PALM OIL

technical bulletin

In This Issue...

GLOBAL ACCEPTANCE OF MALAYSIAN PALM OIL

ISSN 1394-4983

A Publication of the Palm Oil Research Institute of Malaysia (PORIM) P.O. Box 10620, 50720, Kuala Lumpur, Malaysia

GLOBAL ACCEPTANCE OF MALAYSIAN PALM OIL

By
Yusof Basiron and Johari Minal

Since the early days, man had found that cooked foods were more delicious than raw foods. As a result, they gradually learned the various ways of cooking using oils and fats as the main media. Their selection of the oils and fats for cooking was based solely on the availability of these oils and fats. As time passed by, consumers developed additional criteria in selecting the oils and fats for consumption, *i.e.* preference and economic factors. They also realised that some oils and fats provide greater source of energy than carbohydrates. Thus, these oils and fats can serve important functions other than making food delicious.

Today, however, consumers do not consider only factors such as preference, taste and economic factors; they also consider nutritional attributes and technical aspects as equally important factors. When making a selection for an oil or fat, all these factors may compromise one another. One factor sometimes may dominate the others depending on the consumers' needs and thus forming a consumption pattern.

Of all the oils and fats, palm oil is perhaps the only oil that suits all criteria for selection of oils and fats. It is abundantly available, relatively cheap, technically suitable for most food products and it is a 'healthy' oil. It is also highly interchangeable with most oils and fats either directly or through certain processing techniques. Furthermore, it has increased its versatility in food products and its interchangeability with other oils and fats. This is the outcome of endless R & D efforts conducted in the past 15 years in the areas of processing, utilization and formulations. As a result, about 90% of palm oil currently goes into food applications and the remaining 10% into non-food uses. Currently about 60%-65% of palm kernel oil serves as oleochemical feedstock and the balance ends up in specialized food products. Apart from its direct use in cooking and frying, palm oil is also used in margarines, vanaspati, ghee, confectioneries, filled milk and many more. That is why the development of palm oil in terms of production, export, usage *etc.* have been very rapid within a relatively short period of time, *i.e.* in three decades.

Such rapid developments took place regardless of whether the price of palm oil was low or high. Prior to 1994, palm oil was traded at a low price but since then, it has been traded at a relatively high price. In both cases, exports continue to increase and never meets the demand. This proves that palm oil has become the preferred oil worldwide due to its nutritional attributes and functionalities and not due to its low price. Thus it is now globally accepted by the world. This paper discusses the acceptability from the technical point of view in various consuming countries.

Global Market Acceptance

Total world imports of palm oil had been rising sharply from 922 700 tonnes in 1970 to 3 675 000 tonnes in 1980 or 298% increment and further increased to 8 400 000 tonnes ten years later representing another increment of 128%. In 1994, the quantity again increased to 10 261 000 tonnes. These figures show that palm oil imports continue to annually increase at high rates without fail.

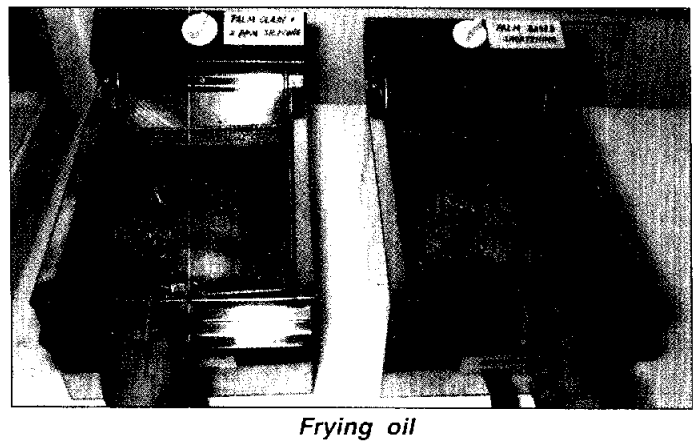
The Asian region was the world's largest importer of palm oil products in 1994 with 6 423 400 tonnes against 260 800 tonnes in 1970. This was followed by Europe, Africa and Americas. Respectively, they imported 2 340 100; 901 300 and 488 300 tonnes of palm oil in 1994 against 569 100; 18 580 and 79 120 tonnes in 1970. These statistics again indicate that palm oil has been well accepted by the Asians, Europeans, Africans and Americans and obviously palm oil has some secrets of its success.

Cooking and Frying Oil

Research projects conducted by PORIM as well as other coveted and recognized international research institutions have shown that palm oil is possibly one of the best natural frying oils. In fact, bulk quantities of palm oil go into frying. Studies conducted in Germany and Switzerland revealed that palm oil and palm olein are comparable, if not better than groundnut oil (Bracco *et al.*, 1981; Herendi & Bethke, 1982; Zeddelman & Wurziger, 1973). Toregard & Eriksson (1979) from Sweden found that palm olein performs better than hydrogenated soyabean oil. It also lengthens the shelf-life of fried products (Augustin *et al.*, 1988; Mashasi *et al.*, 1985). *Table 1* shows that palm oil complies with the specifications for deep-frying oil very well.

Studies have also shown that palm oil does not leave unpleasant odour due to the absence of linolenic acid; has high resistance towards oxidation due to low polyunsaturation, does not polymerize to gums; has a melting point below the human body temperature and has nutritionally balanced composition of fatty acids.

Table 2 and *Figure 1* depict that palm oil has an excellent oxidative stability compared to other oils and fats especially the liquid oils. There are also oils that exhibit better oxidative



Frying oil

Table 1. Comparison Between Deep Fat Frying Oil a..d Palm Oil Specifications

Parameter	[1]Deep Fat Frying Oil	Palm Oil
1. FFA	< 0.1%	0.1% max[2]
2. Odour & Flavour	bland	bland
3. Colour	Light	3R max[2]
4. Moisture	< 0.1%	0.1 max[2]
5. Smoke point	> 200°C	> 200°C[3]
6. PV	< 1.0 meq/kg	1.0 meq/kg[4]
7. Composition 18:3	< 1%	0.4%[5]
C12 & Less	< 1%	0.2%[5]
8. Melting point		
Solid fat	< 40°	< 39°C[2]
9. Induction period	> 30 hrs (AOM > 60 hrs)	39 hrs[6]

Source: 1. Berger (1984); Stevenson *et al.* (1984)
2. PORAM standard specifications
3. Razali and Nor'aini (1994)
4. PV value of "Fresh" palm oil
5. PORIM Report PO(172)90 Restricted
6. Razali (1993) (Note: I.P. for Palm Olein is 44 hrs)

stability as shown in *Table 2*, but they are either hardened oils which contain the hazardous trans fatty acids or lauric oils which dominate the LDL-cholesterol raising fatty acids. Animal fats, on the other hand, are cholesterol rich fats.

Furthermore, palm olein can be blended with other soft oils to suit the requirements of a particular country. For countries whose population prefer its oil to have a particular characteristic of flavour *e.g.* groundnut oil or mustard oil, it is possible to blend the oil with palm olein to provide more oil with the same characteristic flavour and maintain the price stability.

Those who use oil with higher linolenic acid level can also benefit by blending with palm olein which gives a higher oxidative stability to the oil. *Table 3* shows that the induction periods of soft oils are increased significantly when they are blended with 30% of palm olein.

