Science Academies' Lecture Workshop

On

"Fundamentals of Chemistry"

28th-29th April 2023

Sponsored by

Organized by

Department of Chemistry

Dibrugarh University
(Dibrugarh, Assam-786004,
India

Report

A two-day science academies' lecture workshop on "Fundamentals of Chemistry was held on 28th to 29th April 2023 at Dibrugarh University. The workshop was organized by the Department of Chemistry, Dibrugarh University. The Lecture workshop was sponsored by the Science Academies, Indian Academy of Science (IASc) Bengaluru, Indian National Science Academy (INSA), and National Academy of Science (NASI) New Delhi. Professor Uday Maitra, Department of Organic Chemistry, Indian Institute of Science, Bangalore was the convener and Dr. Surajit Konwer, Department of Chemistry, Dibrugarh University was the coordinator of the programme. A total strength of one hundred fifty (150) students from different colleges from the three different districts along with host institution itself also took

part in this workshop. Apart from, the faculties, non-teaching staff of the host department were involved in this event to make it a grand success.

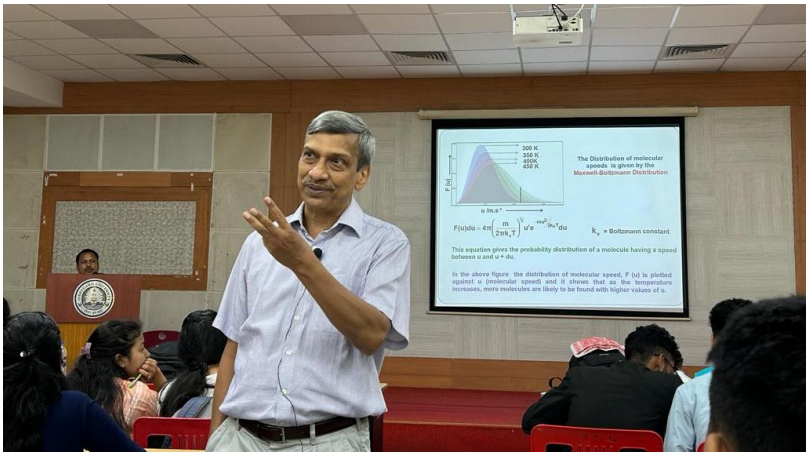
A total of 8 lectures (each of the 4 resource persons gave 2 lectures) of 90 minutes duration including a beautiful chemistry experimental demonstration were delivered by the four well-known Indian scientists/teachers covering the fundamental aspects of chemistry in this Science Academies' lecture-workshop. The topic of the lectures was carefully selected by the convener Professor Uday Maitra, IISc, Bengaluru, to ensure that the participants get a comprehensive understanding of the fundamentals in chemistry in order to pursue their studies further. There were altogether 8 lectures delivered by the following:

1. Prof. Uday Maitra, Department of Organic Chemistry, Indian Institute of Science, Bangalore, 560 012
2. Prof. Pushpendu K Das, Department of Inorganic, and Physical Chemistry, Indian Institute of Science, Bangalore, 560 012
3. Prof. Tapan Kanti Paine, School of Chemical Sciences, Indian Association for the Cultivation of Science, Kolkata 700032
4. Prof. Suhrit Ghosh, School of Applied and Interdisciplinary SciencesIndian Association for the Cultivation of Science, Kolkata 700032

Two-day Science Academies' Lecture workshop was inaugurated on 28th April 2023 at 9.00 AM in Indira Miri Conference Hall where Prof. Jiten Hazarika, Vice Chanchellor of the University, inaugurated the two-day workshop. Dr. Dipak Chetia, Dean, Research and Development, Dibrugarh University graced the occasion as a chief guest. Prof. Geetika Borah, Head of Department of Chemistry, Prof. Uday Maitra, Convener of the workshop, Department of Organic Chemistry, IISc, Bangalore, Prof. Pushpendu Kumar Das, Chaireman of three Indian science academies', IISc. Bangalore addressed the gathering to set the tone for the event. Prof. Tapan Kanti Paine, School of Chemical Sciences of IACS, Kolkata, Prof. Surhit Ghosh, School of Applied and Interdisciplinary sciences of IACS, Kolkata were present on the dias. Dr. Surajit Konwer, the programme coordinator, Department of Chemistry, expressed her wishes and gave a vote of thanks.

The first lecture was delivered by Prof. Surhit Ghosh on *"Introduction to Polymer Chemistry"*. He started out with the history of rubber and how rubber was thought to be used of as polymer to teach about the difference between chain growth polymerization and step growth polymerization using various illustrations. During his talk he explained that, although polymeric materials play a pivotal role in our life, but they too pose a major threat to the environment in terms of their decomposition. In his first lecture he concluded that bioplastics also make it possible to develop innovative and alternative solutions compared to conventional plastics.

