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STRENGTHENING OF THE TECHNOLOGICAL CAPABILITY OF THE THAI PACKAGING CENTRE
DP/THA/87/019
THE KINGDOM OF THAILAND

Technical report: Applied research and quality control on plastic film and laminate packages*

Prepared for the Government of Thailand
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of J. Miltz,
expert in film and laminate packages

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United Nations Industrial Development Organization
Vienna

* This document has not been edited.

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Summary

This report summarizes the work performed by the expert during the second part of his mission to the Thai Packaging Centre (TPC) for the period of February 1992.

The main purpose of this mission was to strengthen the knowledge and understanding of TPC's Technical Personnel on Structure - Property - Application relationships of polymers in general and plastic films and laminates in particular and to train this personnel in research methods and in laboratory testing and interpretation of results.

Twelve lecture hours on the subjects of Structure - Property - Application of Polymeric Packaging Materials and Manufacturing of Packages were presented to all TPC's technical personnel. The MOCON instrument for measuring oxygen permeability of plastic films and packages was brought into operation and the interpretation of results was explained.

In addition, advice and assistance was given to this group in conducting tests for industrial firms in compliance with their request.

Two research projects were designed to be carried out by TPC personnel after the expert has left and the author agreed to review and assist in analyzing the results after the completion of the experimental work.

1. Introduction

1.1 General

This report summarizes the work performed by the expert during the second part of the split mission to the Thai Packaging Centre (TPC) in February 1992.

Although some parts in this report were given in the Final Report of the first split mission (July - August, 1991), the author has decided that for the sake of clarity and integrity of the present report these parts should be given again (primarily the parts of the Introduction) with some slight modifications or additions.

1.2 Job description

Upon arrival at the duty post, it was realized that the technical personnel at TPC do not have a sound background in the area of polymers and plastic packaging. As a result and after discussions and consultation with the director of TPC, Dr. Amornrat Swatditat, the job description was altered somewhat (Compared to the original) to cover primarily the following subjects :

1. Lecturing on Structure - Property - Application relationship of polymeric packaging materials.

2. Advising and training the technical personnel in testing of plastic films and laminates and especially in the interpretation of results.

3. Assisting in industrial problems solving.

4. Visiting industrial firms.

5. Training the technical personnel in research methods required in order to choose a proper film or laminate from which a pouch to package a domestic or export product would be prepared.

6. Submitting a one day seminar to industry, including a plenary session of questions and answers on "New Developments in Plastic Packaging."

7. In addition, as the author of this report is considered to be also an expert in "Protective Packaging" (compression, shock, vibration) he was asked and complied with the request to advise and assist in tests in these areas being carried out for industrial firms. The author was also asked to assist in the area of one of his expertise: "Cushioning Properties of Plastic Foams."

1.3 Background

The Thai Packaging Centre (TPC) is part of the Thailand Institute of Scientific and Technological Research (TISTR) established, in the present form, in 1979. It is run under the Ministry of Science, Technology and Energy. TISTR is the only one of its kind in Thailand and contains Research Centres in almost all areas of Science, Engineering and Technology. TPC, established in 1984, is also the only Packaging Centre in the country. It contains three major fields of activities in alphabetic order :

a) Promotion and Training
b) Research and Development
c) Testing and Consultancy

Each of the three activity groups has a group leader. The counterpart of the author of this report was the leader of the Testing Group Mr. Sakkhee Sansupa. The Testing Lab is involved in different kinds of testing activities. It contains most of the equipment required to evaluate the properties and performance of packages and packaging materials. The list of available equipment was given in Appendix A of the first report. The equipment is of very good quality.Nevertheless, some instruments of very great importance for analysis and testing are missing and they will be mentioned in the recommendations. The technical personnel in the Testing Group is relatively young; although very capable and eager to learn, their

experience in "Packaging" in general and in "Plastic Packaging" in particular is limited. Although the majority of this group are engineers, none of them had formal, in depth, courses in "Pclymer Engineering and Science" at the University level. Some of them were however exposed to short courses, seminars and/or training sessions. This was the reason behind the decision to initiate a series of lectures on structure - property - applications relationship of polymeric packaging materials.

