

India International Science Festival 2016*

The Second India International Science Festival (IISF) 2016 was organized to popularize science and pool all scientific knowledge for the larger benefit of rural masses. The focal theme was 'Science for the masses' which focused on communicating Science and Technology to masses and linking science and society. The function was inaugurated by Rajnath Singh, Home Minister of Government of India. Harsh Vardhan, Union Minister for Science and Technology and Earth Sciences, Government of India also graced the occasion.

The festival witnessed various scientific activities under different theme programmes such as Science Village, DST-INSPIRE Camp, Young Scientists Conclave, NGOs Conclave, Industry-Academia Interaction, Scientist-Students Interaction, Mega Science, Technology and Industry Expo, International Science Film Festival, Scientific Laser show, etc. The Science Village is one of the most unique concepts and the programme introduced for the first time aims to reach the unreached and is well connected with the 'Sansad Adarsh Gram Yojna'. Members of Parliament from both Lok Sabha and Rajya Sabha nominated five students each from their adopted villages to participate, gather and acquire knowledge about fundamental science, engineering, and technology in this mega science festival. The participants (students and teachers) of Science Village were distributed under 8 different houses named after 8 distinguished scientists of India (A. P. J. Abdul Kalam, S. Chandrasekhar, Aryabhata, J. C. Bose, H. J. Bhabha, Srinivasa Ramanujan, K. S. Krishnan and C. V. Raman). Innovation in Science Pursuit for Inspired Research (INSPIRE) under the flagship of DST, has an objective to motivate young talented minds of

the country. This programme has an agenda to communicate science at an early age which encourages them to take up science as a career which strengthens human resource pool and expands the science and technology system and R&D base. The most interesting and innovative activity during this event was to set the largest gathering of 550 school students from different parts of India dressed as Albert Einstein. The main objective was to develop a sense of awareness among students about Einstein's contribution to the world. This step broke the earlier Berkeley's Black Pine Circle School (USA) world record for the largest gathering of Albert Einstein lookalikes and by doing so India has made an entry into the *Guinness Book of World Records*.

The Young Scientists' Conclave (YSC) was an effort to provide opportunity for young scientists below the age of 45 years from all over the country to showcase their innovations and technologies to the masses. This event was conducted under 14 themes: innovative agriculture practices and livestock management; indigenous science and technology; waste to wealth; Swachh Bharat; Swasth Bharat; materials for sustainable development; Namami Gange; green energy; green synthesis and cleaner production; sustainable development and cleaner production; smart city; Digital India; Make in India and strategic application. Six plenary sessions were conducted in which several eminent scientists and young researchers shared their research work through a series of highly informative talks. Padma Bhushan Vijay Bhatkar (father of modern computing in India and President, Vijnana Bharati - VIBHA), unfolded the history of electronics in India from the invention of radio till supercomputers. Gulshan Rai (Chief Information Security Officer, India) spoke about the paradigm shift in the field of technology for the last 15 years in India from the World Wide Web to cyber warfare. He also apprised the policies of cyber security adopted by the Government of India. P. Goswami (CSIR-NISTADS) delivered his talk on the topic 'IT pathways to a knowledge society'. Sudhir

Mishra (DRDO, BrahMos Aerospace) talked about the past, present and future prospects of missile technology in India. S. Somnath (Liquid Propulsion System Centre, Thiruvananthapuram) discussed the 'Roadmap for space application and exploration'. Vijaymohan Pillai (CSIR-CECRI, Karaikudi) spoke on the application of engineered carbon for electrochemical energy storage. During Young Scientists' Meeting (YSM), poster sessions were also organized everyday which included topics on various subjects of national importance having great relevance to the society. R. K. Kotnala (CSIR-NPL, India) talked about the hydroelectric cell: a green energy device for the masses. Accentuating the significant role of NGOs in taking science into villages, this year the NGOs conclave was organized to provide a platform for those NGOs which immensely contributed in science and technology as well as rural community development programmes consisting of agriculture, biotechnology, education, environment, renewable energy, women empowerment, etc. Scientist-student interaction was organized to communicate the recent developments in the areas of light, space science and soil science. Distinguished scientists from across the country interacted with the students and young researchers during this meet to ignite their minds.

Industry Academia Interaction (IAI), one of the most important programmes of this festival, provided a distinct platform to various industries/academicians/regulatory bodies/policy makers to have a fruitful interaction through technical sessions on various aspects such as technologies available at national laboratories (CSIR, DRDO, DST, DBT, MoES, ISRO, ICAR, ICMR); industry-oriented curriculum development, entrepreneurs for laboratory ideas to induct able technologies in small industries; metrology for time and frequency, electrical, electronics; metrology for mechanical and metrology for optical parameters; need for environment pollution monitoring initiatives and agriculture and industries. The mega science, technology and industry expo, in which ISRO, DRDO, ONGC, GAIL, ICAR, DAE, CSIR, autonomous

*A report on 'The Second India International Science Festival' (IISF-2016) held at CSIR-National Physical Laboratory, New Delhi from 7 to 11 December 2016. The festival was jointly organized by the Ministry of Science and Technology, Ministry of Earth Sciences, and Council of Scientific and Industrial Research in association with Vijnana Bharati (VIBHA).

institutions of DST, DBT, MoES, IITs, AICTE, UGC, Central Water Commission and BrahMos, participated and highlighted the outstanding achievements of science and technology and R&D institutes of India. At the International Science Film Festival, short films were screened, relevant to our country's scientific needs and aspirations, under various themes: sciences for the masses, scientific approach to problem solving; health awareness with special reference to vector borne diseases; food safety and climate change; indigenous science; ideas and innovations and my perception of science.

