# PALM OLEIN IMPROVES COOKING OIL BLENDS*

AUGUST 1994
22

by: TEAH YAU KUN and DR. AHMAD IBRAHIM

PORIM INFORMATION SERIES ISSN 0128 - 5726

## INTRODUCTION

Cooking oils are used very widely indeed, and in enormous quantities. Generally speaking, housewives prefer a clear, light-coloured oil of vegetable origin with cold stability as well as good flavour and oxidative stability. The oils in common use for making such products are mostly derived from seeds, and include soya bean oil, cotton seed oil, sunflower seed oil, peanut oil, safflower seed oil and others. These have varying degrees of flavour and oxidative stability depending on the composition of the oil and on manufacturing standards. Highly unsaturated oils generally have poor flavour and oxidative stability and are often partially hydrogenated to overcome these defects.


Palm olein, the liquid fraction resulting from the fractionation of palm oil, is widely used as a cooking oil in the tropics. It has excellent flavour and oxidative stability, but it becomes cloudy and tends to crystallize partially in cold weather in temperate countries, which detracts from its appearance, although its quality is unaffected. Blends of palm olein with more unsaturated vegetable oils have better cold stability and are suitable for use in a wider range of climates. In many instances such blends are cheaper than highly unsaturated vegetable oils alone.

Palm Oil Research Institute of Malaysia, Ministry of Primary Industries, Malaysia
P.O.Box 10620, 50720 Kuala Lumpur, Malaysia. Tel: 03-8259155, 8259775, Telex: MA31609, Telefax: 8259446
* Originally published *in Palm Oil Developments No. 15.*

## ADVANTAGES OF BLENDING

As already mentioned, polyunsaturated liquid oils present problems in regard to flavour and oxidative stability. Partial hydrogenation reduces these difficulties by removing some of the double bonds which are the sites of oxygen attack, and thereby rendering the oils more stable.

Blending the unsaturated oils with palm olein is an alternative to partial hydrogenation, since it also has the effect of reducing the percentage content of the polyunsaturated linoleic and linolenic acids. It has been shown that vegetable oils such as those from rapeseed, groundnuts and rice bran are improved by blending with palm olein, *i.e.* the blends are superior to the unmixed oils in quality and stability, including heat stability: primary and secondary oxidation, and the formation of polymers and polar compounds are all reduced.

Present-day guidelines on human nutrition suggest that dietary fat should be made up of approximately equal amounts of saturated, monounsaturated and polyunsaturated fats. It is not difficult to devise blends of palm oil with other vegetable oils which come close to this 1:1:1 ratio. Thus a mixture containing 50% of palm olein and 50% of soya bean oil has saturated, monounsaturated and polyunsaturated fatty acids in the ratio 1.01:1.00:1.11.

## BLENDING PALM OLEIN WITH OTHER VEGETABLE OILS

Experimental studies at PORIM have shown that it is possible to obtain blends of different cloud points by mixing palm olein with other vegetable oils; the cloud point varies with the proportion of palm olein in the blend, and also with the identity of the other oil used (*Figure 1*). The figure helps to identify blends of different cloud points required, *e.g.* 0°C.

The blending of certain oils and fats produces eutectic mixtures, an effect which could be used to maximize the use of palm olein and other palm oil products in certain applications. For example, blends of palm kernel oil and single fractionated palm olein show a minimum in the cloud point at about 35% – 40% of palm kernel oil (*Figure 2*). Similar effect is observed with other palm products such as palm stearin and palm oil. This is useful in the manufacture of margarine where the eutectic behaviour could be used to introduce more palm products.

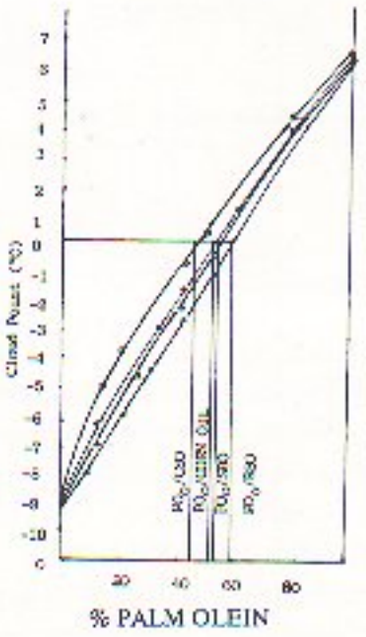


*Figure 1. Cloud Points of Blends of Vegetable Oils with Single Fractionated Palm Olein (The cloud point of the unblended palm olein was 7° C. CSO = cotton seed oil; SBO = soya bean oil; RSO = rape seed oil).*

