diesel blend
- Studies on effect of additive on BS-IV diesel
- Studies of fire-resistant hydraulic fluid
- Research of the new processes of motor fuel production from wastes. Hydrogen and synthesis gas generation from solid bio-mass and domestic wastes. Conversion of bio-mass-derived gases (syn-gas) to second-and third-generation liquid bio-fuel using nano-catalysts
- Pilot plant run for hydrogenolysis of glycerol 1,2,propanediol
- Depolymerisation of lignin
- Utilization of C₄ refinery stream to produce high-value chemicals
- Performance investigation of lubricating oil

RESEARCH OUTPUT

Papers Published

- Graphene oxide grafted with iridium complex as a superior heterogeneous catalyst for chemical fixation of carbon-dioxide to dimethylformamide, *Subodh Kumar, Pawan Kumar, Arghya Deb, Debabrata Maiti and Suman L Jain, Carbon, 100, 632-640, April 2016*
- [Fe(bpy)₃]²⁺ doped graphitic carbon nitride hybrid for visible light-assisted oxidative coupling of benzylamines under mild reaction conditions, *Pawan Kumar, Chetan*

Joshi, Arvind Kumar, Srikanth Ponnada, Asgar Ali, Abhishek Pathak, B Sreedhar and Suman L Jain, Green Chemistry, 18(8) 2514-2521, April 2016

- Ternary hybrid polymeric nano-composites through grafting of polystyrene on graphene oxide-TiO₂ by surface-initiated atom transfer radical polymerization (SI-ATRP), Arvind Kumar, Ankushi Bansal, Babita Behera, Suman L Jain and Siddharth S Ray, Materials Chemistry and Physics, 172, 189-196, April 2016
- Tuning the band-gap of h-boron nitride nanoplatelets by covalent grafting of imidazolium ionic liquids, Sangita Kumari, Rashi Gusain and O P Khatri, RSC Advances, 6(25), 21119-21126, April 2016
- Catalytic oxidation of aromatic amines to azoxy compounds over Cu-CeO₂ catalyst using H₂O₂ as an oxidant, Astha Shukla, Rajib Kumar Singha, L N Shivakumar Konathala, Takehiko Sasaki and Rajaram Bal, RSC Advances, 6(27), 22812-22820, April 2016
- Fabrication of Ag nano-particles supported on one-dimensional (1D) Mn₃O₄ spinel nano-rods for selective oxidation of cyclohexane at room temperature, Shankha Shubhra Acharyya, Shilpi Ghosh, Sachin Kumar Sharma and Rajaram Bal, New J. Chem., 40, 3812-3820, April 2016
- Kinetics, thermodynamics and mechanisms for hydroprocessing of renewable oils, Mohit Anand, Saleem Akhtar Farooqui, Rakesh Kumar, Rakesh Joshi, Rohit Kumar, M G Sibi, Hari Singh and A K Sinha, Applied Catalysis A: General, 516, 144-152, April 2016
- Real-world vehicle emissions: their correlation with driving parameters, Sunil Kumar Pathak, Vineet Sood, Yograj Singh and S A Channiwalla, Transportation Research Part D: Transport and Environment, 44, 157-176, May 2016
- Effect of gas oil composition on performance parameters of the extractive desulphurization process, Sunil Kumar, V C Srivastava, Ashutosh Kumar and S M Nanoti, RSC Adv., 6(30), 25293-25301, May 2016
- Carbonized glycerol nano-tubes as efficient catalysts for bio-fuel production, N Viswanadham, Suman Debnath, Sandep K Suman and Ala'a H Al-Muhtaseb, RSC Advances, 6(47), 41364-41368, May 2016
- Study of a novel phenolic-ester as anti-oxidant additive in lube, bio-diesel and blended diesel, Raj Kumar Singh, Aruna Kukrety, O P Sharma, Siddharth Baranwal, Neeraj Atray and S S Ray, Journal of Industrial and Engineering Chemistry, 37, 27-31, May 2016
- Ionic-liquid-functionalized copper oxide nano-rods for

photo-catalytic splitting of water, Rashi Gusain, Nikita Singhal, Raghuvir Singh, Umesh Kumar and O P Khatri, ChemPlusChem, 81(5), 489-495, 2016

