REPORT ON SESSION- III

The topic of the session was **"Green Chemistry and Green Technology"**. The main focus of this session was on sustainability, design, source, reduction, innovations and viability. Green chemistry involves the invention, design and application of chemical products and processes to reduce or to eliminate the use and generation of hazardous substances. Green chemistry is not limited to chemistry only. It aims with interdisciplinary approach to study the development and design phase rather than waste treatment. There is a need to switch to the greener part of the chemistry now to save our earth and environment.

Prof. V. S. Parmar, Head, Department of Chemistry, University of Delhi, was the chairperson of this session. He emphasized the need of biology driven pharmacology and strong interactions between biologists and chemists is required. According to him, green chemistry is no longer an option but it is a compulsion and chemistry can't move without biology and biology can't move without chemistry. He was glad to see the involvement of undergraduate students in oral/poster presentations.

The speakers of the session were as follows:

- Prof. R. K. Saxena, Department of Microbiology, University of Delhi,
- Dr. V. C. Kalia, Scientist F, Institute of Genomics and Integrated biology,
- Prof. H. U. Dahms, Sangmyung University, South Korea and
- Dr. Rita Kumar, Scientist G, Institute of Genomics and Integrated biology.

The first speaker, **Prof. R. K. Saxena** talked about "**leather processing: a Global Challenge for Biotechnologists"**. He explained how leather processing can be carried out by biotech process. His main work was on hydrolytic enzymes. He explained the advantages of Bio processing over chemical processing. Bioprocesses are novel, use catalyst, less capital expensive and byproducts are not hazardous. It is basically use of enzymes implicated in many processes. Enzymes have very little impact on environment so enzymes can be boon for the leather industry.

His achievements are:

- Enzyme mediated dehairing and
- Enzyme mediated defleshing.

Pilot plant of 30 L, 200 L and 300 L capacity are working in his laboratory in University. He challenged the participants "To search an enzyme which can grow hair on bald head surface".

The second lecture was delivered by **Dr. V. C. Kalia** on **"Microbial Genomics in aid of Greener Technologies for Production of Bio energy and Bio products"**. He said bacteria can do anything or everything for us. According to him, the main causes of environment pollution are waste disposal and fossil fuel. He explained the production of

bio fuels (methane, hydrogen) and bio plastic (Poly hydroxyl alkanoate) by anaerobic digestion of biological waste.

He searched:

- Novel microbes which can be easily grown on the waste which produces hydrdrogen
- An organism (Burkholderia fungorum) which not only help in producing hydrogen but also produces bio plastic.

He reported that municipal waste can be degraded up to 50 %. Industrial waste, pollutants and aromatic hydrocarbons can be degraded by microbes. He developed an enrichment technique to collect bacteria from Nazafgarh drain. His main mission is"**Grass to gas**". He thinks that judicious use of bio waste will ensure a bright future for India.

The third speaker was **Prof. Hans-Uwe Dahms**. He talked on "**UVR Effects on Communities, Organisms and Molecules – Implications for basic and Applied Research**".

In his talk, he emphasized on the increase in solar UVR (Ultra Violet Radiations) during the last few decades and provides an important ecological stressor with global impacts mainly in polar region.

According to him the UVR effect depends on:

- Photon flux – density of spectral composition
- Environmental UVR gradients in space (air & water) and time (deil, seasonal, inter annual). While UVR penetration in atmosphere depends on
- Latitude
- Elevation
- Cloud Cover
- Atmospheric Composition, and
- Industrial Activities (Photochemical smog, Ozone)

And UVR penetration in water column depends on

- Ice / Snow Cover
- Surface turbulences (Waves)
- Depth
- POM (DOM/DIM)
- Density of Organism

He explained that all plants, animals and microbial lives are susceptible to UVR to a highly variable extent which depends not only on the individual organism but also on the other factors of its environment. UVR effects on organism are:

- Animals – orientation, motility, pigmentation, metabolism and growth

- Plants – Photosynthesis

He explained that UVR has been found to affect DNA to increase mutation rate, to impair photosynthesis, enzyme activity and nitrogen incorporation, to bleach cellular pigments and to inhibit motility and orientation, to affect reproduction and development and reduce the productivity in several marine organisms.

Global consequences of UVR are:

- Carbon Fixation / Carbon Sink
- Increase in temperature
- Production and food web
- Change of trace gas transduction at air – water interface (Carbon dioxide, DMS, DMSO)
- Abundance and diversity

Methodical approaches to measure UVR affect are:

- Field / lab studies
- Distribution and abundance studies
- Experimental studies
- Parameters to be measured are – Abundance, distribution, survival, growth, physiological and molecular (ROS, Stress gene expression, DNA damage and repair mechanism)

He predicted that UVR will remain elevated for next several decades and so there will be a need to further investigate the molecular targets of UVR. According to him a better understanding of the UVR protection will allow the development of technology for the indication and against the adverse impacts of enhanced UVR.

According to him photo protective chemicals in the sun screens and enzymes photolyse are helpful in the protection.

Fourth speaker was **Dr Rita Kumar** and she talked upon "**Apt Biosensors for Reliable and Fast Monitoring of Environmental Pollution**".

She defined biosensor as analytical unit which can be obtained by merging a biological entity with a signal transducer. According to her industries rely on rapid measurement of analysts for their operations and biosensors offers the possibility of real time analysis.

Biosensors are cheap, reliable and fast technology as compared to the conventional methods. Biosensors are made up of three components:

- Biological element (Highly specific, stable under storage conditions and immobilized)
- Transducer (acts as an interface, measuring the physical change that occurs with the reaction at the bio-receptor then transforming that energy into measurable electrical output)
- Detector (where the signals are amplified and analyzed)

Main properties of an ideal biosensor are selectivity, long shelve life, minimal calibration, reproducibility, stability, high sensitivity, low detection limit, large dynamic range, fast response time, fast recovery time, simplicity – ease of operations, cost effectiveness, possibility of miniaturization etc. Ideally it may not be possible that every biosensor technology or application will exhibit all of the above mentioned features. A biosensor product can of course offer real benefits to the user even when only selected features are incorporated into its development.

She developed BOD biosensors and phenol biosensors which are at different stages of commercialisation. BOD biosensor is able to sense the BOD load of a wide variety of industrial waste waters having low – moderate – high biodegradability within 5 to 10 minutes. She also emphasized the novelty of the immobilized microbial membrane with respect to the support, the bio catalyst and the mode of immobilization. She developed a more stable membrane with increased shelve life and viability, exhibiting higher reusability and a good correlation between BOD values estimated by the conventional method and that by the developed sensors.

Industries play a very important role in polluting water. BOD test (to measure the level of pollution in water) takes 3 days in India. Pre treatment for BOD test is done as neutral pH is required to perform the test on water. Bacteria neutralizes it from 30 minutes to 1 hour and then BOD test is performed. Advantages of bio sensors are that BOD is measured in 2 to 3 hours, capable of measuring BOD of all types of waste water and good correlation with conventional BOD values.

The session ended with vote of thanks to various distinguished speakers.