Having such characteristics, it is not surprising that many countries have shifted to use palm oil in frying, especially deep-fat frying. These include PR China, Japan, South Korea, South Africa, the USA and Europe.

PR China has become the largest importer of palm oil. In 1970, no imports of palm oil were recorded but in 1994 the imports were 1.830 million tonnes. Almost all imported palm olein goes towards the food industry; mostly for deep-frying of instant noodles, potato chips and use in restaurants (Fan and Chen, 1994).

Japan is the second largest importer of palm oil in the East Asian Region. The imports were 40 000 tonnes in 1970 and rose to 349 200 tonnes in 1994. About 75% of palm oil imported or 262 000 tonnes were used as frying fat. Frequently, palm oil or palm olein is blended with rice bran oil or lard to meet the demand of customers who prefer the taste and flavour of the latter. The frying oil is used to fry instant noodles, snack foods and tempura. With the development of udon, a Japanese noodle and the growing health consciouness, almost all instant noodles are fried in either palm oil or palm olein or a mixture with lard and no product is fried in 100% lard (Hiroyuki and Takashi, 1994). A study made by PORIM on

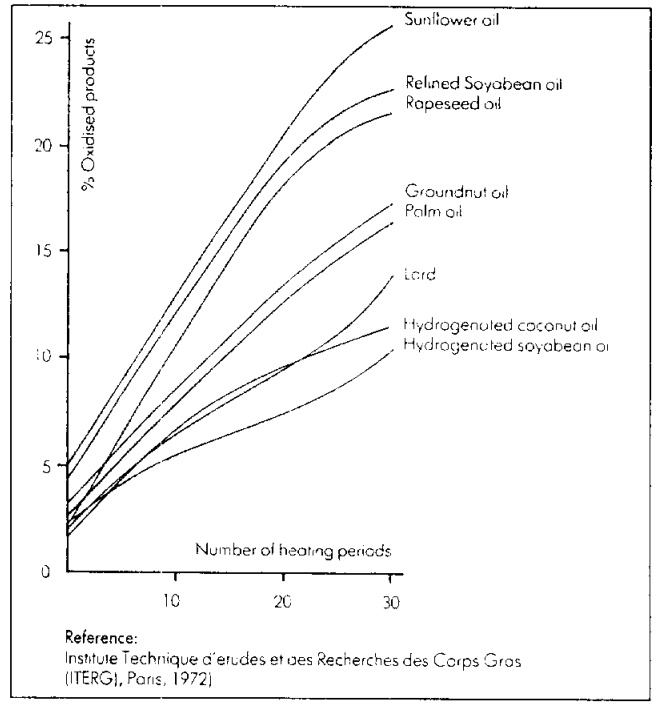


Figure 1. Oxidation of oils and fats during deep frying under standard conditions.

Table 2. High Temperature Oxidative Stability of Oils and Fats

IV	Oil/Fat	Oxidative Stability
–	Coconut	Excellent
50-55	Palm Oil	Good
56	Palm Olein	Good
105	Peanut Oil	Fair
99-119	Cottonseed Oil	Fair
120	Maize Oil	Poor
133	Sunflower Oil	Poor
133	Soya bean Oil	Poor

Source: Teah and Karimah (1986)

Table 3. Induction Period (I.P.) of Individual and Blended Oils

Oil/Blend	I.P. (hrs)
Groundnut	15.0
Groundnut/Palm Olein	21.0
Rapeseed	11.5
Rapeseed/Palm Olein	16.0
Soya bean	9.0
Soya bean/Palm Olein	16.0
Sunflower	8.0
Sunflower/Palm Olein	10.8

Source: Teah (1988); Razali (1993)
Note: - Each blend contained 30% of palm olein.
- Starting induction period was 0 hour.

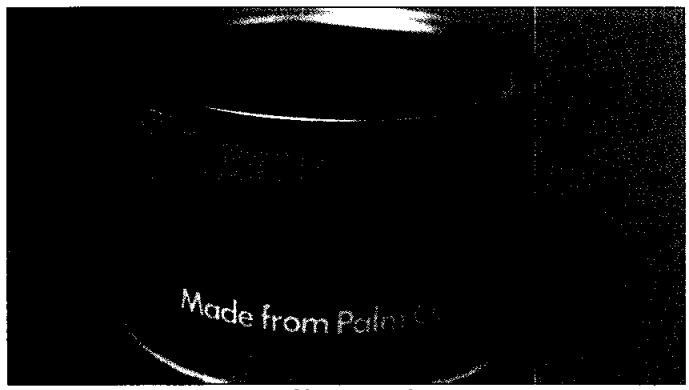
oils/fats used to fry instant noodles of a company in Japan showed that since 1991 lard and hydrogenated oil have been replaced by either 100% palm oil or 100% palm olein (Razali and Nor'aini, 1994). Palm olein is also mixed with the traditional corn oil, rice-bran oil or rapeseed oil for frying snack foods and rice crackers.

South Korea is a producer of an instant noodle, called ramyon. Her imports of palm oil increased from 500 tonnes in 1970 to 195 000 tonnes in 1994. The major portion of the import (60-65%) is for the production of fried ramyon. In 1993, palm oil had nearly replaced all tallow as the frying medium for ramyon. Some instant noodle manufacturers have even used the blend of palm olein with palm stearin in the production of ramyon. South Korea is the largest producer of instant noodles with production of about 7 billion packs/year (Suk, 1991).

Other palm oil importing countries where the major portion of the oil goes for industrial frying are the USA, Europe, South Africa and Australia.

Palm oil is preferred in the frying industry because it is cost-effective, lasts longer, does not produce gums that need extra maintenance for the fryer and most importantly, the fried products can be kept at least six months without going rancid. Compared with the traditional frying fats, lard or tallow, palm oil is cholesterol-free. It is trans-free as opposed to hydrogenated soft oils.

It is interesting to note that when palm oil is used for industrial frying operation, there is no need to discard the oil. Instead, fresh palm oil is added during the operation to top up the oil absorbed by foods.



Vanaspati

Apart from industrial frying, palm oil is also popular as a household cooking oil especially in tropical countries. In Malaysia, 95% of household cooking oil uses palm olein. Palm olein is also blended with groundnut oil or sesame oil or both to obtain the flavour of the latter oils while maintaining the competitive price. It is also blended with sunflower oil to enhance the nutritional attributes of the oil and marketed as mono-unsaturate oil. Annual consumption of edible oils in Malaysia is about 350 000 tonnes of which 90% is palm oil and palm olein.

India is the largest importer of palm oil for use as household cooking oil. No import of palm oil was recorded in 1970. In 1980, India imported 533 500 tonnes of palm oil and by 1988, the imports grew to nearly one million tonnes before they dropped sharply to only 150 500 tonnes in 1993 due to the success of the self sufficiency programmes. However, in 1994, India again recorded 378 300 tonnes of palm oil imports and in 1995, the imports of palm oil from Malaysia alone had exceeded 750 000 tonnes.

Palm oil used to be imported by the State Trading Corporation (STC) for the Public Distribution System and the National Dairy Development Board (NDDB) for the Market Intervention Operation. Economy liberalization followed by import liberalization of edible oils under the Open General License gave the private sector the opportunity to import palm oil. In May 1995, the Government of India reduced the import duty on edible oil imports to only 30% for the private sector while the import duty for STC and NDDB remain at 20%. This has encouraged the private sectors to participate actively in the import of palm oil. A few companies have now marketed palm oil in the open market for household cooking oil. NDDB has even blended palm olein with groundnut oil in the ratio 70:30 for sale in the open market.

