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**UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANISATION**



**INTERNATIONAL CENTRE FOR
SCIENCE AND HIGH TECHNOLOGY**



***UNIVERSITY OF CONCEPCION
FACULTAD DE CIENCIAS QUIMICAS***

FINAL REPORT

Workshop on

***ENVIRONMENTALLY DEGRADABLE PLASTICS,
PLASTICS RECYCLING
AND POLYMERS WASTE MANAGEMENT***

Concepcion, Chile 17-19 December 2003

**UNIDO PROJECT TF/GLO/00/105
CONTRACT No 2002/278**

Objectives

- The main objectives of the meeting were:
- To raise public awareness on the impact of increased plastic production and waste on the environment, and to emphasize the positive contributions of environmentally degradable plastics (EDPs) to the environment.
- To introduce and to transfer the recent industrial and academic developments and the actual application of plastics recycling and EDPs.
- To simulate international research and technology transfer and enhance international cooperation through possible collaboration and joint projects.
- To help ICS in identifying qualified academic and industrial centers for future joint ventures for EDPs development.

Organization

The workshop was jointly organized by the International Centre for Science and High Technology of the United Nations Industrial Development Organization (ICS-UNIDO) and the University of Concepcion (Faculty of Physical Sciences and Mathematics).

The local organizing Committee consisted of:

Galo Cárdenas

Departamento de Polímeros

Facultad de Ciencias Químicas

Universidad de Concepción (Chile)

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Francisco Martínez

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Lucia H. Innocentini Mei
Departamento tecnología de Polímeros
Facultad de Engenharia
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The ICS-UNIDO Committee consisted of:

Stanislav Miertus
ICS-UNIDO Trieste, Italy

Emo Chiellini
ICS-UNIDO and University of Pisa

Andrej Krzan
Nacional Chemical Institute – Ljubljana, Slovenia and ICS-UNIDO Trieste, Italy

Conference Venue

The Workshop was held at the Facultad de Ciencias Químicas, Auditorium located in the Universidad de Concepción Campus. Edmundo Larenas 129 Street, Concepción (Chile).

Funding

The ICS-UNIDO contribution for the organization of the workshop amounted to US\$ 15,000, of which US\$12,000 were received before the starting date of the workshop. The total actual disbursement amounted to US\$14,997, which were used to cover air tickets for international lecturers and participants, accommodation expenses, local transport and publication of proceedings. Participants not resident in Concepción were sponsored (partial or total airfare, full living expenses and accommodation): Participants resident in Concepción were sponsored for all social activities and meals relating to the workshop.

The University of Concepcion should therefore receive the remaining amount of US\$ 2,997. Please refer to detailed budget table under Annex 1.

Scientific program

Monday 25 November:::~::~:

09:00 hrs. 09:30hrs. Credentials

09:30 hrs. a 10:30.- Dr. Emo Chiellini ITALY : ICS ENVIRONMENTALLY DEGRADABLE PLASTICS AND ICN-UNIDO GLOBAL PROGRAMME.

10:30 hrs. a 11:00.- Coffee

11:00 hrs. a 12:00.- Dr. Ramani Narayan U.S.A. :NEW DEVELOPMENTS IN BIOBASED PRODUCTS AND BIODEGRADABLE PLASTICS

12:00 hrs. a 12:50 hrs. Dr. Joost Meijer, CONAMA STGO. CHILE : PLASTIC WASTE MANAGEMENT: ENVIRONMENTAL IMPACTS AND REGULATIONS

13:00 hrs. a 14:00 hrs. Lunch

14:30 hrs. a 15:30hrs. Dr. Fernando Maya MÉXICO : SISTEMA DE GESTION DE RECICLADO DE PLÁSTICOS EN MEXICO (UNAM)

15:30 hrs. a 16:30hrs. Sr. Gerhart Braunegg AUSTRICHE :ENVIRONMENTAL LEGISLATION

16:30 hrs. a 17:00hrs Coffee

17:00 hrs. a 18:00 hrs. Dr. Emo Chiellini ITALY : STANDARDS ON PLASTIC WASTE MANAGEMENT IN EUROPE INCLUDING EDP'S

18:00 hrs. a 18:30 hrs. Inauguration

18:45 hrs. Cocktail

.....:Tuesday 26 November:.....

