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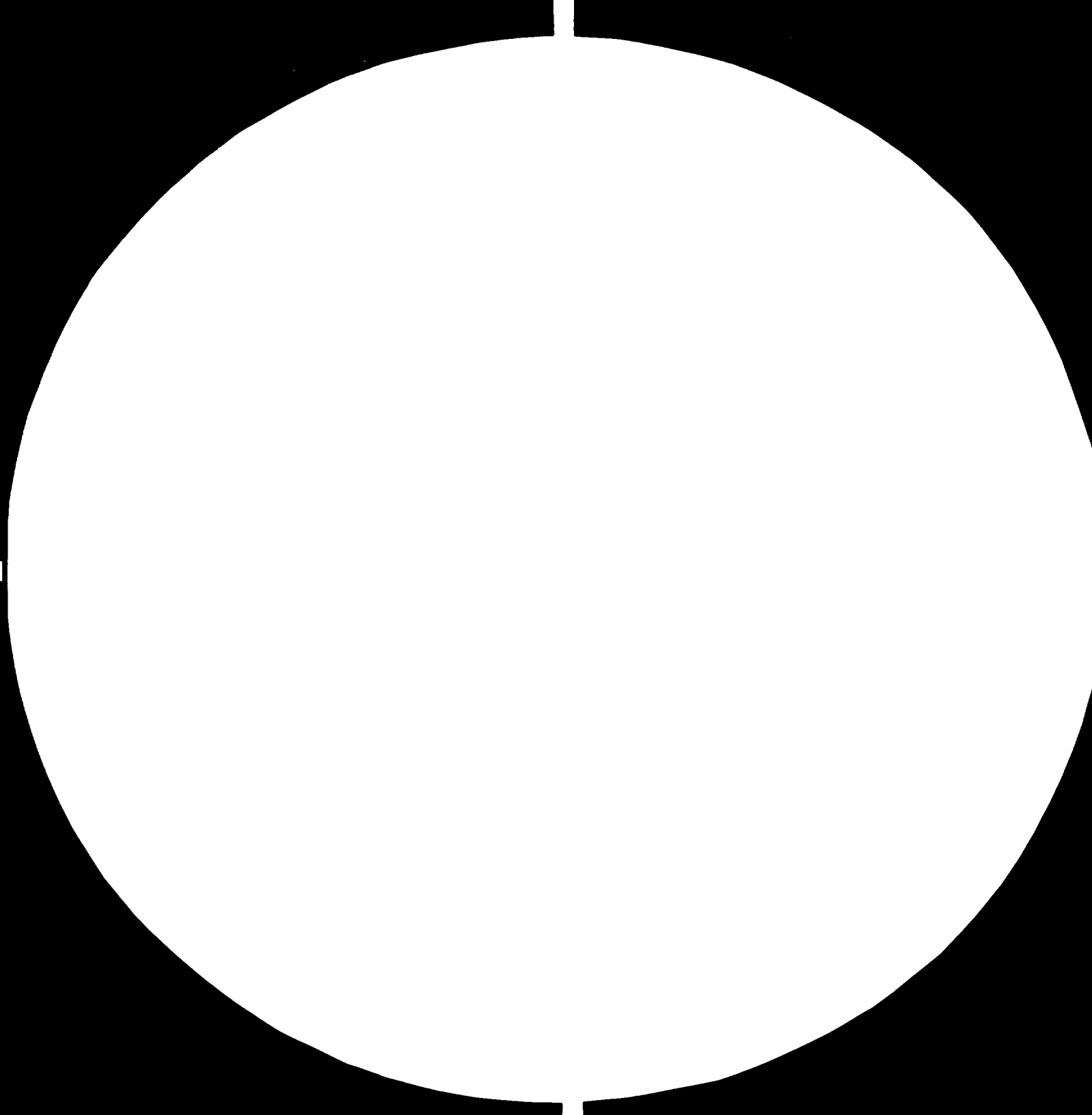