- Influence of presence/addition of asphaltenes on semi coke textures and mesophase development in petroleum feedstocks, Subhash Kumar and Manoj Srivastava, Fuel, 173, 69-78, June 2016
- A two-in-one approach: renewable support and enhanced catalysis for sweetening using chicken feather-bound Cobalt(II) phthalocyanine under alkali-free environment, Suman Lata Jain, RSC Advances, 6(57), 51983-51988, June 2016
- Halogen-free ammonium-organoborate ionic liquids as lubricating additives: the effect of alkyl chain lengths on tribological performance, Praveen K Khatri, Chetan Joshi, G D Thakre and Suman L Jain, New Journal of Chemistry, 40, 5294-5299, June 2016
- Mass transfer and hydrodynamic aspects of kinetics studies in light oil sweetening: A review, S K Ganguly, Neetu Varun, Anshul Sharma, Kareena Gill, Poonam Gupta, Suman L Jain and L Laura A, Pellegrini, ChemBioEng Reviews, 3(3), 159-170, June 2016
- Anti-microbial and lubrication properties of 1-acetyl-3-hexylbenzotriazolium benzoate/sorbate ionic liquids, Paramjeet Singh Bakshi, Rashi Gusain, Manisha Dhawaria, Sunil K Suman and O P Khatri, RSC Adv., 6(52), 46567-46572, June 2016
- Partial oxidation of methane to synthesis gas over Pt nano-particles supported on nano-crystalline CeO₂ catalyst, Rajib Kumar Singha, Shilpi Ghosh, Shankha S Acharyya, Aditya Yadav, Astha Shukla, Takehiko Sasaki, Anna Maria Venezia, Chandrashekar Pandem and Rajaram Bal, Catalysis Science & Technology, 6(12), 4601-4615, June 2016
- Fabrication of Ag/Mn₃O₄ nano-architectures for the one-step selective oxidation of 3-picoline to niacin: a key to Vitamin B3 production, Shilpi Ghosh, Shankha S Acharyya, Sachin K Sharma and Rajaram Bal, Catalysis Science & Technology, 6, 4644-4654, June 2016

Patent(s) Sealed in India

- A process for direct hydroxylation of aromatic hydrocarbons, Suman L Jain, Jomy Joseph, Sweety Singhal, Bir Sain, Ragunathan Sivakumaran and Basant Kumar, Patent No. 273296, dt. 30.05.2016
- A process for production of improved quality feedstocks from FCC bottoms for catalytic cracking and conversion into industrial carbon materials, M O Garg, Manoj Srivastava, Manoj Kumar, Neeraj Atheya and Krishan Kant Singh, Patent No 273778, dt. 28.06.2016

...cont'd on page 8

TALKING SCIENCE TALKING TECHNOLOGY

CSIR-IIP-RIL Technology for Simultaneous Production of US - Grade Gasoline and High Purity Benzene from C₆ Heart Cut of FCC Gasoline : World's First



Civil / Construction Work of the Benzene Recovery Unit at RIL Jamnagar (circa late December, 2014)

The Need for the Technology

The MSAT – II regulations which became active on January 1, 2011 (“EPA Regulatory Announcement” – EPA420-F-07-017, February 2007), restrict the average benzene level in Gasoline sold in the US (except California), to 0.62 % vol.

Currently, FCC gasoline comprises nearly 10-20% of the gasoline pool in a typical refinery. Full-range FCC gasoline contains around 15-30 vol% aromatics with up to 2 vol.% benzene and 1000 – 2000 ppm sulphur. A narrow C₆ heart cut fraction of the full-range gasoline contains anywhere between 11 – 19 wt% benzene and up to 500 ppm sulphur.

