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CONSOLIDATION OF PACKAGING CENTRE AND ESTABLISHMENT OF PLASTICS CENTRE AT BUREAU OF STANDARDS

DP/JAM/82/004
JAMAICA

Technical report: Laboratory Testing of Packaging and Plastic Materials and Plastic Products *

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

Based on the work of Laszlo Koronczay,
Expert in Laboratory Testing of Packaging
and Plastic Materials and Plastic Products

United Nations Industrial Development Organization
Vienna

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CONTENTS

SUMMARY

This report summarizes the work performed by the expert during his visit to the Jamaica Bureau of Standards for the period January - February 1985.

The main purpose of this mission was to help in developing the existing Plastics Laboratory in the Non-Metallic Section of the Jamaica Bureau of Standards and in training the local technical staff using the equipment and in the interpretation of the results.

The different sampling, preparing, conditioning and plastics testing techniques and equipments were discussed in detail. Actual tests were done and the interpretation of results as well as the application and limitation of thedifferent methods were outlined.

Video films describing the different test methods and the area of applicability were prepared. Video film were also prepared discussing the identification methods and systems of polymers.

Weekly lectures to the technical personnel of the Plastics Laboratory and the Packaging Centre were held, reviewing the identification methods of plastics, the flammability properties of plastics and the common mechanical testing methods, specification and standards. The testing of plastic bottles and finished items was also discussed.

A four and a half day seminar was presented to the people of the local industry. Additional list of recommended equipment and accessories for the Plastics Laboratory was prepared.

1. INTRODUCTION

1.1 General

This report summarizes the work performed during the period of January - February 1985 in the established Plastics Laboratory at the Jamaica Bureau of Standards.

1.2 Job Description

The objectives of the present post were to help in consolidating the Plastics Testing Laboratory in the Non-Metallic Section of the Jamaica Bureau of Standards in general and in particular:

(a) Advise on the methods of use of the Plastics Laboratory testing equipment already in place and on additional equipment that may be considered essential. The equiment is principally related to testing the physical properties of plastics.

(b) Advise on the interpretation of the results from the above equipment and on their application to typical problems faced by plastics converter factories and users of plastic containers and other plastic products.

(c) Assist the project manager in preparing the script for a series of video training films that will record the key points made by the expert during his mission.

(d) Assist the Plastics Laboratory staff in preparing testing schedules for typical problems associated with plastic containers and components.

(e) Advise on the nature of standards that would be helpful to the export industries and on the preparation of buying specifications.

(f) Present six one-hour talks to the Bureau's staff concerned with such topics as plastic types and their principle properties, plastics manufacture, the principle methods of test, plastics and the environment and future developments.

(g) Present two three-hour seminars on plastics laboratory testing techniques for participants from local industry.

1.3 Background

The Jamaica Bureau of Standards was established in 1969 and is presently run under the Ministry of Science, Technology and Environment. It consists of the following departments in alphabetic order:

(a) Administration
(b) Chemistry
(c) Engineering
(d) Food Science and Agricultural Commodities
(e) Information
(f) Materials Science
(g) Packaging
(h) Regulations and Compliance
(i) Standards.

The Non-Metallic Section which belongs to the Materials Science Department was established in 1972 and only in 1981 it was decided to form a Plastics Laboratory in this Section. Most of the technical personnel in the Non-Metallic Section are young graduates who received their education and training in the West Indies, where there are no programmes dealing with plastics technology, processing and applications of plastics. One of them attended a training course concerning processing and testing of plastics in Vienna.

The Jamaican plastics industry comprises a small number of big manufacturers and many small companies. The big companies all have facilities for quality control and testing, but most of the small companies and the users of plastic packaging materials or containers have no testing facilities at all.

The types of plastics used in Jamaica are limited to the common ones (PE, PP, PS, PVC). The processing technologies currently used are the following:

- film blowing
- thermoforming
- blow moulding
- injection moulding
- extrusion (PVC pipes).

The blow moulded films are processed further by heat sealing to pouches, carry bags etc. The engineering polymers like polyamids, polycarbonate and the advanced polymers for packaging purposes like polyester, PVDC, ionomers are presently not used.

