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CSIR-IIP ON THE PATH TO GREEN AVIATION

Hydroprocessing Route to Aviation Fuels from Non-Edible Vegetable Oils

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Jet fuels must meet very stringent international specifications, due to which it is more difficult to develop an alternative fuel for aviation than for automobile applications.[1] Biojet fuels are in high demand for several reasons. Firstly, they provide security to the airlines against fluctuation in ATF prices. Secondly, ATF availability is expected to reduce gradually in the near future. It can also be used as a drop-in fuel. The ASTM committee has now approved upto 50% blend of biojet fuels with normal fuels (ASTM D7566). The European Union has imposed carbon tax on airlines and other nations are expected to tow the same line since the International Air Transport Association (IATA), which represents 93% of the world's carriers, aims at 10% of its fuel from renewable sources by 2017 and the Airbus expects 30% biojet blend by 2030. With all these projections, we can say that if such renewable fuels are commercialized they would have an immense potential in the aviation sector.

The CSIR-IIP has taken a step forward in the development of aviation fuels from non-edible oil (*Jatropha*) sources. The Institute has developed a catalyst as well as a process for conversion of plant oils directly to aviation fuels (drop-in type fuels). We are the first institute in India to have produced 150 litres of high-quality biojet fuel from *Jatropha curcas* oil for aircraft engine manufacturer, viz. M/s Pratt & Whitney, Canada. This fuel has been tested by both the Indian Oil Corporation Ltd. (IOCL) and the Hindustan Petroleum Corporation Ltd. (HPCL) and has been found to meet all specifications as per ASTM D 1655 and ASTM D7566 for Jet A-1 fuel (ATF). A large pilot plant with the production capacity of 20 litres/day of bio-Jet is in operation, a quantity enough for conducting tests in aircraft engines.

Hydroprocessing catalysts supported on mesoporous zeolites, silica-alumina and alumina were used to convert triglycerides to obtain pure hydrocarbons for biojet fuel production from *Jatropha* oil. The desired products were obtained by using highly acidic supports in a single step. But, the long-chain hydrocarbons produced from hydrotreating reactions (over the alumina-supported catalyst) are selectively hydrocracked and hydroisomerized in the second step using suitably designed catalysts to give products that include jet fuel range of hydrocarbons.

The entire process involves pre-treatment of plant-oil followed by hydro-deoxygenation, hydrocracking, hydroisomerization and aromatization. Hydroconversion reactions were carried out in fixed-bed trickle reactor with sulphided catalysts. The catalysts

A word from the Director...

When you have this newsletter in your hands it would already be 2013. To begin with let me wish you and your families a very happy and prosperous 2013.

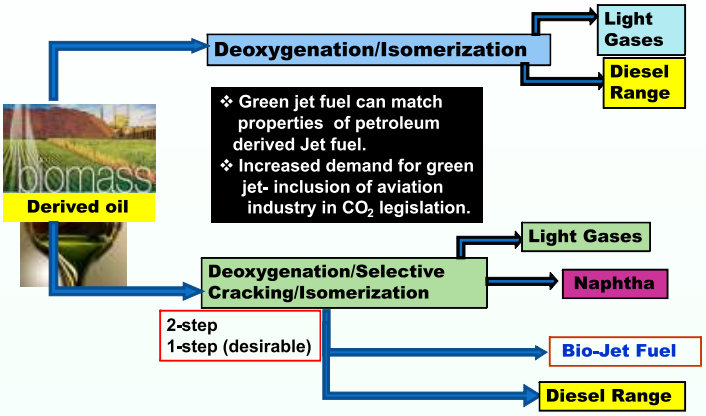
This quarter was extremely busy with several national and international conferences that are typically organized during this part of the year. Our Institute was heavily represented in all these conferences and our scientists have made presentations showcasing our science and technology. In addition, we had several visitors who gave interesting colloquia on specific topics of interest to our scientists.

The XII Five Year Plan which got officially kicked off in April, 2012, has now led to formulation and finalization of several projects within the Chemical Cluster laboratories of CSIR which CSIR-IIP would lead. I am happy to inform that most of these projects have taken off with the finances released by the CSIR. The next one year will be crucial with a view to see these projects taking route, which would be the starting point through high-ended research within the next four years. I shall keep you updated on these in the forthcoming newsletters. Our scientists have continued to file patents as well as published papers in peer review journals. Several project proposals have been submitted to various agencies which are expected to get funded in the near future.

Our congratulations to Dr Y K Sharma for being awarded the DSc Degree by the B R Ambedkar University, Agra and to Dr T Bhaskar for receiving the Fellowship (FBRS) of the Biotech Research Society of India (BRSI) as well as for being selected as a Distinguished Researcher by the AIST, Japan. Our heartiest congratulations for their achievements !!

As we enter 2013, we look forward to your continued support and best wishes to reach greater heights and an all-round development.

• *Dr M O Garg*



The CSIR-IIP Process (single- and two-step) for biojet fuel from plant oil

were prepared by conventional impregnation method. Preliminary studies focussed on preparation of different catalysts and their screening. Metal loadings and supports were varied and optimized during the preparation. The process parameters were optimized after selection of suitable catalysts. The parameters affecting the product property were: (1) reaction temperature, (2) pressure, (3) hydrogen-to-oil ratio and (4) liquid hourly space velocity (LHSV).