The second lecture was given by Prof. P. K. Das on *"Chemical Reaction Rates- why are they still important to measure?"*. He made the audience familiar with the concept that the reaction of H_2 molecule and I_2 follows simple 2^{nd} order kinetics, whereas that of the reaction of H_2 and Br_2 follows a photochemical reaction mechanism with order of 3/2 and that H_2 with O_2 follows an explosion reaction mechanism.



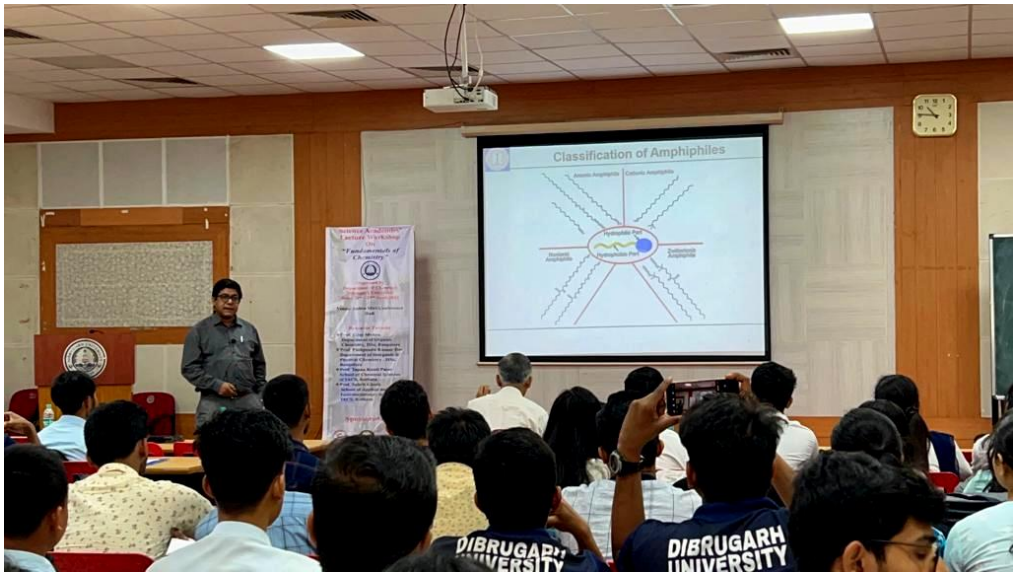
After the lunch break, it started out with the third lecture by Prof. T. K. Paine on *"Chlorocarbons- From boon to bane"*. He started out by telling about what are chlorocarbons and emphasized on a fact that ice relies on the principle that solid ice absorbs heat from its surroundings and melt.

During his lecture he explained about the mechanism of refrigerators and about chloroflurocarbons (CFCs) He then mentioned about some of the environmental problems that arise due to petrochemicals and other toxic and non-biodegradable chemicals. He mentioned about DDT (Dichloro-diphenyltrichloroethane) as a well known pesticide, but again it possessed healt risk to humans and the environment. He mentioned about a herbicide named 'Agent Orange', a defoliant to destroy the forest cover, so that the communist forces do not find place to hide themselves during the Vietnam War (1970s). He concluded by mentioning about the bad effects of chloroform that was used as an anesthetic during early years because it caused liver injury.

The 4th lecture of day-1 was delivered by Prof. Uday Maitra on *"Stereochemistry, conformation and reactivity"*. During his lecture he explained what is stereochemistry and raised several questions that why tetravalent carbon-atom is tetrahedral in structure, why the tetrahedral bond angle is 109.5° etc. He taught about diastereomers, enantiomers and also mentioned about mesomerism citing the example of meso-tartaric acid. He also taught about conformation, that it can be defined as the shape adopted by a molecule caused by optical rotation around one or more single bonds. He concluded by asking the students to solve some basic questions like, who discovered the triple helical structure of collagen, what is the IUPAC name of infinitine, is 4,5-di-(tert-butyl)oct-1,3,5,7-tetraene optically active, etc as home assignments. All four speakers cleared the doubts of the students with intense interaction during their classes. Every student left the first day inspired and motivated to approach these concepts in a different light in the future.