It is, however, the opinion and conclusion of the expert that some of them will be introduced to Jamaica in the future.

Some of the technical people working in the industry were trained abroad and have knowledge and experience in plastics technology. On the other hand they do not have all the equipment that is and will be available in the Plastics Laboratory, therefore a co-operation between the people of the Plastics Laboratory and the technical people from industry could be beneficial to both sides. It is the opinion of the expert that the Plastic Laboratory of the Jamaica Bureau of Standards has many facilities for helping the local industry in testing of raw materials and finished products, as well as in trouble-shooting in the plastic and packaging industry.

2. DESCRIPTION OF WORK PERFORMED

2.1 General

The activities of the expert was agreed upon in co-operation with the national counterparts and the UNIDO project manager taking into consideration the equipment existing in the laboratory and arriving in the near future. The programme is given in Appendix 1.

2.2 Testing Equipment for the Plastic Laboratory

Upon arrival at the post, the following instruments were available at the Plastic Laboratory:

(a) Melt Flow Index Tester (Davenport)
(b) Falling Weight Impact Tester (Davenport)
(c) Universal Testing Machine (Zwick)
(d) Impulse Heat Sealer (Sentinel)
(e) Melting Point Tester (Fisher-Johns)
(f) Viscometers - Ubbelohde (Fisher)
(g) Punches (ISO Standards)
(h) Carver Press, just arrived not mounted
(i) Surface Tension Test Kit.

Other related instruments exist in the Packaging Centre (Hot Bar Sealer, Elmendorf Tear Tester, Water Vapour Transmission Rate Cells Drop Tester) and in the Chemistry Laboratory (Infrared Spectrometer) and may become available when required. The expert found that the following instruments were ordered but not delivered:

- Temperature Regulated Tank
- Moulds for Carver Press
- Environmental Stress Cracking Devices
- Pendulum Tensile Impact Tester with IZOD and Charpy accessories
- Notch Cutter, Tensile Kut (special saw)
- Heat Deflection Tester.

It is the opinion of the expert that the Plastics Laboratory will be well equipped to test most of the relevant mechanical properties of plastics.

The expert examined the different hardness testing facilities existing in the Non-Metallic Laboratory. He is of the opinion that testing of all kinds of chemical properties (including permeability other than water vapour, monomer content, migration, solvent residue) exceeds the scope of tasks of this Plastics Laboratory. Keeping in mind the role of the Plastics Laboratory, the author of this report recommended access to the existing additional equipment.

2.3 Video Films on Testing Methods

The expert revised the list of priorities of the different testing methods which had been established before and discussed it with the counterparts and the project manager.

The kinds of density measuring, its meaning for the identification of plastics were explained in detail to the technical staff of the Packaging Centre and the Non-Metallic Section. Several experiments were carried out using a series of liquids with different density and pycnometer. A video film describing in detail the test methods, the common mistakes and the density rates of the various polymers was prepared. The Melting Point apparatus, its composition and function were explained and demonstrated to the technical personnel. A video film showing the test method, explaining the using of the various accessories was prepared. The long stroke extensometer was mounted onto the Zwick Tensile Compression Tester. The function and the use of the extensometer was explained in detail. The existing video film was extended to show all the features of tensile testing.

The pneumatic jaws were mounted on the Zwick Tensile Compression Tester. The use of pneumatic jaws for tensile test and selecting the appropriate jaws was explained. A video film showing the explanation and use of the pneumatic jaws was prepared.

The compression head was mounted on the Zwick Tensile Compression Tester. The compression test, the type and shape of the specimen, the effect of test rate and the slenderness ration on the results was explained.

Compression tests on plastic bottles were carried out and the result analysed. A video film showing some aspects of compression testing was prepared.

2.4 Video film on Identification of Plastics

At the beginning of the work, it was clear that most of the technical personnel in the Non-Metallic Section and in the Packaging Centre were not familiar with the appearance of the plastics and they had no experience in the identification of plastics.

The systematical identifying process was outlined in detail. The behaviour of plastics in the flame was demonstrated. The most important chemical reactions were briefly dealt with. A video film was prepared concerning the identification of plastics.

