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17638

DP/ID/SER.A/1224
6 July 1989
ORIGINAL: ENGLISH

ESTABLISHMENT OF A PACKAGING UNIT AT THE INSTITUTE FOR RESEARCH AND DEVELOPMENT FOR CHEMICAL INDUSTRY (BBIK)

DP/INS/86/005

INDONESIA

Technical report: Establishment of the food packaging laboratory*

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

Based on the work of B. I. Turtle, food packaging consultant

Backstopping officer: J. Belo,
Engineering Industries Branch

United Nations Industrial Development Organization

Vienna

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* This document has not been edited.

V.89 57552

CONTENTS

Abstract

The consultant spent 3 months at the Institute for Research and Development in Jakarta (BBIK) establishing a Food Packaging Laboratory. Theoretical instruction was given to the counterpart and her staff in all aspects of retail packaging in metal, paper, plastics, flexible plastics, and glass containers. Eight internal seminars were presented on food packaging, and further lectures during the BBIK-UNIDO Industry Seminar, 19-23 June. Other subjects covered in detail were shelf-life theory, documentation reporting and databases, food packaging regulations and standards. Practical instruction was given on the test methods, organoleptic and physical, used to evaluate food packaging, and the consultant made sure that BBIK personnel could operate correctly all the laboratory equipment such as heat sealers, the vacuum gassing machine, and torque tester. Joint visits were made with the counterpart to food firms and supermarkets to study industry practise. Shelf-life trials with Indonesian foods such as Krupuk and Dodol were carried out. Finally recommended workplans were drawn up to cover the Food Packaging Laboratory until 31 March 1992. The mission ended 26 June 1989.

Key Words

BBIK, counterpart, food packaging, shelf-life, equipment, visits, standards, seminars, personnel, workplan, conclusions, recommendations.

I. INTRODUCTION

The purpose of this project as a whole is to establish a packaging unit at the Institute for the Research and Development for Chemical Industry (BBIK). This unit will provide testing and advisory services to packaging materials producers, converters, and users of packaging.

The purpose of this mission was to train the Manager of the Food Packaging Laboratory, Mrs. Sumirah Suryandari, and her staff in all aspects of food packaging and relevant test procedures.

II. TERMS OF REFERENCE

The specific duties of the consultant were as follows:

1. Visit food producers and packers to identify problems with primary food packaging, and select Indonesian food products for shelf-life studies.

2. Explain and instruct BBIK personnel in all aspects of shelf-life testing and organoleptic evaluation. Provide relevant test methods and documentation.

3. Assist in the installation of equipment in the Food Packaging Laboratory, and ensure personnel are fully able to operate it correctly.

4. Advise on all aspects of reporting, documentation, filing, databases, and provide the necessary standard test report forms.

5. Assist counterpart on the formulating of draft Indonesian standards for primary food packaging.

6. Carry out seminars on primary food packaging.

7. Recommend documentation on food packaging.

III. DESCRIPTION OF THE MISSION

The consultant spent two periods in Jakarta, January and May-June, 1989. He was briefed by Senior Consultant, Mr. K.H. Carmin, and a workplan drawn up after joint discussions with BBIK senior staff, see Annex II. Much of the time during January was spent gauging the food packaging situation in Indonesia and getting to know the individual knowledge and abilities of the counterpart and her staff. Visits were made to local packers of food and supermarkets with the counterpart. A critical evaluation of a Dodol shelf-life trial started in September 1988 was made, and a new trial planned and started. All the laboratory equipment was checked and found to be in good order. Finally the counterpart was briefed on her February-March visits to Michigan State and

Ital, so as to obtain maximum benefit from them.

On his return on 1 May the consultant debriefed the counterpart following her visits, and explained unclear areas. Dodol evaluations continued and recommendations were made to the customer. Krupuk Palembang and other products were packed and the laboratory staff given practical as well as theoretical training in the conduct of shelf-life trials. The specific duties listed in II were carried out, plus other training required. Eight internal seminars were presented to BBIK personnel, and the consultant also lectured on food packaging at the BBIK-UNIDO Seminar for Industry, held in Jakarta 19-23 June 1989. Because the Japanese Aid Agency, via private consultants UNICO, are proposing to allocate money to BBIK, suggestions were made as to further laboratory equipment which would extend the scope and quality of the services offered to industry. Finally, at the request of Mr. K.H. Carmin, draft workplans were drawn up for the Food Packaging Laboratory until 31 March 1990 (Annex 7) and 31 March 1992 (Annex 8). The consultant left Jakarta on 26 June with happy memories of the enthusiasm of the laboratory personnel, and the friendliness of Mr. J. Kusnadi, the Director of BBIK, and every one of his staff.

IV. OBSERVATIONS AND CONCLUSIONS

1. Visits to Food Companies

In conjunction with BBIK, five visits were arranged to food packers in Jakarta. The purpose of the visits was two-fold.

a) To enable the consultant to assess the level of food packaging expertise in local industry, and
b) To show BBIK personnel, particularly the counterpart, how the food and food packaging industries operate.

Brief descriptions of the visits are given in Annex 3. However a full report was written for each, and copies left with the counterpart at BBIK, and with UNDP Jakarta. Full addresses of the companies are listed in Annex 1. These visits achieved their purposes, and in addition important contacts were made for future BBIK-Industry cooperation at Indomilk and PT Sanmaru Foods Ltd.

2. Shelf-Life Testing

This subject is the most important one for a food packaging laboratory and so a major part of the time was spent on theoretical and practical instruction. The fundamentals of setting up a shelf-life trial were written down into a laboratory procedure (No.1), and these guidelines followed practically in the Dodol and Krupuk Palembang trials. Other Indonesian foods chosen for shelf-

life trials are Kripik Pisang, Krupuk Udang, mangos, durian, salak, rambutan, kacang panjang, kangkung, and cabbage.

Organoleptic evaluation techniques for odour and taste were completely new to BBIK personnel. Hence practical sessions were held to explain the reasons for the precise routines which need to be followed. Members of the taste panel have been chosen, and the counterpart has been given a food simulant testing pattern to help in the training of members to improve their sensitivity.

Current predictive testing techniques were explained to the counterpart, in particular the use of short-term accelerated moisture pick up at 38 degrees/90% R.H. Also the use of the theoretical equation $\frac{CR}{t} = \frac{C}{x} - \frac{x}{C}$ was fully explained. In view of the complicated nature of predicting shelf-life where oxidation of the food is a factor, it was recommended that this should be left until very much more experience had been gained. However, the work of M. Karel and others was briefly outlined.

Before the consultant left the counterpart had successfully conducted both odour and taste tests, and reported conclusions which were accurate. BBIK personnel would now appear to have a good understanding of this very important area.

3. Laboratory Equipment

All the equipment ordered so far had arrived before the consultant left, except for the Callenkamp climatic cabinet which was at Jakarta docks. Some adjustments to controls and wiring were necessary on the heat sealers, but all the equipment is now in perfect working order. Laboratory personnel were instructed in the use and purpose of the equipment and laboratory procedures written as required. The most important tool for the laboratory is the Supervac CK183/1 chamber vacuum gassing machine. This enables all types of flexible materials to be vacuum or gas packed, which is vital for foods subject to oxidation. In addition the Supervac can be used for modified atmosphere packaging, which is becoming a widely used technique for increasing the shelf-life of perishable foods. Trials with N2 gassing showed the machine could achieve the specified level of 1% residual O2. One member of staff, Mr. Soesilo, showed an especially good understanding of the Supervac and equipment generally. It was recommended to the counterpart that he be given special responsibility for all equipment.

4. Reporting, Documentation, Databases

There was no need to stress the need for accurate assessment and objective reporting of all results, since the staff are trained scientists. However, the importance of presenting those results in a clear easily understood form to Industry people who

might be non-technical was emphasised. Layouts for various types of reports were given to the CP. The basic requirements of documentation and filing of reports on food packaging were discussed, and the value of keeping customer related files was stressed. Of particular importance in such a diversely scientific area such as food packaging is a good database. A scheme was outlined which referenced information under categories, the main ones being: packaging materials properties; consumer packages in metals, paper, plastics, FP, and glass; characteristics and processing of foods; packaging processes; and standards, legislation, toxicity, test methods, etc. It was recommended that as soon as the paper filing system had become well established, it should be augmented by a computerised database. This is essential because of the fact that information on a food packaging problem will always be found in several files. Total data will never be fully extracted from the information store without a computer database. Finally, the availability of world databases on food packaging technology were explained, and their value stressed where a problem needed to be investigated in depth.

