Chemistry's in Sciences – IYBSSD celebration in Pakistan

by Rafia Azmat

The 3rd International Chemistry Conference and its Role in Sciences (ICCRS III) was held from 3-5 January 2023 at the University of Karachi in Pakistan under the auspices of the International Year of Basic Sciences for Sustainable Development (IYBSSD) and themed **"Sustainability: Basic to Advance Sciences."**

The Vice Chancellor of the University of Karachi, Khalid Mahmood Iraqi, and Chief Guest, Special Assistance to Chief Minster Mr. Tariq Hasan, and the Dean of the Faculty of Science, Samina Bano; Chair, Rehana Saeed; Chief Organizer, Rafia Azmat and guests from National and International Universities, took part in the inauguration Ceremony of IYBSSD 2022. The Chair of the Conference, Rehena Saeed, welcomed the guests of honour and all participants. She discussed the ICCRS III in the context of Basic Science subjects, the role of the Department of Chemistry and highlighted the UNESCO endorsement and agenda for 2030.

Rafia Azmat, a chief organizer of ICCRS III, provided information about the past ICCRS events and the IYBSSD 2022. She thanked several renowned scientists from National and International Universities. Furthermore, she highlighted the engagement of the Pakistan Scientific community with event: 155 abstract submissions, of which 135 were selected, 250 attendees daily for each of the three days. Azmat also highlighted the well wishes of the IUPAC team for this event and their encouragement for closer collaboration of the Pakistan Scientific community within international community.

In his opening remarks, the Vice-Chancellor of the University of Karachi, Khalid Mahmood, welcomed the Chief Guest, Distinguished Delegates and the Participants. He shared his wisdom for uplifting the University of Karachi. He expressed his appreciation to the organizers of the Conference, i.e., the Department of Chemistry of the University, for celebrating the IYBSSD. He argued that the sustainability of the planet is strongly linked to a clean drinking water supply and therefore expressed his support for research on running stream safety, especially drinking water. He hoped that Universities contributing to the Conference achieved the agenda for 2030. In his address as Chief Guest, Mr. Tariq Hasan, a political leader, said that we will achieve the agenda of 2030 and pledged Government support for researchers to develop Basic Science subjects in their universities, colleges, and schools. Finally, he thanked the University of Karachi for providing the chance to learn and stand with IYBSSD 2022.

The ICCRS scientific program consisted of several sessions related to basic to advanced sciences, including four workshops:

1. Impact of fake news (related to fake research and news for sustainability).
2. Workshop on forestry, based on a green transformation, in which discussion on why forests and natural livestock are indispensable for human beings; and need for sustainable practices.
3. Chemical Education workshop, attended by school and college-level students from 9th to 12th grade (80 students) in which one participant from the USA (Sarah Usmani) was online. Ailiyan Saleem and Rafia Azmat explain different terms used in chemistry attractively and easily. In these units, the kinetic theory of gases and gas laws, solutions, number of moles, oxidation-reduction reactions and transition states were discussed and explained.
4. Patent, writing, filing, and commercialization was presented as an advanced part of this Conference.

Renowned scientists from national and international universities in person and online discussed their latest research and contributions to sustainability and development in different sessions. Some of these are highlighted below as a best part of the achievements in different Basic Science subject areas.

Azhar Mahmood (University of Science and Technology) presented the research work of his group on the development of waterproof and heat-resistant Montmorillonite clay-modified high-pressure plywood composite from renewable and inedible agricultural waste. Azhar et al. said their group's research has good potential to develop marketable, improved-quality plywood products that can contribute to sustainability.