2.5 Weekly one hour lectures and discussions were held with the technical personnel of the Non-Metallic Section and the Packaging Centre. The various heat sealing methods, the testing of burning and flammability and the various test methods of physical characteristics were outlined. The role of the weathering and stress cracking and permeability testing were discussed.

The difference between a simple quality control test in industry and a more complicated one that can be carried out in the Plastic Laboratory was outlined. The interpretation of results and their applicati to a given processing machine running in the local industry was carried out.

The purpose of using a personal computer system in a testing laboratory was discussed with the counterpart and the project manager.

2.6 Visit to Industry

The two biggest plastics processing companies and a smaller one were visited. These are

(a) Thermoplastics (Ja) Ltd
(b) West Indies Synthetics Ltd
(c) Wilpak Ltd

The expert also visited the packaging plant of Seprod Ltd.

The tour of Thermoplastics covered the Compression Moulding, the Injection Moulding, the Blow Moulding and the Extrusion Divisions. Discussions were held with the General Manager and the Technical Works Manager. Arrangements were made as to how the Plastics Laboratory could help in solving the problems experienced in the Company. The Company benefitted from the assistance provided during the duration of the consultancy.

The tour of West Indies Synthetics covered the thermoforming, the film blow moulding and the printing divisions. Discussions were held with the General Manager and the Quality Control Supervisor. Areas were looked at where the Bureau of Standards could be of help.

The Wilpak Ltd is interested in processing polyethylene by film blowing and bag making. The developing problems were discussed with the managers.

The tour of Seprod Ltd covered the packaging plant for powdered detergent. Discussions were held with the plant manager and maintenance people. The report is submitted in Appendix 2.

2.7 Seminar for Industry

The Jamaica Bureau of Standards arranged a four and a half day seminar for the Caribbean Area industry concerning Flexible Packaging Technology. The expert gave lectures dealing with the thermoforming, film blowing and co-extrusion of plastics and sterilising and printing problems of flexible packaging materials and took part in the panel discussion of specific questions raised by course participants. The timetable of the course is given in Appendix 3.

2.8 Upon arrival at the post, the expert learned that the Bureau of Standards and the Plastics Laboratory are equipped with some basic books that are necessary to the daily work. It is the opinion of the expert that it would be very helpful to further provide the libraries with books concerning the processing technology of the most used plastics in the local industry.

3. RECOMMENDATIONS

3.1 It is recommended that all of the technical people in the Plastics Laboratory be thoroughly trained in using the different instruments. This is very important because the technical staff is formed by a small group.

3.2 It is highly recommended that close co-operation be built up between the Plastics Laboratory and the local plastics processing and packaging industry for the purpose of exchanging information and experience. This co-operation will be beneficial to both sides.

3.3 It is highly recommended that every effort should be made to find the resources for purchasing a professsional personal computer. It can be used for information storage and retrieval, as a data bank and as a super calculator also. A system consisting of CPU with 64 kbyte RAM, two floppy disks and matrix printer is preferable.

3.4 As there is no course on plastics technology in the University of the West Indies, it is recommended that the technical personnel of the Plastics Laboratory, be sent to more advanced training abroad.

3.5 It is recommended to complete the testing facilities with the three point and stiffness testing. To perform this it is recommended that the necessary accessories for the Zwick UTM be made in the workshop of the Bureau of Standards to the standard given in the relevant ISO and ASTM standards.

APPENDIX 1

PROGRAMME FOR MR. LASZLO KORONCZAY
UNIDO CONSULTANT IN PLASTICS TESTING

Week beginning	Activity
January 9 1985	Arrival, Kingston - 21.00
January 10 1985	Administrative matters, UNDP etc
January 11 1985	Programme Development. Basic discussions with counterpart staff.
Monday January 14, 1985	Sealability - Cold Seal, Welding, Impulse, Hot Bar, High Frequency, Friction, Video
	Seal Strength - Tensile, Hand, Visual.
	Abrasion.
Friday January 18, 1985	Talk to Staff - 2.00 - 3.00

PROGRAMME FOR MR. LASZLO KORONCZAY
UNIDO CONSULTANT IN PLASTICS TESTING

k beginning	Activity
y January 21, 1985	Identification - Chemical, Physical, Appearance, Burning, UV, Density, Solubility, Video
	Visit to Thermoplastics - 2.30 p.m.
	Melting Point - Video
	Flammability, Oxygen Index
	Chemical Resistance
sday January 24	Visit to Wisynco - 11.00 a.m.
y January 25	Talk to Staff - 3.00 - 4.00 p.m.
y January 28	Stress Cracking
	Water Vapour Transmission Rate. Patra Dish and Meter.
	Weathering, Light Resistance.
	Density Column and Pycnometer.
y February 1	Talk to Staff - 3.00 - 4.00 p.m.