Studies on catalyst life, catalyst regeneration and the performance of regenerated catalysts are underway. Scanning electron microscopy (SEM) and elemental composition (EDAX) of the spent catalyst have shown the presence of coke as occluded material which can be removed by burning, while the metal impurities in *Jatropha* oil feed tend to deposit on the catalyst surface. Therefore, it was necessary to remove all the impure metals from the feed oil by a suitable pretreatment procedure which has already been optimized.

The innovativeness of our single-step process is that all the reactions can be carried out by a single catalyst. Also, the biojet fuel produced contains 10-20 % aromatics which is an added advantage in the process and reduces any addition of costly aromatic additives.

The environmentally polluting SO_x from the biojet is also 10-20 times lower as compared to that from petroleum-based aviation fuels. In addition to biojet, the process also produces gasoline and diesel fuel cuts which can also be blended in the fuel pool. The process is very similar to refinery processes and hence it can also be integrated into the current refinery infrastructure.[2] Several patents have been filed for this invention.

References

1. D Verma, R Kumar, B S Rana, A K Sinha, *Aviation fuel production from lipids by a single-step route using hierarchal mesoporous zeolites,* Energy and Environmental Science, 2011, 4, 1667-1671.
2. A K Sinha, M Anand, B S Rana, R Kumar, S A Farooqui, M G Sibi, R Kumar, R K Joshi, *Development of hydroprocessing route to transportation fuels from non-edible plant-oils*, Catalysis Survey from Asia, 2013, 17(1), 1-13.

RESEARCH ACTIVITIES

Sponsored Projects Taken Up

- Feasibility study for value addition to low polymer wax

RECOGNITIONS

Dr Y K Sharma, Chief Scientist, was awarded DSc degree by the B R Ambedkar University Agra, on his thesis entitled "Studies on the mechanism of degradation behaviour of distillate fuels."

The problem of degradation can be studied in terms of stability in storage, when fuel is stored for a period longer than usual.

This study involves a new approach for understanding the mechanism of degradation occurring in distillate fuels by concentrating the hydrocarbon sediment precursors from cracked stocks and doping them with stable fuel. The real composition of sediment-forming compounds of cracked stocks provides a more realistic picture of degradation. The main emphasis has been on the separation of those classes of compounds responsible for the stability of cracked stocks such as light cycle oil and visbreaker gas oil. This work has elucidated the characterization of such fuels.

Dr Thallada Bhaskar, Senior Scientist, was selected as a Distinguished Researcher by the *National Advanced Institute of Science and Technology (AIST)*, Japan for the year 2012 for his work on *'Recovery of useful resources from e-waste'.*

Dr Thallada Bhaskar, is currently heading the Thermo-catalytic Processes Area under the Bio-Fuels Division of the Institute. He has 18 years of research experience which cover various fields of science revolving around his expertise in heterogeneous catalysis for thermo-chemical conversion of biomass, waste plastics and e-Waste plastics into value-added hydrocarbons. He received his PhD from Osmania University and carried out Post-doctoral Research at the Okayama University, Japan. He has about 75 publications and 9 patents to his credit. His contributions in the field of sustainable hydrocarbons are in the form of process knowhow transfer to, and catalyst commercialization in, various organizations worldwide. His patents and publications discuss crucial points encompassing wide areas of thermochemical conversion like pyrolysis and hydrothermal liquefaction to microchannel reactors for separation processes. His main focus is to develop various methods using conventional/ non-conventional energies for the sustainable production of hydrocarbons utilizing the polymeric wastes available. His various assets include Science and Technology Agency (STA)-Japan Fellowship from the DST, India (2000); Venture Business Laboratory (VBL) Postdoctoral Fellowship, Japan (2000); Republic of Greece Scholarships Foundation (IKY) Fellowship for Postdoctoral Studies (2000); Most Progressive Researcher Award from FSRJ, Japan (2008); JSPS-Visiting Scientist at the Tokyo Institute of Technology (TIT), Japan (2009) and Fellowship (FBRS) of the Biotech Research Society of India (BRSI) (Nov. 2012).

- Value- addition to kerosene fractions
- Research into new processes of motor fuel production from wastes. Hydrogen and synthesis gas generation from solid biomass and domestic wastes. Conversion of biomass-derived gases (Syngas) to second- and third-generation liquid biofuel using nanocatalysts
- Functionalised hierarchical nano-composite materials for synthetic and renewable fuel production
- Studies on fuel stick in petrol and diesel
- Study on deposit characteristics of two numbers of a merchant client's scooter engine components
- Oxidation and thermal stability of hydraulic oil
- Oxidation stability of Lub-Hydraul HFDU-68 as per ASTM D2440-99
- Quick explorative study on conversion of Naphtha Feed