The Thai plastic industry is developing and expanding very rapidly. A list of major manufactures of polymers, including quantities, is attached as Annex 1 to this report.
From this list it is evident that only the commodity polymers are currently manufactured in Thailand. The advanced polymers like the different nylons, polyethylene terephthalate (PET), crystalliized PET (CPET), ethylene - vinyl alcohol copolymers (EVOH) and others are not manufactured in Thailand and the use of some of them (PET) is limited. However, with the current rate of expansion of the Thai polymer industry accompanied by new converting techniques and equipment, there is no question in the author's mind that this situation will change and in the future, advanced plastic materials, laminates and package will be available also in Thailand.

Upon arrival at the duty post, it was realized and conceived by the author that although the technical personnel at the Center is familiar, to a certain extent, with the Thai

plastic and food industry, strengthening of the ties between the Centre and major food and packages manufacturers would be beneficial to both parties. As a result, he has recommended to arrange visits to industrial firms and received a very favourable response from the TPC management. The list of visited companies and names of contact persons are given in Annex 2.

To strengthen the ties between TPC and industry, the expert has also offered to present a seminar to industry on the subject : "New Trends in Plastic Packaging for Food" and again received a very favourable response from TPC management.

To summarize, it is believed that the Thai Packaging Centre has the potential, in manpower and equipment, to become an excellent facility for helping the local industry in testing of raw materials and finished packages, for doing research and development work in packaging, for involvement in troubleshooting problems in industry and for assisting in preparation of specifications and standards.

2. Work performed

2.1 Lectures

During the first part of the mission lectures were given on different properties of polymeric films. In the present mission 6 lectures, two hours each, were given on:

- Structure, properties and applications of condensation polymers.
- Molecular structure of polymers, including molecular weight averages and molecular weight distribution and methods for their determination.
- The relationship between structure and properties of polymers.
- Processing of polymers and package manufacturing.

2.2 Methods of testing plastic films and laminates.

Although many of the methods were discussed and demonstrated in the first mission, during the present mission the MOCON instrument for measuring oxygen permeability has arrived. The author participated in bringing this instrument into operation, including utilization of the instrument in measuring oxygen permeability of plastic films, laminates and containers at different temperatures and relative humidities. It was also explained to the technical personnel how to interprete oxygen permeability of a whole package in terms of the permeability of the material and the permeability constant.

2.3 Advice in testings for industry.

Advice on methods of tests carried out for industry and interpretation of results was given during the first and current missions.

2.4 Training in research methods.

During the first mission, a research project on the shelf life of instant noodles packaged in different plastic pouches was designed. The main purpose of this project was to train the technical personnel in research methods. Instant noodles were chosen as this is a typical product manufactured in Thailand with a potential for export. The project was carried out by the TPC personnel during the period between the two missions (Sept. 1991 - Jan. 1992). During the present mission the results were analyzed. The project was carried out as planned to the great satisfaction of the author. However, the duration of the project was too short and some tests could not be carried out because of objective reasons. It was therefore decided to consider this project as a preliminary one and to carry out the project again on a full scope. It was agreed that upon the completion of the research plan, the results would be sent to the author and the latter has agreed to assist in reviewing and analyzing the results. This research project will take at least six months.

In addition, a research project on the effect of temperature and relative humidity on the permeability to oxygen of hydrophilic plastic films was designed. The testing and research group at TPC will carry out the research. Again it was agreed, that upon the completion of the research work, the results would be sent to the author for review and analysis.

2.5 Other tasks from the job description.

Items 4,6 and 7 in the job description (Annex 3) were carried out during the first mission.

2.6 Miscellaneous.

The author has learned that some trips to industrial firms were carried out by the Research Group but none by the Testing Group. Such visits are highly desirable and recommended as outlined in the Final Report of the first mission (July - August 1991). The author has also learned that the books that he has recommended to purchase were ordered and some of them even arrived at TPC. On the other hand, none of the recommended instruments has been ordered as yet.

It is the author's opinion that although the technical personnel of TPC was trained in different aspects of "Packaging", there is at least one area (which is of a growing attention and concern all over the world) "Environmental Aspect of Packaging" in which this personnel has no background and knowledge whatsoever. Thus the very important aspects of "Recycling", "Packaging of Dangerous Goods" and others are completely unknown to this personnel. It is the author's opinion that training the people in these areas is imperative and an additional UNIDO project should be sponsored to cover these topics. In preliminary discussions that the expert had held with the UNIDO Country Director, Mr. Nils Ramm Ericson and his assistant, Mr.