PROGRAMME FOR MR. LASZLO KORONCZAY
UNIDO CONSULTANT IN PLASTICS TESTING

eek beginning	Activity
day February 4	Friction.
	Thickness and Dimension.
	Shrink Ratio.
	Falling Dart (existing material elaboration).
	Wetting Tension (finish existing video).
	Gas Permeability (discussion only).
day February 8	Talk to Staff - 3.00 - 4.00 p.m.

PROGRAMME FOR MR. LASZLO KORONCZAY
INIDO CONSULTANT IN PLASTICS TESTING

eek beginning	Activity
day February 11	Tensile, existing material only. Compression, Shear
	3 Point Bending
	Stiffness and Rigidity
	Tear, Existing Video, Elaboration.
	Softness and Hardness.
	Fatigue and Creep.
iday February 15	Talk to Staff - 3.00 - 4.00 p.m.

PROGRAMME FOR MR. LASZLO KORONCZAY
UNIDO CONSULTANT IN PLASTICS TESTING

Week beginning	Activity
Monday February 18	(J.S. Tripartite Review). Final Report Prepared.
	Tensile - Carver Press, Sample Preparation, Tensile-Kut
	IZOD, Charpy, Tensile Impact
	Melt Flow, existing film elaboration.
Friday February 22	Talk to staff - 3.00 - 4.00 p.m.

PROGRAMME FOR MR. LASZLO KORONCZAY
UNIDO CONSULTANT IN PLASTICS TESTING

Week beginning	Activity
Monday February 25	Flexible Packing Course starts. Final report being typed.
Tuesday February 26	Flexible Packaging Course
Wednesday February 27	Flexible Packaging Course
Thursday February 28	Flexible Packaging Course
Friday March 1	Flexible Packaging Course - Consultant's last day
Saturday March 2	Consultant leaves for UK.

APPENDIX 2

REPORT ON VISIT TO SEPROD LTD

Date of visit: February 11, 1985

Time of visit: 3 pm

1. Introduction

The visit was made by:

(i) Mr. L. Koronczay - UNIDO Consultant in Plastics Testing

(ii) Mr. L. Cohen - Non-Metallic Laboratory, Bureau of Standards

(iii) Mr. J. McCarthy - Non-Metallic Laboratory, Bureau of Standards

(iv) Miss I. Bennett - Packaging Centre, Bureau of Standards.

The above mentioned individuals were accompanied by Mr. Jones, the mechanical foreman and Mr. D. Daley, laboratory technician.

2. Purpose of Visit

A change in the plastic packaging material for the powder detergent resulted in heat sealing problems. Previous work performed by the JBS revealed that the new material is heat sealable. However, no satisfactory seal could be obtained by the work crew at the Seprod Company.