Sponsored Projects Completed

- Studies on crude oil analysis of IC complex
- Techno-economic feasibility of open-loop thermo-chemical S-I cycle of H_2S split for carbon-free hydrogen production in a petroleum refinery
- Novel doped 3-D nanoporous oxodes for dye-sensitized solar cells
- MAT Testing of catalyst samples from a client oil company
- Corrosion inhibitor performance evaluation studies
- Setting up of modernized emission measurement facility
- Testing of 4-samples for FR and 4-ball wear test/ characteristics
- Overhauling of a CFR Octane/Cetane engine at a merchant client's refinery
- Study on deposit characteristics of two numbers of motor cycle engine components
- Investigation of oil blackening of AI-20 Aero engine
- Comparative testing and analysis of fresh and degraded engine oil used in MI-17 helicopters
- Testing of ISO HV-68 and VG-32 oils
- Studies on fresh and used oil samples of SU 30 MKI
- Studies on reformate sample from import parcel of a client oil company
- Studies on creosote sample from a merchant client
- Evaluation of 7 samples from the SSP, UT, Chandigarh
- Study on deposit characteristics of two numbers of motor cycle engine components
- Comparative testing and analysis of Russian and Indian hypoid oil in MI 18/ MI 17 IV helicopters
- Evaluation studies on crude oil samples from the Mangla field of Rajasthan besides studies on Flash Point and BS&W of the crude oil from Viramgam and ASI 33 terminals

RESEARCH OUTPUT

Papers Published

- Dispersion of alkylated graphene in organic solvents and its potential for lubrication applications, *Shivani Choudhary, Harshal P Mungse* and *O P Khatri*, Journal of Materials Chemistry, 22(39), 21032-21039, Oct 2012
- Reappraisal of the Skarstrom Cycle for CO_2 recovery from flue gas streams: new results with potassium-exchanged zeolite adsorbent, *Anshu Nanoti, Soumen Dasgupta, Arti, Nabanita Biswas, A N Goswami, M O Garg, Swapnil Divekar* and *Chandrasekhar Pendem,* Ind & Engineering Chem Res., 51(42), 13765-13772, Oct 2012
- Thiourea dioxide catalyzed multi-component coupling reaction for one-step synthesis of naphthopyran derivatives, *Sanny Verma* and *Suman L Jain,* Tetrahedron Letters, 53 (45), 6055-6058, Nov 2012
- Aqueous phase reforming of glycerol to 1, 2-propanediol over Pt-nanoparticles supported on hydrotalcite in the absence of hydrogen, *Chandrashekar Pendem, Piyush Gupta, Nisha Chaudhary, Sarvajit Singh, Jagdish Kumar, Takehiko Sasaki, Arunabha Datta* and *Rajaram Bal,* Green Chemistry, 14(11), 3107-3113, Nov 2012
- Oxidation of sulphides to sulphones with hydrogen peroxide in the presence of acetic acid and Amberlyst 15, *T V Rao, Sapna Bondwal, Priyanka Bisht, Chandrashekar Pendem* and *Jagdish Kumar*, Reaction Kinetics, Mechanisms and Catalysis, 107(2), 449-466, Dec 2012
- Predicting the performance of an LPG extractor: a nomographic approach, *A Jain, N Rathi* and *S K Ganguly*, Petroleum Science and Technology, 30(23), 2494-2503, Dec 2012
- Temperature-dependent reaction pathways for anomalous hydrocracking of triglycerides in the presence of sulphided Co-Mo-catalyst, *Mohit Anand* and *Anil K Sinha*, Bioresource Technology, 126, 148-155, Dec 2012
- Mechanistic kinetics of catalytic oxidation of 1-butanethiol in light oil sweetening, *Sudip K Ganguly, Gautam Das, Sunil Kumar, Bir Sain* and *M O Garg*, Catalysis Today, 198 (1), 246-251, Dec 2012
- Reforming of methane with CO_2 over Ni-nanoparticle supported on mesoporous ZSM-5, *Bipul Sarkar, Ritesh Tiwari, Rajib Kumar Singha, Shashank Suman, Shilpi Ghosh, Shankha Shubhra Acharyya, Kshudiram Mantri* and *Rajaram Bal*, Catalysis Today, 198(1), 209-214, Dec 2012
- Synthesis, characterization and catalytic activity of cobalt phthalocyanine dichloride in sweetening of heavier petroleum fractions, *Gautam Das, Bir Sain* and *Sunil Kumar*, Catalysis Today, 198(1), 228-232, Dec 2012
- Catalytic functionalities of FSM-16 ordered mesoporus silica-supported molybdenum hydroprocessing catalysts, *Shelu Garg, Kapil Soni, Manoj Kumar, Thallada Bhaskar, J K Gupta, K S Rama Rao* and G Murali Dhar, Catalysis Today, 198(1), 263-269, Dec 2012
- *Jatropha* oil conversion to liquid hydrocarbon fuels using mesoporous titanosilicate-supported sulphide catalysts, *R K Sharma, Mohit Anand, B S Rana, Rohit Kumar, Saleem Farooqui, M G Sibi* and *Anil K Sinha*, Catalysis Today, 198(1), 314-320, Dec 2012
- Chemically-modified expended starch grafted Ni-acetylacetonate/TBAB: an effective reusable catalytic combination for cycloaddition of carbon dioxide to epoxides, *Subodh Kumar, Suman L Jain* and *Bir Sain*, Catalysis Today, 198(1), 204-208, Dec 2012