Hydro-processing routes for benzene and sulphur reduction in FCC Gasoline result in olefin saturation, thus lowering the octane. Unprocessed FCC Gasoline contains reactive impurities like oxygenates, metals, chlorides, sulphur compounds, nitrogen compounds, di-olefins and organic peroxides. Due to the complex nature of this feedstock, an economic and reliable benzene removal/recovery process is difficult to develop and has not been practiced in the industry so far.

CSIR-IIP-RIL Technology

In September 2011, M/s Reliance Industries Ltd. (RIL) contacted the Institute to enquire whether it has a technology to remove benzene from gasoline stream containing high contents of olefins and several other impurities such as diolefins, chlorides, oxygenates etc. The economic incentive for Reliance was to produce low-benzene gasoline required to be sold in the US market



The Benzene Recovery unit (BRU)

while extracting and producing pure benzene which has a high market value.

The Institute started to carry out experiments and generated a large amount of data to develop the required technology. Thermo-dynamic data were generated, coupled with the development of a process flow sheet and its rigorous simulation. The complete process package was developed and submitted to M/s Reliance within a period of eight months.

At this stage, a technical team from the RIL joined hands with the Institute along with an engineering company to develop the whole process package with engineering input. The plant was built at the Reliance Refinery in Jamnagar.

Commissioning

The plant was mechanically completed in April 2016 and the commissioning team of the Institute along with the RIL commissioned the unit on May 21, 2016 flawlessly and brought the unit to full capacity within 48 hours. The unit is operating smoothly while producing gasoline with non-detectable benzene, sulphur as well as other impurities. It is also producing extract containing more than 96% aromatics.

With the commissioning of this unit, it has been proved to the world that this difficult stream can be used to produce not only low-benzene gasoline but also rich aromatics.

Uniqueness and Novelty

The unique and novel aspects of the technology are: it is the first of its kind in the world, based on a thermally and

chemically stable and tunable solvent system discovered to handle reactive impurities-laden complex feedstocks such as FCC Gasoline.

It has been conceptualized and designed with an out-of-the box process configuration which minimizes solvent loss and utility requirements and maximizes yield & purity of products.

The technology does not require any energy-intensive and high expenditure feed pre-processing steps like selective hydrogenation or hydro-desulphurization.

The indigenous technology was recently granted a US Patent (US. 8722952 B2) in May – 2014. The technology has also been distinguished and awarded the prestigious Council of Scientific and Industrial Research – Technology Innovation Award 2014, amidst a stiff competition from several award applications from thirty-seven CSIR Research Laboratories all across India.

Plant Highlights

- Plant Design Throughput: 0.7 MMTPA
- Location: RIL site, Jamnagar, Gujarat

Envisaged impact of the Innovation

- Economic Impact

A 0.7 MMTPA unit has the potential to fetch ~400 Million US \$ per annum including ~44 Million US \$ per annum from the sale of high-purity benzene.

The payback period for the Benzene Recovery Unit is expected to be not more than two years.

Like the RIL, there are many refineries in India and abroad having similar feedstock streams and they will be ready to adopt the technology. Hence, this technology may be sold to the clients abroad bringing foreign exchange to the country.

- Societal Impact

Gasoline produced using this technology is relatively benzene-free, and hence environmentally benign; and as benzene is highly carcinogenic, people involved in distribution, and consumers in general, will be benefitted more while using this benzene-lean petrol.

New plant will employ engineers and shift operators, hence creating new employment.

Future Implications

- The technology will serve as a role model to exemplify the Make in India mandate of the current government.
- With shale gas boom in North America and rapid

conversion of conventional naphtha crackers to gas crackers, there will be a steep decline in aromatics (hence, benzene) production worldwide. This technology will soon become the need of the hour, in view of not only producing clean sulphur and benzene-free gasoline but also for an efficient recovery of the high-purity benzene (a valuable aromatic compound) from alternative feedstocks such as FCC Gasoline.