Bangladesh is also an importer of palm oil for household cooking although the image of palm oil is poor due to smear campaigns in 1980s. Bangladesh started importing palm oil in small quantities in 1978. In 1994, she imported 135 000 tonnes of palm oil and almost 90% of the amount went to household cooking.

Sri Lanka is a coconut oil consuming country. Whenever there is a shortage in coconut production, palm oil is imported to bridge the gap. About 90% of palm oil import is for cooking oil, mostly household cooking oil and the remaining is for margarines and industrial uses. Sri Lanka has been importing palm oil as early as 1970 with 1200 tonnes and in 1994 the imports were 41 000 tonnes.

Myanmar has been importing palm oil for household cooking for the past 15 years and has not imported any other oils for the same purpose. Less than 5% of palm oil imported goes to solid fats products and industrial uses. With only 29 000 tonnes in 1980, the import reached 185 000 tonnes of palm olein in 1994.

In temperate countries palm olein is marketed as blended oil with polyunsaturated oils. The blends are stable at lower temperatures without crystallization. In 1992, Unilever in Italy became the first western company to market household liquid frying oil using palm olein as the main component blended with sunflower and groundnut oils. The product is sold in Italian supermarkets under the brand name of "FRIOL". Following Unilever's success, a second company, Salindo SRL, also in Italy, came out with a similar product under the brand name of "FRIMAX". Both these products are packed in one litre plastic bottles and sold at about half the price of olive oil, which is the traditional cooking/salad oil in the Mediterranean region (TAS News, 1991).

Vanaspati

For many years butter ghee has been used in a number of countries for frying. As a result of industrialisation and urbanisation, the demand for butter ghee has increased and the price has gone beyond the means of traditional consumers. As an alternative vanaspati or

vegetable ghee was first introduced in India in the 1930s. Gradually, vanaspati has become a separate industry by itself. Vanaspati is now a popular cooking medium in the Indo-Pakistan sub-continent and in most Arab countries.

Originally vanaspati was made from a single oil e.g. hydrogenated groundnut oil. Blends of various types of oil, normally cottonseed oil, soya bean oil, rapeseed oil and palm oil, locally sourced or imported, are being used in vanaspati manufacture currently.

Hydrogenation is needed to harden the soft oils to the required melting point. The process is costly. It also results in the formation of hazardous trans fatty acids and lowers the content of essential fatty acids significantly.

Palm oil is the best alternative to the hardened soft oils. The melting point is in the range of 37°C which is close to the range of melting points of vanaspati which is between 37°C and 39°C or even to the maximum of 41°C in some countries. By blending with other soft oils, with or without partial hydrogenation, the required melting point with coarse or smooth crystals can be formulated.

The physical properties of commercial vanaspati from various sources are shown in *Figure 2*. Blend 1 contains a small amount of hydrogenated palm oil. The formulae for Blend 1 is as follows:

1. Hardened palm oil (m.pt. 42°C)) 24%
2. Palm Oil 56%
3. Liquid vegetable oil 20%

It is clearly shown that Blend 1 suits the melting profiles of commercial vanaspati perfectly. In some countries it is accepted that fully refined palm oil is used directly as vanaspati.

Since palm oil provides a cost-effective and nutritionally better vanaspati, many countries have shifted from using hardened soft oils to palm oil. *Table 4* compares formulation of vanaspati from various countries in 1983 and in 1993.

Pakistan has been importing palm oil for the past 25 years or so for the manufacture of vanaspati. In 1970, imports of palm oil were only 2000 tonnes and increased sharply to 1 198 000 tonnes in 1994. Almost 100% of palm oil import is consumed by the vanaspati industry. Initially, palm oil incorporation in vanaspati was only 5%-20%. The levels of palm oil incorporation were gradually increased from 20% to 40% in early 1980s; 65% in late 1980s; 80% in early 1990s; and finally 80%-100% by the year 1992 (Iftikhar Ahmad, 1994).

Dramatic changes in palm oil usage were also witnessed in the West Asian countries. In 1970, only Iraq imported palm oil in significant amounts of 66 000 tonnes. By 1994, almost all the Arab countries imported palm oil and a quantity of 537 700 tonnes were recorded. Almost all of these imports were for the manufacture of vanaspati.

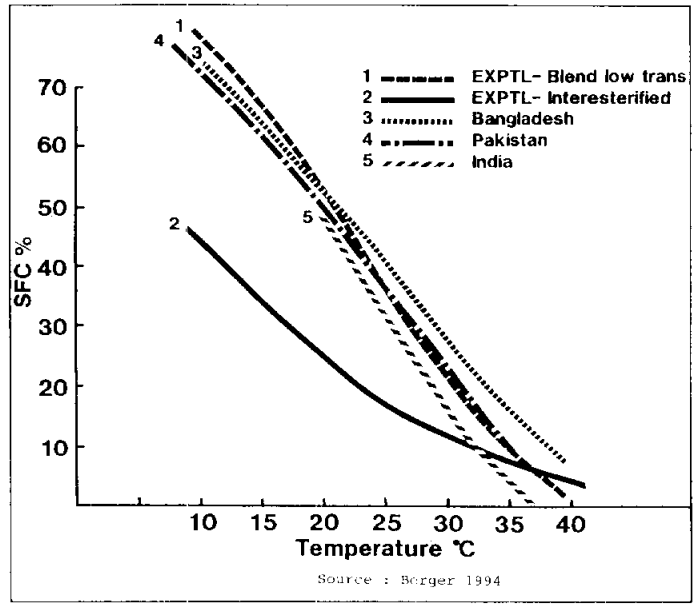


Figure 2. Solid fat content of vanaspati.

Margarine and Shortening

Margarine was developed to replace butter which was expensive. It was first formulated with animal fats, but today most margarines are formulated with vegetable oils. The product range includes table margarines (packet and tubs), bakery margarines and pastry margarines. Recently, the product range has been extended to various "low calorie" spreads which contain higher levels of water.

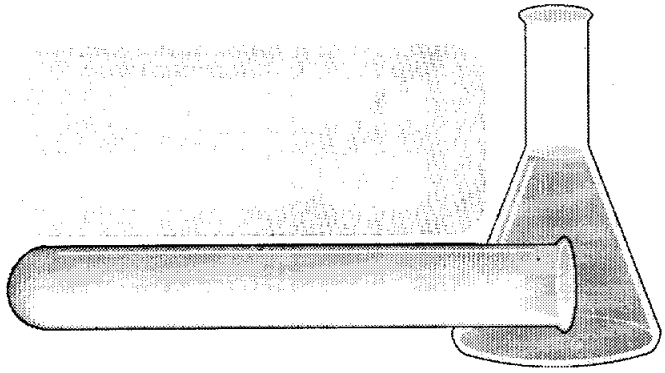
Tub margarine has fairly low solids at low temperature