5. Draft Indonesian Standards for Food Packaging

The Indonesian Industrial Standard Catalogue, 1988, lists 2347 standards, of which 114 relate to food and drink. Except for a few standards concerning building materials, none of the standards are compulsory. The only standards relating to consumer food packaging deal with heat sealable OPP film, PVC bottles, polyolefin containers, and PVC film for twist wrapping of sweets. While there are standards for HIPS containers and polypropylene bags, these do not relate to food packaging. It was therefore recommended that draft standards should be proposed to the Department of Industry for the following:

- Plasticised PVC film for wrapping bacon and cheese
- Polypropylene film for oily products such as krupuk or other snackfoods
- PET bottles for carbonated soft drinks
- HIPS cups for vending and general drinking purposes

It was also proposed that these and the existing food packaging standards be made compulsory.

6. Seminars on Food Packaging

Only the counterpart and her deputy, and the manager of the Materials Testing Laboratory, had any knowledge at all of food packaging technology. Hence the consultant arranged a series of 1.1/2 hour seminars to inform a pool of 10-15 people who could benefit from all or some of the lectures. They were presented in an informal, 'schoolroom' way, with participants encouraged to ask if any point was unclear. The consultant was very impressed with

the enthusiasm to learn shown by the BBIK personnel, and their willingness to participate and ask questions. Typewritten handouts describing the main themes of the lectures were given to all participants. An example is shown in Annex 4, BBIK Seminar No.5 on Rigid Plastics Packaging. The eight subjects were as follows:

1. Microbiology and Food
2. The Nature of Food
3. Metal Packaging
4. Flexible Plastics Packaging
5. Rigid Plastics Packaging
6. Glass Containers and Closures
7. Food Preservation Methods
8. How to Choose Food Packaging

Additional copies of these handouts were left with the counterpart at BBIK, and the UNDP office.

7. Documentation on Food Packaging

Mr. K.H. Carmin, Senior Consultant had already supplied the BBIK library with a good selection of internationally acceptable textbooks, such as Paine's Handbook of Food Packaging, and Modern Packaging Encyclopedia. While it was quite possible to recommend additional textbooks, these would only cover the same ground and be largely a waste of money. However, the counterpart was given copies of articles, monographs, and lecture notes, on specific aspects of food packaging not dealt with adequately in the literature. These covered subjects such as organoleptic testing, shelf-lives of packaged foods, high barrier packaging, microwave packaging, dual ovenable plastics containers, EEC food packaging directives, etc. A full list is given in Annex 5. One aspect of information which is missing is a subscription to an international packaging journal such as Modern Packaging, Package Engineering, or Packaging Week. This is vitally necessary if BBIK are to keep up to date, and the Director was advised of this.

8. BBIK Food Packaging Laboratory Procedures

It was necessary for the consultant to prepare laboratory procedures for two reasons. Firstly there are some areas such as organoleptic testing and cap torque testing where existing ISO or ASTM standards are difficult to interpret. Secondly some procedures, such as setting up a shelf-life trial, do not exist or may need to be expanded. After discussions with the counterpart and Mr. Karyadi, it was agreed that nine procedures were required. These documents explain the purpose of the procedure, the practical steps are outlined, and the interpretation of the results explained. Theory is kept to a minimum so that laboratory assistants should have no difficulty in learning the procedures.

However, the counterpart was more fully briefed on their applications and limitations, and the interpretation of results. It was agreed with BBIK that they should be translated into Indonesian. An example is shown in Annex 6, No.7, Significance of Ranked Data. The nine titles are as follows:

1. Setting Up a Shelf-Life Trial
2. Determination of Headspace Oxygen
3. Determination of Equilibrium Relative Humidity
4. Heat Sealing with the Audion TT-300S
5. Odour Level in Flexible Packaging
6. Controlled Taste Test on Food
7. Significance of Ranked Data
8. Operation of Supervac CK-183/1
9. Determination of Screwcap Removal Torques

9. Future Workplan for BBIK

At the request of Mr. K.H. Carmin, Senior Consultant, two workplans were prepared for the Food Packaging Laboratory. The first covered the period to 31 March 1990 in detail (Annex 7), while the second less detailed continued the plan to 31 March 1992 (Annex 8).

The 9 months to 31 March 1990 should be largely considered as a consolidation and experience gaining period. A very great deal of practise in the laboratory procedures for examination and analysis of packaging is needed before accurate results can be guaranteed. Much greater knowledge of packaging and potential problems is also required before the Laboratory can achieve the credibility it needs to help the Indonesian food packaging industry. Hence, while all requests for help should be welcomed for their valuable experience, work should not be actively sought for a few months. Seven areas were listed as needing most attention, as follows:

1. Familiarisation with retail packages
2. Laboratory heat sealers
3. Conduct of shelf-life trials
4. Predictive testing
5. Packaging of Indonesian food products
6. Analytical work
7. Background knowledge

The two years following the consolidation and training period should find BBIK growing in stature, and actively seeking to help further development of Indonesian food packaging. Book and journal study and attendance at training courses and seminars on packaging should be a permanent feature. This should take approximately 10% of available man-hours. It was recommended that the remaining time be split between the following five projects, which were outlined in the workplan.

1. Experience in Industry
2. Investigation of Industry Problems
3. Packaging of Indonesian Food Products
4. Evaluation of Indonesian Export Packaging
5. Expansion of Laboratory Facilities

V. RECOMMENDATIONS

1. Familiarisation With Retail Packages

Much of food packaging evaluation consists of visual examination and subjective assessments. Metal cans must be examined for corrosion, pinholing, sulphur staining, lacquer softening, etc. Plastics bottles checked for flavour absorbtion, incipient stress cracking or body wall collapse. Liquid containing cartons examined for microleakage or wicking. And so on for all the different types of packaging. This type of evaluation requires far more experience than say a Torque Test on screwcaps, or Determination of E.R.H., where a precise answer can be given in numerical terms. The period to the end of 1989 is considered as a time in which priority should be given to the gaining of the necessary experience. Some of this will come via requests for assistance from industry. However there must be a definite training schedule, as outlined in the consultant's Workplan to 31.3.90. The main areas suggested for familiarisation with retail packages were:

a) Visit manufacturers of packaging materials and converters to obtain sample materials and discuss problems.

b) Purchase typical retail packages and make detailed breakdown analyses. eg a laminate for, say, a dried food would be delaminated, ply thicknesses measured, materials identified, and a general note taken of package condition, quality of decoration, etc.

c) Cooperate with the Materials Testing Laboratory to measure the physical properties of the retail packages, such as the burst strength of liquid holding cartons, or seal strengths.

2. Workplans

These have been proposed to cover the operation of the Food Packaging Laboratory until 31.3.1992. Their strategic aim is a progressive increase in personnel knowledge and experience, matched by an ever increasing workload from Industry. Too much work, too soon, could destroy the potential credibility of an inexperienced laboratory. Hence these workplans should be carefully followed, so that a situation is reached by 1992 where a proactive Laboratory is spending a major part of its time investigating Industry problems. There is no doubt that the Indonesian food packaging industry needs this help to achieve optimum results.

3. Shelf-Life Trials

The vital importance of shelf-life testing was stressed under IV.2., and the need to train a taste panel in organoleptic evaluation technicques Shelf life trials are already in progress with Dodol, Krupuk Palembang, and Kripik Pisang. However it is essential that as many trials as possible are carried out, both to gain experience and to demonstrate this unique capability to Industry. They should mainly be on Indonesian food products such as durian, salak, tomatoes, rambutan, krupuk, kacang panjang, kangkung, apples, and cabbage. A programme of modified atmosphere packaging should be discussed with Bogor Agricultural Research Institute.

4. Expansion of Laboratory Facilities

At present the laboratory is only equipped to work with dried foods, and shelf-stable liquids such as coconut oil or strong vinegars. However the facilities should be extended to allow the investigation of :

a) carbonated and/or processed liquids, such as Coca Cola, beer, or fruit juices, in open top cans and glass bottles, and

b) pasteurised or sterilised meat, fish, fruits, vegetables, etc, in open top cans, flexible packaging, glass, and rigid plastics. This would greatly extend the range of Industry problems which could be investigated. Additionally, because very few packers of food have such facilities, the Industry demand is likely to be considerable. The equipment required has already been requested under the UNIDO development grant aid scheme. The main items comprise an Alcan RO capper, Filamatic volumetric liquids filler, FMC steam retort, Metal Box can seamer, and Crown Cork capper.

5. Staffing

At present the food laboratory head, Mrs. Susmirah Suryandari has an adequate staff of two engineers and three graduates. However the expansion of laboratory facilities recomended under 4 will require an extra graduate with a knowledge of food technology. If such a person is not available a suitable scientist may be trained; this training would however need to include practical instruction in food sterilisation technology in an establishment such as ITAL. Mrs. Susmirah also has 10 staff working on inorganic and organic analysis, and one of these could well be a suitable candidate for the above position. Another graduate scientist is also required, dealt with below in 6.