08:30 hrs. a 09:30 hrs Emo Chiellini / ICS : ENVIRONMENTALLY DEGRADABLE PLASTICS. AN OVERVIEW (University of Pisa)

09:30 hrs. a 10:00 hrs. Dra. Lucia Mei BRASIL : AN OVERVIEW OF SOME CASE STUDIES OF ACADEMIC WORKS ON BIODEGRADABLE POLYMERS IN BRAZIL AFTER WEDPLA 98 (UNICAMP)

10:30 hrs. a 11:30 hrs. Dr. Sylvio Ortega BRASIL :BIOCYCLE PRODUCT AND PROCESS TECHNOLOGY OF POLY (3 - HIDROXYBUTYRATE) - PHB OBTAINED FROM SUGAR CANE.

10:30 hrs. a 11:00 hrs. Coffee

11:00 hrs. a 11:45 hrs. Dr. Patricia Miranda MÉXICO : CHITOSAN FILMS. APPLICATIONS IN FOOD STORAGE. (UNAM)

11.30hrs. a 12:15 hrs. Dr. Galo Cárdenas CHILE : CHITOSAN DERIVATIVES AS SLOW RELEASE BIOCIDES (University of Concepción)

12:15 hrs. a 13:00 hrs. Dr. Miguel Bahiense / Instituto de PVC. MÉXICO : PVC MECHANIC RECYCLING IN BRAZIL

13:00 hrs. a 14:00 hrs Lunch

14:30 hrs. a 15:15 hrs. Dr. Alicia Ronco ARGENTINA : PLASTICS AND THE ENVIRONMENT SITUATION FROM ARGENTINA

15:5 hrs. a 16:00 hrs. Dr. Javier Nakamatsu PERU : PLASTICS IN PERU, WHERE COME FROM AND WHERE THEY GO. CONTROLLED RELEASE FROM CHITOSAN MATRICES.

16:00 hrs. a 16:50 hrs. Dr. Ramani Narayan U.S.A. STANDARDS FOR BIODEGRADABLE PLASTICS & BIOBASED PRODUCTS

16:50 hrs. a 17:15hrs. Coffee

17:15 hrs. a 17:45 hrs. Dr. Edgard Resto Puerto Rico : POLYMERIC MATERIALS CHARACTERIZATION BY SURFACE MICROSCOPY TECHNOLOGIES

17:45 hrs a 18:15 hrs. Dra. Rosa Catalán / Depto. The Polymers U.de C. CHILE : GRAFT COPOLYMERS OF SECONDARY CELLULOSIC FIBERS CHILE

19:00 hrs. Dinner " Riquen Restaurant "

:::::Wednesday 27 November:::::

08:30 hrs. a 09:30 hrs. Dr. Andrej Krzan SLOVENIA : ICS POLYMER RECYCLING: AN OVERVIEW

09:30 hrs a 10:30 hrs. Dr. Peter McKrostie ASIPLA CHILE : THE DYNAMICS OF THE PLASTIC INDUSTRY IN CHILE

10:30 hrs. a 11:00 hrs. Coffee

11:00 hrs. a 12:00 hrs. Dr. Gerhart Braunegg Technical University of Graz, Austria : BIOPOLYESTERS - A CONTRIBUTION TO SUSTAINABLE INDUSTRIAL DEVELOPMENT

12:00 hrs a 13:00 hrs. Dr. Andre Vilhena CEMPRE BRASIL : RECYCLING IN LATIN AMERICA : TRENDS AND OPPORTUNITIES

13:00 hrs. a 14:30 hrs. Lunch

14:30 hrs. a 15 :30 hrs. Dra. Ofelia Noceti URUGUAY : PLASTIC RECYCLING POLYCLING POLICIES IN URUGUAY

15:30 hrs a 16:15 hrs Dr. Jovino Avaria CHILE : PETROQUÍM WASTE MANAGEMENT IN POLYPROPYLENE PLANT CHILE

16:30 a 18:30 hrs. Conclusions

19:00 hrs. Dinner

PARTICIPATION

Lecturers were selected for their expertise in the issues dealt with in the workshop. Lecturers and participants came from a variety of countries and institutions and are listed in table 1. Their affiliations included universities, R & D institutes. A copy of the lecture notes has been included (on Cd-Rom) as Appendix 4.