- Pt- nanoparticles supported on mesoporous ZSM-5: a potential catalyst for reforming of methane with carbon dioxide, *Bipul Sarkar, Shashank Suman, Ritesh Tiwari, Rajib Kumar Singha, Shilpi Ghosh, Shankha, Shubhra Acharyya, L N Sivakumar Konthala, Chandrashekar Pendem, Kshudiram Mantri* and *Rajaram Bal,* Indian Journal of Chemistry, Section A: Inorganic, Bio-inorganic, Physical, Theoretical & Analytical Chemistry, 51A (9-10) 1348-1353, (Sept-Oct) 2012

Patent(s) Sealed Abroad

- Process for preparation of ethanol from starch, *D K Adhikari, Tsering Stobdan, R P Singh* and *A K Gupta*, USA, Patent No. 8227220B2, dt. 24.07.2012

Patent(s) Filed in India

- A single-step catalyst and process to convert triglycerides and free fatty acids directly into isomerized hydrocarbons, *A K Sinha, B S Rana, Rohit Kumar* and *Deepak Verma*, Application No. 3196Del2012, dt. 12.10.2012
- An improved process for selective separation of linear terminal olefins and n-paraffins from a coker distillate, *Indrajit K Ghosh, Suman Lata Jain, Jagdish Kumar, A K Chatterjee* and *Bir Sain*, Application No. 3192Del 2012, dt. 12.10.2012
- Process for production of renewable fuels and chemicals from baggasse pith in a bio-refinery, *D K Adhikari, Savita Kaul, Debashish Ghosh, Deepti Agrawal, Rashmi, Diptarka Dasgupta, Sunil K Suman, Dinesh Bangwal, M S Negi, U K Jaiswal, Pankaj K Arya, R K Jain, Vasantha V Thakur, R M Mathur, Diwaker Pandey* and *Dharmendra Kumar* (CPPRI), Application No. 3444Del 2012, dt. 07.11.2012
  Jointly with the Central Pulp & Paper Research Institute (Dept. of Industrial Policy & Promotion, Ministry of Commerce & Industries, Govt. of India), Saharanpur
- An improved process and catalyst for selective dehydrogenation / oxidative dehydrogenation of ethane to ethylene, *Rajaram Bal, Bipul Sarkar, Rajib Kumar Singha, Chandrashekar Pendem, Shankha Shubhra Acharyya* and *Shilpi Ghosh*, Application No. 3443Del2012, dt. 07.11.2012
- An improved process and catalyst for single-step conversion of glycerol to acrylic acid, *Rajaram Bal, Bipul Sarkar, Rajib Kumar Singha, Chandrashekar Pendem, Shankha Shubhra Acharyya* and *Shilpi Ghosh*, Application No. 3442Del2012, dt. 07.11.2012
- A catalytic process to convert microbial lipids, bio-crude and lignin directly into aromatic-rich feedstock, *A K Sinha, Mohit Anand, D K Adhikari, Saleem Akthar Farooqui, Debashish Ghosh, Rashmi, Rakesh Kumar, R K Joshi, Rohit Kumar, Jagdish Kumar, Deep Chand, Tasleem Khan* and *Parvez Alam*, Application No. 3441Del2012, dt. 07.11.2012
- A single-step catalytic process for conversion of naphtha to diesel-range hydrocarbons, *N Viswanadham, Peta Sreenivasulu, Sandeep K Saxena, Rajiv Panwar, Devaki Nandan* and *Jagdish Kumar*, Application No. 3485Del2012, dt. 08.11-2012.
- Biodegradable base stock as neat cutting oil, *Savita Kaul, P Nagendramma, G D Thakre, R P S Bisht* and *M R Tyagi*, Application No. 3483Del2012, dt. 08.11.2012
- An improved process for biodiesel production, *M O Garg, Adam Harvey, Jyoti Porwal, Dinesh Bangwal, Richa Singhal* and *Savita Kaul*, Application No. 3616Del2012, dt. 26.11.2012
- An improved coke-resistant solid catalyst and process for methane reforming reaction with carbon dioxide, *Rajaram Bal, Bipul Sarkar, Chandrashekar Pendem, Rajib Kumar Singha, Shankha Shubhra Acharyya* and *Shilpi Ghosh*, Application No. 3614Del2012, dt. 26.11.2012

TRAINING PROGRAMMES ORGANIZED

Programmes on *Petroleum Refining Technology*

- Programme for the Chemical Engineers of different refineries viz., CPCL, Chennai, India; KPRL, Mombasa, Kenya; NRL, Numaligarh, India and IOCL, Panipat, India, October 1-19, 2012
- Programme for the Chemical Engineers of HPCL, Bangalore, November 26 – December 14, 2012
- Programme for the Chemical Engineers of IOCL, New Delhi and CPCL, Chennai, November 26, 2012 - January 11, 2013

Faculty and participants of the training programme during November 26, 2012 - January 11, 2013

Other Programmes

- Workshop-cum-Training Programme on '*Vehicular Pollution*' for the Officers of the MRTH, New Delhi, October 19 - November 2, 2012

Faculty and participants of the training programme dated October 19- November 2, 2012

- Programme on Laboratory Practicals for the Chemists of NTPC, NOIDA, December 24 – January 4, 2013