6. Contacts With Industry

The prime function of the Packaging Unit is to serve the needs of Industry. To do this it must establish its worth to Industry by advice and experiment, and build up it's contacts with Industry so that as many problem areas as possible are identified. There are four ways in which this contact should be achieved.

6.1 By responding quickly and positively to any requests for help, giving advice at least even if the laboratory facilities are insufficient to provide practical assistance.

6.2 Gaining experience of industry problems by actually working in plants for several weeks or more. Indications are that converters such as PT. Multi Guna Agung, and food packers such as PT. Indomilk, would be cooperative towards this idea. Personnel for these assignments should be carefully selected; they should not only gain valuable experience but also make constructive comments on the packaging operations they observe.

6.3 The Indonesian Packaging Institute already has very extensive contacts with Industry. While it can offer advice it has no laboratory facility and cannot give practical help. Therefore close contact with the Institute would be extremely valuable in channelling requests for work to BBIK.

6.4 It is strongly recommended that a customer liason scientist be taken onto the laboratory staff. While the person would spend some of the time working in the laboratory, more time would be spent visiting firms to discuss and seek out problem areas, report results, etc. This person would need to have the right personality and communication skills, and there may be a need to appoint someone from outside BBIK. The effectiveness of the laboratory would be increased to a very considerable extent if such a person were to be appointed.

7. Evaluation of Indonesian Export Packaging

Indonesia wishes to increase the value of its non-oil exports. In the food area, high quality, cost-effective packaging is particularly necessary for success in a very competitive field. By the end of 1990, or perhaps, sooner, BBIK will be in a position to accurately analyse a packaging area and recommend improvements as necessary. Hence a series of visits should then be made to the major exporters of packaged foods, and to any other exporter who requests help. Advice may then be given, after laboratory work if needed, and Industry will thereby be encouraged to present further problems to BBIK as they arise. Because of the especial importance of outer packaging in an export situation, someone from the Transport Packaging Laboratory should also be involved in this project.

8. Background Information

The food packaging field is an ever changing one, and at this

time there are many new developments such as MAP, microwave packaging, irradiation and chill food techniques, etc. To keep abreast of developments it is necessary to spend approximately 10% of available man-hours on book and journal study, and attendance at seminars and training course. In addition, it is strongly recommended that an annual subscription be taken out for one of the major packaging journals, such as Modern Packaging, Package Engineering, Packaging Week, etc.

9. Follow-Up Project

The area of food packaging demands such a great deal of experience, as well as basic knowledge, that further consultancy visits would be very valuable. If the food technology scientist is appointed, then they will also need guidance in relation to the Indonesian canning and bottling industry. A consultancy visit of two month's duration in about one year's time would be ideal. If this consultant were given the assignment, he would be able to assess progress with the Workplans, assist with ongoing investigations, guide the food technology scientist, and generally provide a stimulus to the further development of the laboratory.

PRINCIPAL CONTACTS MADE

ANNEX 1-1

UNDP P.O. Box 2338 14, Jl. M.H. Thamrin Jakarta Tel. 321308 Telex 44178 UNDEVTROIA	Mr. G.L. Narasimhan, SIDFA Mr. D. Andersen, UNIDO JPO Mr. K.H. Carmin, Senior Packaging Consultant
Balai Besar Industri Kimia (BBIK) Institute for Research and Development of the Chemical Industry P.O. Box 16 JATTK Pekayon - Pasar Rebo Jakarta Timur Tel. 8401913	Ir. J. Kusnadi, Director Mr. D. Karyadi, Head Packaging Unit Mrs. Susmirah Suryandari, Head of the Food Packaging Laboratory Mrs. Robiatun Mr. Sulaiman
Ministry of Industry Dit.Jen. Industri Kecil Jl. Catot Subroto Kav. 52-53 16th Floor Jakarta 12790	Mrs. Luki Hartini Setiadi
Indonesian Packaging Institute Jl. Cikini IV/8 Jakarta Pusat 10330 Tel. 333663 Telex 44506 Sari Jkt Fax 5782620	Ir. Soetanto R., Deputy Executive Director Mr. D. Budiono, Consultant
Indomilk Jl. Raya Bogor KM 26,6 Candaria, Jakarta Tel. 870211 Telex 48255 INDOMK IA	Mr. E. Suana, Production Manager
PT Sanmaru Food Manufacturing Co. Ltd. Jl. Ancol I No. 4-5 Ancol Barat Jakarta Utara Tel. 671141 Telex 63012 INDOMI IA	Ir. Taufik Wiraatmadja, Factory Manager
PT Multi Guna Agung Jl. Raya Cakung Cilincing, Jakarta 13910 Tel. 121047 Telex 63012 INDOMI IA	Mr. Aswan Tukiaty, General Manager

ANNEX 1-2

Mariza Food & Beverages Jl. Prof. Dr. Latumeten Komplek Kota Grogol Permai No. A25/26 Tel. 594629 Telex 44087 MARIZA IA	Mr. Jatmatama, President Director
PT Khong Guan Biscuits Jl. Raya Bogor KM 26 Tel. 870508	Mr. Budi, Factory Manager
Pabait Kacang Goreng Jl. Jamlung Tiah Tel. 5846118	Mr. Amir, Managing Director
PT Herlinah Cipta Pratama Jl. Pasundan 72A Garut 44112 Tel. 0262-81220	Mr. Dimdim Yudhamiharja, Marketing Manager

ANNEX 2-1

WORKPLAN FOR FOOD PACKAGING EXPERT

B. I. TURTLE

PROJECT DP/INS/86/005/11-03

The mission is in two parts January and May - June 1989, giving a total of 12 weeks clear at BBIK. The following schedule has been agreed after consultation with Mr. K. H. Carmin, Project Manager, and Mr. Karyadi, Head of the Packaging Laboratories. It covers the 8 items listed in the Job Description. Please note that the subjects to be discussed with the Counterpart will :

a) cover all food packaging aspects as required, not just those mentioned below, and

b) that instruction of the CP is an ongoing continuous process in addition to the formal tutorials.

Week 1

1. Introduction to Counterpart (CP) and other BBIK personnel, UNDP personnel, and note administrative procedures and facilities of BBIK.

2. Establish ability, awareness, and level of packaging knowledge possessed by counterparts.

3. Preliminary discussion with Messrs. Carmin and Karyadi regarding the workplan.

4. Agree with Mr. Karyadi a short programme of visits to Jakarta industry with counterpart to gauge the overall level of sophistication of food packaging practise.

Week 2

1. Agree the workplan with Project Leader.

2. Visit P.T. Indomilk and J. T. Khong Guan Biscuit, Jakarta.

3. Tutorial with CP on the overall requirements of food packaging.

4. Attend seminar on Transport Package Testing.

ANNEX 2-2

Week 3

1. Ensure that laboratory equipment is functioning correctly, including the Supervac vacuum/gassing machine, the Audion heatsealer, and the Karl Schroder thermohydrograph.

2. Recommend additional documentation on food packaging.

3. Establish by critical evaluation with the CP, the results obtained from the Dodol samples packed in September 1983.

4. Tutorial with CP on shelf-life testing methodology.

5. Tutorial with CP on food packaging materials.

Week 4

1. Set up packing trial with Dodol.

2. Visit a packager of Krupuk.

3. Discuss the CP's forthcoming visits to Michigan State and ITAL, outlining those areas which should be given special attention.

4. Propose experimental work to be carried out by the CP in April, including a two month's examination of Dodol samples.

Intervening Period

While in England, the Expert will ensure that the information, samples, and visual aids required for seminars are obtained, following the experienced gained in January.

Week 5

1. Debrief CP on the knowledge and experience gained from Michigan State and ITAL.

2. Ensure that food packaging personnel are competent in the operation of all laboratory equipment.

ANNEX 2-3

Week 6

1. Evaluation with CP of the Dodol samples after 3 months

2. Tutorials with CP on food legislation, biological safety, and migration from packaging materials.

Week 7

1. Set up packing trial with krupuk

2. Give three seminars on the following subjects :

   - Microbiology and Food
   - The Nature of Food
   - Metal Packaging

3. Tutorials with CP enlarging the seminar subjects

Week 8

1. Commence preparations for Industry Seminar

2. Give three seminars on the following subjects:
   - Flexible Packaging
   - Rigid Plastic Packaging
   - Class Containers and Closures

3. Tutorials with CP enlarging the seminar subjects

Week 9

1. Tutorial with CP on organoleptic evaluation using Taste Panels.

2. Give two seminars on the following subjects:
   - Food Preservation Methods, and
   - How to Choose Food Packaging

3. Tutorials with CP enlarging the seminar subjects.

Week 10

1. Select Indonesian products for further shelf-life studies by BBIK.

ANNEX 2-4

2. Propose and discuss possible Indonesian Food Packaging Standards, based on existing international legislation.

3. Final evaluation with CP of the Dodol samples after 4 months.

Week 11

1. Critical examination with the CP, [illegible] the Krupuk samples after 4 weeks.

2. Discussion and revision with the CP to cover all the food packaging aspects and laboratory procedures covered over the previous ten weeks.

