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FINAL REPORT

**International Workshop on
ENVIRONMENTALLY DEGRADABLE PLASTICS**

The House of Scientists of the Slovak Academy of Sciences

Smolenice, Slovakia

4 - 8 October 1999

**UNIDO PROJECT No : TF/GLO/96/105
CONTRACT No : 99/178**

INTRODUCTION

A workshop on ENVIRONMENTALLY DEGRADABLE PLASTICS was organized by ICS UNIDO, Trieste and Polymer Institute of the Slovak Academy of Sciences, Bratislava. The workshop has been scheduled to be held in Slovakia due to the importance of this issue in the countries of Central Europe. The countries possess rather high industrial potential with a great deal of plastics consumption and developed plastics industry. On the other hand, the knowledge on EDPs is rather limited and the applications are marginal. Therefore the region provides a sound opportunity for spreading the EDPs concerning a developed industry and well organized research institutions active in the Central European countries. Furthermore, the region suffers from rather serious environmental problems among which plastic waste disposal is a closely monitored issue at present and is supposed to become even more important when the economy of the countries will improve.

OBJECTIVES

The main objectives of the workshop have been defined as follows:

- To provide to participants from Central European countries the updated knowledge and information on recent achievements of research as well as new technologies regarding environmentally related problems in polymer producing, processing and end of life disposal industries.
- To update the scientific and technological knowledge of the participants in terms of the waste management of polymeric materials and to stimulate planning for the minimization of waste generation.
- To provide recent information regarding legal aspects of plastic waste formation and waste disposal management and the role which environmentally degradable plastics can play in the whole system, especially taking into account the effort of the countries of the region to join European Community in near future.
- To raise industrial, academic and public concern on the issues of environmental effects of plastics, and to emphasize the positive contributions which manufacturing industries can make including the increased utilization of environmentally degradable polymers (EDPs).
- To stimulate international research and technology transfer and enhance international co-operation through possible joint or follow-up projects, and feasibility studies by identifying regional R&D centres in developing countries through contacts established with the participants in the workshop, thus giving ICS the possibility for identifying competent academic and industrial centres for future joint ventures for the EDPs development.

ORGANIZATION

The workshop was organized by Polymer Institute of the Slovak Academy of Sciences, Bratislava in cooperation with ICS UNIDO Trieste. Following bodies took responsibility for the scientific and organization niveau of the event:

Local Organizing Committee :

Dr. Ivan Chodák, DSc, chairman of the Local Organizing Committee

Ms. Katarína Csomorová, secretary of the Local Organizing Committee

Prof. Dušan Bakoš

Dr. Igor Lacík, PhD.

Dr. Ivica Janigová, PhD.

Ms. Zuzana Hloušková

International Organizing Committee :

Prof. Stanislav Miertus, ICS Trieste, chairman

Prof. Dušan Bakoš, Slovak Technical University Bratislava

Dr. Gerhart Braunegg, University of Technology Graz

Prof. Emo Chiellini, University of Pisa

Dr. Ivan Chodák, Polymer Institute, Bratislava

Prof. Sherif Kandil, University of Alexandria

Prof. Piet Lemstra, Eindhoven University of Technology

DATE AND SITE

The workshop was held in The House of Scientists of the Slovak Academy of Sciences (Smolenice castle) in Smolenice, Slovakia on October 4 - 8, 1999. The facility provides both accommodation including full board services and conference hall equipped with projecting and audio tools.

FUNDING

The total expenses for the organization was US \$ 23 570 compared to planned US \$ 28 900. The amount received from UNIDO was US \$ 16 800 and additional US \$ 4 200 will be invoiced to the total US \$ 21 000 planned as UNIDO contribution. Two participants (Yugoslavia and Rumania) cancelled their participation just less than a week before the event and it was impossible to invite substitutes. US \$ 600 was saved on meals because of this.

The travel expenses (7228 US \$) were higher than planned (6600 US \$) by 9.5 % which is within the 10 % limit. The expenses for accommodation and meals were decreased accordingly and the difference was covered from other sources.

It is proposed to use the left-over of US \$ 600 for the publication of further 80 copies of the book of proceedings (around 250 - 300 pages) of the Workshop (this expense was not foreseen in the original budget). The publication will be ready by the end of December 1999 and will be sent to ICS-UNIDO.

PARTICIPATION

Participants have been selected with the aim to cover fully the scope of the workshop regarding the key lectures and to cover the participation from all the countries from the region.

From the latter point of view, participation from Slovakia, Czech Republic, Hungary, Poland, Ukraine, Bulgaria, Rumania, Belarus, and Austria (as an example of the country of the region but with different political and economical development) was considered to be necessary, with the possibility to invite participants from Baltic countries and the countries of former Yugoslavia. The response from Baltic countries was surprisingly negative while the participant from Yugoslavia cancelled his participation due to serious reasons. Total 51 participants from 16 countries took part in the workshop.

