Proceedings of the Workshop are available at a cost of M$25 post paid.

FORTHCOMING EVENTS

PORIM/Kejuruteraan Semangat Maju Training Seminar: *Application of Variable Speed Drives for Palm Oil Mills*

This is a one-day seminar sponsored by Kejuruteraan Semangat Maju Sdn. Bhd. and will be free of charge. Participation will be on a first-come first-serve basis so register early to avoid disappointment. Please ensure your attendance once you are registered to avoid depriving others from attending. Lunch and tea will be provided.

For further information and registration please contact the following at PORIM (Tel: 8259155)

Laisah A. Hashim (1223/1016)
Nicholas B.H. Lim
J.H. Maycock
Ma Ah Ngan

Venue : PORIM Conference Hall
Date : TUESDAY 29th November 1988
Time : 9.30 a.m. - 4.30 p.m.

NATIONAL SEMINAR ON PALM OIL INDUSTRY

Palm Oil Research Institute of Malaysia will be organising the above seminar on 11 - 15 October 1988 in Kuala Lumpur. The seminar will consist of the following four modules:

Module 1 : Mechanization, Fertilizer and Oil Palm Nutrition.
Module 2: Current Developments in Processing Technology.
Module 3: Nutrition and Palm Oil Products Developments.
Module 4 : Market Development for Palm Oil.

Further details can be obtained from En. Hussin Salleh of PORIM (Tel: 03-8259482).

SEMINAR ON COLOUR MEASUREMENT IN THE OILS AND FATS INDUSTRY

Colour is an important quality control parameter in the oils and fats industry. It is usually stipulated as a requirement in trading specifications of refined oil, fatty acids as well as glycerine.

Different equipment is used for measuring colour of different product. In addition different Standard Test Methods (*e.g.* BS or AOCS) have different requirements in terms of procedure, colour scales and equipment. PORIM, in collaboration with Interscience Sdn. Bhd and Tritometer Ltd. UK is organising a half-day Seminar on colour measurement to help alleviate confusion in this area on Wednesday 19 October 1988, from 9.30 a.m. to 1.00 p.m. The registration for this Seminar is free. Applications to attend the seminar should be made on the available registration form. Please use one form per applicant. Photocopies are acceptable. Closing date is 12 October 1988. Forms are available from Cik Laisah, Secretary, Bahagian Kimia dan Teknologi, PORIM.

END - USES OF PALM OIL

PART I. FOOD USES OF PALM OIL

Introduction

Palm oil has emerged as one of the most important oils in the world oils and fats market.

The reasons for this tremendous growth are undoubtedly due to its unique properties and characteristics which lend itself to the many applications in the food and non-food industries.

About 90% of the palm oil is used as food world wide and the other 10% is good basic raw material for the soaps and oleochemical industries.

In the first two parts of this series, some general applications of palm oil and its products in food will be discussed. Subsequent, parts of the series will touch on the non-food application of palm oil products.

Food Uses of Palm Oil and Palm Oil Products

Palm oil and its products may be blended or modified by available processing techniques (such as hydrogenation, fractionation, interesterification) for a wide range of food applications, such as margarine. In formulating for edible products application an easy and convenient way is to match the solid-fat profile for compatible physical characteristics.

The solid-fat content is a measure of the amount of solid present in the sample.

The solid-fat profile of palm oil and its derivatives are depicted in *Figures 1* and *2*. It can be seen that these derivatives could be blended together and with other oils to produce fat blends of different solid-fat profiles for different applications.