Fouzia Sadiq, National Lead in Familial Hypercholesterolemia (FH), in collaboration with the Shifa Tameer-e-Millat University (STMU), Islamabad, spoke about introducing Pakistan's first-ever registry of FH patients at her university. She also discussed her recent launch of the first paediatrics lipid clinic in Pakistan at Shifa International Hospital, Islamabad, the teaching hospital of STMU. She said the clinic helps to identify FH patients during childhood, offering timely disease management. FH patients are also offered free genetic screening for susceptibility. In her online presentation, Sabina Jhaumeer-Laulloo, University of Mauritius, discussed surfactants. She discussed the manifold roles of surfactants, in which amino-acid-based surfactants attract much interest because of their biodegradability, low toxicity and favourable biological properties. Her

Attendees listen to a lecture at The 3rd International Chemistry Conference and its Role in Sciences (ICCRS III) at the University of Karachi in Pakistan.

research group synthesizes and characterizes cationic and non-ionic aromatic amino acid-based surfactants from L-phenylalanine, L-tyrosine, and H-Tyr(3-OH)-OH, as well as their Gemini surfactant derivatives. These show good antibacterial activities, which are influenced by the length of the hydrophobic tail.

Waseem Ahmed (University of Haripur) discussed bio-drugs and their role in human life. He said that the world is dealing with many health-saving and curing medicines, but many lives are lost due to substantial infection resistance. Natural bioactive compounds like polyphenols, flavonoids, terpenoids, alkaloids, carotenoids, stilbenes, and anthocyanins from fruits, vegetables or medicinal herbal plants might replace synthetic drugs to avoid resistance to infections. The exploration, biosynthesis, and amplification of the potential biological activities of natural and non-natural molecules have remained among the most exciting trends in biotechnology products and future medicine concepts. Qaiser Jabeen exposed the analgesic, anti-inflammatory and anti-arthritic properties of Viola canescens (locally known as Banafsha), which is beneficial in the treatment of arthritis and prevents weight loss. Nidaa Haroon (University of Okara) reported on the highest bioactive compound in the methanolic extract of Casuarina equisetifolial. Some other scientists also highlighted the significance of natural bioactive compounds as a future natural medicine.

In the Nanotechnology session, several scientists from across Pakistan presented their research on the synthesis, characterization and application of nanoparticles (NPs). Their applications include controlling microbial activity, managing metal pollution, dye wastewater management, curing wrinkles on textile fabrics and cleaning action, drug discovery, use in LED lights and green chemistry. Hajira Tahir, in her lecture, highlighted the latest research in nanotechnology that addresses pollution prevention using a green synthesis of nanomaterials and products. Zeshan Akhtar and his group presented their research using TiO_2 and SiO_2 for self-cleaning and antimicrobial activities on cotton fabrics individually and in combination to observe any synergy. Characterization revealed that the approach was successful as the treated fabric showed self-cleaning and antimicrobial features, but no synergy between the materials was observed. Shiza Tariq use Se NPs with growth-promoting rhizobacteria (PGPR) to control Cd metal accumulation in plants. Rehana Saeed discussed the application of Ag NPs on dye degradation. At the end of the session, a group of scientists (Rafia Azmat, Rehana Saeed, Hajira Tahir, Zeshan Akhtar and Fakher un Nisa) explored the activity of NPs. They concluded that nanoparticles show a similar distribution of energies as atoms and molecules, and therefore follow the Maxwell-Boltzmann distribution.

A new advanced oxidation process (AOP), namely a magneton reaction using KMnO4, urea, acid, base, and a neutral medium, was discussed by Rafia Azmat and her Ph.D. scholar Mohammad Hasan (University of Karachi). They reported an AOP where two oxidizing species, namely nascent oxygen [O] and Urea--hydrogen-peroxide complex [UHC], were established for the first time to restore dye wastewater at low pH with no sludge. Sludge was reported at neutral and basic pH. The pH of the filtrate was 7.6. They reported that the sludge and filtrate were both beneficial for the growth of the plants in the soil and aquatic life, respectively, and concluded that the magneton reaction has advantages over the existing oxidation process for soil and running streams. Rehana Saeed (University

of Karachi) talked about restoring of dye wastewater through adsorption on ground fruits and nuts peels without degradation to control dye pollution for running stream safety. Iqleem Haider Taqvi highlighted the contamination associated with drinking groundwater which is the main source of water supply for many countries, including Pakistan. Iqleem *et al.* plan to investigate the degradation of groundwater due to interaction with rock and soil in the province of Sindh using spatial mapping of elements in the soil.

