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## **Environmentally Degradable Plastics**

**21 June - 3 July 1997**

**Alexandria, Egypt**

### **Background**

The International Centre for Science and High Technology ICS-UNIDO hosted in Trieste-Italy a group of experts to look into the area of environmentally degradable plastics. The meeting that took place in December 1996 revealed that little awareness of this subject exists in the developing countries. In some instances it was clear that the concept of environmentally degradable plastics was not encountered before. It was decided to hold a regional training course in Egypt followed by an international workshop to take place in India.

The Arab Society of Materials Science, which is an NGO, non profit scientific society established in Alexandria, Egypt in 1990 to promote the understanding and application of Materials Science, expressed its will to organize the workshop. With the support of the International Centre for Science and High Technology, ICS-UNIDO the training course on "Environmentally Degradable Plastics" was conducted in Egypt by the Arab Society of Materials Science.

This course was timely as it meets a need in the region where the plastic industry is booming meanwhile the accumulation of plastics waste constitutes an increasing environmental problem.

The course received political and technical support as it was inaugurated by Her Excellency Prof. Venice Gouda; Minister of Scientific Research of Egypt, as well as Prof. Handy Morsy; the President of Egyptian Academy of Science and Technology, Prof. Stanislav Miertus, ICS Area Coordinator; Prof. Emo Chiellini, ICS Scientific Consultant; and Prof. Sherif Kandil, President of the Arab Society of Materials Science. Moreover, the course received financial and technical support from many organizations (see Annex 1).

## **Objectives**

- To introduce the modern concepts of environmentally degradable plastics within a global view of the environmental problems as a way of solid waste minimization.
- To illustrate some training on the fundamental aspects concerning the degradation mechanisms and the effects of biodegradable plastics.
- To give some case-studies regarding the technology transfer aspects and technology management in plastic industry, which would reflect positively on raising the scientific and technological understanding and practices of participants.

## **Advertisement**

The course was advertised throughout the Middle East region and Egypt via letters and leaflets (see annex 2). Also the leaflets were distributed throughout the conferences and meetings taking place in the region. Al-Ahram News Paper published an announcement about the training course (see annex 3).

A good response was received where applications were received from various parts of the region and Egypt. Participants were chosen according to criteria indicated by ICS-UNIDO and the organizing committee of the course.

## **Venue and date**

The training course was held in Egypt in various sites (Alexandria, Cairo, Luxor and Aswan) in the period 21 June to 3 July 1997. In Cairo, the inauguration and introductory lectures were delivered at the Egyptian Academy of Scientific Research and Technology (22 June 1997). The inauguration at the Academy, the highest official scientific institutions in Egypt, conferred prestige to the activity. While in Alexandria, the training took place at the Institute of Graduate Studies and Research which is a prestigious institute for Materials and Environmental studies at the University of Alexandria (23-29 June). The Technology Transfer Management symposium took place in the last three days in Upper Egypt (30 June - 3 July). This arrangement gave the participants the chance to see various scientific institutions in modern Egypt and were given the chance to taste the flavor of the Ancient Egyptian heritage.

## **Organization and Organizing Committee**

The training course was jointly organized by the international Centre for Science and High Technology (ICS-UNIDO), Italy and the Arab Society of Materials Science, Alexandria with the support of The Egyptian Academy of Scientific Research and Technology, and the International Development Research Centre , IDRC, Canada. The Arab Society of Materials Science acted as the contractor and hosting institute. The organizing committee was constituted as follows:

- Prof. Emo Chiellini, Pisa University, Italy; (ICS Scientific Consultant)
- Prof. Mohamed El-Gamal, IGSR, Alexandria, Egypt
- Eng. Randa Ishak, Course Administrator, ASMS, Alexandria, Egypt
- Prof. Sherif Kandil (Local Organizer) ASMS, Alexandria University, Egypt;
- Prof. Prof. Stanislav Miertus / (ICS Area Coordinators), Trieste, Italy;
- Ms Paola Volpi, ICS-UNIDO Secretariat

Further support was provided by Prof. Gerald Scott, Aston University, England.