1) Lecturers (keynote speakers)

17 keynote speakers participated in the workshop. They presented 22 lectures covering whole range of the workshop's scope. The list of the lecturers together with the topics of the lectures is given in Table 1.

Table 1: Keynote lecturers

<i>Lecturer</i>	<i>affiliation, country</i>	<i>topic of the lecture</i>
G. Braunegg	Univ. Graz, Austria	synthesis country report
E. Chiellini	Univ. Pisa, Italy	introductory overview blends & composites
F. Degli-Innocenti	Novamont, Italy	application, blends testing
F. Edgecombe	CPIA, Canada	environmental assessment
H. Haschke	Constantia, Austria	application, packagings
U. Hänggi	Biomer, Germany	application aspects
S. Imam	USDA, USA	industrial application
S. Kandil	Univ. Alexandria, Egypt	photodegradation follow up procedure
P. Hrdlovič	Slovak Acad. Sci., Slovakia	photodegradation
B. Lemmes	IBPMA Merlin, Belgium	legal aspects
P. J. Lemstra	TUE Eindhoven, Netherlands	general aspects of EDPs
S. Miertus	ICS UNIDO, Italy	activities of UNIDO, introductory talk
R. Narayan	Michigan State Univ., USA	technologies testing, standards for EDPs
E. Pras	ATO-DLO, Netherlands	applications overview
F. Rypáček	IMC, Czech Republic	applications in medicine
I. Tomka	ETH, Switzerland	synthesis, properties, overview application
M. Vert	URA CNRS, France	degradation, bioassimilation

2) Participants

Around 100 announcements have been sent to various institutions, companies and governmental as well as non-governmental organizations. The workshop was announced at the web site as well. 34 participants from 8 countries attended the lecturers. They presented 10 special contributions, out of these 2 keynote lectures have been selected (Prof. Hrdlovič, Prof. Rypáček, see the Table 1). 8 country reports have been presented covering the situation concerning the Environmentally Degradable Plastics application and plastics waste management in the respective countries. Prof. Kowalczyk presented an introductory country report as a full lecture, while Prof. Kandil gave the last talk at this section as a Follow up example of the workshop. The overview of all the participants is given in Table 2.

Table 2: Participants according to the countries

<i>Country</i>	<i>number of participants</i>	<i>univ. R&D companies</i>		
Austria	3	1		2
Belgium	1			1
Belarus	1	1		
Bulgaria	1	1		
Canada	1			1
Czech republic	4		3	1
Egypt	1	1		
France	1	1		
Germany	2			2
Hungary	1	1		
Italy	3	2		1
Netherlands	2	1	1	
Poland	1	1		
Slovakia	24	9	6	9
Switzerland	1	1		
Ukraine	2	1	1	
USA	2	1	1	

Participants came from universities (49 %), R&D (23 %) and companies (28 %). Together with key lecturers the portion of the scientists coming from the companies and R&D was 51% from the total number of the scientists present.

WORKSHOP MATERIALS

Each participant and lecturer obtained conference materials. The Aide Memoire was distributed as electronic version only by email. This was sent not only to the participants and lecturers but it was a part of the announcement sent to all the persons and institutions which were informed about the event prior to the workshop. The invitation containing the main objectives of the workshop and some details on the organization was distributed by the same way as the Aide Memoire.

At the registration following materials were given to all the registered persons:

Program

Book of Abstracts and List of participants

Brochures

Book on Selected papers from ICS UNIDO Expert Group Meeting in Trieste, April 1998 was distributed free during the workshop. The participants obtained the book on request.

OPENING CEREMONY

Several inviting guests participated in the opening ceremony. The opening speech was delivered by the vicepresident of the Slovak Academy of Sciences Prof. Jozef Tino. Then ICS - UNIDO Area Coordinator Prof. Stanislav Miertus addressed the audience, followed by the Italian Ambassador in Slovakia, His Excellency Dr. Egone Ratzenberger. At the end of the opening ceremony Prof. Pavol Hrdlovič, director of Polymer Institute, officially opened the workshop. Afterwards Prof. Miertus delivered the introductory talk on the aim and ICS UNIDO coordinated activities in the area of chemical research.

PROGRAM

The scientific programme consisted of several topics, which are listed below together with the number of contributions :

- | | |
|------------------------------|-----------------------|
| • general | 3 lectures |
| • synthesis | 4 |
| • blends, composites | 3 |
| • applications, technologies | 6 |
| • degradation, composting | 2 |
| • photodegradation | 3 |
| • testing | 3 |
| • legal aspects | 1 |
| • environmental assessment | 1 |
| • medical applications | 3 |
| • country reports | 8 plus Follow up talk |

Besides the lectures, two panel discussions were included in the programme, namely on Legal aspects and testing (Wednesday) and Follow up (Thursday). Both panel discussion brought lively discussion, some valuable conclusions and were appreciated by the participants.