SERVING THE INDUSTRY

S&T Services Conducted for Merchant/Govt. Clients from India and Abroad

- Compatibility test on oil
- Testing of plastic oil sample
- Testing of MGO sample
- Testing of Flash Point
- Testing of Bitumen VG-40
- Testing of FRHF sample for four-ball test

- Testing of FRHF sample (organic ester type)
- Testing of polyglycol sample for Flash Point & Cloud Point
- Testing of FRHF, HFC type sample by four-ball test
- Lube oil compatibility test
- Homogeneity and miscibility test on HFDU type polyoil ester based FRHF's
- RON Analysis

EXCHANGE OF KNOWLEDGE

Papers Presented in Conferences/Seminars

Third International Symposium on Green Chemistry for Environment, Health and Development, Skiathos Island, Greece, October 3-5, 2012

- Thiol-yne mediated synthesis of nanostarch grafted oxo-vanadium Schiff base for oxidation of alcohols, *Sanny Verma* and *Suman L Jain*

ASME/STLE 2012 International Joint Tribology Conference, Denver, Colorado, October 7-10, 2012

- Performance evaluation of journal bearings used in sugar mills using Taguchi methods, *S M Muzzakir, Harin Hirani* and *G D Thakre*

10th International Oil & Gas Conference and Exhibition, PETROTECH-2012, New Delhi, October 14-17, 2012

- *Jatropha* oil conversion to liquid hydrocarbon fuels using mesoporous titanosilicate supported sulphide catalysts, *R K Sharma, N Naidu, M Anand, B S Rana, R Kumar, S A Farooqui, M G Sibi, R K Joshi, R Kumar* and *A K Sinha*
- Optimization of process parameters for CO_2 absorption/regeneration by loading with aqueous solutions of 2-amino-2-methyl-1-propanol (AMP) and AMP with piperazine, *S K Biswas, S Halavath, P Kumar, S M Nanoti* and *M O Garg*
- Studies on the compositional analysis of liquid and gaseous hydrocarbons obtained from waste polyethylene, *H U Khan, Manisha Sahai, Sanat Kumar* and *Jagdish Kumar*
- CFD Studies on hydrodynamics of an internal loop airlift reactor, *Madhavi Gera, Jasvinder Singh, D K Adhikari* and *M O Garg*
- Investigation into vehicular performance and emission from isomers of butanol blended in gasoline, *Mritunjay Kumar Shukla, Yograj Singh, L Robindro, A K Jain* and *S K Singal*
- Tribological behaviour of lubricating greases and their analytical perspectives, *G D Thakre, P Nagendramma, Savita Kaul, R P S Bisht* and *M R Tyagi*
- Feedstock options for petrochemicals, *Sudip K Ganguly, Shounak Sen* and *M O Garg*

4th International Conference on Advanced Nano Materials (ANM 2012), IIT-Madras, Chennai, October 17-19, 2012

- Synthesis of copper oxide nanorods in ionic liquids and its potential for lubricant applications, *Rashi Gusain* and *O P Khatri*

2012 AIChE Annual Meeting at Pittsburgh, USA, October 28 – November 2, 2012

- Single-column VSA studies for CO_2 recovery using metal organic frame-work adsorbent: comparison with commercial zeolite, *Arti Arya, Soumen Dasgupta, Swapnil Divekar, Anshu Nanoti, A N Goswami, M O Garg, Anne Anderson, Jasmina Hafizovic Cavka* and *Richard Blom*
- 1,3-dimethylimidazolium-2-carboxylate derived from dimethyl carbonate: a recyclable green catalyst for the chemical activation of CO_2, *Suman L Jain* and *Subodh Kumar*

National Conference on Carbon Materials 2012 (CCM 2012), BARC, Mumbai, November 1-3, 2012

- Hydrothermal deoxygenation of graphene oxide, *Shivani Choudhary* and *Harshal P Mungse*
- Synthesis and characterization of graphene oxide/polymer composites for lubricating applications, *Arvind Kumar, Babita Behera, Ankushi Bansal, A K Chatterjee* and *S S Ray*
- Optical microscopic imaging of mesophase pitches and petroleum semicoke catalyzed by transition metals, *Subhash Kumar* and *Manoj Srivastava*
- Preparation of petroleum pitches for different applications from refinery/petrochemical residues, *Manoj Srivastava, Manoj Kumar, U C Agarwal* and M O Garg

International Conference on Industrial Biotechnology (ICIB-2012), Punjabi University, Patiala, November 21-23, 2012

- Catalytic hydrothermal liquefaction of wheat husk, *Rawel Singh, Thallada Bhaskar* and *Bhavya Balagurumurthy*

7th Uttarakhand State Science & Technology Congress, November 21-23, 2012

- Synthesis and characterization of cellulose palmate esters for biolubricant application, *Raj K Singh, Anshul Verma, Raghuvir Singh, G M Bahuguna, L N Shivakumar* and Sandeep Saran

Winter School on Frontiers in Material Science, International Centre for Material Science, JNCASR, Bangalore, December 3-8, 2012

- Spectroscopic studies on deoxygenation of graphene oxide in water, *Harshal P Mungse, Shivani Choudhary* and *O P Khatri*

One-day Workshop on Understanding Real-world Indian Driving Cycle and its Impact, CRRI, New Delhi, December 4, 2012

- Development of a driving cycle for passenger cars in a Tier-II city, *Sunil Pathak* and *S K Singal*

TAPSUN Conference 2012 on Advances in Futuristic Solar Energy Technology, organized by CSIR-NPL, New Delhi, December 4-5, 2012

- Protein-based solar photovoltaics: Bioprospecting photosynthetic micro-organisms and purification of its photosynthetic protein, *Neelima Shah, Deepti Agrawal, Rashmi, Sunil K Suman, Debashish Ghosh, Diptarka Dasgupta, Sheetal Bandhu* and *D K Adhikari*.