The scientific committee was composed of the following members:

- Prof. Emo Chiellini, Pisa University, Italy; (ICS Scientific Consultant)
- Prof. Mohamed El-Gamal, IGSR, Alexandria University, Egypt
- Prof. Shaker Helmi, IGSR, Alexandria University, Egypt
- Prof. Sherif Kandil (Local Organizer) ASMS, Alexandria University, Egypt;
- Prof. Gerald Scott, Aston University, UK
- Prof. Graham Swift, Rom & Haas Co., USA
- Prof. Ahmed Walley, NRC, Cairo, Egypt

## **Program**

The program of activities was scheduled for the 13 days of the workshop. The number of lectures was 39, and were delivered by 19 lecturers. the course also included laboratory exercises (16 hours) and discussion and problem solving sessions (10 hours).

All lectures, were held during morning sessions while the afternoons were devoted to hands-on experience, visits to research and/or industrial institutions.

The inauguration of the training course took place at the Egyptian Academy of Scientific Research, Cairo. The inauguration was dignified by

the presence of Her Excellency Prof. Venice Gouda, Minister of Scientific Research of Egypt, who delivered a welcoming speech. Prof. Hamdi Morsi, Head of Egyptian Academy of Scientific Research and Technology, Egypt; Prof. Stanislav Miertus, ICS Area Coordinator; Prof. Emo Chiellini, ICS Scientific Consultant; and Prof. Sherif Kandil, Chairman of the Arab Society of Materials Science, Egypt welcomed the participants and oriented the attendance to the activities within the course. A copy of the schedule of the opening day is attached (annex 4)

Mornings were dedicated to the presentations of the 39 lectures. Some of these were aimed to give a global outlook of the environmental problems at large with emphasis on plastic waste disposal. Then, the fundamental concepts of polymeric and plastic materials; their classification, structure/property relationship were explained. Then a special attention was given to the environmentally degradable plastics which covered the different ways and detailed mechanism of polymer degradation. Some other lectures were more related to specific applications of degradable plastics in different fields e.g. agriculture, pharmacy, biomedical, etc. and the future trends in biodegradable polymeric materials. The lecturers were given enough time to express their topics in a relaxed atmosphere and had enough time for answering questions and conducting discussions.

Apart from presentations, many lecturers showed and distributed samples of produced degradable plastics to the participants.

Afternoons were dedicated to laboratory work and demonstrations, where the principles of biodegradation were explained and hands-on experience were reached. Various techniques on plastic degradation were demonstrated. Also video presentations, discussion and problem solving sessions as well as industrial visits were conducted.

The last three days were dedicated to the UNIDO symposium of Technology Management, where a case study of tire industry from Turkey was presented.

A complete scientific program is attached in annex 5.

By the end of the program, participants received a certificate indicating their attendance of the training course (annex 6). Also a group photo was distributed to participants (annex 7).

## Visits

Two field visits were included in the program:

1. A visit to the Plastic Development Centre, Alexandria. Participants were given the chance to get in touch with the plastic processing machines for biodegradable plastic films as they practiced the process of adding biodegradable additives to the blown films for themselves. It also gave the participants the chance to get acquainted with the different polymer tests and characterization techniques as well as the specific tests for polymers tolerance for the environment.
2. A visit to Rp Scherer Egypt, Borg El-Arab, Alexandria was arranged to give the participants an industrial insight to the application of biodegradable materials in drug encapsulation, particularly the production of softgels. The visit started by an introduction to the company, then lectures were delivered on the basic concepts of using biodegradable polymers in medicine and the pharmaceutical industry, followed by a visit to the company departments. Visitors were divided into small groups guided by an expert from the company.

## Lecturers

A total of 39 lectures was delivered by 20 lecturers who came from many countries as indicated in table (1).