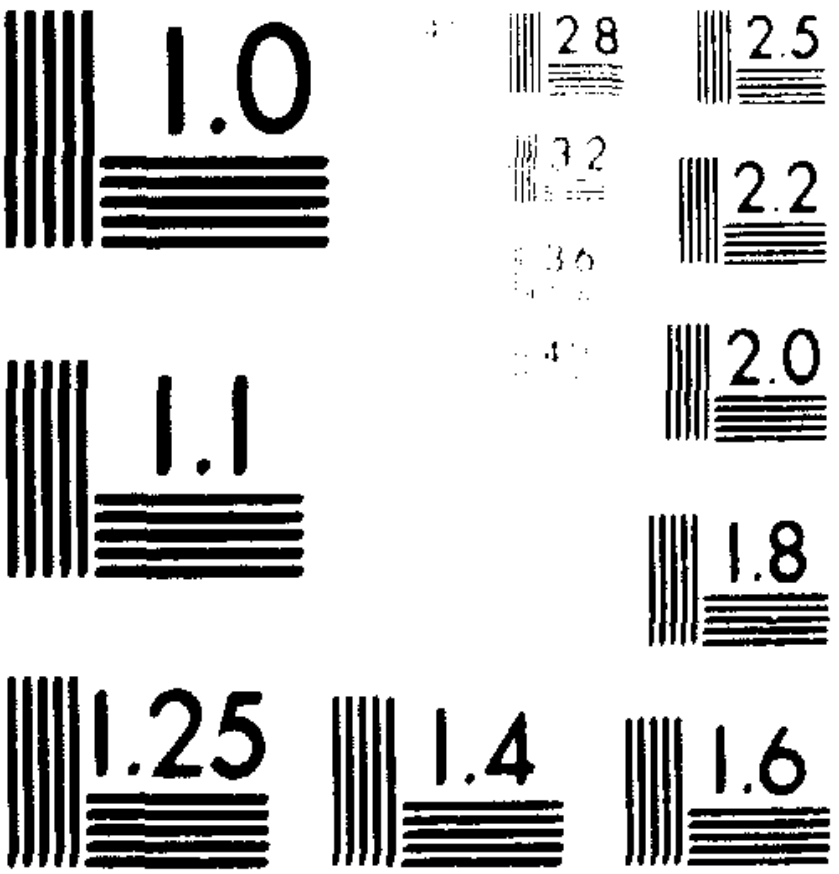

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CONSOLIDATION OF THE MEXICAN INSTITUTE FOR ASSISTANCE TO INDUSTRY

DP/MEX/78/011

MEXICO

Technical report: Plastic and transport packaging*

Prepared for the Government of Mexico
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Joseph Miltz, expert in plastic and transport packaging

United Nations Industrial Development Organization
Vienna

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SUMMARY

The IMAI and LANFI institutes are presently in the process of reorganization and rapid expansion in manpower and facilities which will enable them in the future to fulfill their objectives in serving the country in the fields of packaging and food preservation .

The present technical personnel has good theoretical and scientific backround . However, the majority of the people are young and of limited practical experience in packaging engineering and technology and therefore a program for advanced studies and practical training should be prepared and carried out .

Most of the cheep polymers are manufactured in Mexico and are quite extensively used in the packaging industry. However, many of the more expensive and with better properties polymers are not manufactured in the Republic of Mexico and are used in the packaging industry only to a limited extend .

The quality control in some of the polymerization and converting plans is insufficient and therefore to much residual monomers ans solvents can be found in the final packages. The methods of residual monomers and solvents determination was outlined and work was begun on residual VCM in PVC. IMAI- LANFI will be able in the future to play an important role in improving the quality of the local packages .

A study on transport packages for fresh produce (fruits and vegetable) was carried out by IMAI. More tests at standardized conditions and with different packages have to be carried out in order to obtain more significant results and thus to arrive at the optimal shipping containers for the different products . The properties of a foamed polystyrene tray for fish packaging were evaluated

in order to determine its suitability for the above mentioned use. Advice was given to the group carrying out this study in regards of testing methods and analysis of results .

The program on flexible packages for heat processed foods was reviewed and altered in accordance with existing limitations in materials and equipment. Work has begun on preservation of acid foods and advice was given concerning the polymeric films that should be used for this purpose .

A series of in-house lectures on structure-properties relationships in polymeric materials and on methods of applied research and analysis were given to all people in the packaging department .

Many visits to industrial firms were made in order to familiarize the technical staff with the local plastic and packaging industry .