The main food uses of palm oil and its products

FIGURE 1: SOLID FAT CONTENT PROFILE OF PO & PO DEIVATIVES

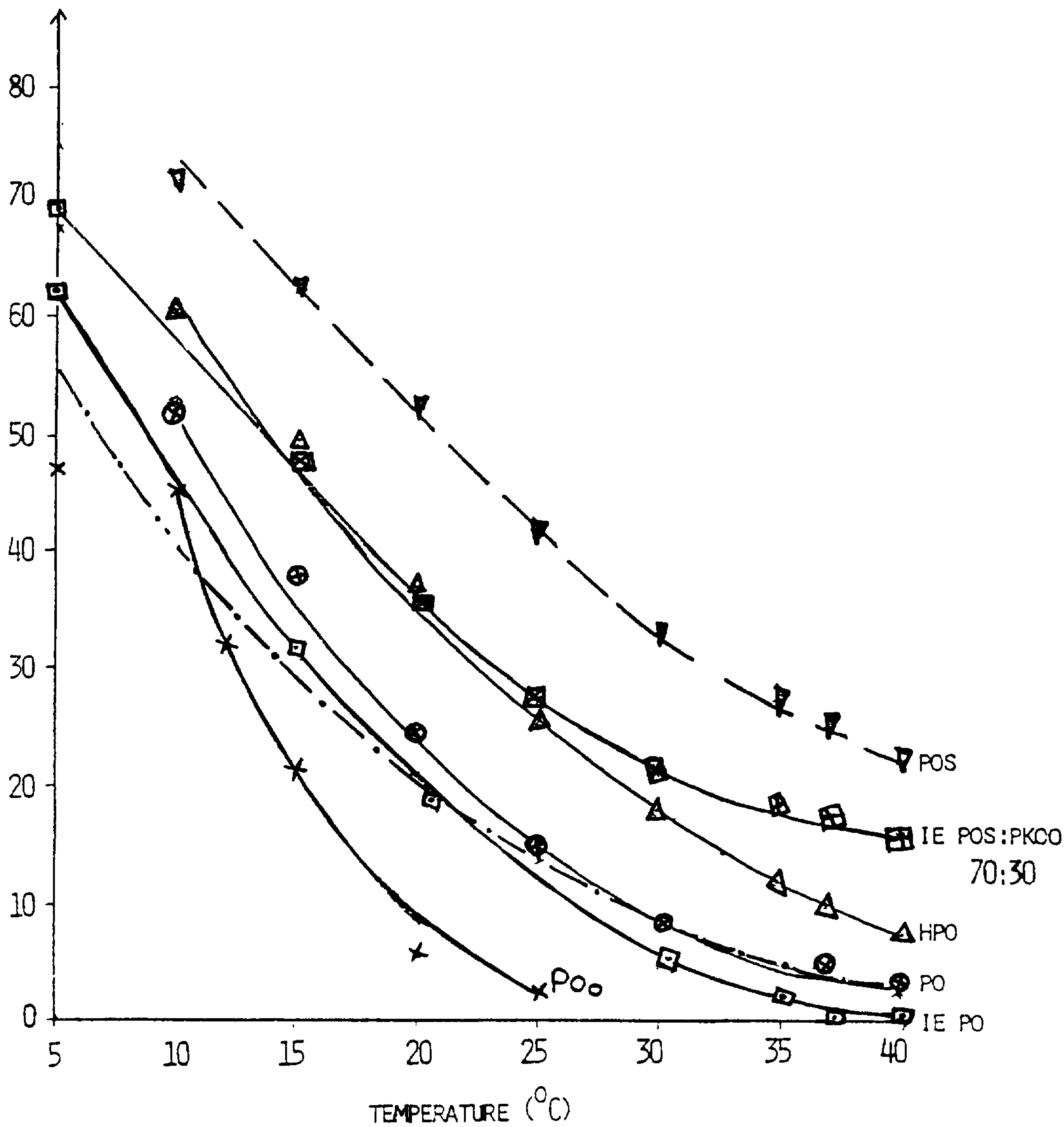