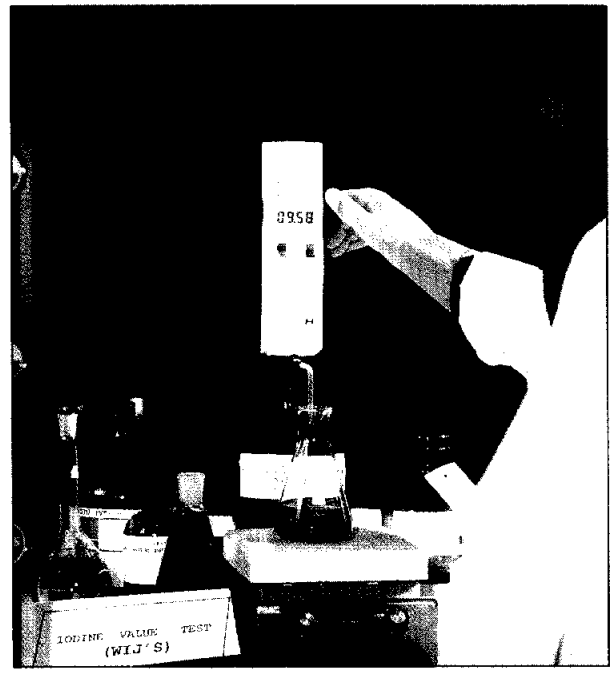
● *TURN TO PAGE SEVEN*

Table 4. Comparison Between Vanaspati Formulation in 1983 and 1993

Country	1983	1993
*India	5% Sesame oil 15% Palm oil 80% Hydrogenated oils (mainly soya, cottonseed)	5% Sesame oil 60%–80% Palm oil 20%–40% Hydrogenated oils
Pakistan	40% Palm oil 60% Hydrogenated oils (soya, cottonseed)	80-100% Palm oil 0-20% Hydrogenated oils
Iraq	80%–100% Palm oil	100% Palm oil
Egypt	20% Cottonseed oil 60% Hydrogenated cottonseed oil 20% Tallow	100% Palm oil
Saudia Arabia	–	100% Palm oil

**Note:* India had once used up to 80% of palm oil in vanaspati. The percentage may not be applicable presently since the type of oils and sometimes their percentages are regulated by the Government.





Iodine value

THE ACCURACY OF IODINE VALUES

Contributed by
T.P. Pantzaris and Dr. B.A. Elias

The Iodine Value (IV) is one of the oldest tests carried out on oils and fats and is still among those most widely used. It is featured in the specifications of practically every oil and is very useful in determining the purity of an oil and in the control of major factory processes such as hydrogenation and fractionation.

The IV is defined as the percentage of iodine combining with the oil under the conditions of the test and measures the average degree of unsaturation of the sample. More detailed information on the unsaturation is given by the fatty acid composition (FAC) profile as determined routinely now on the fatty acid methyl esters by GLC, but the IV still offers the convenience and clear message of a single number.

Some Problems

Recently, the IV test as usually determined by the Wijs method (*e.g.* ISO 3961 and PORIM Method P3.2) had raised some concerns because of its use of a hazardous solvent, carbon tetrachloride. Partly for that reason and partly for reasons of economy, some laboratories now prefer to calculate the IV from the FAC, by multiplying the percentage of each unsaturated fatty acid by the appropriate factor.

However, natural oils and fats, especially in the crude state, contain variable quantities of free fatty acids, unsaponifiable material, *etc.*, which affect the Wijs IV differently from the calculated IV, while the FAC determination may underestimate some unsaturated fatty acids present in very small amounts. For these reasons, exact agreement between the two methods is not theoretically to be expected. Two questions therefore arise.

- How well do the two methods agree?
- Which one is the most precise or in other words, has the smaller scatter of results in repeated determinations.

Experimental Results

A good light on these matters was shed by tests carried out in England in 1986(1). Food RA distributed identical samples of palm kernel oil and sunflower oil to 23 participating laboratories which to determine the IV by both the Wijs method (BS 684:2:10 {1976}) and by calculation from the FAC (AOCS T 1c-85). The results on PKO are shown in *Table 1.*

It is seen that the mean values of the two methods were very similar and their difference was found to be statistically 'not significant'. However, the calculated IV method gave a larger standard deviation and so both its reproducibility and repeatability were much poorer. Even on oils of low IV such as PKO, different laboratories found to agree within about four units, while on oils of higher IV such as sunflower, agreement was even poorer (5 units). The calculated IV is therefore not suitable for trading purposes and cannot be recommended as a substitute of the Wijs IV, except perhaps for results which are only to be used within the company for process control.

On the contrary, this work has highlighted the fact that there is considerable variability in the results of the FAC of oils obtained by different laboratories and it may be advisable to use the Wijs IV as a check of their accuracy.

Table 9. Statistical Analysis of the IV of PKO Determined by Wijs and by Calculation from FAC

	Wijs IV	Calculated IV
No. of laboratories	23	23
No. of accepted results	21	19
Mean	17.48	17.87
Repeatability (r) 95%	0.27	1.04
Reproducibility (R) 95%	0.68	4.11

Glycerol – Some Medical Applications

Contributed by
Dr. N. Chandrasekharan

Glycerol (glycerine) can be obtained as a by-product in the refining of oils and fats or by chemical synthesis on an industrial scale. Glycerine by itself has no pharmaceutical effects on the cardiovascular system. It will be metabolized by the body as another source of carbohydrates for energy. Nitroglycerine is an explosive liquid (main component of dynamite), but safe in the tablet form (Glyceryl trinitrate). The active component is the nitrate (which has to be reduced to the nitrite and probably to nitric oxide) and not the glycerine.

CH_2ONO_2 = (Nitroglycerine
$CHONO_2$ glyceryl trinitrate
CH_2ONO_2 trinitroglycerine)

Angina Pectoris (myocardial ischaemia) is characterized by pain, because of imbalance between the amount of oxygen needed by the heart and the amount supplied by the coronary blood vessels. Relative ischaemia could also be due to increased demand for oxygen or a diminished supply of oxygen. The sensation is one of life threatening, throttling pain in the chest. It is seen most often in men (80%) under 50 years and is precipitated by exertion or emotion and relief is obtained by rest. (Angina pectoris is not to be confused with myocardial infarction which is most often due to a clot or thrombus interfering with the blood flow to the heart).

Treatment of Angina

Organic nitrites and nitrates are used and nitroglycerine is used much more frequently than any other drug in the treatment or prevention of individual attacks. It leaves little to be desired as it acts within two minutes and termination of the pain is usually sudden and complete. It is one of the most effective drugs for providing rapid symptomatic relief of angina, but its effect lasts only for 20–30 minutes. Nitroglycerine dominates short term therapy and is the best available drug for the treatment of angina pectories and the wealth of proprietary preparations of nitroglycerine testifies to its popularity.

Mode of Action

The active component in nitroglycerine is the nitrate and it:

- increases coronary blood flow (relaxes smooth muscles in all types of vessels and so decreases resistance).
- dilates the coronary blood vessels resulting in more blood to the heart.
- dilates collateral blood vessels (alternate supply of blood increased).
- reduces cardiac output and cardiac workload by reducing the myocardial oxygen requirement. Reduction in cardiac workload by use of vasodilators important in management.

Administration and Metabolism

The usual dose is 0.2 to 0.6 milligram. Nitroglycerine can be chewed or taken sublingually (kept under the tongue) and so is absorbed and transformed rapidly and the major end products are carbon dioxide, urinary glycerol, the glyceryl nitrates and organic acids. After a sublingual dose of 0.6 mg, the average duration of action is 18 minutes. Maximum blood levels are reached within 30 minutes.