In addition, a three day seminar on Food Packaging,Preservation and Shelf-Life was organized .

This seminar was attended by aproximately 40 people from the industry and other institutions and by about 20 from IMAI-LANFI and will undoubtfully lead to more contacts between the institute and the local industry .

1. INTRODUCTION

1.1 General

The duration of the present project was scheduled to be six months. However, as the mission was divided form the begining into two parts (to be carried out during the periods July-September 1980 and July-September 1981), the present report summarizes the work performed during the first of the two periods .

1.2 Objectives of projects :

To advice in evaluating existing and in developing new plastic and transport packages in general and specifically :

1. Make a general evaluation of the plastic packages which are being used in the country with regard to appropriateness and coverage of their present uses.
2. Make an appraisal of raw materials, techniques and equipment utilized in the country for the manufacture of plastic packages.
3. Discuss and advise on complementary fields of utilization and new or improved materials for plastic packages suitable for the country .
4. Advise in developing a package suitable for thermally processed foods .
5. Assist in developing methods for evaluating transport packages for fresh produce .
6. Advise in setting up standard testing procedures and standards for transport packages in general and fresh produce in particular.

7. Give lectures regarding above mentioned subjects and train personnel in relevant methods of analysis .

1.3 Backround

The Mexican Institute of Assistance to Industry (IMAI) constituted in 1977 and the National Laboratories for Industrial Development (LANFI) established in 1948 are now in the process of reorganization and consolidation of the two institutes into one autonomous institute to be called LANFI. Together with the reorganization, these institutes are presently undergoing a rapid expansion in manpower and facilities with the aim of increasing the activities and services rendered to the local industry in the fields of packaging and food preservation .

IMAI-LANFI, being the only Packaging Institute in the Republic of Mexico will undoubtfully play, in the authors opinion, an important role in this country after the training period is completed and when it becomes more known to the local industry. The role of this institute may become even bigger as a result of the recently adopted national plan (called SAM-Sistema Alimentario Mexicano) to increase food production and preservation .

The major activities and services of the packaging department are testing, design, quality control, information, training and applied research. The technical personnel involved in the above mentioned activities have good theoretical and scientific backround .

However, the majority of the people are young and unexperienced and have therefore only a limited practical experience in packaging science

engineering and technology. It should also be mentioned that while for testing, quality control, design, training, etc. a first degree (B. Sc.) is adequate and sufficient, an advanced degree is almost a must in order to carry out research and development projects. This is also the opinion of Dr. C.H. Mannheim, expert in packaging and preservation of fresh and processed foods . However, only a very limited number of persons in the packaging department have an advanced degree. It is recommended to set up a program for practical and advanced training of the appropriate people .

As far as plastics and plastic packaging are concerned, the number of available books and journals in the LANFI-IMAI library is very limited. A preliminary list was prepared. There is also a lack of certain pieces of equipment for characterization and testing, some of them simple and inexpensive. Lists of required equipment were prepared together with the head of the packaging department, the UNIDO Co-Director and Dr. C. H. Mannheim (See Appendix 3) . . There is also a lack of laboratory space however this problem will probably be resolved with the completion of the new laboratory which will be built soon .

At the beginning of the authors stay at IMAI-LANFI it turned out that the technical personnel is not acquainted enough with the plastics packaging industry in Mexico and that the industry is not familiar with the institution. Therefore, an extensive plan of field trips was drawn up and many local packaging plants were visited ,

2. DESCRIPTION OF WORK PERFORMED

2.1 General

It was pointed out in the "Backround" that upon arrival at the post, the people were not well familiar with the plastic and packaging industry.

In order to achieve the objectives of the post (which also includes making an evaluation of the plastic packages being used in Mexico) and at the same time enable the technical people in IMAI -LANFI to see plastics and packaging factories, extensive visits to such fac - tories were arranged.

The list of visits is given in Appendix 1.

Although these visits cover only partly the Mexican plastic and packaging industry and more visits are planned to take place during the second part of the mission in summer 1981, the following has been noticed :

many of the common and relatively cheap polymers like low-density polyethylene (LDPE) high density polyethylene (HDPE), polystyrene (PS) polypropylene (PP) and polyvinyl-chloride (PVC) are manufactured in Mexico and quite extensively used in the packaging industry .