FIGURE 2: SOLID FAT CONTENT PROFILE OF PALM KERNEL OIL, PALM KERNEL OLEIN AND PALM KERNEL STEARIN

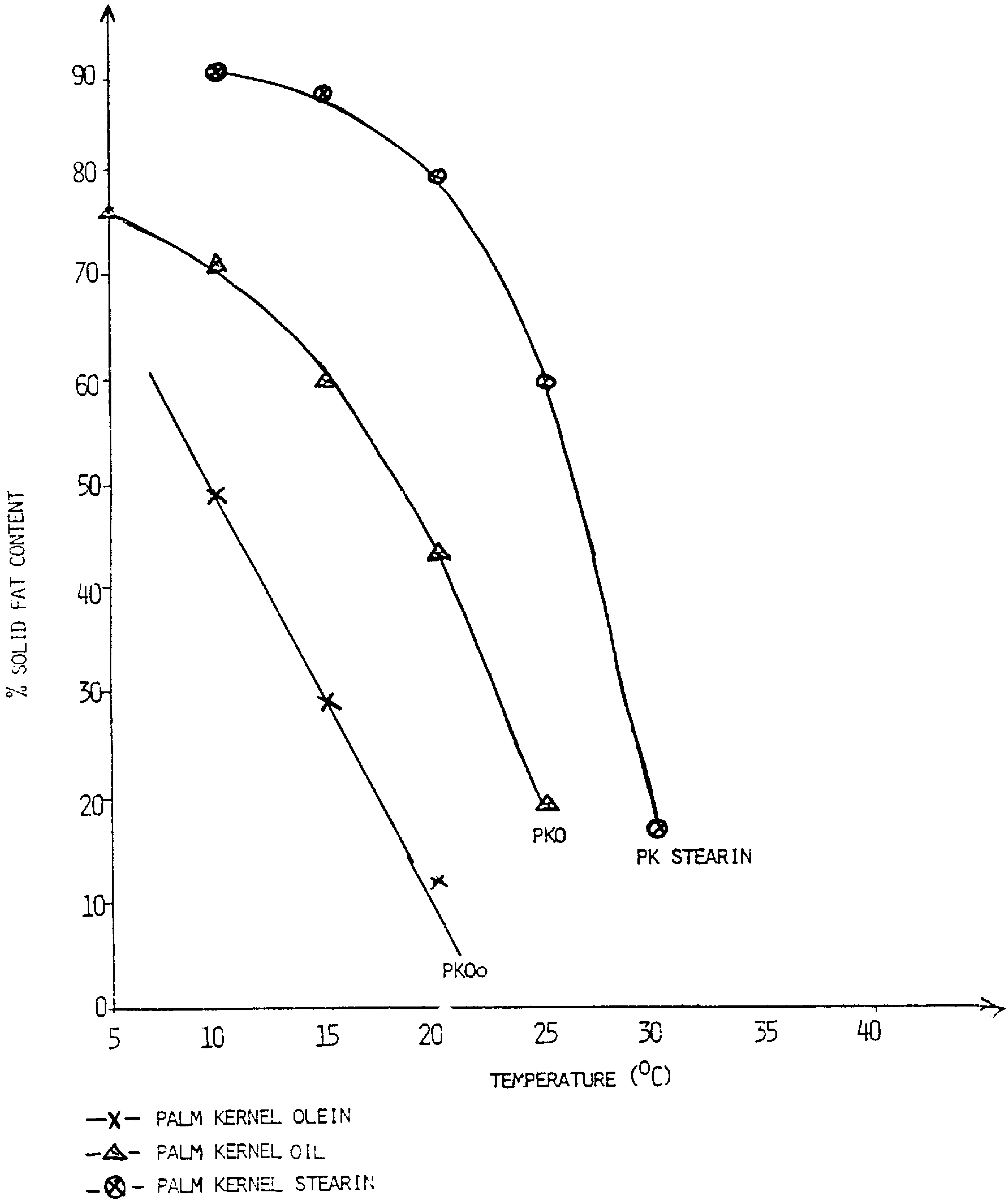
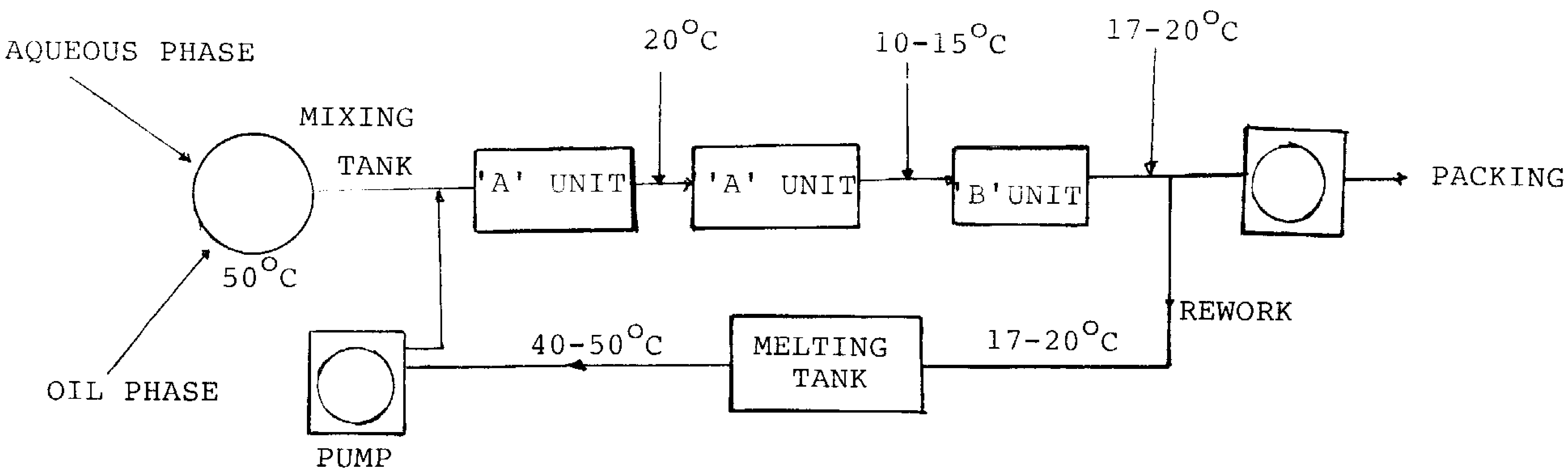