The second day of the Lecture Workshop program started at around 9:00 a.m. The first lecture of day-2 was by Prof. Pushpendu K Das on *"Chemical Reaction Rates- why are they still important? – Part 2".* The lecture started interactively with a discussion of the transition state theory which also known as the theory of absolute reaction rates is essentially a refined version of collision theory, which treats the reacting molecules as the rigid spheres without any internal degree of freedom. He explained that the theory explains the rate of chemical reaction assuming a special type of chemical equilibrium between the reactants and the activated state (transition state complex). This transition state molecule decomposes to form the products of the reaction. The rate of this reaction is then equal to the rate of decomposition of activated complex. It was truly an eye-opening session that introduced the students to new, exhilarating possibilities.

The 2nd lecture of Day-2 was by Prof. Surhit Ghosh on *"Amphiphiles"*. He started out by telling us about amphiphiles and defined as molecules possessing both hydrophobic (water-loving, polar) and hydrophobic (water-hating, non-polar) properties. He covered about concept of saturation point and also explained about micelle and micelle formation where micelles are formed by self-assembly of amphiphilic molecules. He concluded by telling the students that amphiphilic polymers have low CMCs, high stability and enhanced permeability.



The third presentation of Day-2 was by Prof. Maitra on *"Learning Chemistry from Simple experiments"*. He started out with an experiment on combusting a balloon filled with methyl chloride. He presented the experiment of elephant toothpaste wherein hydrogen peroxide reacts with soap solution to form excessive foam with the liberation of oxygen gas. Then two of the volunteers among the students were being called up the stage to hold a big-sized paper on to which ferric chloride solution was sprayed, and amusingly, it was written, "CHEMISTRY IS FUN" with alternate letters in red-blue colour. It seemed to be like a magic. He beautifully explained that it was the reaction of potassium ferrocyanide with ferric chloride solution that gave rise to the blue-coloured potassium iron(III) hexacyanoferrate(II) and the red-colour of the letters were due to the reaction of potassium thiocyanate with ferric chloride to give ferrous thiocyanate. He also explained the reactivity order of butyl chloride, 2-chlorobutane and tert-butyl chloride by presenting the reaction of these alkyl chlorides with silver nitrate solution. The 3° alcohol formed a white precipitate of silver chloride instantaneously, whereas the other, 2° and 1° reacted very slowly with deionized silver nitrate solution. He also showed experiments related to chemilumnescence in a very impressive manner. He concluded presenting the periodic table song sung by the musical humorist and lecturer Tom Lehrer at Harvard. The experimental presentation was very exciting and interesting for the participants.

The last lecture of the workshop was by Prof. Paine on *"Metal (ions) in biology"*. He started out by telling about what are essential and non-essential elements for the living system. He covered about how metal ions into living organisms have incorporated and how it changed over time. He also explained that major (Fe, Mn, Zn, Mg) and minor (Cu, Co, Ni, Mo, W) metal ions have become aligned with living organisms through the interplay of biogeochemical weathering and metabolic pathways involving the products of that weathering. He also covered about transferrin, ferritin, haemoglobin etc. and about the different structures of protein, viz., primary, secondary, tertiary and quaternary. He concluded by mentioning about the main fields of research in bioinorganic chemistry like biomineralization, biomimetic chemistry and bioinspired catalysis.

The closing session of the workshop comprised of the feedback from the students and their closing remarks. In the feedback session, the young and energetic participants from various

colleges expressed their views about the lecture workshop. They felt this workshop was really beneficial for them and will help them in the future. This kind of workshops also helps to gather more information as well as knowledge about various topics in Chemistry that are related to each other. So they suggested that this kind of workshop should be continued more in the near future. They appreciated the lectures delivered by resource persons and the good arrangements made by the Department of Chemistry, Dibrugarh University.

The closing address was given by Professor Uday Maitra, Convener of the Lecture Workshop. He thanked the organizer Department of Chemistry, Dibruagrh University and the three science Academies' for their financial support to successfully conduct the workshop.

An award was also given by Prof. Maitra to the participant for the successful completion of the home assignment given by him.

The workshop was concluded by a vote of thanks given by Prof. Surajit Konwer, Assistant Professor, Dibrugarh University. He expressed his heartiest gratitude to all the esteemed speakers for sparing their valuable time for the students. The speakers made up to their best to impart knowledge about the subject.

The workshop was eventually a successful one.

Details of Participants

Sl. No.	Institutions / College	Participants representing institution
1	DHSK College, Dibrugarh	16
2	MDKG College, Dibrugarh	11
3	Dibru College, Dibrugarh	11
4	Tinsukia College, Tinsukia	12
5	Silapathar College, Dhemaji	11
6	Dibrugarh University	89
Total		**150**

Composition of participants

Sl. No.	Composition of participants	Number
1	Teachers	22
2	Students	128
3	**Total**	**150**