Another polymeric film that is extensively used in different forms and combinations with other polymers is cellophane. Most of the more expensive and of better properties polymers like the polyamides (PAM - also known as nylons), polyethylene terephthalate (PET), polycarbonate (PC), homo- and copolymers of acrylonitrile and polybutylene (PB) are not manufactured in Mexico and their use in packaging is limited.

Polyester and nylon imported films are used relatively very little .

It seems that the local industry and primarily the local customers care more about the price of the package than about the quality of the packaged product. Thus, the author has seen coffee that is considered to be of very good quality packaged in a polyethylene bag which is definitly inadequate for this purpose .

The author has also experimented, more than once, drinking coffee from a foamed polystyrene cup in which he was able to detect (sensorily) residual styrene. The last problem stems from insufficient quality control. Although some factories have advanced converting equipment, it seems that they are not utilizing all their potential to manufacture advanced plastic packaging materials. Plastic laminates are very commonly used now in the packaging of goods in the industrialized countries. In the whole of the Republic of Mexico there are, to the best of the authors knowledge, only two co-extruders and only two laminating plants which would not be sufficient for a country like Mexico if it would use the proper packaging materials .

This situation is probably a result of two reasons :

1) Lack of local advanced polymers and the necessity to import .
2) Lack of the awareness of the benefits of advanced polymeric packages and therefore also lack of demand for improved, but also more costly packages .

Thus for instance, light and unbreakable PET containers for carobonated bevarages are extensively used in the United States and Europe while in Mexico only cans and bottles are used for this purpose. But, not only advanced polymeric materials are not sufficiently used in the country. Even the cheap polymers are not always completely utilized. Thus for instance, foamed PS is extensively used in the US for eggs

packaging while in Mexico only carton is used for this purpose .

Another problem that the author has noticed in some of the local plastic and packaging industries is insufficient quality control in the polymerization and converting processes .

Thus, not enough attention is paid to reduce the amount of vinyl-chloride monomer (VCM) from PVC, of styrene monomer from polystyrene and of residual solvents (used during the laminating and printing processes) from plastic laminates .

Other work related to specific projects is given below :

2.2 Transport packages for fresh produce

Upon arrival to IMAI-LANFI, the Institute was completing a study on transport packages for 40 different fruits and vegetables. This study was later summarized in 40 reports, describing the amount of produce and the location of each of the products and the different packaging materials used in Mexico and abroad. The report also included a relatively short section on the tests that were performed and recomendations for future action. Some of the tests performed before my arrival were not carried out in the most suitable way. This was corrected with the remainder of the tests but due to lack of time , only limited tests could be repeated. Moreover, in my opinion more tests at standardized conditions, as outlined and adviced , by Dr. C. H. Mannheim and myself had to be carried out in order to obtain more significant results. But again due to lack of time (as the reports had to be submitted) this could not be performed .

The most common transport packages for fruits and vegetables in the Republic of Mexico are wooden boxes.

These boxes are relatively expensive and do not provide proper protection to the product. Moreover it is a custom to overfill these boxes (probably in accordance with the consumers request) and this causes significant damage to the products during storage, handling and transportation. A properly designed corrugated carton box may be more economical and provide better protection to the product .
It was suggested to the group working in transport at IMAI-LANFI, to carry out well designed and controlled experiments with different products and alternative containers in order to arrive at the optimal shipping containers for the different products. Based on the results of these experiments, standards (that do not exist today) should be established .

2.3 Polystyrene trays for fish packaging

IMAI received a project from "Plasticos Espumados" to analyze the properties of expanded polystyrene trays for their suitability for fish packaging. The project was discussed with the people responsible for carrying out the studies. Advices were given as for the tests to be carried out and conditions to be used.
The project was followed up and suggestions were made in the interpretation of the results .

2.4 Residual vinyl-chloride monomer (VCM) in polyvinylchloride (PVC) and in contained food.

Work was begun in analyzing residual VCM in PVC packages and in the contained food using gas chromatography. Written instructions were prepared outlining the procedures and quantities that have to be used in order to construct calibration curves for packages and foods or

simulating solvents .

