

Chemistry for Harmonious Development and Sustainable Future

Advances in chemistry in recent years have undoubtedly created considerable benefits for humankind which have led to improved health, enhanced quality of life, a better environment, and more sustainable development. At the same time, new scientific discoveries may lead to new risks, including the potential for new chemical compounds to be used in chemical warfare. The rapid increase in the use of chemicals and its build up in our environment also comes at a price for human health and biodiversity. Many toxic chemicals have been associated with direct impact on global warming, polluted air and water, causing chronic health problems. As our understanding of chemistry and science increases, so must our sense of responsibility towards harnessing chemistry for humanity's cherished goal of peaceful, happy and harmonious coexistence. Strengthening the positive aspects of chemistry through research and development is necessary to maintain harmony between human kind and nature. It is also important to raise awareness and educate people regarding various beneficial uses of chemicals, recent innovations, potential risks, trends and practical challenges in the field of chemistry.

In an endeavour to provide a common platform for researchers and students from academia and industry to share their valuable views, experience and research on the peaceful uses of chemistry, Department of Chemistry, Shyam Lal College, University of Delhi organized a UGC-sponsored two-day conference entitled 'National Conference in Chemistry: Environment & Harmonious Development (NCC-2016)' on 7-8th April 2016 at the India International Centre, New Delhi. The Conference also aimed to raise awareness about the Chemical Weapons Convention (CWC), an international disarmament treaty which came into force on 29 April 1997, banning the development, production, stockpiling, transfer, and use of chemical weapons worldwide. Thirty-five scientific papers and seventy posters were presented by the students and researchers showcasing their latest findings and new developments in the field of chemistry.

Dr. Rakesh Kumar Sharma, Scientist from CBRN Defence, INMAS, DRDO in his keynote address talked about the surge in terrorist acts involving hazardous chemicals and chemical warfare agents. He emphasised on pro-active integration of chemical intelligence into military doctrine and homeland security. The second keynote address was given by Mr A D Bhatt from National Authority for Chemical Weapons Convention (NACWC). He told the audience about NACWC which was established under the Chemical Weapons Convention Act, 2000 for implementing the provisions of the Convention and was signed on behalf of the Government of India at Paris on 14th January, 1993. He apprised the participants that UGC in its letter in 2015, directed all the universities and institutions to incorporate vital issues such as weapons of mass destruction, disarmament and peaceful uses of chemistry in the University Curricula.

Plenary sessions set the scene for the Conference and included presentations by leading scientists engaged in cutting-edge research. The first plenary session (PL-1) entitled 'Interface of Chemistry & Biology' discussed how science at the chemistry-biology interface brings the synthetic, mechanistic and analytical powers of chemistry to bear on new and exciting areas of biology. Prof. Dr. Pawan K. Dhar, School of Biotechnology, Jawaharlal Nehru University discussed the emerging trends in synthetic biology. He presented his inspiring work on artificially made genes and proteins from non-coding and not-coding DNA, historically called 'junk DNA' Prof. Dr Ashok K Prasad, Department of Chemistry, University of Delhi, discussed

how biocatalysts are an attractive alternative to conventional chemical ones. He described an environmentally harmonious way to synthesize novel nucleosides, amphiphiles and [2] Pseudorotaxanes using enzymes. Prof. Dr. Prasenjit Ghosh, Indian Institute of Technology, Bombay, illustrated a new “wonder ligand”, the N-heterocyclic carbenes (NHCs) and their utility in biomedical applications.

The second plenary session was about environmental sustainability. Prof. Dr. Dileep K. Singh, Department of Zoology, University of Delhi shared his work on bioremediation of agrochemicals such as Endosulfan, DDT and Lindane and heavy metals *viz.* Cu, Cd, Ni, Zn, Pb and Cr present in Yamuna and drainage water used for irrigation in urban and peri-urban agricultural areas using fungal and bacterial strains. Later, Dr K K Sharma, Network Coordinator, All India Network Project on Pesticide Residues, Indian Agricultural Research Institute informed the audience about the project on pesticide residues being carried out in a network of 15 laboratories since 1984-85 by Indian Council Agricultural Research (ICAR). The project aimed at developing uniform protocols for the safe use of pesticides by recommending ‘good agricultural practices’. He also shared that in order to know the status of pesticide residues in market samples, government has started a central sector scheme, “Monitoring of Pesticide Residues at National Level” in food commodities and environmental samples like water. Dr. S. K. Tyagi, Scientist, Central Pollution Control Board (CPCB) discussed about the status, challenges and strategies in air pollution management in India. He stressed on the fact that contribution of every citizen is equally important in reducing air pollution.