Week 12

1. Lecture on food packaging at BBIK Industry Seminar.

2. Write Final Report and submit to Project Manager for approval.

B. I. Turtle
19 May, 1989
aj.

VISITS TO FOOD COMPANIES IN JAKARTA ANNEX 3-1

1. PT Khong Guan Biscuits

Seen: Mr. Budi - Factory Manager

P.T. Khong Guan are the major biscuit packers in Indonesia. The packaging lines are very labour intensive except for one 200 ppm automatic Fuji flowrapper. Flexible packaging uses mainly OPP/PE, while metal tins are slip lid and fully soldered lever lid squares. Packaging costs have been kept to a minimum, but Khong Guan have no problems at present. BBIK were requested to keep them up to date with future developments in flexible packaging.

2. PT Indomilk - 9.1.89

Seen: Mr. E. Suana - Production Manager
Mr. Suwarto - Chief Chemist

PT Indomilk are the largest packers of milk products in Indonesia. These include liquid fresh milk, dried milks, butter, and dairy ice creams. They import some metal cans and Pure Pak blanks. However, they also have a John Heine 400 cpm line to make 300 x 301 sweetened condensed milk cans. The packaging lines were well run, and there is an extensive quality control system for incoming food and milk products, and the packaging materials used. This is a very good contact since Mr. Suana indicated a willingness to give BBIK staff packaging experience in the factory. In addition it was arranged to carry out a case burst testing investigation for Indomilk at BBIK.

3. PT Sanmaru Foods Ltd. - 16.1.89

Seen: Mr. Taufik Wiriaatmadja - Factory Manager
Mr. Aswan Tukiaty - General Manager, PT Multi Guna Agung

Sanmaru pack noodles and powdered babyfoods for home and export trades. They use a great deal of flexible packaging, mainly from PT Multi Guna Agung. Most of the varieties of noodles use OPP/CPP, and there are 6 main packing lines. Fully automatic Tokiwa flow wrapping machines run at 140-150 ppm. The babymilk powders are either in PET/PE/PP laminate in cartons, or round double seamed cans. Both packs are nitrogen flushed to give less than 1% oxygen. Quality control is particularly tight on the babyfood operation. This was a very informative visit for BBIK personnel, and Sanmaru said they would be willing to cooperate should BBIK require production packed samples for test purposes.

ANNEX 3-2

4. Mariza Food and Beverages - 23.1.89

Seen: Mr. Jatmatama - President Director
Mr. Andi - Sales Manager

This is a private company whose premier product is a range of high quality fancy layer cakes. All the cakes have a shelf-life of 6 months lus in PA/PE or foil/PE for some round slip lid tins. A range of jams and marmalades in Twist-Off capped jars, and canned and bottled limejuice are their other main products. They ar always searching for better/cheaper forms of packaging and a long discussion ensued with the consultant. Mariza asked that BBIK keep them informed of new packaging, and new techniques such as modified atmosphere packaging.

5. Pabait Kacang Goreng - 23.1.89

Seen: Mr. Amir - Managing Director

The purpose of this visit was to acquaint BBIK staff with the problems of a small food packaging business having no technical back-ups such as QC. Only dried foods are packed such as peas or peanuts fried in oil and coated, biscuits, fondant decorations, etc. Packaging is very basic in stapled, undecorated PP bags, but this is quite adequate since sales are in local areas only. Mr. Amir said he had no packaging problems at the moment, but he was pleased that BBIK would be able to help him if necessary in the future.

ANNEX 4-1

BBIK FOOD PACKAGING SEMINAR NO. 5

RIGID PLASTICS PACKAGING

1. INTRODUCTION

Food grade plastics are used to make a wide variety of bottles, tubs, trays, widemouth containers, lids, and closures, for both solid and liquid foods. While possessing good rigidity, so they may be handled similarly to metal or glass containers, they are nevertheless much lighter in weight and unlike glass do not shatter on severe impact. Hence they are now indispensable to any large food distribution system.

2. THE NATURE OF PLASTICS

Plastics are made by a polymerisation process which forms long chain molecules from an initial reactive monomer - eg. ethylene becomes polythylene.

All the plastics of interest for food packaging are "thermoplastic", that is they soften when heated and can then be formed into any shape required. The other main benefit of this thermoplasticity is that they can easily be sealed with a closure made of a similar plastic. By the application of heat under pressure the two surfaces are fused together.

3. PLASTICS FOR FOODS

For three dimensional containers, the most important plastics are LD polythene, HD polythene, polypropylene, high impact polystyrene (HIPS), and PET. All these plastics may be formed into any type of container. HIPS is seldom used for bottles however as it is less easy to blow mould.

As for flexible packaging, it is possible to produce a pot or bottle by coextrusion whose walls are made of layers of two or more plastics. A typical container for an oxygen sensitive food like tomato ketchup is made by combining polypropylene and PVDC. The outer polypropylene layers provide stiffness and strength and good moisture barrier, while the PVDC gives the necessary oxygen barrier.

All plastics used for foods must be "biologically safe", that is, they do not offer any hazard to health. The main danger would be in the additives in plastic, such as antioxidants, lubricants, colours, etc. Hence government regulations worldwide have listed those which are safe to use.

ANNEX 4-2

4. TRANSMISSION RATES

Unlike metal or glass containers, all thermoplastics have a measurable transmission rate for all gases and vapours. Of particular importance to food packaging are the transmissions with respect to moisture vapour (MVTR) and oxygen (OTR), and these are shown in Appendix 1 and Appendix 2.
Only PVDC has a very low rate of transmission to both water vapour and oxygen. Polypropylene and the polythenes have very low MVTR's, and EVOH a low OTR. The other plastics have values in between, and so by combining materials it is possible to produce the necessary barrier properties at the lowest cost.

5. CONTAINER MANUFACTURE

There are three main methods, injection moulding, blow moulding, and thermoforming. Choice of method depends on which plastic is to be used, the shape of the container, the precision with which the container needs to be made, and the planned cost of the pack.

5.1 Injection Moulding

Cold, granular, or powdered material is fed into an electrically heated cylinder containing a revolving screw. Here the material becomes soft and fluid so it may be injected into a mould under pressure. After a short cooling period the mould opens to eject the finished article, and the cycle then starts again. This process is capable of producing articles of a very high quality. (see Appendix 3).

5.2 Blow Moulding

As for injection moulding, the plastic is made molten, but it is then extruded in the form of a hollow tube, called a "parison". This parison is then clamped into a mould and blown up by air pressure to the shape of the container. After cooling it is ejected and the cycle starts again.
There are two important variations of the standard blowmoulding procedure. Injection blowmoulding is used for high quality containers which cannot be made by standard injection moulding, and stretch blowmoulding produces highly oriented bottles and pots of great strength. (see Appendix 3).

5.3 Thermoforming

A sheet of plastic or plastics laminate is placed over the mould and then heated by infra-red until near it's softening point. At this stage it is drawn into the mould by vacuum,

assisted for more complicated shapes by air pressure or mechanical plugs. After cooling the article is ejected, and the cycle begins again. Originally only a low cost process, it is now possible to produce high quality thin wall containers by this method. (see Appendix 4).

6. FOOD IN PLASTICS

One of the great strengths of plastics packaging is the ability to vary the materials used to give the required amount of protection and no more. Costs are consequently kept to a minimum. The protection needed by a perishable food varies with the temperature at which it is stored, the three main categories being as follows :

6.1 Deep Freeze

Temperature of -20°c are normal in display cabinets, with warehousing and longer term storage at -30°C. Since there are no food poisoning or spoilage hazards at these temperatures, the containers do not have to be hermetically sealed for microbiological reasons. However most will have a board lid or a heat sealed diaphragm to avoid spillage or contamination of the foods. Typical foods in plastics are ice cream, mousses, fruit desserts and frozen cakes. ABS tubs with snap-on LD polythene lids, and PVC or HIPS pots with board lids, give good protection. They must however be correctly designed to avoid low temperature embrittlement and the risk of shattering on impact.

6.2 Chill Cabinets

At chill temperature around 5-7°C, bacterial growth is slowed, though not stopped completely. Foods such as yoghourts and desserts have a 2-3 weeks shelf life, and will be hermetically sealed with a foil diaphragm to achieve this. Butter, margerine, yellow fats, cottage cheese however are suitable with a snap on lid of HIPS or PVC. Most of the containers are made from HIPS or polypropylene.