An excursion to a paint producing plant Chemolak Smolenice was a part of the programme (Wednesday morning). Besides general information on the production, the representatives of the factory presented their attitude towards improving the environment.

SOCIAL EVENTS

Since the workshop was held in a closed facility where the participants stayed for the whole day with little possibility to leave, the social events were carefully selected to enjoy the participant and to show them the life in the region. Following social events were organized :

Monday, Oct. 4	Wine testing
Tuesday, Oct 5	Violin concert
Wednesday, Oct 6	Typical Slovak goose party
Thursday, Oct 7	Barbecue with slovak folk-music

Most of the expenses for these events were sponsored by local companies and institutions.

ASSESSMENT

A standard questionnaire was distributed to participants, 36 participants returned the filled questionnaires. The opinion of the participants is summarized in Table 3.

<i>A. Organization</i>	<i>Excellent</i> %	<i>Very good</i> %	<i>Good</i> %	<i>Fair</i> %
Information process	61	33	6	0
Announcement	44	44	12	0
Scientific Programme	50	44	6	0
Applied lectures	33	50	11	0
Time spent in class	53	47	0	0

	<i>Balanced</i>	<i>Unbalanced</i>
Students' knowledge	94	6

<i>B. Duration of programme</i>	<i>Just right</i>	<i>Too long</i>	<i>Too short</i>
No of days	72	22	6
Length of working days	83	6	12

<i>C. Training facilities</i>	<i>Excellent</i>	<i>Very good</i>	<i>Good</i>	<i>Fair</i>
Lecture room	61	39	0	0
Breaks/refreshments	56	44	0	0
Accommodation	53	37	10	0
Meals	45	33	22	0
<i>D. Organizers response</i>	89	11	0	0
<i>E. Overall organization</i>	83	17	0	0

F. Would you recommend the participation in the future to the others ? 100 % yes

Regarding the written part of the questionnaire, following suggestions and comments are worth to mention :

1. Most useful part of the activities

Generally all the parts of the programme have been approved, panel discussions were the most appreciated

2. Which part should be expanded

An advise regarding the form and means for transferring the knowledge / ideas obtained in the respective countries, relations to economic situation.

Student participation, case studies, more information on application.

Poster session, panel discussions, more time for discussion after the lectures and personal discussions,

3. Which part should be dropped

Biomedical applications (one participant)

4. Other suggestions to the programme

Extend the participation of young scientists and students

Presentation of new results, small local exhibition

Too long talks (45 minutes), some lectures too general, programme should be more focused

5. Could the topics of the workshop be used by the industry ?

No straight forward procedure, an approach via Ministries, no immediate application possible. A pilot project would be useful as an example of application. Standardisation and certification as the easiest applicable topics.

6. Suggestion for future activities

Information on simple and cost-effective technologies on recycling and incineration.

More information on waste management.

Continue with the series of workshops, extend to other East European countries, show successful industrial applications.

7. How do you and your institution benefit from the workshop ?

The majority of participants appreciated mainly the established personal contacts.

8. How will you disseminate the information acquired ?

Local professional journals, implementation of some information in student graduate courses, lectures in local scientific and industrial meetings, start a research project on EDPs.

RESULTS AND SUGGESTIONS FOR FOLLOW UP

The workshop was generally considered as very successful and useful by most of the participants. A friendly atmosphere, stimulating site of the meeting and balanced programme was stressed as positives by the participants.

It was suggested that an establishment of a focal point should be proposed with the aim to keep up and extend the network on EDPs in the region, which was formed during the workshop. The proposal will be prepared by the organizers (Slovak Academy of Sciences and Slovak Technical University together with ICS UNIDO Trieste). Bratislava is suggested to be the site of the focal point with possibility to extend the activities to other countries if needed.

Some joint projects on EDPs have been discussed during the workshop among participants. This will speed up the process of spreading the know - how in the region.

It was suggested and discussed to organize an East-West Cooperation Conference, which would be mainly sponsored by the Dutch Institute of Polymers and the Dutch Association of Industries, under the auspices of ICS-UNIDO. Several project concepts were discussed and will be submitted to ICS-UNIDO by the end of December.

APPENDIX

Summary of the final budget

<i>UNIDO contribution</i>	<i>planned in TOR</i>	<i>actual</i>
Travel - 17 invited speakers	5 100	5 618
Travel - participants	1 500	1 610
Travel - local	900	1 000
Accommodation and meals invited speakers	5 100	5 401
Accommodation and meals participants	8 400	6 777
TOTAL	21 000	20 406

Contribution of hosting institution and other co-sponsoring organizations

Conference hall	250	224
Fax / telephone / post	500	400
training materials	1 250	450
secretariat	400	520
contribution to cover local participants	3 000	220
other items (pre-conference travel etc.)	2 500	1 350
TOTAL	7 900	3 164
TOTAL EXPENSES	28 900	23 570

It is suggested that the 600 US \$ which were saved due to the absence of participants from Yugoslavia and Rumania will be spent for preparing the Workshop proceedings.