Table (1): Geographical Distribution of Lecturers

Country	No. of Lecturers
Italy	3
England	2
Turkey	2
Egypt	13

In order to reach a balance between theoretical and applied approach to the topic, lecturers were selected from academic universities, applied research and development institutions, and industrial enterprises. Scientific case studies from industry were selected to provide examples of already existing technology and applications of degradable plastics in various domains (pharmacy, agriculture, biomedical ...). By doing so, it was believed that a complete spectrum of the subject, ranging from basic

research to industrial applications supported by laboratory practicals, was achieved. The lectures' institutional distribution is reported in table II.

Table (II) Lecturers Institutional Distribution

Institution	No. of Lecturers
Universities	9
Research Centres	5
Industry	5
Governmental Agencies	1

Two of the participants were asked to present a lecture on their own activities as their research was particularly distinguished and relevant to the topics of the training course. They were therefore listed as lecturers as well as participants (Prof. Piskin and Eng. Gharib).

## Participants

Invitations and calls for application were circulated through universities, various industrial, R&D centres, research institutes and universities in the Middle East, Mediterranean and African countries and Egypt. Selection was made through evaluation of the application forms and the curriculum vitae of each candidate.

The selection of participants was based on the following.

1. Relevance to the subject with potential reflection on the participants institutions, performance and career.
2. Balance between the regional representations (two participant from each country at most).
3. Balance between participants from academia, research and development and industrial / governmental institutions
4. The gender issue was observed (8 ladies).
5. Younger applicants were given a priority.

The total number of accepted participants was 23 which represented the various regions (table III), as well various academic and industrial institutions (table IV). At the very last moment the two candidates of Saudi Arabia and Syria apologized for unforeseen circumstances. The candidate of United Arab Emirates also participated for only the first day

when he was called upon to go back to his home for emergency reasons. The actual number of participants was finalized to 20.

Table III illustrates the geographical distribution of the participants

Country	No. of participants
Jordan	2
Lebanon	2
Qatar	1
Turkey	2
Egypt	13 (5 Cairo, 5 Alexandria, 2 Tanta, 1 Fayoum)

Table IV: The Institutional Distribution of Participants

Institution	Number of Participants	
	Fully Supported	Partially Supported
Universities	10	1
Research Centers	3	1
Industry	3	
Governmental Agencies	2	

A complete list of names and addresses of participants is reported in Annex 8.

### **Financial Support**

As for financial contribution, all participants and lecturers were supported with full accommodation, domestic transportation, and travel as will be reported later. All participants and lecturers were accommodated in 5-stars hotels (Sheraton Montazah of Alexandria, Helnan Shepherd in Cairo and RA II in Aswan) and were transferred from the hotel to the training sessions and industrial visits and return by air-conditioned coach. Also, international travel expenses were covered by the course for those who could not secure it from their institutions. A special arrangements were made to meet participants and lecturers coming from abroad at the airport, providing them with meet and assist services at the airport and then transfer to the hotels. Also at the end of the course, arrangements were done to transfer the participants to the departing hotel and the airport.



Some participants were accommodated for extra nights to comply with their international flight schedule when needed.

No registration fees were requested.

## **Materials Distributed**

As well as the general workshop materials (brochure, program, list of participants, list of lecturers, ICS brochure, etc...) Participant were also provided with a brief-case which had the course name/date printed. A file of abstracts as well as hard-copies of the delivered lectures were included in the case. A copy of the Journal of "*Advances in Materials Technology Monitor*" by UNIDO (issue 4/1995) was also distributed to the participants. A copy of the book of "*Development in Textile Chemistry and Chemical Technology*" by Prof. Ali Hebeish; ex-president of the Egyptian Academy of Science and Technology, who lectured at the course, was also handed to participants. Some leaflets, brochures and samples from industry were also distributed e.g. Idroplast, Italy and Rp Scherer Egypt for Softgels.

It was planned to distribute the book of "*Degradable Polymers: Principles and Application*" by Prof. G. Scott among the participants. Unfortunately, the Cargo Company could not deliver the books at the exact time of the course and unfortunately the budget limits hindered this scheme. There is some negotiations to bring the books to Alexandria and to distribute them to all participants by mail.