BRU Feed Cutin Ceremony



The BRU commissioning Team (photograph dated May 21, 2016)



The Benzene Recovery unit (BRU) by night

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Patent(s) Filed Abroad

- Ni nano-cluster supported on MgO-CeO₂-ZrO₂ catalyst for tri-reforming of methane and a process for preparation thereof, *Ankur Bordoloi, Rajib Kumar Singha, Rajaram Bal, Manoj Kumar and Chandrashekar Pendem, USA*, Application No. 15/093984, dt. 08.04.2016
- An improved process for selective production of N-methyl-2-pyrrolidone (NMP), *Indrajit K Ghosh, Suman L. Jain, Praveen K. Khatri, S S Ray and M O Garg*, PCT, Application No. PCT/IN2016/050141, dt. 16.05.2016

Patent(s) Filed in India

- Development of new-generation bio-degradable lubricants for micro electro-mechanical system applications, *Ponnekanti Nagendramma, G D Thakre, Neeraj Atray and D K Adhikari*, Application No. 201611014034, dt. 22.04.2016

TRAINING PROGRAMMES ORGANIZED

Programmes on *Petroleum Refining Technology*

- For the Chemical Engineers of Numaligarh Refinery Limited, (NRL) & Reliance Industries Limited (RIL), Jamnagar, June 6-17, 2016



Programme on Petroleum Refining Technology, June 6-17, 2016

Other Programmes

- Programme on 'Operation and Maintenance of CFR Engine' for Quality Control Officers/Chemists of Different Refineries, April 11-22, 2016
- Programme on Crude Assay for Quality Control Officers/Chemists of RIL, Jamnagar, June 20-24, 2016
- Programme on 'Testing of Bitumen, Bitumen Binders and Instrumentation Techniques', for the Executives of HMEL, Bhatinda, June 27 – July 1, 2016



Faculty and Officers of the Training Programme during June 27 – July 1, 2016

EXCHANGE OF KNOWLEDGE

Papers Presented in Conferences/Seminars/Symposia

International Symposium on Fuels & Lubricants (ISFL 2016), organized by IOCL (R&D), Faridabad, April 18-20, 2016

- Oxidation and pour point behaviour of *Jatropha curcas* oil in polyol ester blend, *Ponnekanti Nagendramma, Prashant Kumar and Neeraj Atray*
- Kinetics, thermo-dynamics and pathways for hydroprocessing of renewable oils, *M Anand, Saleem Akhtar Farooqui, R Kumar, R Joshi, M G Sibi, H Singh and A K Sinha*
- Feasibility studies to improve bitumen properties using co-polymers, *Kamal Kumar, Anand Singh, Manoj Srivastava and M O Garg*
- A single-step catalytic process for production of higher range-hydrocarbon fuel stocks from naphtha, *Nagabhatla Viswanadham, M O Garg, Peta Sreenivasulu, Amit Sharma, Rajeev Panwar and Sandeep K Saxena*
- Fatty acid substituted phosphazene compounds as multi-functional fuel additives, *Praveen K Khatri, Mounika Aila, Raj K Singh and Suman L Jain*
- Graphene and its inorganic analogs as novel materials for tribological applications, *OP Khatri*
- Breakthrough increase in production of bio-fuel blending stock from bio-diesel glycerol, *Sandeep K Saxena, Amit Sharma, Rajeev Panwar and N Viswanadham*
- Effects of DME-blended LPG on polymeric components: an analytical assessment, *Pankaj K Arya, Krishan C Joshi, Pankaj K Kanaujia, G D Thakre and Amar K Jain*
- Thermal efficiency of domestic burner fired with LPG, PNG and DME: experimental and numerical studies, *Pankaj K Arya, G D Thakre, Krishan C Joshi, Satish Kumar and Amar K Jain*