Stability

Nitroglycerine deteriorates with exposure to air, moisture and sunlight. Therefore if the tablet does not produce relief, it may be inactive and a fresh supply has to be obtained. Most patients quickly learn the dose that gives them the best balance between relief of pain and the unpleasant side effects. However, the problem of tolerance occurs with time.

If pain continues in spite of increasing the dose, the patient should consult his physician as an emergency. It is necessary to treat the causal/precipitating factors. It is also used in Raynauds disease – to relieve pain by increasing the blood flow. Nitroglycerine ointment – the effect is more prolonged with duration of action up to 5 hours.

Other Clinical Uses

Glycerine is a component of moisturizing creams. Protects the nipples during breast feeding (prevents dryness and cracking). As a demulcent, it alleviates irritation – tends to coat the surface and so protects the underlying cells from stimuli. Used for softening the wax in the ear before syringing. Glycerine is miscible in water/alcohol and so is a vehicle for many drugs applied to the skin. It absorbs water and is dehydrating and so has bactericidal action. Glycerol suppositories (A laxative – acts as a rectal stimulant by virtue of its mild irritant action and so is useful in the evacuation of the bowel).

It is also used to mask the obnoxious taste of certain drugs. In glaucoma (increased eyeball pressure): glycerol given orally is useful as a short term therapy for reducing the intraocular pressure.

Cerebral Edema

In the initial days following major cerebral infarction, cerebral edema may occasionally threaten life. Oral therapy with glycerine or dissolved in saline solution given IV daily is another form of therapy with anti-edema effects.

Mouthwash: Glycerol 10%, thymol 0.05% with colouring and flavouring has a mechanical cleansing action and freshens the mouth. (However, there is no convincing evidence that gargles are effective).

Protective medium: Glycerol is a protective medium for freezing red blood cells, sperm cells, cornea and other living tissues in medical practice.

FROM PAGE FIVE

which enables it to be spreadable direct from the refrigerator. The fat blends have a solid-fat content profile which indicates that the margarine has a uniform consistency over a wide range of temperature. The fat blends are completely melted below 37°C and hence have very good oral melt-down. Palm kernel oil and palm kernel olein have steep solid fat profiles and hence have good melt-down in the mouth. They are incorporated in table margarines because of this characteristic. A universal premium table margarine (tub) consists of hydrogenated soyabean oil (35%), soyabean oil (40%) and palm oil (25%). However, up to 50% of palm oil could be used in standard tub margarine but at the expense of oral melt. Palm olein could be increased to 40% for premium tub margarine.

Only about 10%-15% of palm stearin could be used in tub margarine. By a process of interesterification, an excellent margarine base-stock was produced in PORIM utilizing both by-products of fractionation process of palm oil and palm kernel oil.

Packet margarine is formulated more like butter where spreadability at 15°C–20°C is important. More palm oil could be used (50%) in packet type margarine. However, with interesterification process, a 100% palm oil product-based formulation had been formulated in PORIM for the Danish market.

Palm oil and palm stearin form good bases for industrial margarine and shortening. Because of the inherent high solids requirements of these products, a fairly high proportion of palm oil and palm oil products could be used. Typical specification of industrial margarine is shown in *Table 5*.

TURN TO PAGE EIGHT

● FROM PAGE SEVEN

Table 5. Solid Fat Content of Industrial Margarines

Solid fat content: (NMR)	
	% solids.
20°C	40% – 50%
30C°	20% – 30%
40°C	< 10%

Source: Teah (1992)

Various levels of palm oil products could be used ranging from 50% to 100% for formulation of industrial margarine and shortening.

Pastry margarine is a more specialised product tailor-made to make vent, puff pastry *etc.* Palm oil products featured very well in this product and could range between 50%-80% in composition.

In Japan 25% of palm oil imported is used for margarine and shortening. Only a small amount of palm oil was used prior to 1970. However, its share rose to 9.9% for margarine and 22.2% for shortening in 1985, with further increases to 16.5% and 33.8% respectively in 1991. In contrast, the share of animal fats, including hydrogenated fish oils, in margarine fell from 71.8% in 1985 to 36.7% in 1991. During the same period, the use of animal fats for shortening decreased from 76.2% to 23.0%, mainly because of reduction in the use of hydrogenated fish oils and domestic tallow.

Stick margarines are very important products in both Canada and the USA. A survey by E. Postmus et.al. (1989) revealed that the canola based stick margarines contained between 3% – 11% palm oil. The incorporation of palm oil in stick margarine formulation is required to stabilise the "β" crystalline of canola oil. With the growing concern about trans-fatty acids, three trans-free margarines were launched in Canada in 1993. They were, by brand, Becel, Olivina and Navel. The formulations of these margarine were made possible by the incorporation of palm oil. Navel is canola and soya bean oils based while Olivina is made from refined olive oil, sunflower, canola and palm oil. In 1994, Canada produced 183 500 tonnes of margarines (FAO, 1995) of which palm oil share was about 8%–12% or between 15 000 tonnes - 22 000 tonnes. About 25 000 tonnes of palm oil were imported by Canada in the same year.

The success of palm oil in establishing itself in the shortenings market of the EEC has been truly outstanding. Presently in UK, more palm oil is used for shortenings than all the other oils and fats put together *(Table 6).*

The same table clearly shows that the market of palm oil in the UK has increased from 34% in 1993 (Jan-May) to 46% in 1994 (Jan-May). Total import of palm oil into the UK in 1994 was 432 100 tonnes of which about 50% went into margarine and shortening making.

Ex-USSR used to import about half a million tonnes of palm oil annually. Most of the imports went into margarine manufacture. In 1990, USSR produced 1454627 tonnes of margarine against the imports of 614 500 tonnes of palm oil. Currently, though actual data are hardly available, Soyuzmargarinprom, the giant margarine manufacturer in Russia, is still importing considerable amounts of palm oil for margarine production.

Nutrition

As more people become conscious of health and nutrition, many have been persuaded to reduce the intake of foods that contain cholesterol or that can raise blood cholesterol in order to minimize the risk of heart disease.

Nutritional studies in the sixties established that dietary saturated fats raise blood cholesterol, while polyunsaturated fats lower it. Since palm oil has long been classified a saturated fat for no valid reason, the idea that its consumption may be bad for health has unfortunately gained currency among scientists and the public.

Because of this, the Palm Oil Research Institute of Malaysia (PORIM) initiated a research programme on the nutritional properties of palm oil with the objective of establishing its wholesomeness and reassuring consumers of its safety.

The programme focused on the effects of palm oil on plasma cholesterol, atherosclerosis and thrombosis; its effects on experimental carcinogenesis; as well as the effects of minor components of palm oil, particularly the carotenoids and vitamin E.

In studying the biological effects of palm oil, a comparison was made with other edible oils and fats.

In all animal-based studies, it was found that total serum cholesterol levels of animals on palm oil-based diets were not significantly higher than those in corn oil-fed animals. This was an encouraging finding as it showed that in the rat model, the cholesterolemic effect of palm oil was about the same as that of a typical, polyunsaturated oil.

Observations from other studies were consistent with the hypothesis that polyunsaturated fats promote, while fats of lesser unsaturation (greater saturation) retard, mammary cancer development and progression.

In retrospect, these animal studies were important as their results gave us confidence that in palm oil, we have an edible oil that is likely to be wholesome to humans. It also possesses nutritional properties almost equal to, and in some respects superior to those of the polyunsaturated oil.