Actual work was also started. Procedures were outlined how to test residual solvents in plastic films and laminates and residual styrene in polystyrene .

2.5 Flexible packaging for thermally processed foods .

After the arrival at the post, a preliminary project was started to evaluate the possibility of using polymeric flexible packaging materials (instead of cans) for acid foods like chile and tomato paste. The main purpose of the project was to train the people in proper planning of the experiments and analysis and to lay the foundation for the development of the retortable pouch. The author participated in the selection of the polymeric films and advised on the films that should be used .

2.6 Training

A series of in-house lectures concerning methods of ånalysis, experimental design, problems solving etc. were given to the entire packaging group by C.H. Mannheim and myself. A variety of subjects related to plastic materials, residual solvents and monomers, metal, cans and coatings, etc.were covered. In addition a three day seminar on the topic of Packaging and shelf-life was organized during the dates August 27-29, 1980 .

Approximately 40 people from the local industry and from the universities in addition to about 20 people from IMAI-LANFI partipated in this seminar. Two folders with about 300 pages of lecture notes and reference material were prepared and given to each participant. From

the questions and comments at the end of the seminar it was learned that it was very successful and will certainly contribute to better connections between LANFI and the industry

The program of the seminar is given in Appendix 2.

3. RECOMMENDATIONS

3.1 It is recommended to establish a program for advanced studies and practical training of the people. It is highly recommended that at least the group leaders continue their studies for an advanced (M. Sc.) degree in their fields. These studies should take place in technological institutions or universities with strong scientific and practical programs in the appropriate fields. The other people should be sent for short periods, 3-6 months, of practical training abroad .

3.2 It is recommended to order the missing equipment listed in Appendix 3.

3.3 It is recommended to carry out additional, well controlled experiments with a limited number of sensitive but important fresh fruits and vegetables packed in different packages in order to evaluate the most suitable trasnport containers for the local market .

3.4 It is recommended to continue the work on residual VCM in PVC packages as well as residual styrene in polystyrene and/ residual solvents from the laminating and printing processes .

3.5 It is recommended to continue the in-house lectures and training in the field of structure, properties and applications of polymers used as packaging materials .

3.6 It is recommended to continue to look for different plastic pouches for acid food products as a basis for the development of a retortable pouch system in the future .

3.7 It is important for Mexico and the local packaging industry to establish plants for the manufacturing of polymers of advanced properties like nylons, polyethyleneterephthalate (PET), polycarbonate etc. This can be of special value as Mexico is a big oil producer so that the raw materials for the polymers production are, or can become available, in the country

3.8 It is highly recommended to extend the range of plastic materials to be used in the packaging industry in Mexico .

3.9 It is recommended to acquire an extruder and a laminator (and at a later stage a coextruder) if LANFI is to enter into research and development studies of flexible packaging materials like pouches for acid foods and the retort pouch.

A P P E N D I X I

LIST OF VISITS

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Ejido 7 bis esq. 16 de septiembre
San Francisco Culhuacán
México 21, D.F.

APPENDIX II

1.-	NOMBRE DEL SEMINARIO:	"Seminario de Envases para Alimentos"
2.-	OBJETIVO:	Dar a conocer las técnicas empleadas para la determinación de la vida de anaquel, la simulacion de transporte de envases da productos alimenticios.
3.-	DIRIGIDO A:	Profesionistas e investigadores cientificos y técniocos que estén trabajando en la industria de envases para alimentos.
4.-	PROGRAMA Y LISTA DE PONENTES:	Se anexan
5.-	FECHAS Y HORARIO:	27, 28 y 29 de Agosto de 1980 De 8.30 a 12.00 Hrs. y de 13.30 a 17.00 Hrs.
6.-	LUGAR:	Auditorio de la Cámara Nacional de la Industria Textil (CANAITEX) Plinio 220, esquina Horacio Plinio 220, esquina Horacio Polanco, México 5, D.F.
7.-	COSTO	5,000.00 (Cinco mil pesos 00/100 M.N. más el IVA) Incluye Diploma
8.-	INFORMES E INSCRIPCIONES:	Lic. Julio A. Blackaller R. Lic. Margarita Barrientos Tel. 589-01-99 Exts. 142, 124 y 125