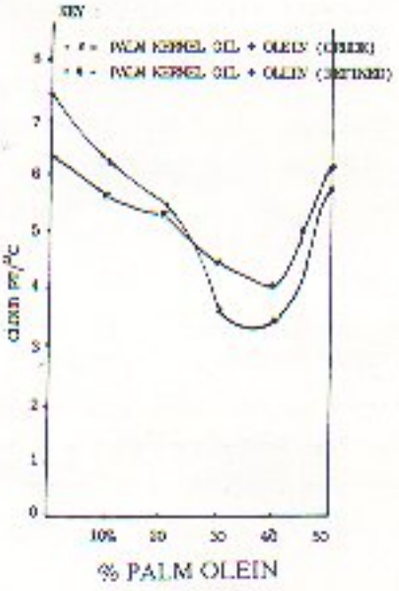


*Figure 2. Eutectic Behaviour of Mixtures of Palm Kernel Oil and Palm Olein.*

A similar effect is observed with blends of palm olein and groundnut oil, in which the cloud point is minimal when the groundnut oil content is about 15% (*Figure 3*). This could be exploited in markets where groundnut oil is commonly consumed, *e.g.* in southern China. Blending an appropriate percentage of palm olein with groundnut oil will give an acceptable cloud point and improved stability, together with a cost saving, since palm olein is considerably cheaper than groundnut oil.

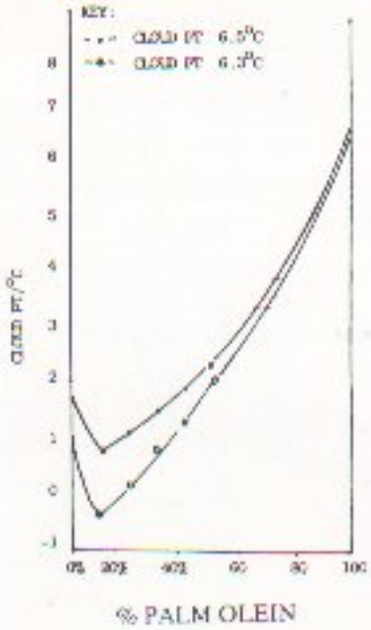


*Figure 3. Eutectic Behaviour of Mixtures of Groundnut Oil with Palm Olein (two different samples with cloud points of 6.5°C and 6.3°C respectively).*

Along with the differences in cloud point of different blends containing palm olein, there are differences in cold stability at various storage temperatures. *Table 1* summarizes the properties of blends of single fractionated palm olein (cloud point, 8.3°C) with sunflower seed oil (cloud point, –7.8°C) in various proportions.

As the table shows, blends with 70% and 50% of palm olein crystallized at 10°C. With 30% of palm olein the blend became cloudy after about a day at 10°C, but it remained pourable for as long as three months (*Figure 4(a)*). Somewhat better cold stability was observed for the blends at 15°C.

Blends prepared with double-fractionated palm olein (IV 60, cloud point 5.6°C and IV 65, cloud point 5.0°C) showed better stability than those with single fractionated olein (*Table 2* and *Figures 5(a)* and *5(b)*).

*Figure 4(a). Cold stability of blends of single fractionated palm olein with sunflower seed oil after three months at 10°C. The blends are those listed in* Table 1, *with (L to R) 100%, 70%, 50%, 30% and 0% of palm olein.*

*Figure 4(b). Cold stability of blends of single fractionated palm olein with sunflower seed oil after three months at 15°C. The blends are the same as in* Figure 4(a).

*Figure 5(a). Cold stability of blends of double-fractionated-palm olein (IV60) with sunflower seed oil after three months at 10°C. The blends are those listed in* Table 2, *with (L to R) 100%, 70%, 50%, 30% and 0% of olein.*

*Figure 5(b). As* Figure 5(a), *but illustrating blends with double fractionated palm olein of IV65.*

A blend of double-fractionated olein (30%) with sunflower seed oil, or a similar oil, would be suitable for temperate countries.

Results broadly similar to those described above were obtained when palm olein and double-fractionated palm olein were blended with canola oil (*Tables 3* and *4*) or soya bean oil (*Tables 5* and *6*).

Since refined, bleached and deodorized palm olein is bland in taste and pale in colour, it can be used in any country importing it to blend with other oils available locally. Since soya bean oil is commonly available in many countries, the data on cold stability of blends with palm olein in *Tables 5* and *6* may be of use as a guide to blending.

**TABLE 3. COLD STABILITY OF SINGLE-FRACTIONATED PALM OLEIN (IV56) AND BLENDS WITH CANOLA OIL**

| Ratio | Time to crystallization during storage | |
|---|---|---|
| POo : Canola | 10°C | 20°C |
| 100 : 0 | < 1 hr | < 1 day |
| 70 : 30 | ~ 3 hr | < 3 days |
| 50 : 50 | < 6 hr | < 6 days |
| 30 : 70 | 1 day | clear |
| 0 : 100 | clear | clear |

If a blend is required to remain clear at 15°C or below for more than three months, the proportion of single-fractionated palm olein that could be included would be very low – less than 20%. However, at a