6.3 Room Temperature

Dried foods such as skimmed milk powder or cocoa only need moisture protection, and are the simplest to pack - an HD container with LD polythene closure being ideal. Foods needing oxygen protection, such as salad cream or tomato ketchup, will require a bottle made from polypropylene laminated with EVOH or PVDC, with a hermetic foil seal. HD polythene and polypropylene have good heat resistance, which enables milk and flavoured milks to be heat sterilized to give a fully shelf stable pack. Aseptic

filling of preformed polypropylene pots, or aseptic form fill seal, is now well established for yoghurts, rice puddings and other desserts.

BI Turtle

16.4.89

ANNEX 4-5

MOISTURE VAPOUR TRANSMISSION RATES

Plastic (25 mu thick)	$g.m^{-2}$ $24\ hr^{-1}$ at 25°C/75% R.H.
PVDC	1
Polypropylene (oriented)	$1\frac{1}{2}$
High Density Polythene	2
Polypropylene	3
Low Density Polythene	5
Polyester	8
PVC (unplasticised)	20
Barex	30
Polystyrene	30
Nylon 6	35
ABS	40
Polycarbonate	50

ANNEX 4-6

OXYGEN TRANSMISSION RATES

Plastics (25mu)	$cm^3m^{-2}24hr^{-1}atm^{-1}$ at 25°C/50%RH
PVDC	2
EVOH copolymers	0.5-10*
Acrylic multipolymers	15
PVDC-PVC (Saran)	15
Nylon 6	50-150*
Polyester	80
PVC (unplasticised)	200
OPP	1400
HD polythene	1400
ABS	1500
Polypropylene	1800
HIPS	4500
Polycarbonate	5000
LD polythene	8000

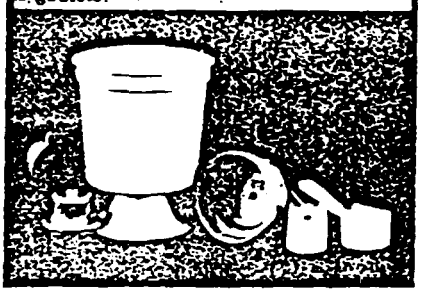
* Humidity Dependent

Methods of Manufacture

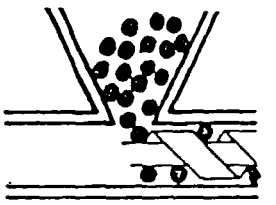
ANNEX 4-7

Injection Moulding

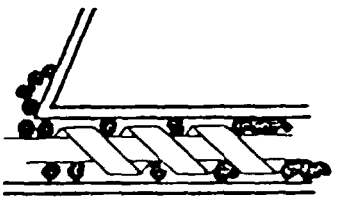
This method is used to make plastics containers, closures, tubes and dessert goblets.



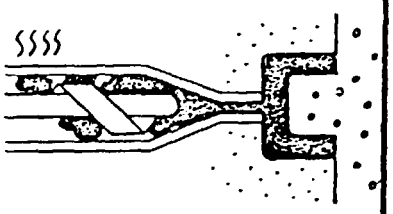
1 The plastics material, in the form of granules, is tipped through a hopper into a horizontal cylinder which contains a revolving screw.



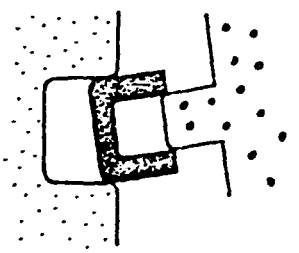
2 The friction causes the plastics granules to soften and become a molten material.



3 The heater gives a precise temperature control. The liquid is forced into a cavity in a cold, closed mould, where it is cooled and becomes rigid.

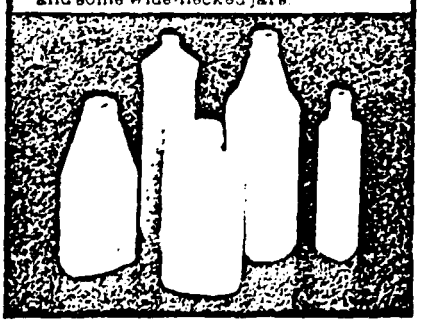


4 The mould is then separated and the shaped, plastics article is removed.



Blow Moulding

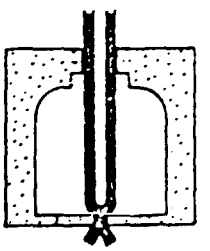
This method is mainly used for bottles and some wide-necked jars.



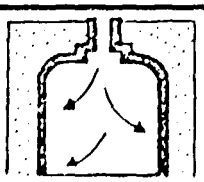
The first two stages are the same for this method, as in injection moulding except that the heated plastics liquid is thicker with a treacle-like consistency.

3 The liquid is then extruded into a thick-walled, hollow tube shape, which is called a 'parison'.

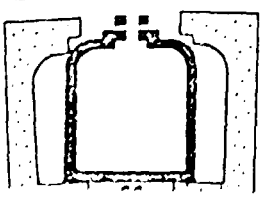
4 A two part cold mould is then clamped around the hollow tube and one end is pinched shut.



5 Cold air is blown into the hollow plastics tube, which is still hot and pliable, forcing the plastics out against the walls of the mould. The cold air and the contact with the cold mould cause the plastics to become rigid.

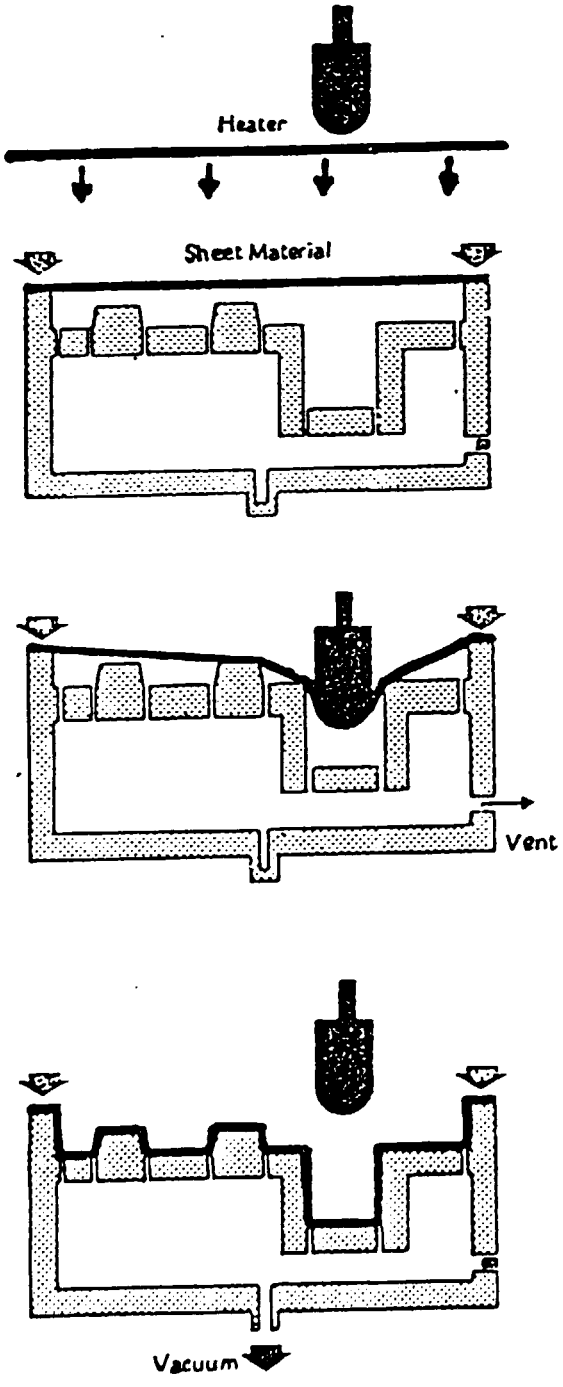


6 The mould is then opened, the plastics shape drops out and the surplus pieces of plastics are trimmed away. These pieces are not wasted, they are re-ground and used again.



ANNEX 4-8

THERMO FORMING



ANNEX 5-1

ADDITIONAL LITERATURE WITH CP

1. BBIK Food Packaging Laboratory Procedures 1-9

2. BBIK Food Packaging Seminars 1-8, lecture notes

3. Safe Food Pkg. Shorten, D.W. World Pkg. Dir. 1988 pp 103-109

4. BS 1133: Pkg Code Section 5: Protection against spoilage of pkges and their contents by micro-organisms, insects, mites, and rodents.