Table 1. Lecturers

European Lecturer	Institution	Country
Emo Chiellini	ICS-UNIDO	ITALY
Andrej Krzan	ICS UNIDO	SLOVENIA
Gerhart Braunegg	Technical University of Graz, Austria	AUSTRIA
Ramani Narayan	Chemical ENG. Michigan U.S.A.	U.S.A
Patricia Miranda	UNAM	MÉXICO
Fernando Maya	UNAM	MÉXICO
Lucia Innocentini Mei	Campinas University	BRAZIL
Andre Vilhena	CEMPRE	BRAZIL
Miguel Bahiense	Instituto do PVC	BRAZIL
Silvio Ortega	BIOCYCLE	BRAZIL
Edgard Resto	University of Puerto Rico	PUERTO RICO
Alicia Ronco	University of the Plata	ARGENTINA
Javier Nakamatsu	Pontificia Universidad Católica del Perú	PERU
Ofelia Noceti	Chemical and Pharmacy Society	URUGUAY
Peter Mcrostie	ASIPLA	CHILE
Joost Meijer	CONAMA	CHILE
Jovino Avaria	PETROQUIM	CHILE
Francisco Martínez	University of Chile	CHILE
Rosa Catalán	University of Concepcion	CHILE
Carlos von Pleasing	University of Concepcion	CHILE
Claudio Sandoval	PETROQUIM	CHILE

Alex Berg	UDT	CHILE
Jaime Baeza	Director de Investigación U.De C.	CHILE
Justo Lisperguer	Director de Investigación U. Bio Bio	CHILE
Claudio Maggi	CORFO Regional	CHILE
Ximena Cortés De La Masa	Unidad de Medio Ambiente	CHILE
Sergio Lavanchy	Rector University of Concepcion	CHILE
Bernabé Rivas	Decano / Faculty Chemical	CHILE
Mario Suwalsky	Director Faculty Chemical	CHILE
Marcela Zacarías	UDT	CHILE
Dr. Martín Zilic Hrepic	Director Programa de Desarrollo Regional	CHILE
Ximena Moya	CORFO	CHILE
Aldo Vallerino	U. B.B. Ingenieria	CHILE
Gustavo Cabrera	Phd / Chemistry	CHILE
Edelio Taboada	Phd / Chemistry	CHILE
Galo Cárdenas	University of Concepcion	CHILE

In addition, country reports were solicited from participants selected to attend the workshop. Each presented an outline of the industries and natural resources in their country, the major industrial pollutants and an indication of the presence or availability of less polluting technologies

The organizers sent the applications by means of Chemical Societies of North, Central , South América and emailed to Institution. In addition the workshop was advertised on the Internet.

Table 3 details the geographical and institutional origin of participants. Table 3. Participants according to countries

COUNTRY	NUMBERS OF PARTICIPANTS
Austria	1
Argentina	1
Brazil	4
Chile	22

Italy	1
Mexico	2
Peru	1
Puerto Rico	1
Slovenia	1
Uruguay	1

WORKSHOP MATERIALS

Each participants and lecturers was provided with a folder bag containing the following:

- A CD- ROM containing files of the lectures
- Detailed workshop program
- List of participants with their mailing addresses
- Pen and notebook
- Identification badge

OPENING CEREMONY

The workshop was officially opened by the President of the Chilean Chemical Society (Prof. G. Cardenas) and the representative of ICS-UNIDO (Prof. Emo Chiellini)

SOCIAL EVENTS

Coffee and lunches were provided for all participants of the workshop. A welcome reception was held at the Faculty of Chemical Sciences on the evening of November 25th. A conference dinner was held at the Riquen Restaurant on the final evening of the workshop.

ASSESSMENT

The workshop was assessed by the participants by means of an anonymous and optional questionnaire. Participants evaluated the workshop organization as being very good.

The general sense among participants was that the lecturer presentation were good.

POSSIBLE FOLLOW – UP

The workshop was considered a success amongst participants. There is now a greater awareness of state-of-the-art catalytic technologies and the design aspects of green chemistry. The establishment of a Centre for EDP' s policies in a number of Latin

America countries is expected to facilitate communication between academic and industrial institutions in this important area.

During the concluding session, a general discussion based on country reports was held. The following conclusions were drawn:

- There was general agreement that the workshop had been valuable in discussion of pollution problems by plastics. The replacement for EDP's and the importance to establish laws and rules in Latin America and regional policies was discussed. A summary of the workshop, including key lectures and country reports will be written up and submitted to the Journal Green Chemistry, with the intention of having this publish in the " News and Views " section of the journal.
- A certified laboratory to classify and measured some parameters of EDP'S from a Synthetic Polymers will be set up in the only existing Department of Polymers in Chile, under direction of Prof. Galo Cárdenas.
- Preparation of a detailed action plan of the proposed follow-up activities will be done jointly by ICS-UNIDO and the Chilean Chemical Society.

APPENDIXES

Appendix 1 :

Summary of budget and expenditure

Appendix 2 :

Detailed programme of the workshop

Appendix 3 :

List of lecturers and participants (with full addresses)

Appendix 4 :

CD-ROM of key lectures presented in the workshop