RELACION DE TEMAS Y PONENTES PARA EL SEMINARIO DE ENVASES PARA ALIMENTOS

	TEMA	POMENTE
(I)	Inauguración	Dr. Juan Antonio Careaga Director General Laboratorios Nacionales de Fomento Industrial Ing. Abelardo Reynosa Vega Director Técnico de los Laboratorios Nacionales de Fomento Industrial
(II)	Introducción	Dr. Chaim Mannheim investigador del Technion de Israel
(III)	Vida de anaquel de Productos perecederos	Dr. Chaim Mannheim Investigador del Technion de Israel
(IV)	Estructura y propieda- des de materiales poli méricos laminados	Dr. Joseph Miltz Investigador del Technion de Israel
(V)	Visita a los LANFI	Ing. Francisco Munõz
(VI)	Materiales flexibles	Dr. Joseph Miltz Investigador de Technion de Israel
(VII)	Permeabilidad, migración Sellado y estabilidad de plásticos	Dr. Joseph Miltz Investigador del Technion de Israel
(VIII)	Vida de anaquel de pro- ductos enlatados	Dr. Chaim Mannheim Investigador del Technion de Israel

	TEMA	PONENTE
(IX)	Efecto de los barnices en la vida de anaquel de productos enlatados	Ing. David Reznick Israel
(X)	Métodos para predecir y determinar la vida de anaquel de productos alimenticios	Dr. Chaim Mannhiem Investigador de Technion
(XI)	Desarrollo y tendencias en la preservacion de productos perecederos	Dr. Chaim Mannheim Investigador del Technion de Israel
(XII)	Evaluación del Transporte y manejo de envases para productos agricolas	Ing. Olga Arce León I M A I
	Determinación de isotermas de productor alimenticios mexicanos	Q.F.B. Cecilia Rojas I M A I
	Conclusiones y Clausura	Dr. Juan Antonio Careaga Ing. Carlos Rodríguez Caldera LANFI

HORARIO PARA EL SEMINARIO DE "ENVASE PARA ALIMENTOS"

HORA \ DIA	MIERCOLES 27	JUEVES 28	VIERNES 29
8.30 a 9.00	PONENCIA (I)	PONENCIA (VI)	PONENCIA (X)
9.00 a 10.00	PONENCIA (II)	PONENCIA (VII)	
10.00 a 10.30	CAFE	CAFE	CAFE
10.30 a 12.00	PONENCIA (III)	PONENCIA (VIII)	PONENCIA (XI)
12.00 a 13.30	COMIDA	COMIDA	COMIDA
13.30 a 15.00	PONENCIA (IV)	PONENCIA (IX)	PONENCIA (XII)
15.00 a 15.30	CAFE	CAFE	CAFE
15.30 a 17.00	VISITA A LOS LANFI (V)	MESA REDONDA MILTZ, REZNICK, MUÑOZ, MANNHEIM	CONCLUSIONES Y CLAUSURA

APPENDIX III

RECOMMENDED LIST OF EQUIPMENT

Equipment	Estimated Cost (U.S.$)
First Priority	
Multi-point temp. recorder(12 points;0 to 150 or 0 to 200 C range)	3 ,000
Vacuum pouch sealer	10,000
Vacuum can sealer (Metal Box MB 1A)	12,000
Racks(cages) for pouches	to be made locally
UBBELOHDE viscometers	400
2 vacuum gauges for cans	200
Can pressure Tester-Metal Box Can Hand Tester	200
Micrometer for films with 1/1000 mm	200
WACO can seam analyzer complete with saw	2,000
WACO Enamel Rater	1,000
Magnetic lacquer thickness gauge	300
Falling Dart Impact Tester	3,000
Second Priority	
Oven for Instron	
Autoclave for retort pouches	75,000
Dissolved Oxygen. analyzer	1,000
Water Activity analyser (Beckman)	8,000
Hunter Color Difference Meter	8,000

Other facilities

Accessory pieces of equipment for gas chromatography like syringes, columns, packing materials and solvents are very much needed.

For LANFI to enter into research and development studies of flexible packaging materials like pouches for acid foods and the retort pouch, an extruder, a laminator and probably also a co-extruder will be required.