This confidence was soon put to the test when in late 1986, the ASA and certain health and consumer groups in the US mounted the anti-tropical oils campaign. The institute, faced with the need to intensify and accelerate the research programme, committed substantial funds to support projects by external investigators to obtain information needed to counter the smear campaign.

At the time, there were only four reports available on dietary intervention studies in humans evaluating palm oil. Conducted in the US, the studies showed that subjects on a palm oil diet had serum total and LDL-cholesterol levels higher than those on a polyunsaturated oil diet. However, serum total cholesterol levels after the palm oil regimen were in fact lower than baseline levels, *i.e.* when the subjects were on their habitual diets. However, the latter fact was conveniently ignored by the anti-palm oil campaigners.

The defense for palm oil, being meagre and weak, was seen to need buttressing to withstand the onslaught launched at almost all conceivable levels. Attacks were also made in the countries, where the esta-

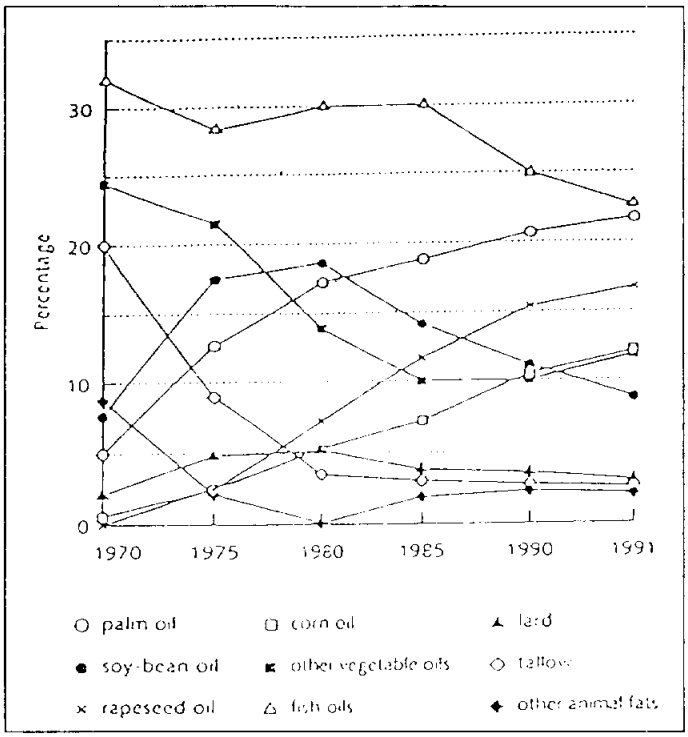


Figure 3. Fats and oils used in making margarine and shortening in Japan, 1970-1991.

Source: Hiroyuki and Takashi (1994)

Table 6. UK : Consumption of Refined Oils and Fats in Margarine and Shortenings (%)

Commodity	1994 Jan - May		1993 Jan - May	
	Marg.	Short.	Marg.	Short.
Soya/Sun/Rape	55.3	15.8	63.2	30.1
Palm Oil	13.1	55.8	9.0	41.7
Laurics *etc.*	3.2	5.8	1.2	5.1

Source: Dept. of Statistics, UK

blished market for soyabean oil was being challenged by palm oil, and by proxies.

Costly human intervention studies were commissioned in several countries and by July 1989, when the American Soyabean Association agreed to call off the smear campaign against palm oil, a few studies, all attesting to the safety and wholesomeness of palm oil, were completed.

The research programme in palm oil nutrition was however maintained and to date, 86 research projects have been implemented. These efforts have yielded a core of fundamental and applied knowledge pertaining to the nutritional effects of palm oil, which can be summarized as follows:

- A palm oil-enriched diet does not raise plasma cholesterol compared to the habitual fats consumed by the populations of the countries concerned. In some cases, a palm oil-enriched diet even results in lower plasma cholesterol levels. Palm oil feeding also modulates the LDL-cholesterol to HDL-cholesterol ratio in a beneficial manner.
- In animal studies, a palm oil-enriched diet has been found to reduce the tendency of blood to clot, thereby minimising the risk of thrombosis.
- A palm oil-enriched diet confers a protective effect on animals with experimental breast cancer, as evident from a lengthening of the latency period and a decrease in tumour number compared to animals fed with polyunsaturated oils.
- Tocotrienols, the unsaturated analogues of tocopherols present in palm oil, have been shown to suppress cholesterol biosynthesis in the liver, to act as powerful antioxidants, to prevent platelet aggregation and to reduce the thromboxane: prostacyclin ratio. Preliminary data also point to their anti-cancer action.
- The carotenoid components of unrefined (red) palm oil have anti-oxidant and anti-cancer roles in the body.

The smear campaigns were extinguished. Palm oil is now, nutritionally accepted. It has gained even greater acceptance recently following the fear of adverse effects of trans fatty acids. The trans issue is now a great concern not only in the UK, US and other developed countries but developing countries have also awakened to the much publicised hazardous effect of trans-fatty acids. There have been calls for the labelling of trans-fatty acids.

In a recent development The World Health Organization/Food and Agriculture Organization Joint Expert Committee endorsed that trans fatty acids can cause adverse effects to health such as risk of heart disease and possible damage to foetus.

Trans fatty acids have now been confirmed to reduce the beneficial HDL-cholesterol, raise the atherogenic LDL-cholesterol and alter the LDL/HDL-cholesterol ratio detrimentally. Such lipid changes have been computed to enhance relative risk from heart diseases for the general public by several folds. Of even greater concern is the ability of trans fatty acids to increase lipoprotein Lp(a) levels which is an independent and powerful risk factor for heart disease. The population study of Willet *et al.*, (1993) gives even greater credence to the rising concern against trans fatty acids. Willet has suggested that even at his lowest estimates from the effects of trans fatty acids on blood lipids, more than 30 000 deaths per year in the United States alone may be due to the consumption of partially hydrogenated vegetable fat which includes polyunsaturated margarines.

The fear of the adverse health implications by trans fatty acids has resulted in manufacturers shifting to palm oil. Hardened soft oils have been replaced by palm oil or palm stearin which is naturally solid at ambient temperature, in the manufacture of margarine, shortening, vanaspati and frying fats.

Quality

In the tight international competition, quality pays. Quality products always have the right competitive edge in the market place. Therefore, quality is given the highest priority in the production of Malaysian palm oil. The emphasis on

quality of Malaysian palm oil starts from the very beginning of its production i.e. the sale and movement of oil palm planting materials up to the finished products. These activities (altogether fifteen activities) are licensed by the Palm Oil Registration and Licensing Authority (PORLA). Malaysian Palm Oil Surveying Courses are conducted twice a year to provide the palm oil surveyors with enough knowledge of inspecting the quality of palm oil products. With effect from January 1995, only companies which employ at least two licensed surveyors are allowed to operate. All surveyors must pass the stringent Palm Oil Surveying Examination before they are given a license to conduct surveying works on palm oil.

Apart from that, inspection is made to all mills every two years to ensure that a high quality crude palm oil is produced. Mills that pass the inspection are awarded the Mill Certificate of Competency. The same inspection round is also conducted for refineries annually. Qualified refineries are awarded with the Refinery Certificate of Competency. It is notable that mills and refineries in Malaysia have adopted the latest technologies available as can be seen from the increased score marks obtained by a particular mill or refinery. PORIM has adopted a more stringent inspection to suit those highly efficient mills and refineries.

