INAUGURAL ADDRESS BY SMT. D. PURANDESWARI, MOS (HRD-H.E) GOVERNMENT OF INDIA AT THE SEMINAR ON ENVIRONMENTALLY BENIGN SYSTHETIC METHODOLOGIES IN CHEMISTRY AT KAKATIYA UNIVERSITY WARANGAL ON 9TH FEBRUARY 2009

Mr. Vice Chancellor, Faculty members and our distinguished guests and friends, I feel greatly honoured to have been invited here to a inaugurate the seminar on Environmentally Benign Synthetic Methodologies in Chemistry organized by the Kakatiya University. Although somewhat technical, the suject matter of the seminar is of topical importance in the context of widespread global development based on science and technology.

As are all aware, green Chemistry is the synthesis of chemical products and processes with a view to reducing and eliminating the use and/or production of hazardous substances. Also described as “environmentally benign”, Green Chemistry aims to minimize the use and production of unsafe products and maximize the efficiency of chemical processes. Green Chemistry research has grown over the past decade and a half, with new technologies focused on reducing waste and energy use, using renewable resources and generating safe products. The benefits are not only health- and environment-related, but also economical, as the costs of storage, regulation and protecting workers and the public from exposure to hazardous chemicals are reduced.

This term, which was coined at the Environmental Protection Agency (EPA) by Paul Anastas, represents the assumption that chemical processes that carry

environmental negatives can be replaced with less polluting or non-polluting alternatives. Green chemistry is the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products, associated with a particular synthesis or process. Thus chemists can greatly reduce risk to human health and the environment.

The society in modern era is dependent in many ways on the chemical industry to maintain the current standards of living and to improve the quality of our lives – 'better living through chemistry'. The past few decades have been an era of successful chemistry. Developments in water treatment, waste disposal methods, agricultural pesticides and fungicides, polymers, material sciences, detergents, petroleum additives and so forth, have all contributed to the improvement in our quality of life. But unfortunately all these advances come with a price tag of 'pollution' a price too heavy for mankind. Today, with growing awareness, in industry, academia and the general public, of the need for sustainable development, the international chemistry community is under increasing pressure to change current working practices and to find greener alternatives. Scientists and engineers from both the chemical industry and the academic world have made efforts to correct pollution problems by the more extensive use of 'green chemistry' concepts, i.e. development of methodologies and products that are environment friendly. In other words, the green chemistry movement aims to make humanity's approach to chemicals, especially synthetic organic chemicals, environmentally 'benign' or 'sustainable'. For better living, what is needed is:

(a) An increasing awareness in industry of the importance of concepts such as waste minimization and atom utilization.

(b) Greater involvement by governments in controlling the use of resources and the productive disposal of waste; and

(c) Emergence of other underpinning concepts as general principles which can be used in the conception and execution of synthetic chemistry and in the usage of chemicals produced;

Green chemistry covers the following areas:

- (i) Application of innovative technology to established industrial processes;
- (ii) Development of environmentally improved routes to important products;
- (iii) Design of new green chemicals and materials;
- (iv) Use of sustainable resources;
- (v) Use of biotechnology alternatives; and
- (vi) Methodologies and tools for evaluating environmental impact.

From the kitchen to the laboratory, 'microwave chemistry' has come up as a boon in disguise for the eco-friendly conscious chemists. The microwave mediatedorganic reactions take place more rapidly, safely, and in an environmentally friendly manner, with high yields. Very little solvent and even the use of water as a solvent is a big advantage of microwave chemistry. In many cases,

microwave-mediated reactions are carried out in dry media on solid support, i.e. without the use of solvent. Therefore the use of toxic and expensive organic solvents can be avoided. Such reactions not only reduce the amount of waste solvent generated, but also the products often need very little or no purification. These processes will hopefully be adapted by big industries as well, thereby contributing to the betterment of the environment. The scientists are hopeful that within two decades it should be possible to:

(a) Eliminate nearly 100% of emissions in polymer manufacturing and processing.
(b) Replace all solvents and acid-based catalysts that have adverse environmental effects with solids, or 'greener alternatives'.
(c) Achieve 30–40% reduction in waste and
(d) Reduce more than 50% quantity of plastics in landfills.

Inception of green chemistry in USA

Shortly after passing the Pollution Prevention Act of 1990, The Office of Pollution Prevention and Toxics (OPPT) in USA explored the idea of developing existing chemical products and processes to make them less hazardous to human health and the environment. In 1991, OPPT launched a model research grants programme 'Alternative Synthetic Pathway for Pollution Prevention'. Since then, the green chemistry programme has built many collaborations with academia, industry and other government agencies to promote the development and implementation of innovative chemical technologies for pollution prevention, both in a scientifically sound and a cost-effective manner.

Green chemistry in India

The green chemistry wave has reached our country too and we need to work for its betterment by encouraging the practices of green chemistry. Collaborations between industrial and academic partners are important to expedite the transfer of significant green products to the marketplace. For such collaborations to be successful, individuals in these two differently motivated cultures need to work together to advance green science. Governments could undoubtedly facilitate formation of more effective industrial/academic partnerships. Under an agreement with the Green Chemical Institute, University of Delhi has been accepted as an international chapter. The Indian chapter will promote green chemistry through education, information collection and dissemination, research and international collaboration via conferences, workshops, meetings and symposia.

I am glad to learn that two workshops were organized at National Environmental Engineering Research Institute (NEERI), Nagpur and at National Institute of Pharmaceutical Education and Research (NIPER), Mohali, to generate awareness of 'Green Chemestry' among researchers and industry representatives. Around 150 researchers attended each workshop. The outcome of the workshops formed a significant input in preparing a monograph on "Green Chemistry Experiments". The monograph, written in a pedagogical manner contains many laboratory experiments for under-graduate and post-graduate chemistry students. These "green experiments" do not use hazardous chemicals, and provide good alternative to the existing hazardous experiments currently in practice in many universities. The following projects were funded:

I also understand that Ministry of Science and Technology also served useful projects pertaining to development of biodegradable plastics for packaging applications and development of completely biodegradable polymer composites.

The chemical industry plays a key role in sustaining the world economy and underpinning future technologies, is under unprecedented pressure from the effects of globalization and change in many of its traditional markets.

As the natural resources are used up in the world, chemists and biotechnologists are being asked to come up with innovative ways in which renewable resources can be used to replace nonrenewable ones. But there will continue to be a demand for some non-renewable resources. If we wish to make materials that use less resources today, we should try to minimize the amount of raw material that is incorporated in the object. As new materials are developed, new standards must be made to ensure fitness for the purpose of these materials. Analytical chemistry provides the means for ensuring that the material should meet the purpose for which it is designed. For this, green chemistry principles must be applied to the resources industry and raw material use.

With these words, I hope that all cognate issues relating to the subject matter will be considered and the symposium will arrive at meaningful deliberations which world provide invaluable inputs for scientists, technologists and policy framers.

Jai Hind