Johan Nelis and with Mr. Bernardo Jamila - Head of Area Programs in Asia and the Pacific, the question was raised whether the Thai industry could support such a project. It is the expert's opinion that the Thai industry would not finance such a project in the near future. Moreover, even if the Thai industry would be ready to finance such a project (which as mentioned earlier is against the author's belief), TPC would not be able to carry out such a project as their personnel is not trained in these areas. Such a project could be carried out only after an appropriate training program and acquisition of equipment. This project should be sponsored, in the author's opinion, by UNIDO. Finally, it is the author's belief that because of the complete lack of knowledge in these areas, TPC personnel is not capable to prepare an appropriate proposal for such a project and they should get assistance from a UNIDO consultant in the preparation of the proposal which will then be submitted for sponsoring. If agreed upon, the present expert agreed to assist in the preparation of the proposal.

3. Recommendations.

3.1 It is highly recommended that the two designed research projects outlined in the present and previous reports, namely on shelf-life of instant noodles and on the effect of temperature and relative humidity on the permeability to oxigene of hydrophilic plastic films, are carried out in full.

3.2 It is recommended to find the appropriate funds to purchase the equipment recommended in the first report namely : a Gas Chromatograph with dual flame ionization and thermal conductivity detectors, a Melt Flow Indexer and a Sample Cutter.
3.3 It is recommended that more visits to industrial firms (Food and Packaging Companies) are carried out by the personnel from the Research and Testing groups.

3.4 It is recommended to sponsor an additional UNIDO project in order to train the TPC personnel in the area of "Packaging and the Environment" (including "Packaging of Dangerous Goods").

3.5 It is recommended that TPC personnel gets UNIDO assistance in the preparation of the proposal for the project on "Environmental Aspects of Packaging".

Acknowledgements

The expert would like to express his gratitude to all TPC's technical and administrative staff and especially to TPC's director, Dr. Amornrat Swatditat, to his counterpart Mr. Sakkhee Sansupa and the Group Leader Ms. Anchalee Kamolratanakul and Ms. Mayuree Paklamjeak for their close and fruitful cooperation and for the excellent atmosphere which prevailed during all his mission and that made his task easier and enjoyable.

Many thanks are also extended to UNIDO country director, Mr. Nils Ramm - Ericson and his assistant Mr. Johan Nelis and to Ms. Natiyar for their cooperation and assistance.

Finally, many thanks to Ms. Amprang Kaenthai for typing this report.

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Polymers Manufactured in Thailand

Polymer and Manufacturer	Quantity (ton/year)
1. POLYETHYLENE	442,000
- THAI POLYETHYLENE	152,000
- THAI PETROCHEMICAL INDUSTRY	150,000
- BANGKOK POLYETHYLENE	140,000
2. POLYPROPYLENE	300,000
- HMC POLYMER	100,000
- THAI PETROCHEMICAL INDUSTRY	100,000
- THAI POLYPROPYLENE	100,000
3. POLYVINYL CHLORIDE	275,000
- THAI PLASTIC & CHEMICAL	140,000
- VINYTHAI (C.P + SOLVAY)	135,000
4. POLYSTYRENE	120,500
- PACIFIC PLASTIC	22,500
- ETERNAL RESIN	30,000
- SRITHEPTHAI PLASCHEM	14,000
- HUNTSMAN	25,000
- THAI PETROCHEMICAL INDUSTRY	29,000
5. ABS	25,200
- THAI PETROCHEMICAL INDUSTRY	18,000
- ETERNAL RESIN	7,200

* Taken from the report of Mayuree Paklamjeak
"General Packaging Status in Thailand" January 1991

Visited companies and contact persons.

Company and address	Contact persons	Main products
1. South East Paper Industry 17/9 Petkaseam 81 Nongkham, Bangkok Tel : 4201454,1705 4202883-7	Mr.Viroon Ounhakittinaut Managing Director Mr. Somkid Visesmit Factory Manager Mr. Boonmee Lertviriyavanich Sales Office Manager	Flexible films and laminates
2. Thai President Foods CO.,LTD. 2154/1 TF Bldg. New Petchburi Rd. Bangkok Tel : 318-0059	Mr. Krid Siraprapasin Managing Director Mr. Suchai Ratanajajaroen Vice President	Instant noodles, cokies, wafers
3. TAI OFFSET CO,.LTD. 1741 Trock Chand Rd. Bangkok Tel : 286-2031	Mr. Suthee Limatibut One of the Owners and Manager	Flexible films and laminates
4. Best Pack Co.,Ltd. 66 Chittaram Bldg. Krungthonburi Rd. Klongsan Bangkok 10800 Tel : 4370354	Mr. Prasit Pornpaitoonsakul Managing Director	PVC films, sheets and trays; coextruded nylon with polyolefin films; coextruded PP and PS sheets.