FIGURE 3: PROCESSING OF MARGARINE



can be classified under the following headings:

(1) Cooking oil and frying fats.
(2) Vanaspati.
(3) Shortening.
(4) Margarine.
(5) Sugar confectionery.
(6) Spray dried fats and whipped emulsion.
(7) Miscellaneous.

Cooking Oil and Frying Fats

In many countries, traditional cookery provides a large market for liquid oil for domestic purposes. This oil may be used for salad dressing, frying and for other purposes. One important consumer requirement in temperate countries is that the oil must remain clear at relatively low temperatures. Palm oil glycerides have a melting point of 19°C or above and as such palm olein, the liquid fraction of palm oil clouds and hence is not suitable for this application. However, a proportion of a double fractionated palm olein may be useful by blending with such unsaturated liquid oils as soyabean or rapeseed.

In the tropics, palm olein has been widely used for cooking and frying.

Due to higher ambient temperature, cloudiness is generally not a problem.

One of the major uses of palm oil/olein is in deep fat frying. As the oil is subjected to very high temperature (180°C) over an extended period of time, the oil will deteriorate very quickly due to oxidation and render the fat unsuitable for further use. This is very apparent especially with highly unsaturated oil such as corn or soyabean oil which results in polymerisation (gummy) and unsatisfactory flavours.

The good frying properties of palm oil/olein are due mainly to its moderate degree of unsaturation (10% linoleic acid), virtual absence of linolenic acid and the presence of oleic acid as the main fatty acids combined with a high level of tocotrienols and tocopherols enhances its oxidative stability.

Vanaspati

Vanaspati are imitation ghee products and can be classified, based on their appearance into two types, products having smooth texture (especially popular in Middle East countries) and products having granular texture (India, Pakistan, and Bangladesh).

Products with smooth texture are produced by cooling the oil blend on a scraped surface heat exchanger. Generally these products have a higher melting point criterion and hence up to 100% palm oil/palm oil products can be used.

Products with granular texture are prepared by partial hydrogenation of one or more vegetable oils. The oil blends are packed in containers and cooled slowly in a cold room maintained at 15°C with adequate cold air circulation.

The amount of palm oil/palm oil products that can be used are shown in *Table 1.*

Shortening

Like margarine, shortening is basically a plastic product except that it is not consumed directly as a spread or table fat but is used for cooking and baking in place of lard. As the name implies, it gives baked goods a 'short' or tender eating quality. The shortening prevents the formation of gluten in the dough by coating the flour particles with fat. The consistency, melting behaviour and other physical characteristics of shortening are determined largely by the fats and oils used in its preparation. Blends of flatter type solid-fat profile will give good plastic texture.

Palm oil and palm oil products may be blended, hydrogenated or interesterified to produce various shortening blends. In tropical climates, shortening has been made entirely from palm oil and its products while in temperate climate palm oil/palm oil products could be incorporated to a very high percentage.

Shortening used for making creams incorporate palm oil interesterified with lauric oils improve mouth feel of the cream and also the creaming volume.