## **Funding**

The training course was mainly sponsored by ICS-UNIDO. The ICS - UNIDO Contribution for the activity was set at US\$ 40,000. The course received support from other institutions: The Academy for Scientific Research and Technology, Cairo; The British Council, Alexandria; International Development Research Centre, IDRC (Canada); Rp Scherer Egypt Softgels, Alexandria; Regional Authority for Tourism Promotion, Alexandria.

## **Social Events**

Many social events were organized to achieve better integration among the group in more informal atmosphere. The first event was the inauguration ceremony sponsored by the Egyptian Academy of Scientific Research and Technology, Cairo. At the conclusion of the day, participants had a visit to the Pyramids and Sphinx in Cairo where they were served lunch together. Hospitality was offered by Rp Scherer Egypt while visiting the company. In the last week of the course, participants had the chance to attend some cultural shows and get together parties at night.

On Friday 27th, the whole group had a guided tour to the Alexandria highlights while lunch was served on one of the elegant sea coast restaurants of Alexandria.

## **Results**

1. A high level training course, aiming at introducing the science and basic concepts of environmentally degradable plastics along with the update technology used, was achieved. A balance between theoretical background and practical training was observed. This course was introduced for the first time in the region and was very much appreciated by participants.
2. Interaction among participants was achieved as they exchanged experience and knowledge through the program. A list of participants addresses / telephones / faxes was distributed to participants at the end of the course. Also, a group photo was distributed to participants.
3. The concept of environmentally degradable plastics was perceived among participants who are working in various research and industrial institution. That should constitute an impact on this subject in academia and industry.
4. Interaction with industrial institutions has taken place. Scherer Egypt company is interested in using the waste polymers in useful recycling processes. Contacts with professor Chiellini and Pisa University is about to take place. Hyma Plast company is introducing a line for polyethylene recycling, they are already in contact with the Arab Society for Materials Science for technical support. The company engineers who attended the course were catalytic in this technical support issue.

5. Interaction among participants and lecturers was achieved at its outmost. Lecturers, particularly, Prof. Chiellini, professor Scott, Dr. Griffin and Prof. Kandil who attended the entire training course were very interactive with participants. After the activity the Egyptian Environmental Affairs Agency (EEAA) indicated its interest to encourage this line of activity in its forthcoming policy.
6. One of the participants from the Arab Countries officially applied to join the Ph.D. program of the Institute of Graduate Studies and Research, Alexandria University, Egypt.
7. Some participants are applying for UNIDO support for grants and got provisional acceptance for that. Some were advised for their future studies in Europe.
8. The scientific content was so valuable that a suggestion of producing a book containing the lectures was deemed necessary. Preparations for producing such a book have started already to meet a dead line of September 30.
9. The evaluation of the course reflected the appreciation of the participants. The course was rewarding scientifically and culturally.
10. The event was reported in three Egyptian news paper where the concept of environmentally degradable plastics was highlighted. This will reflect on the public awareness of the subject.
11. A pre-proposal was submitted by Prof. Hebeish for UNIDO seeking support for his applied research on polymer-base starch modification and its application as environmentally degradable polymers.
12. An application for UNIDO support for a feasibility study of environmentally degradable plastics in Egypt is going to be submitted by Prof. Sherif Kandil.

### **Feed Back**

Reaction to the scientific content and general organization of the training course was sought by means of a questionnaire. All participants were keen to fill the questionnaire to express their reflections towards the

course. Lecturers who attended the whole training course, or at least 5 days of the activity were asked to give their opinion and comments.

The completed questionnaires were submitted to ICS-UNIDO indicated a very positive feed-back from participants as far as the scientific content and organization of the course.

Many of the participants and lecturers send other reflections and opinions to the local organizer (ASMS) about the organization of the course after they arrived back home. It may be interesting to state here some of these comments.