8th International Conference on Industrial Tribology (ICIT-2012), organized by TSI, Pune, December 7-9, 2012

- Copper oxide nanorods as potential additives for reduction in friction and wear, *Rashi Gusain* and *O P Khatri*
- Investigation into fatigue life of elastohydrodynamic lubricant point contacts, *G D Thakre, M R Tyagi, Satish C Sharma* and *S P Harsha (Indian Institute of Technology-Roorkee - IITR)*
- Study of lubricant performance in elastohydrodynamic lubricant point contacts, *G D Thakre, M R Tyagi, Satish C Sharma* and *S P Harsha (IITR)*

Biofest-2012, organized by the Bright International Conferences & Events, Hyderabad, December 12-13, 2012

- Biorefinery approach for production of lignocellulosic ethanol and other byproducts from the waste of sugar mills and the pulp & paper industry, *D K Adhikari, R K Jain, Deepti Agrawal, Diwakar Pandey, Diptarka Dasgupta, Debashish Ghosh, Rashmi, Vasanta V Thakur* and *Sunil K Suman*

FICCI's Roving Seminar on Industrial Lubricants and Management, New Delhi, December 18-19, 2012

- Types of lubricants and grease and their applicability in industries, *G D Thakre, Pankaj Arya* and *B M Shukla*

International Conference on Solar Energy Photovoltaic (ICSEP-2012), School of Electronics Engg, KIT University, Bhubaneswar, December 19-21, 2012

- High surface area mesoporous titania for dye-sensitized solar cell, *A K Sinha* and *Vipin Amoli*

CHEMCON-2012, Dr B R Ambedkar NIT, Jalandhar, December 27-30, 2012

- Catalytic cracking of pyrolytic oil model compound with gas oil: a case study of acetic acid, *D V Naik, Vimal Kumar, B Prasad, M O Garg, Neeraj Atheya, K K Singh* and *D K Adhikari*

Colloquia and Talks

- Dr Swaminathan Sivaram, Bhatnagar Fellow & Ex- Director, CSIR-NCL, Pune, *Polymer Membranes for Fuel Cells: Structure, Property, Performance and Challenges*, November 1, 2012
- Dr Mukesh Saxena, Head, AutoChem & Government Business (Lab), Mettler-Toledo India Private Limited, *Technical Presentation on React IR:* in-situ *FTIR Used for Real-Time Reaction Monitoring Easymax: A Parallel Reactor System*, November 8, 2012
- Prof Dr Peter Stryzhak, Head, Institute of Physical Chemistry of the National Academy of Sciences of Ukraine, Ukraine, *Nanomaterials in Heterogeneous Catalysis,* December 3, 2012
- Dr Dudnyk Oleksii Mykolaiovych, Senior Researcher, Coal Energy Technology Institute, National Academy of Sciences of Ukraine, Ukraine, *Conversion of Solid Organic Wastes to Fuels and Chemicals*, December 4, 2012
- Prof Dr Peter Stryzhak, Head, Institute of Physical Chemistry of National Academy of Sciences of Ukraine, Ukraine, *Fischer Tropsch Reactions*, December 4, 2012
- Dr M Shiraj, Project Leader, National Institute of Advanced Industrial Science & Technology (AIST), Japan, *Development of Sustainable Catalytic Reaction System Using Carbon Dioxide and Water*, December 13, 2012

MoU's/AGREEMENTS SIGNED

Within India

- With the University of Petroleum & Energy Studies (UPES), Dehradun
- Non-disclosure agreement with the Hyundai Oilbank R&D Institute, Gyeonggi-do, Korea on *'Conversion of Naphtha to a Heavier Distillate, i.e. Diesel'*