The manufacture of shortening, basically follows the same principles as those of margarine. However, in shortening no aqueous phase is incorporated and the product is usually not emulsified. The shortening is normally aerated by nitrogen gas to give a fine dispersion of air in the shortening and also to impart a whiter appearance.

Margarine

Margarine is a water-in-fat emulsion in which the water droplets are dispersed in the continuous fat phase and kept separated by the crystals. The composition of margarine is genarally a minimum of 80% fat and not more than 16% water. The margarine normally also contains 1% to 3% salt, emulsifiers, preservatives, flavourings, colouring, antioxidants, and fortified with vitamin A and D.

Margarine Processing

The basic steps in margarine processing are:

(i) Aqueous phase preparation.
(ii) Emulsion preparation.
(iii) Texturizing or plasticising the emulsion and controlling its plasticity.
(iv) Packaging of margarine.
(v) Tempering the margarine where relevant.

TABLE 1: PYHSICAL CHARACTERISTICS OF VANASPATI

Code	1137	3402	3406	3407	3410	3411	3412
Blend							
Palm Oil	*	54	57	62	70	69	65
Palm Stearin (50 °C)		6	12	9	7	6	9
Hydrogenated Cotton Seed Oil (34 °C)		40	31	29	-	-	-
Hydrogenated Soyabean Oil (34.5 °C)		-	-	-	23	25	26
Slip Melting Point (°C)	37.5	38.3	39.0	39.0	38.0	38.0	38.5
SFC (%)							
5 °C	66.5	63.4	64.4	64.1	66.0	64.6	65.5
10 °C	58.0	51.8	56.8	56.0	56.7	59.9	57.5
15 °C	44.3	42.3	45.0	44.8	45.2	44.5	45.2
20 °C	31.7	31.4	33.1	32.5	32.6	31.6	32.7
25 °C	20.2	20.1	20.4	20.1	20.5	19.6	21.2
30 °C	12.3	13.4	14.5	13.9	15.8	13.5	13.8
35 °C	7.5	7.5	8.1	8.5	8.4	7.9	8.2
37 °C	4.7	5.4	6.7	6.6	6.2	5.9	7.0
40 °C	0.8	1.0	0.6	0.7	0.4	0.3	0.1
Yield Value g/cm^2 20 °C	400	530	1 441	372	438	749	780

* Vanaspati from Hyderabad.

TABLE 2 : SOME TABLE MARGARINE FORMULATION BASED ON PALM OIL

Code	1	2	3	4	5	6	7
Soyabean Oil	-	-	-	-	-	-	-
Rapeseed Oil	65	65	70	45	50	-	25
Palm Olein	20	-	-	-	-	45	-
Palm Oil	-	30	-	35	50	30	50
Palm Stearin	15	5	20	-	-	-	-
Palm Kernel Oil	-	-	10	20	-	25	-
Palm Kernel Olein	-	-	-	-	-	-	15
Hyd. P. Oil (42 ^{o}C)	-	-	-	-	-	-	10
Yield Values, g/cm^{2}							
5 ^{o}C	924	817	563	932	946	2671	1474
20 ^{o}C	117	123	173	102	143	892	328

TABLE 3: FORMULATION OF INDUSTRIAL MARGARINE AND SHORTENING

Code	1	2	3	4	5
Palm Oil	-	60	-	-	-
Palm Olein	-	-	60	-	20
Palm Kernel Oil	-	30	-	40	-
Palm Stearin	60	10	30	-	50
Soyabean Oil	-	-	10	-	30
Hydrogenated Soyabean Oil (36 °C)	-	-	-	-	-
Rapeseed Oil	40	-	-	10	-
Hydrogenated Palm Oil (42 °C)	-	-	-	50	-
SFC (%)					
10 °C	36.5	55.4	44.7	56.7	36.5
15 °C	29.9	38.9	33.2	47.2	29.5
20 °C	23.3	27.9	23.6	35.7	20.1
25 °C	17.7	19.9	14.5	24.0	14.8
30 °C	14.0	13.7	10.8	15.6	10.8
35 °C	10.1	9.1	8.7	9.8	8.8
40 °C	7.4	8.4	6.5	2.4	5.7

TABLE 4: PASTRY MARGARINE FORMULAE

	1(A)	2(B)	3(B)
Hydrogenated Palm Oil (Melting Point 42 °C)	60	50	50
Palm Stearin (Melting Point 50 °C)	30	-	-
Palm Kernel Olein	10	-	-
Soyabean Oil	-	10	-
Palm Oil	-	40	50