Annex 3

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT IN THAILAND

JOB DESCRIPTION
DP/THA/87/019/11-03/J-13320

Title	Expert in film and laminate packages
Duration	Three months
Date required	March 1991 (subject to confirmation from the field)
Duty station	Bangkok (Thailand), with possible travel within the country
Purpose of project	The purpose of the project in connection with the expert mission is to strengthen the capability of TPC staff on the planning and implementation of applied research and development programmes relevant to the needs of the Thai exporting community, as well as on interpretation of related laboratory testing results and subsequent elaboration of advice to the concerned parties. In connection with this mission, some prototypes of export packages for specific target products and markets are expected to be produced.
Duties	The expert will be assigned to TPC where he will work in consultation with the National Project Director and in close co-operation with the local technical counterparts designated for the mission. He will be specifically expected to:

1. Get acquainted with the Thai Packaging Centre (TPC) in terms of operational structure and installed testing equipment and human resources for research, development and quality control on single plastic film, co-extruded and laminate packages;

2. Co-operate with the National Project Co-ordinator (NPC) in selection of two to three important export products commonly packaged in flexible pouches, for packaging research and development within the frame of the project;

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. BOX 300, VIENNA, AUSTRIA

3. Provide information on the main types of flexible pouches used for the above selected products at the target importing markets, as well as buying habits and purchasing power of the envisaged consumers - information details will be looked for in co-operation with the counterparts if not known to the expert with regard to some of the target markets;

4. Search and gather information on locally (either imported or locally manufactured) single and co-extruded plastic films and laminates, machinery and techniques for production of flexible packages of the main types identified in the target markets; select a laminate pouch for further exhaustive applied research and development;

5. Elaborate a few alternative models of flexible pouches for the case selected above and write out complete specifications and tolerances for them; execute and train the counterparts on a programme of laboratory tests on the concerned flexible materials, tentative prototypes and even packaging contents whenever appropriate for appraisal and improvement of the models being studied - using as much as possible of TPC testing resources and outside complementary testing whenever required or convenient;

6. Analyze the production costs of the technically suitable alternative models, for final discussion and appraisal at joint meeting with TPC, exporters, package and packaging materials manufacturers - together with related graphic design models if already available from the packaging graphic designer who will also be assigned to the project;

7. Co-operate with the NPC and technical counterparts in programming of further works with regard to the remaining important export products which were selected according to section 2.

Qualifications Packaging technologist with university degree or equivalent experience and specialization in plastic film and laminate flexible packaging materials and packages. Specific experience in research, development and laboratory quality control, as well as on structural design and economic appraisal of flexible packages is particularly required.

Languages English

Backstopping officer's comments

This mission benefitted of the fact of being a return mission, therefore of previous reciprocal knowledge between the expert and the project counterparts.

In addition to that the experience of the expert in technical assistance to technological institutions in developing countries led to actual mission activities above the expectations as per the job description.

As a matter of fact the usefulness of a packaging centre in a country depends not only on its capabilities in terms of applied research, development and quality control, but also on effective co-operative links with the national packaging manufacturer and user industries.

In this connection, the visits of the expert together with the technical staff of the Thai Packaging Centre (TPC) to specific industries were very appropriate, on the one hand by promoting the acquaintance of those industries with the services of which they can benefit at TPC, on the other hand by bringing specialists of this institution into direct contact with important technical issues, which they can help to solve.

The recommendations of the expert are pertinent, namely with regard to specific research projects which are being carried out internally, additional testing equipment and visits to industrial firms.

Particular attention should be given meanwhile to the recommendations related to packaging and the environment, including the development of TPC new capabilities related to environment protection in terms of packaging of dangerous goods and re-cycling of used packages from the municipal garbage.

A follow-up project of technical assistance to the Thai Packaging Centre on packaging and the environment could be an important contribution towards reducing environment pollution in Thailand.