DISTINGUISHED VISITORS

- Mr Cheol-Hyun Kim, Hyundai Oilbank Co. Ltd., South Korea, October 25, 2012
- Dr S Sivaram, Ex-Director, CSIR-NCL, Pune, October 31, 2012
- Kenyan delegation from the Kenyan Ministry of Energy's Sectoral Technical Committee on Implementation of the New Constitution, led by Mr Samuel K Keter, Chief Legal Officer; Ms Doreen S Cheptoo Tiern, Chief Legal Officer; Ms Eunice K Kilonzo, Geologist and Er Solomom Njoroge, Engineer, November 23, 2012
- Dr Suresh Das, Dr Ashok Pandey, Dr M Nampoothiri, CSIR-National Institute for Interdisciplinary Science & Technology (CSIR-NIIST), Dr N H Khan and Dr Avinash Mihsra, delegates from CSIR-Cental Salt & Marine Chemicals Research Institute (CSIR-CSMCRI), November, 2012
- Mr Dushyant Singh, Star Group, November 29, 2012
- Prof Dr Peter Stryzhak, Head, Institute of Physical Chemistry of National Academy of Sciences of Ukraine, Ukraine, November 29, 2012
- Ms Renu Sinha, Manager, Gas Authority of India Limited (GAIL), December 4, 2012.
- Dr (Mrs) La Parola Valeria, Dr Pantaleo Biuseppe, Consiglio Nazionale delle Ricerche (CNR), Italy, December 5, 2012
- Dr M Shiraj, Prof Sasaki & Dr Yagamuchi, delegates from Japan and Dr C V Rode, CSIR-National Chemical Laboratory (CSIR-NCL) Pune, December 13, 2012.
- Mr Sudhakar, Managing Director, Indian Herbs Research & Supply Co. Ltd., Saharanpur, December 14, 2012
- Mr T P Antony, Chief Manager, R&D; Mr V S Baid, GM; Mr Manish Saxena, Sr Manager and Mr Chaturvedi, Gas Authority of India Limited (GAIL), December 18, 2012
- Mr Immanuel Selvaraj, Programme Manager, External Network and Technology Intelligence, GE Global Research-SABIC Innovative Plastics Program, Bangalore, December 18, 2012

INTERNATIONAL VISITS

- Dr M O Garg, Director; Dr S M Nanoti, Chief Scientist; Dr B R Nautiyal, Sr Technical Officer and Mr Prasenjit Ghosh, Scientist, visited SABIC Petrochemical, UK for demonstration and installation of BTX Model and to conduct a 3-day training course, October 8-12, 2012.
- Dr Anshu Nanoti, Senior Principal Scientist, visited USA to attend and present a research paper at the *'2012 AIChE Annual Meeting'* at Pittsburgh, USA, October 28 – November 2, 2012.
- Mr Salim Farooqui, Scientist, visited Russia as a team member of a delegation led by the Indian Navy and the Naval Materials Research Laboratory (NMRL) to discuss possible co-operation for the *Indo-Russia Joint Development of Fuel Cell-Based AIP Module*, October 31-November 2, 2012
- Dr A K Sinha, Principal Scientist and Mr Salim Farooqui, Scientist, visited the Coal Energy Technology Institute, National Academy of Sciences, Ukraine, under the *Joint Collaborative Indo-Ukraine Project*, November 3-16, 2012

HRD/AWARENESS EVENTS

Programmes at the HRDC (CSIR), Ghaziabad

- Mr M S Mehra, F&AO attended a workshop on *'Modified*

Accounting Software', October 18-19, 2012

- Mr Prasoon Kumar, SO and Mr Vishvendra Dogra, Assistant, attended the *'CSIR Enterprise Transformation Project: CSIR-Administration; Breaking Barriers Conference-cum-Hands-on Training for ERP-HR Portal Related Processes and Configuration of HR Processes for ESS, PMS and Assessment Modules',* November 5-6, 2012

Other Programmes

- Mr Harshal P Mungse, TA, '*Winter School on Frontiers in Material Science',* International Centre for Material Science, JNCASR, Bangalore, December 3-8, 2012

EXPOSURE OF STUDENTS TO OUR SCIENTIFIC INTELLECT & INFRASTRUCTURE

Visits of students/different groups of students/cadets/ trainers/trainees from the following institutions/ colleges

- A group of trainers from Town Schools Education Initiatives and Directorate General, Resettlement of Personnel, visited our Knowledge Resource Centre (KRC, formerly known as 'Library') on November 20, 2012
- A group of M.Sc. (Bioscience) students from Mar Athanasios College for Advanced Studies (MACFAST), Tiruvalla, Kerala, December 6, 2012