(A) Processed on Kombinator

(B) Processed on Perfecta

The basic set-up of a margarine processing plant using modern scrape surface exchanger is shown in *Figure 3.*

Application of Palm Oil/Palm Oil Products in The Following Main Types of Margarine

(i) Table Margarine - Tub and Packet

The consistency at temperatures of use is important. For packet margarines, the relevant temperature is 15° to 20°C in temperate climate and 25°C in tropical areas. Tub margarines are expected to have spreadability at refrigerated temperature of 5° to 10°C. They have very good oral melt-down.

Table 2 shows some table margarine formulations based on palm oil and palm oil products.

The percentage of palm oil that can be incorporated in table margarine varies from 25% to 40%. Palm olein can be used up to 60%.

(ii) Industrial or Bakery Margarine

The margarine must be able to take up and bind a great amount of air when mixed with other ingredients. This will give a tender cake with good volume, fine structure and even, fine pores.

Normally, these margarines have a solids content of about 20% at 20°C. Palm oil itself has a solid content close to this and hence a substantial amount can be incorporated. Palm stearin, the solid fraction of palm oil can be used to a certain extent. Palm kernel oils with their high content of lauric acid are known to give good creaming properties due to their fast crystalizing property.

Some palm oil/palm oil products formulations of industrial margarine are shown in *Table 3.*

(iii) Puff Pastry Margarine

In producing puff pastry, the basic dough is rolled out and partly covered by a single flat piece of margarine. The dough is then folded over the margarine and the whole piece is then rolled out thinly. The folding and rolling is repeated several times. The function of the margarine is to separate the layers of dough and to produce a uniform flaky texture and high volume in pastry. It is important that each layer of margarine is homogenous and unbroken. This demands that the margarine must be able to withstand vigorous stretching during rolling and the margarine must be exceedingly plastic.

Palm oil and its products are highly suitable fat ingredients for puff pastry margarine. *Table 4* shows some formulation based on palm/palm oil products.

(Dr. Chuah Chaw Teo - Yee Lee Oils)

ENGINEERING PRACTICE

SHAFT FAILURE DUE TO THE APPLICATION OF WELD METAL

I am sure that all our engineers are aware of the dangers of repairing boilers and other pressure vessels by welding but care should also be taken for any repairs by welding.

As an example of a failure caused by welding I am giving below details of a case experienced with a squirrel-cage electric motor.

"The fracture of the shaft of a 10 h.p. squirrel-cage motor took place at the driving end just outside the roller bearing and not at an abrupt change of section behind the bearing where it might be expected to occur. The shaft was therefore examined in the laboratory to ascertain the reason for this apparent anomaly.

The location of the fracture is shown in *Fig. 1,* from which it will be seen that the portion of shaft to the right of the fracture was deeply grooved. It transpired that about a year prior to failure the inner race of the roller bearing became slack on the shaft and the seating was built up by the metal-spray process, the shaft having been machined to form a rough thread to provide the requisite mechanical "key" for the sprayed-on metal. Part of this sprayed-on layer became detached after the fatigue failure occurred.

The appearance of the surface of fracture, shown in *Fig. 2,* was clearly indicative of failure from fatigue. Although the surface of the fracture was not as smooth as is generally seen in failures of this type, the mode of development in stages was quite evident. Failure was initiated at what appeared to be a defect in the material adjacent to the outer surface, but a macro-etched section through the shaft showed this to be associated with the termination of a welded-up keyway, as shown in *Fig. 3.* The presence of this weld deposit is also indicated by the dark-coloured area, forming an extension to keyway, in *Fig. 1.* It was apparent that the quality of the welding left much to be desired, slag inclusions being present adjacent to the sides of the keyway, which had been re-cut shorter than the original one after the welding repair.

Hardness tests showed values of 155 VDP for the material of the shaft (equivalent to a tensile strength of 34 t.p.s.i.), 153 - 193 for the weld deposit, and 282 for the heat-affected zone - the dark etching region - immediately below the weld deposit.

It is evident that, in this particular case, failure at an unusual location was caused by the presence of the weld deposit. After deposition, weld metal contracts