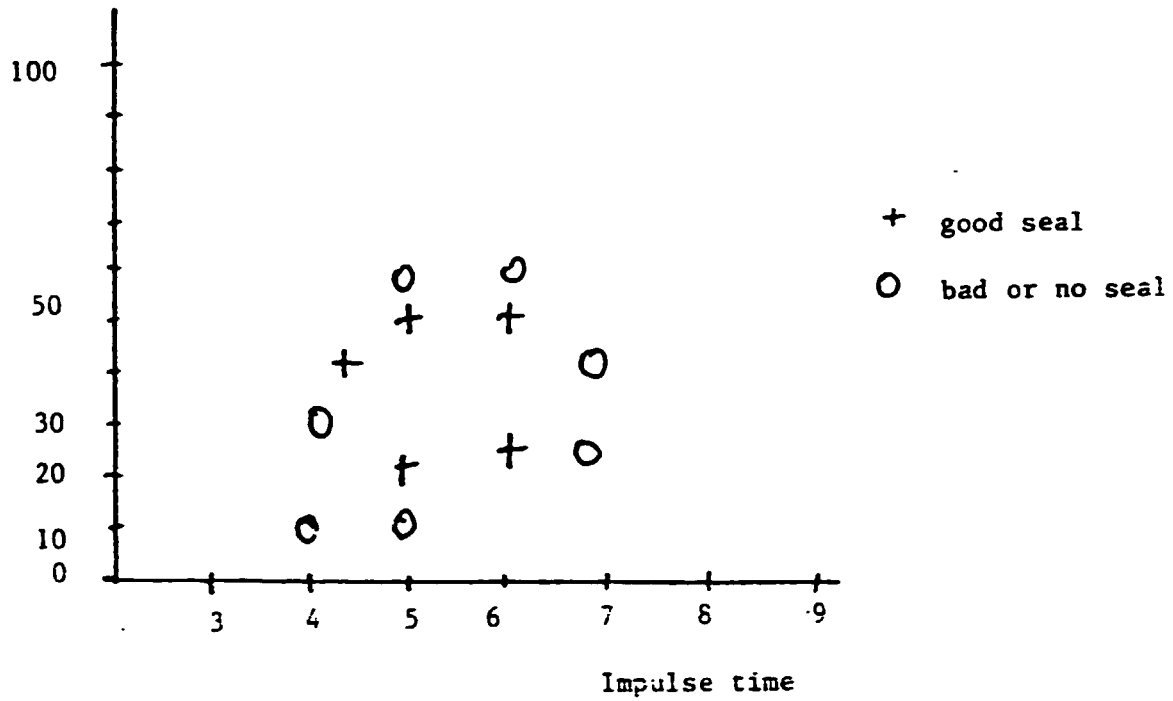
The visit was primarily to examine the heat sealing equipment and subsequently make recommendations as to the adjustments necessary in order to obtain a satisfactory seal.

3. Conclusions and Recommendations

On examination of the sealing equipment, it was agreed that there is no direct correlation between the graduations on the control of the equipment at Seprod and the graduations on the heat sealer at the JBS. It was further agreed that a knowledge of this correlation was not necessary to solve the problem.

The Plastics Laboratory recommends that a series of tests be conducted by Seprod where the material is heat sealed at various conditions of end seal power and impuls time and the results forwarded to the JBS.

At the JBS the heat seal efficiency (i.e. the ratio of the heat seal strength to the material's tensile strength) is determined and a graph s:ch as the one shown in Fig I is plotted.



Thus Seprod has access to a whole range of conditions that are guaranteed to produce a satisfactory seal (a seal efficiency of 70 or 80% may be selected as suitable).

Furthermore, this information allows the highest impulse time i.e. higher production rate to be selected that will give a satisfactory seal for that material.

BUREAU OF STANDARDS

FLEXIBLE PACKAGING TECHNOLOGY COURSE

FEBRUARY 25 TO MARCH 1, 1985

APPENDIX 3

TIMETABLE

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8.30 - 9.00 9.00 10.30	Registration Welcome Introduction to Flexible Packaging Materials	Properties of Materials	Principles Factory Operations	Selection and Application of Materials to Specific Products	9.30 - 10.30 Printing of Flexible Packaging Materials
10.30 - 10.45	C O F F E E	B R E A K			B R U N C H
10.45 - 12.00	Introduction continues	Properties of Materials	Principles Factory Operations	The Sterilisable Pouch - Grace Kennedy	11.30 - 12.30 Panel discussion of specific questions raised by course participants
12.30 - 1.30	L U N C H	B R E A K			12.30 - 1.00 Course Evaluation
1.30 - 2.30	Properties of Materials	Properties of Materials	Principles Factory Operations	Visit to Jamaica Flexographic Ltd	1.00 - 2.00 Closing Ceremony Presentation of Certificates
2.30 - 2.45	C O F F E E	B R E A K			
2.45 - 4.00	Properties of Materials	Visit to Packaging Centre Visit to Plastics Lab.	Principles Factory Operations	Visit to Jamaica Flexographic Ltd