- Effect of investigation of tribological performance of h-BN micro-particles as lubricant additive, *Ajay Kumar, G D Thakre, PK Arya and AK Jain*
- Experimental investigation of Karanja-Ester as lubricant base oil and additive for improved tribological performance, *Pooja Garg, Ajay Kumar, G D Thakre, P K Arya and AK Jain*
- An alternative to petroleum-derived wax, *Manisha Sahai, Archana Kumari, Ajay Kumar and Sanat Kumar*
- Effect of ultrasound cavitation on vacuum residue upgradation, *Ajay Kumar, Manisha Sahai, Sakshi Nanda, Archana Kumari, Sanat Kumar and Manoj Srivastava*
- Halogen-free chelated orthoborate ionic liquids as novel additives for enhanced lubrication properties, *Rashi Gusain and OP Khatri*
- Revamp of solvent deasphalting unit for smooth operation and drastic energy reduction, *Sunil Kumar, S M Nanoti, M O Garg, R Amutha and NVN Nandagopal*
- Prospects of 2,5-dimethylfuran as an alternative fuel : performance characteristics evaluation on a 4S-motorcycle, *M K Shukla, S K Pathak, Yograj Singh and Yogesh Singh*

National Conference on Global Challenges – Role of Science & Technology in Imparting their Solutions (GCRSTS-2016), organised by ISAS-Delhi Chapter, TITS, Bhiwani, April 23-24, 2016

- Synthesis of a novel phenolic-ester-based anti-oxidant and its performance evaluation in polyol, bio-diesel and blended diesel, *Raj Kumar Singh, Aruna Kukrety, O P Sharma, Neeraj Atray and SS Ray*

National Symposium on Bio-fuels & Non-Conservation Energy Sources: Indian Scenario, Uttarakhand University, Dehradun, April 29, 2016

- Development of zeolite catalyst for utilization of bio-ethanol as green transportation fuel, *Sandeep K Saxena and N Viswanadham*
- Carbonized glycerol nano-tubes as efficient catalysts for bio-fuel production, *Suman Debanath, Sandeep K Saxena, Amit Sharma, Rajeev Panwar and N Viswanadham*

3rd International Conference on Nano-technology for better living (Nano-materials for Electronics, Energy, Environment and Structure), Srinagar, May 25-29, 2016

- Covalently grafted thin film-reduced graphene oxide on silicon surface for low friction and remarkable wear resistivity, *O P Khatri, Harshal P Mungse, Yudi Tu, T Ichii, Utsunomiya and H Sugimura*

International Mexican Congress on Chemical Reaction Engineering (IMCCRE 2016), Queretaro, Mexico, June 5-9, 2016

- Role of asphaltene in hydrocracking of residue, *Ravindra Prajapati, Kritika Kohli, SK Maity and MO Garg*
SESFC-2016, Dharmashala, India, June 11-12, 2016

- A comparative assessment on tribological performance of CdS and Cu nano-fluids, *Ajay Kumar, G D Thakre, P K Arya and AK Jain*

17th National Workshop on Challenges in Catalysis Science and Technology, June 23-25, 2016

- Room-temperature production of valeroacetone by hydrogenation of levulinic acid over Pt-hydrotralcite catalyst, *Chandrashekhar Pendem, Nazia Siddiqui, L N Sivakumar Konathala, Manoj Kumar and Rajaram Bal*
- Production of mesoporous γ -alumina with isolated silica sites to produce kerosene via Fischer-Tropsch synthesis in micro-channel reactors, *Aditya Rai, M G Sibi, Saleem A Farooqui, Mohit Anand, Asim Bhaumik and AK Sinha*
- Production of green diesel by hydroprocessing of *Jatropha* oil over aluminum sulphate-derived mesoporous γ - Al_2O_3 -based sulphide catalyst, *Rohit Kumar, Hari Singh and AK Sinha*

