

Conference Report

International Conference on Green Chemistry: Challenging Perspectives

The *Green Chemistry: Challenging Perspectives* Conference was sponsored by IUPAC and co-sponsored by the American Chemical Society (ACS), the US Environmental Protection Agency (EPA), the United Nations Educational, Scientific and Cultural Organization (UNESCO), and with support from the European Commission, Directorate General XII—Science, Research and Development: Directorate D-RTD Actions: Environment.

The Conference was organized by Prof. Pietro Tundo and his colleagues from the University of Venice, Italy, during Sunday 28 September to Wednesday 1 October 1997.

Venice is a fascinating city between sea and sky and can be likened to Venus rising from the waves. It is a truly international tourist city drawing visitors by her charm of water and pellucid light. It is free of dust as there are no terrestrial motor vehicles—all transport is by her many canals. However, there are obvious signs of air pollution from the many motor boats, and severe indications of water pollution, corrosion and especially erosion of many of the fine buildings.

Venice offers unrivalled intellectual pleasures derived from masterpieces which mark the meeting of East and West. The varnished greatness of Venice accounts for the myth of an artificial, voluptuous and, perhaps, a tragic city, the sense of intrigues plotted in an atmosphere of corruption where dreams have become nightmares—this is how it can be described by romantics.

Whilst Venice invites *farniente* (idleness) and strolling, this was not the case at this Conference. Prof. Tundo and his team had met the challenge of following the 1997 *Green Chemistry and Engineering Conference*, held in Washington, DC, with the objectives of addressing and finalizing innovative public and private research programmes towards the development of new clean chemical processes.

Topics

This four-day event covered general, social and technical sessions and covered the following topics:

Chemical Processes: State of the Art for the Environment. Topics included recent developments in environmentally friendly resources and some recent industrial applications.

Inherently Safe Processes. This was related to research performed within the objective of reducing the risks associated with chemical processes and the objective of obtaining profitable, or at the very least, cost-neutral sustainable development.

Inherently Safe Products. The design of safer chemicals is both straightforward and complex. This session addressed the problem of the reduction in the toxicity (and ecotoxicity) of known chemicals without sacrificing efficiency, and the problems associated with the design and invention of new and intrinsically safe molecules.

Catalysis and Biocatalysis. This session discussed new procedures to create alternative synthetic and biosynthetic pathways which can substitute existing processes, which utilize renewable sources, and which operate under mild conditions and at lower costs.

Solventless Processes and Alternative Solvents. This session considered: alternative reaction conditions which have a significant effect on pathways involving overall environmental impact; use of supercritical fluids; and reactions promoted by new irradiation methods.

Chemical Research Policies. Dr Paul Anastas (US-EPA) led this session by introducing different aspects of the policies that govern academic and industrial environmentally compatible chemical research. Particular stress was given to the European Commission and the CEFIC Green Thematic networks in comparison with how similar policies are being developed in the US.

Opening Ceremony

The Opening Ceremony was held at the magnificent Auditorium of the San Margherita on the evening of Sunday 28 September 1997.

Prof. Tundo, in his initial remarks, stressed the immense global and growing significance of 'Green Chemistry', especially for the chemical and all related industries.

Dr Paul Anastas emphasized the initiatives in the

USA, especially the 'President's Green Chemistry Challenge, Awards and Grants for Industry', in particular improvements to the natural environment.

Dr Joseph J. Breen, Executive Director of The Green Chemistry Institute, developed these themes, including the massive support being given by the American Chemical Society.

Prof. Gianfranco Scorrano gave the welcoming address on behalf of IUPAC and indicated the means by which IUPAC was emphasizing its environmental chemistry activities, especially through the Company Associate Scheme and the Chemistry and Environment Division.

The evening's activities concluded with a buffet and a musical concert.

Conference Introduction

The Conference itself was held in the equally and very tranquil surroundings of the Ca'Dolfìn Palace of the Università Ca'Foscari di Venezia, Calle Della Saoneria.

Prof. Tundo stressed that the ultimate goal of 'Green Chemistry' research is to develop and institute alternative syntheses for important industrial chemicals. This entails the challenge of designing new syntheses and extraction procedures that are less polluting.

It is of the greatest importance to collect all the available data on chemical processes of industrial importance, bearing in mind that older processes are the 'backbone' of facilities available in developing/industrializing and especially the least developed countries. These countries need to heed the experiences of the highly developed countries and thus 'leap-frog' to the newer, cleaner, more economic and less polluting production methods. The chemical industry needs to anticipate the evolution of international regulations and needs to overcome this by a new approach to pollution prevention.