Ponnadurai Ramasami (University of Mauritius), a renowned scientist, discussed basic of computational chemistry and recent advances, while other participants also discussed the significance of computational modelling in the current era. Specifically Sobia Ahsan Halim *et al.* from the University of Nizwa, Oman in her online presentation, talked about her targeted studies on prolyl-specific oligopeptidase (POP) because of its interesting role in the progression of several neurodegenerative disorders. She said that the current inhibitors of POP suffer from poor selectivity for protease and less permeability to the blood-brain barrier (BBB). The predicted pharmacokinetic profile suggests that these molecules might function as effective inhibitors. Raheela Naz (University of Karachi) discussed her interest in the computational modelling of different oxidation states of Mn and Fe as important growth nutrients of plants on different bioactive compounds like chlorophyll and works on comparing plants' growth under different oxidation states. Liang Cheng from the Chinese Academy of Science discussed the oxidation phenomenon involved in various biochemical pathways that play a crucial role in numerous pathological events and clinical situations. The precise oxidation states in biological nucleic acids accurately control cellular signalling pathways and have been recognized as a major target for potential pharmaceutical intervention.

Janusz Lipkowski from the Polish Academy of Science talked about hexagonal clathrate lattices, which are formed by Ni(NCS)-2-(4-methylpyridine)-4 (as host) with benzene derivatives (as guests). Two isomers of 1-bromo-4-nitrobenzene (bromonitrobenzene, ortho- and meta-) and 1,3-dinitrobenzene were used as the guest molecules for clathrate preparation. A significant influence of the type of guest on the observed phenomena was found. Clathrates, which are hexagonal at room temperature, undergo significant structural modifications at lower temperatures, which in turn is associated with ordering the guest molecules.

Syed Mohammad Nizami discuss climate change and its impact on the forest cover of the moist temperate forest, resulting in forest fragmentation. He highlighted in his research that if scientific management is carried out properly, fragmentation will be stopped, and carbon stocks will be enhanced to cope with climate change effects in moist temperate forests.

Hussain Kara from Turkey discusses the design of a new hyphenated supercritical fluid system for extraction, determination, and separation of bioactive compounds from medicinal plants and their capsulation for commercial purposes. Khekashan Khan talked about food safety. She said that food safety had long been a matter of concern. The high consumption of processed and red meat is associated with increasing risk to health. N-Nitrosamines (NAs) are a class of carcinogenic compounds in food products. Higher NA content has been reported in protein-rich foods in contrast to vegetables, cereals, etc. These may be a part of raw materials or generated during food processing or storage. N,N-Dimethylnitrous amide (NDMA) is one such carcinogenic compound. It is a semi-volatile organic compound, formed during industrial and natural processes. NDMA exposure may also cause liver damage, fever, nausea, jaundice, vomiting, abdominal cramps, and dizziness. Moreover, aquatic-origin meat contains a higher amount of NDMA. However, antioxidant addition and limited nitrite and nitrate use decrease NA formation in processed meat. These toxins can also be reduced using lactic acid bacteria as a quality enhancer and flavouring agent for food products. Furthermore, ascorbic acid also inhibits the formation of N-nitrosamines. Hence, mitigation strategies should be further improved to reduce N-nitrosamines formation in food products.

Conclusion

The experience of the IYBSSD-2022 at the University of Karachi brings very strong coordination among the Scientific community of Pakistan with International Scientists. The participants from Pakistan and different countries reflected their gratitude that the Conference which was held under the auspices of the International Year of Basic Sciences for Sustainable Development (IYBSSD 2022). Almost all participants enjoyed Sessions and four workshops, especially Chemical Education and Patent filing, which was the first experience of those at any conference. Moreover, innovative outcomes of the Conference, including a conclusive statement regarding Nanoparticles activity that the size of NPs is significant where a large surface-to-volume ratio is involved in the activities of the NPs, two oxidizing species for restoration of dye wastewater, use of bioactive compounds as future medicines, capsulation of natural products and quality plywood products were highly appreciated.

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