5. Food Irradiation as a Preservation Technique. Daniels, SS. JP 26.5.89

6. Workplan for consultant. January, May, June 1989.

7. Statistical significance table for rank sums. Kramer, A. Chemical Senses and Flavor 1974, 1, 121.

8. The Institute of Packaging U.K. Diploma Course lecture notes.
   a) The Canning of Food. Turtle, B.I. 15.1.87
   b) The Pkg. of Food. Turtle, B.I. 12.2.89
   c) Pkg. Materials and Containers. Turtle, B.I. 22.9.87

9. Organoleptic Assessment. Parsons, W.A. Journal S.A. Fd. Ind. 1971, 24, p 5-14

10. EEC Food Additives Identification. UK, MAFF, 1987

11. Shelf-life of Packaged Foods. Richardson, K.C. CSIRO Fd. Res.Q, 1976, 36, p 1-7

12. Modified Atmosphere Pkg. Anon. Pkg. Today, March 1988, p 31-35

13. High Banner Plastics for Food Pkg. Turtle, B.I. Fd. Tech. Intl. Europe, 1988, p 289-296

14. Packaging for the Microwave. Coddard, R.R., Fd. Manf. Nov. 1986, p 29-33

15. Cost Effective Food Pkg. Turtle, B.I. Wld. Pkg. Dir. 1988, p 67-72

16. Hot Stuff Microwaves. Sacharow, S. Pkg. Wk. 26.10.88, p 16-17

17. Ovenable Thermoplastic Pkg. Faithfull, J.D.T., Fd. Tech. Intl. Europe 1987, p 357-361

ANNEX 5-2

18. Shelf-life, Storage and Distribution. Whitear, A.L., Brewers Guardian, Jan. 1981, p 25-31

19. Flexible Plastics for Food Packaging. Turtle, B.I. Fd. Tech. Intl. Europe 1987, p 289-296

20. To achieve an Ideal Pkge Balance Key Factors, Paine, F.A. Packaging, April 1984, p 72-76

ANNEX 6-1

BBIK FOOD, PACKAGING LABORATORY PROCEDURE

SUBJECT : SIGNIFICANCE OF RANKED DATA

No. : 7 Issue No. 1 File Name : Date: 9.5.89

1. INTRODUCTION

Shelf life trials of food packaging are usually made against a, 'control', material which is known to be suitable. Thus tasting tests with the food can show if any test materials are as good as the control. Sometimes however the food will not have been packaged before, and no control will be available. In such cases the different packaging materials under test will be ranked from best to worst. This procedure gives a method of evaluating the significance of the ranking order obtained.

2. RANKING TEST METHOD

The samples will have been prepared, numbered and tasted by the normal test procedure. However, instead of scoring samples on a scale of 1 - 6, the tasters are asked only to rank the samples in order of preference. The recommended maximum number of samples tasted at one time is four, so the ranking will be 1, 2, 3, and 4. If a taster cannot differentiate between two samples, then half the arithmetic mean is given to each, i.e. if 1 and 2 are equal they score 1.5 each. (see Appendix 1).

3. STATISTICAL SIGNIFICANCE

3.1 It is sometimes possible to decide, merely by looking at the scores, that one or two samples may be better or worse than the others. Nevertheless, a statistical analysis is advisable for corroboration of the results in nearly every case. As with all statistical methods for significance, the greater the amount of data available the better. Thus as many tasters as possible should be used for ranking tests, and in any case not less than four.

3.2 The statistical method used here decides whether the level of significance of the rankings is 5% or less. An alternative way of expressing this is by saying that there is 95% confidence that the observed result is correct.

4. RANK SUMS

This method compares the rank sums for each of the samples tested. These are calculated as follows : -

If a sample is given a ranking of 1, 1, 2, 1, 2, by five testers, the rank sum is 7. If the rankings are 2, 2, 2, 3, 3, the rank sum is than 12. etc.

5. KRAMER TABLE

The mathematician A. Kramer gives his name to the statistical table (see Appendix 2) used to analyse the rank sums for significance. Normally the upper values in the table are used. However if one sample is being compared against the other three, the lower values in the table may be used.

6. EXAMPLE OF METHOD

6.1 Assume that five tasters have produced the following rank sums for the four samples A, B, C, and D

Sample	-	A	B	C	D
Rank Sum	-	10	17	6	17

6.2 Examine the table at the point for five tasters and four samples. The two upper values are seen to be 7 - 18.

6.3 Because sample C has a rank sum lower than 7, it is shown to be significantly better than the other three.

6.4 If any sample had a rank sum of 19 of greater it would be significantly worse than the other three. However, since B, C, and D have rank sums between 7 and 18, there is no significant difference between them.

7. COMMENTS

This statistical procedure is based on a simple analysis of variance which only shows up fairly large differences between samples. Nevertheless it is a useful technique to use when the taste panel results are not completely clear. Smaller differences between samples would only be shown by a sophisticated computer programme, based on the Duncan Multiple Range Test, or similar.

B.I. Turtle 9.5.89
aj.

ANNEX 6-3

RANKING TEST RESULTS

Code	Rank	C o m m e n t s
A		
B		
C		
D		

RANKING TEST RESULTS

Code	Rank	C o m m e n t s
A		
B		
C		
D		

Table Rank totals required for significance ($P \leq 0.05$)

Rank totals required for significance at the 5 % level ($P \leq 0.05$). The four figure blocks represent: lowest insignificant rank sum, any treatment-highest insignificant rank sum, any treatment. Lowest insignificant rank sum, predetermined treatment-highest insignificant rank sum, predetermined treatment.

No. of Tasters	Number of treatments, or samples ranked																		
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3 39
	.....	.....	.....	3·9	3·11	3·13	4·14	4·16	4·18	5·19	5·21	5·23	5·25	6·26	6·28	6·30	7·31	7·33	7·35
3	.....	.....	.....	4·14	4·17	4·20	4·23	5·25	5·28	5·31	5·34	5·37	5·40	6·42	6·45	6·48	6·51	6·54	7·56
	.....	4·8	4·11	5·13	6·15	6·18	7·20	8·22	8·25	9·27	10·29	10·32	11·34	12·36	12·39	13·41	14·43	14·46	15·48
4	.....	5·11	5·15	6·18	6·22	7·25	7·29	8·32	8·36	8·40	9·43	9·47	10·50	10·54	10·58	11·61	11·65	12·68	12·72
	.....	5·11	6·14	7·17	8·20	9·23	10·26	11·29	13·31	14·34	15·37	16·40	17·43	18·46	19·49	20·52	21·55	22·58	23·61
5	.....	6·14	7·18	8·22	9·26	9·31	10·15	11·39	12·43	12·48	13·52	14·56	14·61	15·65	16·69	16·74	17·78	18·82	18·87
	6·9	7·13	8·17	10·20	11·24	13·27	14·31	15·35	17·38	18·42	20·45	21·49	23·52	24·56	25·60	27·63	28·67	30·70	31·74
6	7·11	8·16	9·21	10·26	11·31	12·36	13·41	14·46	15·51	17·55	18·60	19·65	19·71	20·76	21·81	22·86	23·91	24·96	25·101
	7·11	9·15	11·19	12·24	14·28	16·32	18·36	20·40	21·45	23·49	25·53	27·57	29·61	31·65	32·70	34·74	36·78	38·82	40·86
7	8·13	10·18	11·24	12·30	14·35	15·41	17·46	18·52	19·58	21·63	22·69	23·75	25·80	26·86	27·92	29·97	30·103	31·109	32·115
	8·13	10·18	13·22	15·27	17·32	19·37	22·41	24·46	26·51	28·56	30·61	33·65	35·70	37·75	39·80	42·84	44·89	46·94	48·99
8	9·15	11·21	13·27	15·33	17·39	18·46	20·52	22·58	24·64	25·71	27·77	29·83	30·90	32·96	33·103	35·109	37·115	38·122	40·128
	10·14	12·20	15·25	17·11	20·36	23·41	25·47	28·52	31·57	33·63	36·68	39·73	41·79	44·84	47·89	49·95	52·100	54·106	57·111
9	11·16	13·23	15·30	17·37	19·44	22·50	24·57	26·64	28·71	30·78	32·85	34·92	36·99	38·106	40·113	42·120	44·127	45·135	47·142
	11·16	14·22	17·28	20·34	23·40	26·46	29·52	32·58	35·64	38·70	41·76	45·81	48·87	51·93	54·99	57·105	60·111	63·117	66·123
10	12·18	15·25	17·33	20·40	22·48	25·55	27·63	30·70	32·78	34·86	37·93	39·101	41·109	44·116	46·124	48·132	51·139	53·147	55·155
	12·18	16·24	19·31	23·37	26·44	30·50	33·57	37·63	40·70	44·76	47·83	51·89	54·96	57·103	61·109	64·116	68·122	71·129	75·135
11	13·20	16·28	19·36	22·44	25·52	28·60	31·68	34·76	36·85	39·93	42·101	45·109	47·118	50·126	53·134	55·143	58·151	60·160	63·168
	14·19	18·26	21·34	25·41	29·48	33·55	37·62	41·69	45·76	49·83	53·90	57·97	60·105	64·112	68·119	72·126	76·133	80·140	84·147
12	15·21	18·30	21·39	25·47	28·56	31·65	34·74	38·82	41·91	44·100	47·109	50·118	53·127	56·136	59·145	62·154	65·163	69·172	71·181
	15·21	19·29	24·36	28·44	32·52	37·59	41·67	45·75	50·82	54·90	58·98	63·105	67·113	71·121	76·128	80·136	84·144	89·151	93·159
13	16·23	20·32	24·41	27·51	31·60	35·69	38·79	42·88	45·98	49·107	52·117	56·126	59·136	62·146	66·155	69·165	73·174	76·184	79·194
	17·22	21·31	26·39	31·47	35·56	40·64	45·72	50·80	54·89	59·97	64·105	69·113	74·121	78·130	83·138	88·146	93·154	97·163	102·171
14	17·25	22·34	26·44	30·54	34·64	38·74	42·84	46·94	50·104	54·114	57·125	61·135	65·145	69·159	73·165	76·176	80·186	84·196	88·206
	18·24	23·33	28·42	33·51	38·60	44·68	49·77	54·86	59·95	65·103	70·112	75·121	80·130	85·139	91·147	96·156	101·165	106·174	111·183
15	19·26	23·37	28·47	32·58	37·68	41·79	46·89	50·100	54·111	58·122	63·132	67·143	71·154	75·165	79·176	84·186	88·197	92·208	96·219
	19·26	25·35	30·45	36·54	42·63	47·73	53·82	59·91	64·101	70·110	75·120	81·129	87·138	92·148	98·157	104·166	109·176	115·185	121·194
16	20·28	25·39	30·50	35·61	40·72	45·83	49·95	54·106	59·117	63·129	68·140	73·151	77·163	82·174	86·186	91·197	95·209	100·220	104·232
	21·27	27·37	33·47	39·57	45·67	51·77	57·87	63·97	69·107	75·117	81·127	93·137	93·147	100·156	106·166	112·176	118·188	124·196	130·206
17	22·29	27·41	32·53	38·64	43·76	48·88	53·100	58·112	63·124	68·136	73·148	78·160	83·172	88·184	93·196	98·208	103·220	108·232	113·244
	22·29	28·40	35·50	41·61	48·71	54·82	61·92	67·103	74·113	81·123	87·134	94·144	100·155	100·158	113·176	120·186	126·197	133·207	139·218
18	23·31	29·43	34·56	40·68	46·80	51·93	57·105	62·118	68·130	73·143	79·155	84·168	90·180	95·193	100·206	106·218	111·231	116·244	121·257
	23·30	30·42	37·53	44·64	51·75	58·86	65·97	72·108	79·119	86·130	93·141	100·152	107·163	114·174	121·185	128·196	135·207	142·218	149·229
19	24·33	30·46	37·58	43·71	49·84	55·97	61·110	67·123	73·136	78·150	84·163	90·176	96·189	102·202	107·216	113·229	119·242	124·256	130·269
	25·32	32·44	39·56	47·67	54·79	62·90	69·102	76·114	84·125	91·137	99·148	106·160	114·171	121·183	128·195	136·206	143·218	151·229	158·241
20	26·34	32·48	39·61	45·75	52·88	58·102	65·115	71·129	77·143	83·157	90·170	96·184	102·198	108·212	114·226	120·240	126·254	132·268	139·281
	26·34	34·46	42·58	50·70	57·83	65·95	73·107	81·119	89·131	97·143	105·155	112·168	120·180	128·192	136·204	144·216	152·228	160·240	168·252