A working party for Environmental Organic Chemistry within IUPAC Commission III.2 on Physical Organic Chemistry under the Chairmanship of Prof. Tundo has

included a project on 'Reaction Pathways and Processes in Green Chemistry'. This project is being undertaken in collaboration with the IUPAC Chemistry and Environment Division. It is extremely timely, as every chemical company has its own programme for achieving environmental requirements. However, the dissemination of information in this field can accelerate the process by stimulating competition.

To achieve this goal it is proposed to collect data on the cooperation of the international agencies (e.g. the UN agencies, the EC), industry (chemical, agrochemical, pharmaceutical, etc.), national agencies (e.g. CEFIC and the EPA), in addition to the national chemical societies. It will be essential that each step taken will result in the creation of a policy for sustainable development, by listing the objectives, e.g. elimination of chlorine derivatives, replacement of organic solvents, oxidation reactions, recycling, atom economy, catalysis, biocatalysis, etc.

Opening Address

This was given by Prof. Maurizio Rispoli, President of the University of Venice.

He emphasized that recent years had witnessed the birth of awareness towards the development of industry, of products and of production processes, especially in view of the needs of sustainability.

He stressed the need for attention to be given to the problem of maintaining a dynamic balance between economic development and with due respect for the environment.

It is well known that the chemical industry, including in particular the petrochemical industry, has become the driving force of economic development over the past 100 years; by providing new materials and products which, due to their accessible prices, can satisfy a wide market demand. This development has allowed for improvement in living conditions for consumers.

However, over the past few years, we have begun to question ourselves on the consequences of the devel-

opment, especially certain production processes, which are empirically and theoretically suspected of causing damage to the ecosystem and to the health of people, animals, plants and all organisms on which mankind depends.

Due to this new sensibility towards the value of life, the chemical industry has found itself in the state of needing to comply with health and environmental regulations. However, now is the time for industry to look at 'Green Chemistry', and view the many challenges as *opportunities*, for new investments, new processes and products; but never view these activities as *impediments*.

The chemical companies that will be able to promote and develop these kinds of approach will be the ones that will gain solid competitive advantages.

Simultaneously, researchers can and must find in this environmental challenge, and in the challenge of 'Green Chemistry', a rewarding field of significant opportunities, where the first to succeed will have a very clear advantage.

Conference Résumé

The Conference was attended by 140 delegates from 12 countries. The working sessions were developed to a series of plenary, invited, technical sessions and lectures. There was also a poster session.

The plenary lecture titles were: Bart Drinkenburg (The Netherlands)—*Green Engineering: Opportunities and Realism*; Ugo Romano (Italy)—*Process and Product Innovations for the Development of Environmentally Compatible Technologies*; Terrence J. Collins (USA)—*The Design of Green Oxidants*; Bernard Witholt (Switzerland)—*Organic Chemistry via Biocatalysis*; Joseph M. De Simone (USA)—*Design and Application of Surfactants for Carbon Dioxide: From Polymer Synthesis to Cleaning/Extractions*.

They were supported by 17 oral, nine invited, seven technical session lectures and 24 posters.

With the support of the Italian Enterprise 'Enirerche', Prof. Tundo had published extended summaries of all of the contributions. It is planned for Conference proceedings to be published by the Oxford Science Publications in Spring 1999.

Inter-university Consortium—Chemistry for the Environment

On Monday 29 September 1997 the Conference participants were invited to join the official inauguration of the recently completed laboratories of the Inter-university Consortium, *Chemistry for the Environment*, located in the Science and Technology Gateway in Marghera.

It took place in the presence of senior representatives

of the Italian Government, including Paolo Costa (Secretary of Public Works), Giovanni Castellani (President of the Parliamentary Cultural Commission) and Giuseppe Tognon [Under-secretary of Ministero dell'Università e della Ricerca Scientifica (MURST)], who are interested in promoting the development of environmentally friendly technologies, particularly in the highly endangered area surrounding Venice.

Conference Conclusions

In summarizing the Conference Prof. Tundo emphasized:

- The work to be undertaken by the IUPAC Working Party on 'Reaction Pathways and Processes in Green Chemistry'
- The need for industry to adopt the use of new organic (green) processes
- International cooperation

The latter would involve liaison with the international agencies, especially the United Nations Industrial Development Organization (UNIDO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the IUPAC Joint Training Program for Safety and Environmental Protection in Chemical, Pharmaceutical and Bio-Technological Research and Production.

Future collaboration would also be maintained between Prof. Tundo, the new University Consortium, the EPA and EC-DGXII.

Prof. Tundo would also open a newsletter via his E-mail: inca@unive.it, URL web site: <http://www.unive.it/inca.html>

Initial plans are to be considered for a second conference on 'Green Chemistry' in 1999.

Mervyn Richardson

Birch Assessment Services for Information on Chemicals (BASIC)—Tel./Fax: +44 (0) 1923 774187