The third plenary session was on 'Innovations in Green Chemistry'. The session focused on sustainable methods, which seek to reduce chemical related impact on human health and the environment, by the use of alternative, environmentally friendly processes and reaction media called Green Chemistry. The session was presided over by Prof. Dr. Arun P. Kulshreshtha, Director General, Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T). In a captivating talk, Prof. Dr. D S Rawat, Department of Chemistry, University of Delhi shared his work on novel recyclable heterogeneous catalysts and nanomaterials for the synthesis of a variety of organic molecules of biological importance. Prof. Dr Mahendra Nath, Department of Chemistry, University of Delhi discussed the development of eco-friendly synthetic protocols using *p*-dodecylbenzenesulfonic acid (DBSA) for diverse arenes and heteroarene analogues.

Dr Sanjeev Kumar Balyan, Hon'ble Minister of State for Agriculture & Food Processing Industries said that chemistry and biology are the main knowledge sets necessary to understand and solve environmental issues. He congratulated the organizers for creating a platform for fruitful deliberations which will deeply enhance awareness about our responsibility towards the environment. Plenary session was on the 'science of the total environment'. Total environment is characterized where the five spheres *viz.* atmosphere, hydrosphere, biosphere, lithosphere and anthroposphere overlap. Prof. Dr. Shrikant Kukreti, Department of Chemistry, University of Delhi unveiled the wide range of effects that the environment may have on the chemistry of biomolecules such as carbohydrates, proteins, enzymes, lipids and nucleic acids and so on to the human health. Prof. Dr. Radhey Shyam Sharma, Department of Environmental Studies, University of Delhi introduced the concept of bioprospecting which is a process of discovery and commercialization of new products, based on biological resources. He also

stressed on the need for ecosystem restoration that is central to achieve the goal of harmonious development and to improve the quality of life.

The plenary session was on the peaceful uses of chemistry. In this session, Dr Anil K Mishra, Scientist, Molecular Imaging and Research Centre, INMAS, DRDO elaborated the ambitious scope of peaceful nuclear energy activities for humankind. He shared his work on the development of several radiopharmaceuticals and MR imaging agents which are as an integral component of nuclear medicines necessary for imaging deadly diseases in human origin. There is a widespread discussion going on in the scientific community how nanotechnology can be used against humankind by concealing weaponised molecular structures with a benign and target-friendly exterior. Prof. Rita Kakkar, Department of Chemistry, University of Delhi revealed how agents of chemical and biological warfare in the hands of terrorists pose a serious threat to mankind. She discussed the work being carried out in her research group on nanotechnology and explained how it can possibly fight terrorism, by taking the warfare agent sarin as an example.

NCC-2016 also became a forum for amalgamation of academia and industry. Mr Rohit Kumar, Director, Guiding Star Digital Publishers discussed about the emergence of global 'Knowledge Economy' and its impact on the education system due to the rapid advancement in information, computing and communication technologies. Ms. Vanya Rohan Gupta from Chapter Apps Inc in her talk 'Bringing Sustainability & Harmony to Education' covered the concept of paperless classrooms. With the advent of technology, students can do their homework, take their tests, and download all of their study materials online. She pointed out that going paperless can have a huge impact on the environment.

An open panel discussion with the participants on 'Role of Chemical Weapon Convention in Chemical Education' was steered by Mr A D Bhatt, NACWC. The key findings and recommendations emphasized the for every chemist in the world to be aware of the potential of their work to be misused, and the steps they can take to prevent that from happening. It was also realized through the discussion that the subject of chemical weapons disarmament provides opportunities to introduce students to the nexus of science and international diplomacy, perhaps inspiring chemistry students to use their scientific training to bring technical insight into policy and diplomacy.

The the Valedictory address of NCC-16 was delivered by by Hon'ble Leader of Opposition in Delhi Assembly, Mr. Vijender Gupta, Mr. Gupta pointed out that we have reached a threshold level of development in the field of chemistry where we have to promote a conducive environment as well as ensure harmonious and sustainable development.

Prizes were given away for best paper and best poster presentations.

. The conference successfully brought together the collective knowledge of academia, industry and government in order to address the duality of chemistry, role of chemistry for environmental sustainability, education and outreach and implementation of the Chemical Weapons Convention in a broader educational context.

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