Colloquia and Talks

- Mr Amir Hanif, Senior Research Fellow, CSIR-IIP, 'Synthesis, characterization and evaluation of high temperature Co_2 adsorbents', April 7, 2016
- Dr Vivek Polshettiwar, Reader, Department of Chemical Sciences, Tata Institute of Fundamental Research (TIFR), Mumbai, 'fibrous nano-silica (kcc-1)-based hybrid nano-materials for catalysis and Co_2 capture', May 5, 2016
- Mr Vipin Amoli, Research Scholar, CSIR-IIP, Dehradun, 'Development of novel nano-structured materials for energy devices', May 6, 2016
- Dr John Harper, Systems Product Manager, AMETEK Solartron Analytical & Princeton Applied Research, 'Photo-electro-chemical techniques and analysis of photo-electrodes for photovoltaic and water splitting applications', May 10, 2016
- Dr Ajit R Pradhan, Leader, Technical Team, Chevron Energy Technology Company, USA, 'Challenges global oil industries facing today due to downturn', May 20, 2016
- Dr Praveen Sharma, Systems Product Manager, Hydrocarbon Solution, New Delhi, 'Application of LCMSMS and LCQTOF in petroleum industry and research', June 8, 2016
- Mr Ankit Jain, Area Sales Manager, Thieme Medical and Scientific Publishers Private Limited, 'Science of Synthesis

(e-Product)--full-text resource for methods in synthetic organic chemistry by Thieme Publishers', June 21, 2016

- Dr Sudarsan Dash, Senior Programme Officer, United States-India Educational Foundation (USIEF), 'Fulbright-Nehru and Fulbright-Kalam Outreach Programme', June 24, 2016

DISTINGUISHED VISITORS

- Mr Jannie Grove, Director – Project Development, ADME Fuels, Australia, April 11, 2016
- Mr D P Singh, Chief Engineer, ONGC, New Delhi, April 11, 2016.
- Mr R K Tripathi, Manager, IOCL, Bahadurabad, April 11, 2016
- Mr S Bhargava, DGM and Mr Bharat Newalkar, Bharat Petroleum Corporation Limited, NOIDA, April 14, 2016
- Dr Prafull Patidar, Research Scientist; Dr Unnikrishnan S, Asstt. Vice President; Dr Prakash Kumar, Asstt. Vice President; Mr Ahindra Bera, General Manager and Dr Gerard de Nazelle, Head, Technology COE, Reliance Industries Limited, April 25, 2016
- Mr Pradeep Kumar, Tech. Advisor, Krishna Anti-oxidants Pvt. Ltd., Mumbai, April 25, 2016
- Mr Hariprasad Macha, Assistant Manager and Mr Balaji Kalyanarangan, Assistant Manager, Renault-Nissan Technology & Business Centre India Pvt Ltd, Chennai, April 28, 2016
- A delegation of 14 senior journalists/ editors from Afghanistan, under the programme 'External Publicity & Public Diplomacy' of the Ministry of External Affairs, New Delhi, April 29, 2016
- Mr Nishant, Departmental Head of Production, Md Barik, Sectional Head of Production, Mr Vivek Gahlot, Sectional Head of Utility-Mechanical, Mr Nagendra, Sectional Head of QA (Chemical Lab) and Mr Rakesh Pundir, Departmental Head of Materials, Asahi India Glass Limited, Roorkee, May 4, 2016
- Prof Robert Berry from Aston University, UK; Dr Sukhmeet Singh and Dr Sagi S from IIT-Ropar, May 20, 2016
- Mr A K Dhussa, Retd. Advisor, Dr Anjan Ray, Director, Honeywell and Mr S R Meena, Scientist–C, Ministry of New and Renewable Energy, New Delhi, May 21, 2016
- Mr S Bhattacharya, Additional General Manager (Design), RWR&DC, Hindustan Aeronautics Limited, Bangalore, May 27, 2016
- Dr Eng Hatem Belfadhel, Global Technology Director and Dr Rajeshwer Dongara, Sr. Manager, SABIC Technology Centre, Riyadh, KSA, June 1, 2016
- Mr Rakesh Nigam, Lead Auditor, DNV, for Re-certification Audit of the Insitute, June 1, 2016

- Dr V Venkatesan, Scientist-E, Research Coordinator, Defence Research and Development Organization, Chennai, June 30, 2016