Source of information: Kramer et al. *Chemical senses and flavor* 1974, 1, 121.

ANNEX 7-1

BBIK FOOD PACKAGING LABORATORY
DRAFT DETAILED WORKPLAN TO 31 MARCH 1990

1. INTRODUCTION

1.1 When the food packaging part of DP/INS/86/005 finishes at the end of June, BBIK personnel will have a knowledge of all the essential techniques. However, a considerable amount of practise is required with many of the procedures, eg. headspace gas analysis or odour testing, before precision can be achieved consistently.

1.2 Much food package testing consists of visual examination for leaks or corrosion, plus tasting of foods, so that these largely subjective techniques tend to be as important as the analytical variety such as headspace gas analysis, moisture content, etc. Hence before the laboratory can achieve the credibility it needs to help the Indonesian food packaging industry, it must first gain experience. Hence this 9 months is predominantly a training period. This is not to say that any outside work offered should be refused, indeed the opposite because it is valuable experience; however, except in a few areas work should not be actively sought from industry.

1.3 The laboratory head, Mrs. Susmirah has an adequate staff of 3 engineers and 2 graduates for this period. However, she also has 10 staff working on various inorganic and organic analyses, some of whom could be transferred to Food Packaging if necessary.

2. AREAS OF ACTIVITY

There are seven separate areas of work where the training and experience gathering should be concentrated. They are listed below, and while they are all important the first three are extremely so.

1. Familiarisation with retail packages
2. Laboratory heat sealers
3. Conduct of shelf-life trials
4. Predictive testing
5. Packaging of Indonesian food products
6. Analytical work
7. Background knowledge

These seven areas are considered in detail, as follows.

3. FAMILIARISATION WITH RETAIL PACKAGES

3.1 Visit manufacturers of packaging materials and converters in the Jakarta area, such as PT Multi Guna Agung who have already given an invitation. This will establish a base of specified materials for subsequent comparison with unknowns, and also indicate what manufacturing faults could affect package performance.

3.2 Purchase typical retail packages from a supermarket in metal, paper, and plastics for breakdown examination and analysis. For example a flexible laminate for a dried food would a) be delaminated, with solvents if necessary, b) thickness of plies measured, c) materials identified by simple tests such as density and/or burning, or IR spectrometry if required, d) general note taken of package condition, level and quality of decoration, etc.

3.3 Collect at least one sample, on its filled container usually glass, of the range of closures covered in Seminar 6. Note: condition of closure, eg rust, etc., and keep in samples store with all other packaging for reference. Purchase samples of screwcapped and twist off capped jars and measure removal torques via Laboratory Procedure No.9.

3.4 Cooperate with Materials Testing to measure physical properties such as seal strengths, and bond strengths of laminates, etc.

4. LABORATORY HEAT SEALERS

4.1 The Audion Electro TT300-S is a simple heatsealer, very easy to use provided Laboratory Procedure No.4 is followed. However, as new laminates are examined, all those with non-melting substrates should be sealed on the TT300-S and the sealing conditions noted. Seal strengths to be monitored by Materials Testing Laboratory.

4.2 The Supervac CK183/1 vacuum packing machine is suitable for sealing all types of flexible packaging, and the sealing conditions for unsupported films should be monitored as in 4.1. At present the functioning of the inert gassing cycle can only be checked down to 2 $\pm$ 1% residual oxygen level by orsat, and it is working correctly. However, when gas sampling syringes are available residual oxygen levels down to 0.1% can be analysed. This will enable laboratory personnel to establish the cycle times required for various oxygen residual levels, and the ultimate performance on double and treble gassing cycles needed for very oxygen sensitive products. Laboratory Procedures No.8 for the Supervac, and No.2 for Headspace Oxygen Determination refer.

5. CONDUCT OF SHELF LIFE TRIALS

5.1 Most of the Food Packaging Laboratory activities are contributory in some way to the carrying out of shelf life tests, eg. sealing packages, determining ERH, evaluating packaging materials. At present there is very little experience of setting up a trial and assessing the results, and this experience must be gained.

5.2 The fundamentals of setting up a trial, ie. material variables, test conditions, pattern of examinations are covered by Laboratory Procedure No.1, and have been carried out with the Dodol and Krupuk Palembang trials. The proposed trials with other Indonesian food products together with further trials on Dodol and Krupuk will help to confirm this methodology.

5.2 Organoleptic evaluation techniques are completely new to BBIK, and much time and effort must be spent in training the Taste Panel and giving it practise. By the time the consultant leaves the members will have been chosen and several evaluations will have been completed. However, people differ widely in their sensitivities to different tastes such as bitter or sour, and these differences can only be shown by experience. Much of the experience will come from the shelf-life trials being conducted. Nevertheless, these should be augmented by testing with food simulants such as a range of sugar and salt solutions. Laboratory Procedures 5 and 6 outline the basic techniques, and 7 testing results for significance.

6. PREDICTIVE TESTING

6.1 By predictive testing we mean the estimation of the shelf-life of a packaged product via short term work. This should be limited exclusively to those products where moisture content changes decide the shelf-life, rather than oxidative effects. There are two main methods to be practised as follows, and in both cases the ERH of the product should first be determined to assess the moisture sensitivity. Laboratory Procedure No.3.

6.2 The first method involves the Callenkamp climatic cabinet. A correlation is first established between ambient conditions c. 30 degrees C/75% RH, and the cabinet set at the standard 38 degrees C/90%RH. The moisture pick-up of 2 or 3 different dried foods in 50u PP or LDPE sachets is determined over 4-6 weeks, and the accelerating factor found. In many cases, use of the 38/90 condition will allow an answer to be obtained in half the time taken at ambient to reach the deterioration point. Such a prediction should always be confirmed at a later date by the ambient results.