In the valedictory function, Harsh Vardhan emphasized on the grand success of 2nd IISF-2016 which set a unique

example of an inimitable festival in bridging the gap between Indian scientific innovations and practices. He also assured the entire youth gathered during the function that the upcoming IISF meet will provide newer avenues for school students especially from rural areas, young researchers and academicians to rise to greater heights. This platform would pave the way in developing new strategies and horizons in science and technology. During this function, young students were awarded for their outstanding projects under the DST INSPIRE programme. Various presentations (both oral and posters) and mega science, technology and industry expo were also awarded. With the motto of 'science for the masses', this science

festival once again created a platform which is an integral part of India's march to creating an innovative society that can play a role in 'Indian Innovation Economy'.

ACKNOWLEDGEMENTS. We thank Prof. Sunil Bajpai, Director, Birbal Sahni Institute of Palaeosciences, Lucknow for encouragement, financial support to attend the Festival and for permission to publish the report.

Shilpa Pandey* and **Md. Firoze Quamar**, Birbal Sahni Institute of Palaeosciences, 53 University Road, Lucknow 226 007, India.

*e-mail: shilpa.bsip@gmail.com

MEETING REPORT

Green chemistry and engineering for sustainable development*

Many chemicals and compounds currently in use are creating an adverse impact on environment and human health. Green chemistry is therefore aiming to develop products which are safe and employ processes that cause minimum damage to the environment.

The GCE 2016 symposium was inaugurated by Suojiang Zhang (Director IPE). It provided a platform for discussions on the latest research and innovation in science and technology of green chemistry for sustainable development. The topics covered included a wide spectrum of renewable energy sources, catalysis, nanotechnology, computational chemistry, energy storage and supercapacitors, green solvents and green carbon science and technology. In the two and half-a-day symposium, there were 11 plenary lectures delivered by scientists from China, India and Korea. In addition

to plenary and invited lectures, 37 poster presentations were held. Participants were from Mongolia, Myanmar, Thailand, Vietnam and Pakistan in addition to those mentioned above.

Two main highlights of the symposium were Green Catalysis and Green Solvents. As catalysts are used in almost 25% of all chemical reactions, to avoid their adverse impact on the environment, green catalysis provides solutions in green chemistry by reducing the amount of waste generation. The catalyst is either recyclable or degradable. Metal Organic Frameworks (MOFs) act as precursor to green catalysis for many reactions. MOFs are known CO₂ capture materials and are used for carbon conversion and utilization, said J. Li (Beijing University of Technology, China).

Green solvents are replacing conventional solvents to minimize their chemical persistence in the environment. At present almost 75% of the chemical reactions need solvents and approximately 20 million tonnes of organic solvents are discharged into the environment every year. Most vital green solvents are CO₂ in supercritical phase, water as well as ionic liquids (ILs). The ILs made of organic salts, constituted by ion pairs having low melting point, are most

promising. They can dissolve cellulose for biofuels, used in hydrocarbons separation, for CO₂ capture and many other potential applications. Many presentations in the symposium were on advanced research in ILs as green solvents and their applications in CO₂ conversion. Performance improvement research on hydrotalcites and ILs were presented by C. Li and team (IPE).

On carbon capture storage and utilization (CCSU), there were a few papers, though none talked of storage. Malti Goel (Climate Change Research Institute and Former Adviser, Government of India) described recent advances in carbon capture and utilization taking place for mitigation of climate change. Green technology perspectives from energy intensive industry were presented. China being the highest coal user in the world and the chief emitter of CO₂ has carried out several assessments of improving the efficiency of CO₂ utilization processes. In the symposium Z. Liu (Institute of Chemistry, CAS, China) discussed research on microporous fluorinated organic polymers for CO₂ capture and conversion. Phenolic azo-polymers exhibit a high CO₂/N₂ separation selectivity. B. Han (also from Institute of Chemistry), while discussing properties and uses of

*A report on the CAS-TWAS Symposium on Green Chemistry and Engineering for Sustainable Development (GCE 2016), held in Beijing during 28–31 August 2016. It was hosted by the Chinese Academy of Science (CAS). The World Academy of Science for the Advancement of Science in Developing Countries (TWAS) and Organized by the Institute of Process Engineering (IPE), CAS.