PARTICIPATION IN CONFERENCES/SEMINARS/ WORKSHOPS/ BRAINSTORMING SESSIONS/DISCUSSIONS

- Dr M O Garg, Dr Anshu Nanoti, Senior Principal Scientist, Dr N Viswnadham, Principal Scientist, Dr O P Khatri, Senior Scientist, Mr G D Thakre, Senior Scientist, Mr Swapnil Diwekar, Scientist, Mr M K Shukla, Scientist, Dr Ajay Kumar, Scientist, Dr Raj Kumar Singh, Scientist, Mr Pankaj Arya, Scientist, Mr Rohit Kumar, Technical Assistant, Mr Kamal Kumar, Technical Assistant, Mr Praveen K Khatri, Technical Assistant, Dr P Nagendramma, Technician, Mr Sandeep K Saxena, Technician and Ms Manisha Sahai, Technical Assistant, attended the '9th International Symposium on Fuels and Lubricants' organized by IOCL, Faridabad, April 18-20, 2016.
- Dr Raj Kumar Singh, Scientist, attended the 'National Conference on Global Challenges – Role of Science & Technology in Imparting their solutions (GCRSTS-2016)', organized by ISAS Delhi Chapter, TITS, Bhiwani, April 23-24, 2016
- Dr Sunil Kumar, Scientist and Mr Presenjit Ghosh, Scientist, 'Two-day Workshop on Sharing of Indigenously Developed Technologies', CHT, NOIDA, June 20-21, 2016
- Dr Anil K Sinha, Principal Scientist, Dr T Bhaskar, Principal Scientist, Mr Rohit Kumar, Technical Assistant, Mr Chandrashekar Pendem, Technical Assistant, Mr Ravindra Prajapati, Mr Aditya Rai, Ms Kritika Kohli, 17th National Workshop on Challenges in Catalysis Science and Technology (CCST-2016)', CSIR-IICT, Hyderabad, June 23-25, 2016

IMPORTANT MEETINGS

- CSIR-IIP Management Council Meeting, May 31, 2016

IMPORTANT MEETINGS ATTENDED

- Dr M O Garg, meeting of the DST-MoR Project Evaluation Committee to consider the modified project proposal entitled 'Increasing Fuel Efficiency and Reduction of Emissions from Locomotive Engine', and to discuss ATF quality issues with ONGC and EIL, IIT-New Delhi, April 5, 2016
- Dr M O Garg, the 30th Governing Council Meeting of SFPL at the Fuel Testing Laboratory, NOIDA, April 11, 2016
- Dr M O Garg, meeting of the Governing Council the PCRA at New Delhi, April 26-29, 2016
- Dr M O Garg, Dr V V D N Prasad, Principal Scientist, Dr Rajaram Bal, Senior Scientist and Mr Wittison Kamei, Senior Scientist, meeting of the DST Expert Group on Methanol and DME for Research & Development, CSIR-NCL, Pune, April 26-29, 2016

- Dr M O Garg, meeting of the Task Force on Alternate Feedstocks of Petrochemicals at the Ministry of Chemicals and Fertilizers, Shastri Bhawan, New Delhi, April 26-29, 2016
- Dr M O Garg, meeting of the Task Force on Alternate Feedstocks of Petrochemicals at the Ministry of Chemicals and Fertilizer, Govt of India, Shastri Bhawan, New Delhi, besides participation in the 17th meeting of the Research Council of the BPCL, New Delhi, May 29-31, 2016
- Dr M O Garg, Dr S M Nanoti, Chief Scientist, Mr Prasenjit Ghosh, Scientist, Mr Sunil Kumar, Scientist, Dr B R Nautiyal, Senior Technical Officer, visit to the Reliance Industries Ltd., Jamnagar in connection with commissioning of the Plant for Recovery of Benzene from FCC Gasoline, Jamnagar, May 17-27, 2016
- Dr M O Garg and Dr S K Maity, Principal Scientist, participation in the Performance Guarantee Test Run at the IOC Haldia Refinery, Haldia, June 8-9, 2016