FACILITIES ADDED

- 2D Iso-electric Focussing
- Anaerobic workstation

PARTICIPATION IN CONFERENCES/ SEMINARS/ WORKSHOPS

- Dr M O Garg, Director; Dr Y K Sharma, Dr S S Ray, Mr S K Ganguly, Dr S K Maity, Dr O P Khatri, Dr V V D N Prasad, Mr Ajay Gupta, Dr Jasvinder Singh, Mr G D Thakre, Mr Mohit Anand, Mr Pradeep Kumar, Ms Manisha Sahai, Mr M K Shukla, Mr Jagdish Kumar, Mr Indrajeet Ghosh, Mr Ankur Bordoloi and Mr Sunil Kumar, Scientists & Technical Officers, attended the *'10th International Petroleum Conference and Exhibition PETROTECH 2012'*, organized by the PETROTECH Society and the IOCL, New Delhi, October 14-17, 2012
- Dr M O Garg, Director, chaired the Technical (Oral) Session on *'Advances in Petroleum Refining'*, during the 'PETROTECH 2012', New Delhi, October 14-17, 2012
- Ms Rashi Gusain, *'4th International Conference on Advanced Materials (ANM 2012)'*, IIT-Madras, Chennai, October 17-19, 2012
- Dr M O Garg, Director delivered a key-note talk in the *'2nd Indo-German Symposium' on Green Chemistry & Catalysis for Sustainable Development'* under the aegis of the DST & BMBF, Germany, UICT, Mumbai, October 30, 2012
- Mr Harshal P Mungse, Technical Assistant, *'National Conference on Carbon Materials 2012 (CCM12)'*, organized by the Indian Carbon Society & BARC, BARC-Mumbai, November 1-3, 2012.
- Mr Devendra Singh, Scientist, *'Workshop on Design and Analysis of Experiments'*, organized by the Indian Statistical Institute, Kolkata (ISI), Kolkata, November 19-23, 2012.
- Mr Raghuvir Singh, Technical Assistant, *'7th Uttarakhand State Science and Technology Congress'*, organized by the UCOST, Dehradun, November 21-23, 2012.
- Mr Rawel Singh, Technical Assistant, *'International Conference on Industrial Biotechnology (ICIB-2012)'*, Punjab University, Patiala, November 21-23, 2012.
- Mr Pankaj Kumar and Mr S P Saklani, Assistants, *'Workshop on Policies & Procedures in Finance & Accounting'*, CSIR-Institute of Microbial Technology, (CSIR- IMT), Chandigarh, November 26-27, 2012.
- Mr Suryadev Kumar, Scientist and Mr Prasoon Kumar & Mr M K Gairola, Section Officers, *'CSIR IT Nodal Officers' Conference and Training of Trainers Programme for ERP'*, CSIR-SERC, Chennai, November 29-30, 2012
- Dr M O Garg, Director, participated in the '*CPYLS Programme'*, and addressed the students with the Director CSIR-CSIO on the *'Diploma on Fire Fighting'* offered by various CSIR Labs, CSIR-Central Scientific Instruments Organization (CSIR-CSIO), Chandigarh, December 3, 2012
- Dr S K Singal, Chief Scientist and Mr Sunil Pathak, Principal Scientist, *'One-day Workshop on Understanding Real-world Indian Driving Cycle and its Impact'*, CSIR-Central Road Research Institute, (CSIR-CRRI), New Delhi, December 4, 2012
- Dr D K Adhikari, Chief Scientist, Deepti Agrawal, Rashmi, Debashish Ghosh, Diptarka Dasgupta, Scientists & Neelima Shah and Sheetal Bandhu, Project Assistants, *'TAPSUN Conference 2012'*, CSIR-National Physical Laboratory (CSIR-NPL), New Delhi, December 4-5, 2012
- Dr M O Garg, Director, *'Indian National Academy of Engineering Annual Convention'*, CSIR-Central Building Research Institute (CSIR-CBRI), Roorkee, December 6, 2012
- Ms Rashi Gusain, *'8th International Conference on Industrial Tribology (ICIT-2012)',* organized by the Tribology Society of India, Western Koregaon Park, Pune, December 7-9, 2012
- Ms Bhavya B and Dr Thallada Bhaskar, Scientists, *'2nd National Conference on Recent Advances in Bioenergy Research,'* organized by the Sardar Swaran Singh National Institute of Renewable Energy, Kapurthala, December 7-8, 2012
- Mr Mohit Anand and Mr Indrajit Ghosh, Scientists, *'LKMT Workshop 2012 on Challenges in Utility Management in Process Industry,* organized by the Petrotech Society and Lovraj Trust, New Delhi, December 13-14, 2012
- Mr G D Thakre and Dr O P Khatri, Senior Scientists, *'FICCI's Roving Seminar on Industrial Lubricants and Management',* New Delhi, December 18-19, 2012
- Dr M O Garg, Director, delivered the *'Keshava Deva Malaviya Memorial Lecture'* entitled '*From Fossils to Solar – A Road Map for a Petroleum-deprived Future'* on the occasion of the KDMIPE Golden Jubilee Celebrations and Foundation Day, KDMIPE, ONGC, Dehradun, December 19, 2012
- Mr D V Naik, Scientist, *'CHEMCON-2012'* organized by IIChE and NIT, NIT- Jalandhar, December 27-30, 2012
- Dr M O Garg, Director, delivered the Plenary Lecture in *'CHEMCON-2012',* Bhim Rao Ambedkar National Institute of Technology, Jalandhar, December 27-30, 2012

HEALTH-CAMPS

A Blood Donation Camp was organized on December 13, 2012 in which 70 units of blood were collected. Blood Camps are a regular feature in the CSIR-IIP community. The practice has the philosophy of saving lives as its basis.

The First Lady of CSIR-IIP, Mrs Alka Garg, inaugurating the Blood Donation Camp, felicitated by Dr Lalita Bakaya, Sr RMO. Dr M O Garg, Director, looks on

INSTITUTIONAL PARTICIPATION

The Institute participated in the *Exhibition & Annual Convention of the INAE*, CSIR-CBRI, Roorkee, December 5-7, 2012

VIGILANCE AWARENESS WEEK

As per the directives of the Central Vigilance Commission, New Delhi received through the CSIR-Hqrs., New Delhi, the Vigilance Awareness Week (October 29-November 3, 2012) was organized at the Institute which commenced with a pledge on 29th October, 2012.

On this occasion, a debate competition was organized on 02.11.2012 with the topic *"Corruption and Public Servant".*

SOCIAL & CULTURAL ACTIVITES

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