6.3 The second method enables a shelf-life in one materials to be calculated for any other material. The equation is given in F.A. Paine's book, Packaging for Climate Protection, where its use is fully explained, ie. $\frac{CR}{t} = \frac{C}{x} - \frac{x}{C}$

Trials should be carried out to experimentally verify the equations predictions, using eg. milk powder and PP bags in 30, 50, 80 thous. thicknesses.

7. PACKAGING OF INDONESIAN FOOD PRODUCTS

7.1 These have already started with Dodol and Krupuk Palembang. At least one more Dodol trial is planned before final conclusions can be made about the packaging. The Krupuk first trial is also only a preliminary to further shelf-life trials.

7.2 Future trials will include other krupuk varieties and qualities. Kripik Pisang will also be examined because a packer has expressed an interest in extending his shelf-life, and the popular Krupuk Udang is essential. Away from dried foods, evaluation procedures are more difficult, and the laboratory should gain experience before looking at fruits and vegetables, etc.

8. ANALYTICAL WORK

8.1 Ongoing analysis of plastics for heavy metals will continue. In addition, PVC materials are being tested for VCM content in cooperation with a PVC manufacturer; the Pye-Phillips PV4500 gas chromatograph being used for this.

8.2 Experience in sampling packs for headspace gas analysis is very limited, and must be practised to achieve precision. Gas packed flexible and rigid plastics containers are ideal packages on which to develop the technique described in Laborary Procedure No.2.

9. BACKGROUND KNOWLEDGE

9.1 Personnel must be encouraged to treat every visit to the supermarket as a training exercise. Examining packs on the shelves which look interesting is an easy way to gain knowledge and keep aware of problems such as rusty cans or stress-cracked plastics, also new packaging as it appears. Any relevant seminars or exhibitions should be visited by all 6 people whenever possible, not just the senior people.

9.2 The BBIK library is now well stocked with packaging books, and the further series of papers and monographs given to the counterpart have filled in much of the necessary detail. However, staff must be instructed to study those areas in which they are currently working, plus general packaging information.

10. COMMENTS

10.1 In view of the current lack of experience in food packaging, personnel should not concentrate to an equal extent on all the above areas. Some degree of specialisation will enable the laboratory to become proficient more quickly, and also increase the credibility factor with industry. Already there is specialisation in the areas of gas chromatography and samples examination, and any personal preferences which appear should be encouraged if they assist efficient working.

10.2 The six members of the food packaging team are enthusiastic and anxious to learn. Given this enthusiasm, there is no reason why a satisfactory level of expertise should not be achieved by 31 March 1990.

B.I. Turtle
5 June 1989

BBIK FOOD PACKAGING LABORATORY
DRAFT WORKPLAN TO 31 MARCH 1992

1. INTRODUCTION

1.1 The period up to 31.3.90 has been covered by a detailed workplan, so this draft covers the two years from 31.3.90 to 31.3.92.

1.2 The first 9 months have been very largely a training period for laboratory personnel to gain experience in all forms of food packaging. Some industry packaging problems will have been investigated, but have not been sought after. However, the laboratory should now have sufficient knowledge to be credible to industry, and should therefore actively seek out industrial packaging problems which it could help to solve.

1.3 The following five main project areas are suggested for the next two years, and some work has already started on two of them. While not included as a project, it should be noted that in the ever changing field of packaging, the acquiring of background knowledge is vital. Book and journal study and attendance at training courses will take about 10% of available man-hours.

1. Experience in Industry
2. Investigation of Industry Problems
3. Packaging of Indonesian Food Products
4. Evaluation of Indonesian Export Packaging
5. Expansion of Laboratory Facilities

A description of the projects is given below.

2. EXPERIENCE IN INDUSTRY

2.1 Purpose:
To enable BBIK personnel to learn something of packaging materials manufacture. Also about the problems experienced by both materials manufacturers and users of packaging.

2.2 Justification:
Knowledge of the working of industry will increase understanding of problems which arise for investigation at a later date.

2.3 Manpower Resource:
Currently available.

2.4 Equipment Required:
None.

2.5 Timescale:
The 9 months to 31.12.90

2.6. Project Outline:
Cooperation is required from a can manufacturer, a flexible packaging converter, and a carton supplier. Also food firms such as Indomilk and Khong Guan. Selected personnel should spend at least a week, and preferably longer, studying operations. If possible they should actually work on the packaging lines and in quality control laboratories. A full report must be written following each assignment for the benefit of other members of the food packaging laboratory.

3. INVESTIGATION OF INDUSTRY PROBLEMS

3.1 Purpose:
To improve both the quality and cost-effectiveness of the packaging used by the Indonesian food industry.

3.2 Justification:
Requested by Government.

3.3 Manpower Resource:
No more laboratory staff are required. However, the effectiveness of the laboratory would be greatly increased if a customer liaison man was appointed. He would spend some of his time working in the laboratory, but more time visiting industry to discuss problems, report results, etc.

3.4 Equipment Required:
None.

3.5 Timescale:
Ongoing.

3.6 Project Outline:
Both receive and seek out industry problems with packaging, and then investigate as necessary via material examination, odour testing, shelf-life trials, etc.

While the laboratory has been established as a food packaging unit, there is no reason why it should not investigate non-food items if necessary. However, these should be restricted to dry goods, pharmaceuticals, and similar products, which will not pose a taint or health hazard to foods.

4. PACKAGING OF INDONESIAN FOOD PRODUCTS

4.1 Purpose:
To increase the shelf-life of perishable foods, and reduce wastage.

4.2 Justification:
Saving of valuable natural resources.

4.3 Manpower Resource:
Currently available.

4.4 Equipment Required:
None.

4.5 Timescale:
Ongoing.

4.6 Project Outline:
The packaging of dry foods such as krupuk is already covered under Industry Problems. This project deals with fruits and vegetables, and possibly also fresh fish. Modified atmospheres such as 5% O_2/5% CO_2/90% N_2 will be investigated. The cooperation of scientists from Bogor Agricultural Research Institute is essential to decide on a joint programme of work. However, likely foods for investigation are fruits such as mangos, durian, salak, apples, rambutan, and vegetables such as kacang panjang, kangkung, and cabbage.

5. EVALUATION OF INDONESIAN EXPORT PACKAGING

5.1 Purpose:
To assess the quality and effectiveness of export packaging, and to suggest improvements where necessary.

5.2 Justification:
Increased non-oil exports.

5.3 Manpower Resource:
Currently available.

5.4 Equipment Required:
None.

5.5 Timescale:
The 6 months from 1.1.91 to 30.6.91

5.6 Project Outline:
Visits are required to the major exporters of packaged foods who are willing to cooperate. Where shortcomings are either

stated by the firm or pointed out by BBIK, further visits will e made to study operations in detail. Laboratory work will then be initiated as necessary.

Because of the special importance of outer packaging in an export situation, someone from the Transport Packaging Laboratory should also be involved in this project.

6. EXPANSION OF LABORATORY FACILITIES

6.1 Purpose:

To enable the laboratory to deal with the problems of carbonated beverages, and foods sterilised by heat in cans or plastics.

6.2 Justification:

The above two types of food packaging are equally as important as the dried food area already covered by BBIK.

6.3 Manpower Resource:

One extra graduate is required with a good knowledge of food technology. If such a person is not available a suitable scientist can be trained. The training must include practical experience of food sterilisation in an establishment such as ITAL.

6.4 Equipment Required:

This has been requested under the UNICO development grant scheme as follows.

RO capper, pedestal model - Alcan, USA
Filamatic volumetric liquids filler - Filamatic, USA
Millwall laboratory retort - FMC, UK
MBIA can seamer - Carnaud-Metal Box, UK
Crown capper, bench model - Crown Cork, USA
Plastics bottle sealer, bench model - Chadwicks, UK

6.5 Timescale:

Ongoing from the time the equipment arrives.

6.6 Project Outline:

The first three months will be spent installing the equipment, learning to use it, and in particular carrying out sterility proving trials of the retort in conjuction with BBIK microbiologists. After this period, the new facilities should be explained to industry at a half day seminr. Apart from investigating industry problems, discussions should also be held with the agricultural and food research institutes. These discussions may identify carbonated or sterilised Indonesian food products which could benefit from improved packaging.

7. COMMENTS

7.1 The facilities available in the food packaging laboratory should be extended as soon as possible. A greater range of problems which can be investigated means more work, more credibility, and a "snowball effect" which should ensure a successful future for the laboratory.

7.2 As mentioned in the 31 March 1990 Workplan, the laboratory staff have a commendable degree of enthusiasm. Given this attitude there is every hope that this proposed workplan is a feasible one.

B.I. Turtle
5.6.89