HRD/AWARENESS EVENTS

Programmes at the CSIR-HRDC, Ghaziabad

- Dr Neeraj Atray, Senior Scientist, Mr Anand Singh, Principal Technical officer and Mr Sarvjeet Singh, Senior Technical Officer, 'Training Programme on the Art of Public Speaking and Technical Writing Workshop', April 11-13, 2016
- Dr Raj Kumar Singh, Scientist, 'Training Programme on Emerging Trends and Best Practices in Managing R&D Projects', May 4-6, 2016
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- Mr Prashant Bhardwaj, Assistant, 'Three-day workshop for ERP coordinators on Implementation of OneCSIR system in all CSIR Labs/Institutes/Units', June 28-30, 2016

Other Programmes

- Mrs Nisha, Mr Piyush Gupta, Mr V Bhanu Prasad, Technical Assistants, '11th Summer School Programme on Petroleum Refining & Petrochemicals', organized by the Petrotech Society, IIPM, Gurgaon, June 6-10, 2016

EXPOSURE OF STUDENTS TO OUR SCIENTIFIC INTELLECT & INFRASTRUCTURE

Visits of students/different groups of students/cadets/trainers/trainees/faculty members etc. from the following institutions/ colleges/regions/states:

- Rajiv Gandhi Institute of Petroleum Technology, April 4, 2016
- B. Pharma students of GRD (PG) Institute of Technology and Management, Dehradun, April 27, 2016
- B.Tech. (Energy & Environmental Engineering) students of the Agricultural Engineering College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, May 10, 2016

- Officers of the National Technical Research Organization-Aviation Base, Dehradun, June 9, 2016

DNV Audit ISO 9001:2008

DNV Audit of the institute was carried out for its re-certification by Mr Rakesh Nigam, Lead Auditor, DNV, June 22, 2016

HONOURS & AWARDS

- Paper entitled 'Waste-to-wealth: production of waxes from waste plastics' presented by Ms Manisha Sahai at ISFL 2016 during April 18-20, 2016, was adjudged as the best paper in the poster category.
- 'Development of zeolite-based catalyst for utilization of bio-ethanol as green transportation fuel', presented by Dr Sandeep K Saxena, was, adjudged as the best oral presentation at the 'National Symposium on Bio-fuels and Non-conventional Energy Sources' organized at the Uttaranchal University, Dehradun, April 29, 2016
- 'Carbonized glycerol nano-tubes as efficient catalysts for bio-fuel production', presented by Mr Suman Debnath was adjudged as the best poster presentation at the 'National Symposium on Bio-fuels and Non-conventional Energy Sources' organized at the Uttaranchal University, Dehradun, April 29, 2016

PhD/D Phil DEGREE AWARDS

- Mr Vipin Amoli was awarded PhD degree by the Academy of Scientific & Innovative Research (AcSIR) on his thesis entitled 'Development of Novel Nano-structured Materials for Energy Devices' done under the supervision of Dr AK Sinha

FACILITIES ADDED

Transmission Electron Microscope (TEM)

Transmission Electron Microscope (TEM) procured from JEOL, Japan is an advanced version of JEM-2100 installed at the Institute. It is a powerful technique for characterization of nano-materials. It also provides information regarding shape, size and morphology of powdered materials. It is an analytical



Transmission Electron Microscope (TEM)

electron microscope having the maximum capabilities of ultra-high resolution, high image quality with magnification 12X10⁶. Its point-to-point resolution is 0.194 nm and lattice resolution is 0.14 nm. It also provides SAED patterns for obtaining lattice structure. The instrument is equipped with various operational attachments such as scanning image observation device that incorporates provision for obtaining elemental distribution map by an EDS. The technique has been extensively useful to study micro-structure at interfaces of multi-layered structures. The bright field and dark field imaging in TEM is useful for detection of particle size, crystallite area, defects, grain boundaries phase transformation.

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