With continuous improvement over the years, the Malaysian refiners are now capable of producing high quality palm oil products to comply with the buyer's most stringent specifications. This is perfectly illustrated, for instance, by a shipment of a special quality of palm oil under nitrogen blanketing, for a company in Osaka, Japan from Pasir Gudang Port to the factory in Hannan. *Table 7* compares the oil quality of shipment out from Felda Johore Bulkers (FJB) and on reception at Hannan. Confirmation received from the company in Osaka indicated that:

- The special quality oil required no reprocessing at the Hannan factory
- There is no change in quality of oil during shipment as shown below:

  FFA – No Change
  PV – Nil - to trace
  Colour – No change
  M & I – No change
  Taste – Good

Shipments by a Malaysian supplier to a company in Algeria are examples of quality compliance of normal quality palm olein. The quality standards required by the Algerian company are as follows:

FFA	=	0.2% max
PV meq/	=	5 max
Colour (1 1/4 cell)	=	1R + 4Y + 0B
Soap	=	Nil

PORIM was directly involved in monitoring the quality changes of the shipments. A total of 16 shipment samples were collected for quality analysis. The monitoring analysis compared the results from Malaysian ports and Algerian ports. The average results of the analysis between September 1992 to December 1993 are given in Table 8. These results proved that the quality of palm olein supplied and received complied with the buyer's specifications.

With the high quality of palm oil supplied by Malaysian exporters, the importers have benefited from the cost saving of re-refining. The oil can be used direct for eg. cooking and frying or as an ingredient for margarine, shortening and vanaspati.

Epilogue

Palm oil, as it was relatively new to the world, was not easily accepted by consumers when it was introduced. In 1970s and 1980s palm oil was always sold at a discount to other competing oils and fats. Realising the fact that more technical information was needed to support the growth of the palm oil industry, The Palm Oil Research Institute of Malaysia (PORIM) was formed in 1979 to take over the research activities on palm oil from the Malaysian Agricultural Institute (MARDI). Since then, research activities on palm oil were intensified. New technologies were innovated. New uses were discovered. Useful technical data were generated. All this information was well disseminated to the consumers through PORIM's Technical Advisory and Service Unit (TAS). Extensive visits were made by TAS officers all over the world to provide technical assistance to importers and to create new markets for palm oil. Plant trials, seminars, workshops, exhibitions and consultancy are services provided by TAS to convince and assist buyers in using palm oil.

When the price of palm oil went up and became premium to some competing oils and fats in 1994, some oils and fats market analysts predicted that the importing countries would shift to other oils and fats. On the contrary, the Malaysian suppliers could not meet the demand. Some people may have wonder why. T' answer is that palm oil has been technically accepted by consumers. In the beginning palm oil was used to substitute the costly oils but later on, the consumers realised that palm oil performed better than the substituted oils. For example, in industrial frying, palm oil was initially used as substitute for hydrogenated oil, lard or tallow. However, palm oil performed better. It does not produce smelly odour, the fried food lasts longer, no gums are formed during frying and the food is tastier. On the other hand, tallow and lard are high in cholesterol content while hydrogenated oils are costly and inherit the harzadous trans fatty acids in the fried products. To food manufacturers, health aspects are the selling points that cannot be sacrificed. The only choice left is to continue using palm oil even though the price is high. Similarly in the manufacture of margarine and shortening, palm oil has proven its superiority. To some extent, a percentage of palm oil is required to make margarine and shortening of superior quality. For instance, as noted earlier, at least 10% of palm oil is required to provide crystal stability in canola stick margarine. As the trans free products start to gain popularity, it is expected that the demand for palm oil will further increase.

In the confectionery sector, no doubt, palm oil and its products are the main players. Palm kernel oil offers more choices of products with greater availability than coconut oil. Therefore, palm kernel oil is the preferred one for lauric-based cocoa butter substitute. Palm mid fraction on the other hand, is the major ingredient to make cocoa butter equivalent while non-lauric cocoa butter

substitute can be made from hydrogenated palm olein.

R&D works in PORIM have and are continuing to develop new uses of palm oil in both food and non-food sectors. These will enhance palm oil competitiveness and acceptability in the world market.

Table 7. Comparison between Oil Quality at Shipment Out from FJB and on Reception at Hannan

Voyage Number analysed	Source of samples	Tank Number	FFA %	PV meq/kg	Colour(51/4") R	M&I %	Taste (arbitrary units)
66	Palmaju	155	0.013	Nil	1.1*12	0.02	9.70
		158	0.014	Nil	1.1*12	0.02	9.68
	Hannan	511	0.014	0.10	1.1*10	-	9.54
67	Palmaju	155	0.014	Nil	1.1*11	0.01	9.67
		158	0.015	Nil	1.0*10	0.01	9.67
	Hannan	511	0.019	0.08	1.0*10	0.01	9.64
68	Palmaju	155	0.008	Nil	0.8*7.0	0.02	9.70
		158	0.009	Nil	0.7*8.0	0.02	9.65
	Hannan	511	0.009	0.05	0.9*9.0	-	9.52

Source: Wee (1992)

Table 8. Results of Analysis on RBD Palm Olein Shipped to Algeria between September 1992 to December 1993

Quality Parameters	Malaysian Ports (Average)	Algerian Ports (Agerage)
FFA % (as palmitic)	0.09	0.11
PV (meq/kg)	0.95	2.1
M&I (%)	0.04	0.03
IV (Wij's)	56.5	57.4
Melting Pt. (AOCS)	21.5	22.7
Colour (51/4" cell)	2.9R+37Y	1.0R+4.1Y (1 1/4" cell)

Source: Mat Rasid Mat Jaais (1995)

REFERENCES

- Augustin, M A., Heng L.K and Nor Aini, I. Evaluation of Potato Crisps Fried in Market Samples of Palm Olein, Corn Oil and Soya Oil. *Pertanika, 113,* 393-398.
- Berger, K G (1984). The Practice of Frying. *PORIM Technology No. 9.*
- Berger, K G (1994). Food Product Formulations to Minimize the Content of