*"The TC was great, the organization perfect and atmosphere very stimulating indeed".*

***Prof. Emo Chiellini, Italy***

*"Here I am back in my office with the excellent memories of an unforgettable trip. Looking into the pictures we have taken and in the books we have bought, we have the feeling that the whole thing was more like a dream than reality.....".*

***Eng. Cem Erugen, Turkey***

*"Egypt were also quite fascinating..... A technical high spot of my visit to Egypt was meeting the staff of the Plastic Development Center. You will recall that Prof. Scott and I were both able to prepare some blown LDPE film at the centre. The results are extremely interesting....."*

***Dr. Gerald Griffin, England***

*"Let me congratulate you on the excellent organization of the course. I thought that the balance between academic, practical and social was just right and the social interactions were particularly catalytic to the course as a whole."*

***Prof. Gerald Scott, England***

**Environmentally Degradable Plastics**  
**22 June - 3 July 1997, Egypt**

Accommodation		Total	
		US\$	US\$
<i>Shepherd Hotel, Cairo (1 Night)</i>			
Participants (21 Person)	\$63 * 21Pax * 1	1323.00	
Lecturers (3 Persons)	\$63 * 3Pax * 1	189.00	
Organizers(2 Persons)	\$63 * 2Pax * 1	126.00	
Extra nights (for participants who arrived earlier)	\$63 * 4	252.00	
Dinner on 21 June 1997	\$20 * 30Pax	600.00	
			2490.00
Reception on 22 June 1997/ Hall and Advertizement, inzuguration session		400.00	400.00
Lunch on 22 June 1997	\$17 * 30Pax	510.00	510.00
<i>Montazah Sheraton (7 nights Half Board)</i>			
Participants (20 Person)	\$75 * 20Pax * 7	10500.00	
Lexturers (4 Persons)	\$75 * 4Pax * 7	2100.00	
Organizers(2 Persons)	\$75 * 2Pax * 7	1050.00	
Meals ( Dinner)	\$20 * 26Pax * 7	3640.00	
			17290.00
<i>RA II (4 nights - Full Board)</i>			
Participants (20 Person)	\$85 * 20Pax * 4	6800.00	
Lecturers (2 Persons)	\$85 * 2Pax * 4	680.00	
Organizers(2 Persons)	\$85 * 2Pax * 4	680.00	
			8160.00
<i>Departure Night (Baron Hotel)</i>			
7 Persons	\$65 * 7Pax * 1	455.00	
			455.00
			29305.00
<b>Meet and Assist at Airport and Transfer to Hotels</b>			
Airport/Hotel in Cairo	\$30 * 9 Pax	270.00	
Airport/Hotel in Alexandria	\$150 * 1 Pax	150.00	
			420.00
Accompanied bus for 8 days		3800.00	3800.00
			4220.00

<b>Travel Expenses</b>			
<i>Air Tickets for Participants and Lecturers</i>			
Prof. Enzo Chiellini (Pisa/Cai/Pisa)		588.00	
Prof. Gerald Scott (Tees-side/Lon/Cai/Lon/Tees-side)		1375.00	
Prof. Gerald Griffin (Lon/Cai/Lon)		714.00	
Ms. Thanaa Zangana (Amm/Cai/Amm)		341.00	
Chem. Alia Kaskas (By/Cai/By)		294.00	
Prof. Irfan Piskin (Ank/Ist/Cai/Ist/Ank)		400.00	
			3712.00
<i>Travel Expenses for Egyptians</i>			
Participants	\$150 * 14 Pax	2100.00	
Lecturers	\$150 * 13 Pax	1950.00	
Organizers	\$150 * 2	300.00	
			4350.00
			<b>8062.00</b>
<b>Others</b>			
Bags	\$25 * 30	750.00	
Printed Material	\$38 * 30	1140.00	
Printed Leaflets and postage		1125.00	
Chemical for Laboratory Exercises		2200.00	
Tel and Faxes		1850.00	
Cost of experiments and training at Plastic Development Centre		1050.00	
Institute of Graduate Studies and Research		1000.00	
(nominal contribution for using labs/lecture rooms and assistance)			9115.00
			<b>9115.00</b>
<b>TOTAL</b>			<b>50702.00</b>

We hope to provide participants with the book "Degradable Polymers: Principles and Applications edited by Prof. Gerald Scott. This book will cost around US\$1921.5. Unfortunately, we are now out of budget. Could the UNIDO provide that?