Shortenings

Hydrogenated Fats Containing Trans and Unusual *Cis* Isomers. *A Lecture Note.*

- Bracco, U., Dieffenbacher, A & Kolarovic, K (1981). JAOCS, 58:6.
- Fan, W. and Chen, X (1994). Food Uses of Palm Oil in China. *Food and Nutrition Bulletin. 15:2,* 147-148.
- Herendi, N.E. and Bethke, R. 1982 Susswaren, p. 411.
- Hiroyuki M & Takashi K. 1994. Food Uses of Palm Oil in Japan. *Food and Nutrition Bulletin. 15:2,* 144-146.
- Iftikhar, A (1994). Impact of R&D on Market Acceptance of Palm Oil in Pakistan. *Palm Oil Tecnical Bulletin, July Issue.*
- ITERG. 1972. Paris.
- Masashi, S; Yoshikazi and Masanori, S (1985). Quality of Fried Foods with Palm Oil. *JAOCS, 62,* 449-454.
- Mat Rasid M J (1994). Breaking into Algeria: PORIM's Experience. *Palm Oil Technical Bulletin.* April Issue.
- Oil World Annual (1995). ISTA Mielke GmbH, Hamburg, Germany.
- Postmus, E; deMan, L and J.M. (1989). Composition and Physical Properties of North American Stick Margarines. *Can. Inst. Food Sci. Technol. J.22:5,* 481-486
- Razali, I (1993). Private Communication.
- Razali, I and Nor'aini, S. (1994). The use of Palm Oil Products in Frying. In *Selected Readings on Palm Oil and its Uses.* pp. 106-117.
- Stevenson, S T; Vaisey-Genser, M and Eskin, N A M (1984). Quality Control the Use of Deep Frying Oils. *JAOCS, 61:6,* 1102-1108.
- Suk, H Y (1991). Korean Food Research Institute. In Razali I & Nor'aini S. 1994. *Selected Reading on Palm Oil and Its Uses.* pp.106-117.
- Teah, Y K (1988). Improvements in the Frying. Quality of Vegetable Oils with Palm Olein. *Palm Oil Developments No. 8.*
- Teah, Y K 1992. Characteristics of Palm Oil and Utilisation in Food System. In *Selected Readings on Palm Oil and Its Uses.* 1st Edition.
- Teah, Y K and Karimah (1986). Palm Oil-An Excellent Frying Medium. *Paper presented at Palm Oil Technical Seminar.*
- Toregard, B and Eriksson, A (1979). *Proc. of 10th Scandinavian Symposium on Lipids,* Nyborg, Denmark, p. A54.
- Wee, F P (1992). Quality Assurance at Felda Johor Bulkers Bulking Installation. *Paper Presented in the Palm Oil Quality Conference,* Genting Highlands.
- Willet, WC; Stampfer, M J; Manson, J E; Colditz, G.A., Speizer, FE; Rosner, B.A; Sampson, L A and Hennekens, CH, 1993. Intake of Trans Fatty Acids and Risk of Coronary Heart Disease Among Women. *Lancet 341,* 581-585.
- Zeddelman, H and Wurziger, J 1973. *Fette Seifen Anstrichmittel 75,* p. 18.

IN BRIEF

Trends and Accuracy of Crop Estimates

Contributed by
T.P.Pantzaris and B.A.Elias, PORIM Europe

All oilseed crops are the subject of regular forecasts from official and trade bodies concerned with the industry and they are very influential in determining their near future prices as well as those of oilseed, oilmeals, oils and fats. Soyabean in particular, is the most important oilseed crop and forecasts of its production are followed keenly by buyers and sellers of oils and fats throughout the world, including Malaysia.

An interesting question is how accurate are these forecasts? As a matter of interest, we asked various traders in the U.K. and other EU countries with whom we have contacts and their replies ranged from "about 5%" to "about 10%". Fortunately, that excellent publication *Oil World*, has recently published some data on USA soyabean crops and forecasts by USDA for six seasons between 74/75 and 94/95 and this has enabled us to assess the accuracy of predications more scientifically.

In *Table 10*, we have given the estimates made in three different months as well as the final (actual) crop, while in *Table 2*, we have calculated the deviation or error of the estimate from the final crop. The smaller the deviation, the more accurate is the estimate.

The figures for the three months, August, October and January (*Table 11*) show that as one would expect, the later in the season the estimate was made, the greater its accuracy. Estimates made on 1 August were within 4% and those on January were within about 1% of the final crop. Further statistical analysis shows that going from 74/75 to 94/95, the estimates have tended to become more accurate, especially those in the early months and that is as it should be. Even the art of fortune telling is improving with time it seems.

Table 10. USA – Official (USDA) Soya bean Crop Estimates And Actual Production ('000 tonnes)

	Aug 1	Oct 1	Jan 1	Final
74/75	1314	1280	1233	1216
84/88	2035	1971	1861	1861
91/92	1819	1934	1986	1987
92/93	2079	2108	2197	2188
93/94	1902	1891	1809	1869
94/95	2282	2458	2558	2517

Source: Oil World 13/10/95

Table 11. Deviation(1) of USDA Soya bean Crop Estimates from The Final Crop (%)

	Aug 1	Oct 1	Jan 1
74/75	8.1	5.3	1.4
84/85	9.3	5.4	0.0
91/92	- 5.9	- 2.7	- 0.1
92/93	- 5.0	- 3.7	0.4
94/95	- 9.3	- 2.3	1.6
Average (2)	6.6	3.5	1.1

Note: (1) Deviations were calculated using the expression (Estimate-Final)/Final
(2) The average values were calculated as the absolute deviations without regard to the algebraic sign.

Olestra Gains US Clearance

Contributed by
T.P. Pantzaris

After more than eight years of deliberation, the US Food and Drug Administration (FDA) has finally approved the zero-calorie fat substitute "Olestra" developed by Procter & Gamble, the food and detergent giant. However, there are concerns about its effect on digestion and so products containing Olestra will have to carry a rather off-putting warning.

Normal fats are compounds of glycerol with three fatty acids attached, while Olestra is a compound of sucrose (sugar) with six to eight fatty acids attached (C&I, 1996, 73). The gastric enzymes in man can break down compounds with up to three fatty acids but not those with six or more. So although Olestra looks and tastes like fat, it provides no calories. Olestra is expected to cost less than the other fat substitutes such as Simplesse, already in use, but its main advantage is that it can be used for baking and frying. Potato crisps fried in Olestra will have less than half the calories of those fried in oils.

But it also has some serious disadvantages; one of them being that since the body does not absorb it, it is totally excreted and so it has a laxative effect which over time, can weaken the bowel action, or cause cramps. Another problem is that it can dissolve the fat soluble vitamins and remove them from the body (C&I, 1995,856). The FDA therefore requires that when Olestra is used to fry savour snacks, it must be fortified with the vitamins it depletes. But Olestra also depletes the body of carotenoid pigments which many people believe to be protective against some forms of cancer and yet there is no requirement for these to be added on the grounds that their protective action is still speculative.

It is said that Procter and Gamble has spent hundreds of millions of dollars on developing Olestra and proving its safety. Their application to the FDA ran to 150 000 pages of data from 150 studies, involving 8000 people. The company has overwhelming evidence that the product is safe but nevertheless, FDA clearly does not feel completely satisfied because it has stated that it will continue to monitor research on this subject and has also ordered P&G to study further the effect of Olestra on carotenoid levels.

P&G said that initially they will use Olestra in a low calorie version of its "Pringle" crisps in the USA and are now seeking clearance in Canada and the U.K. Fritolay, the largest snack maker in the USA will also use it in certain variants of their snacks. As regards to labelling, the FDA has insisted that all Olestra containing products should carry a label warning: "This product contains Olestra which may cause abdominal cramping and loose stools. Olestra inhibits the absorption of some vitamins and other nutrients. Vitamin A,D,E and K have been added".

Several pressure groups and other bodies in the USA have objected to FDA on Olestra's approval. The National Nutritional Food Association has stated "Hundreds of natural nutritious and tasty low-fat or fat-free foods are available in food stores that do not cause cramping or depletion of vital nutrients".

What will the effects be on palm oil? They say there is nothing bad without some good. Enlightened food manufacturers will before long, realise that it is good business to add some extra carotenes to their products to replace that removed by Olestra. For snack makers, the simplest way of doing so would be to use a proportion of red palm olein in their cookers or after their extruders. For P&G, the simplest way to allay FDA's reservations would be to add red palm olein to Olestra before it leaves the factory gates. In fact the more one thinks about it, the more one realises that Olestra and the appropriate palm oil product make ideal companions.