**TABLE 1. PROPERTIES OF BLENDS OF SINGLE-FRACTIONATED PALM OLEIN (POo) AND SUNFLOWER SEED OIL (SFO)**

| Ratio POo: SFO | Cloud Point (°C) | Cold Stability (0) AOCS | Time to crystallization during storage | | |
|---|---|---|---|---|---|
| | | | 10°C | 15°C | 20°C |
| 100 : 0 | 8.3 | < 0.5 hr | < 0.5 hr | 1 day | 1 day |
| 70 : 30 | 3.8 | < 0.5 hr | < 3 hr | 2 days | 2 days |
| 50 : 50 | 6.0 | < 0.5 hr | < 5 hr | 3 days | 5 days |
| 30 : 70 | – 4.6 | < 0.5 hr | ~ 6 hr | < 2 months | > 2 months |
| 0 : 100 | – 7.8 | > 6 hr | clear | clear | clear |

**TABLE 2. COLD STABILITY OF DOUBLE-FRACTIONATED PALM OLEIN (IV60 and IV65) AND BLENDS WITH SUNFLOWER SEED OIL.**

| Ratio | Time to crystallization during storage | | | |
|---|---|---|---|---|
| | 10°C | | 20°C | |
| POo : SFO | IV60 | IV65 | IV60 | IV65 |
| 100 : 0 | < 1 day | 1 day | < 10 days | 10-15 days |
| 70 : 30 | 10 days | 12 days | > 3months | > 3 months |
| 50 : 50 | 3 months (hazy) | 3 months (hazy) | > 3 months | > 3 months |
| 30 : 70 | > 3 months | > 3 months | > 3 months | > 3 months |
| 0 : 100 | clear | clear | > 3 months | > 3 months |

**TABLE 4. COLD STABILITY OF DOUBLE-FRACTIONATED PALM OLEIN (IV60) AND BLENDS WITH CANOLA OIL**

| Ratio POo : Canola | Time to crystallization during storage 10°C | 20°C |
|---|---|---|
| 100 : 0 | < 1 day | < 10 days |
| 70 : 30 | < 1 day | < 15 days |
| 50 : 50 | < 5 days | > 3 months |
| 30 : 70 | < 20 days | > 3 months |
| 0 : 100 | clear | clear |

**TABLE 5. COLD STABILITY OF SINGLE-FRACTIONATED PALM OLEIN (IV60 and IV65) AND BLENDS WITH SOYA BEAN OIL (SBO)**

| Ratio POo : SFO | STORAGE TEMP. 10°C | | 20°C | |
|---|---|---|---|---|
| | IV60 | IV65 | IV60 | IV65 |
| 100 : 0 | < 1 day | 1 day | < 10 days | 10-15 days |
| 70 : 30 | 10 days | 12 days | > 3 months | > 3 months |
| 50 : 50 | Hazy (3 months) | Hazy (3 months) | > 3 months | > 3 months |
| 30 : 70 | 34 months | 3 months | > 3 months | > 3 months |
| 0 : 100 | clear | clear | > 3 months | > 3 months |

**TABLE 6. COLD STABILITY OF DOUBLE-FRACTIONATED PALM OLEIN (IV60 and IV65) AND BLENDS WITH SOYA BEAN OIL**

| Ratio POo : SBO | Time to crystallization during storage 10°C | | 15°C | | 20°C | |
|---|---|---|---|---|---|---|
| | IV60 | IV65 | IV60 | IV65 | IV60 | IV65 |
| 100: 0 | 1 day | 2 days | 2 days | 2 days | 9 days | 3 months (min) |
| 70 : 30 | 2 days | 3 days | 3 days | 3 days | 3 months (min) | 3 months (min) |
| 50 : 50 | < 5 days | < 5 days | 5 days | 5 months | 3 months (min) | 3 months (min) |
| 30 : 70 | 3 months (min) | 3 months (min) | 3 months (min) | 3 months (min) | 3 months (min) | 3 months (min) |
| 0 : 100 | 3 months (min) | 3 months (min) | 3 months (min) | 3 months (min) | 3 months (min) | 3 months (min) |

temperature of 20°C or above, a 50:50 blend of soya bean oil and single-fractionated olein will remain clear for a minimum of three months.

Double-fractionated palm olein performs better in blends for temperate climates. Thus a blend containing 30% of double-fractionated olein and 70% of soya bean oil (or sunflower seed oil) remains clear for three months or more even at 10°C. At higher temperatures higher levels of double fractionated palm olein could be used. The availability of this product is gradually increasing, and the data above show that it could be employed by intending users for blends tailored to the prevailing temperatures in their area.

*Appendices 1, 2* and *3* contain photographs showing the performance of single and double-fractionated palm oleins, and of blends with soya bean oil, in storage at various temperatures.

## Appendix 1

**PALM OLEIN – SOYA BEAN OIL BLENDS AT 15°C STORAGE FOR 1 MONTH**

SINGLE FRACTIONATED OLEIN
IV56 (1 month)

DOUBLE FRACTIONATED OLEIN
IV60 (1 month)

DOUBLE FRACTIONATED OLEIN
IV65 (1 month)

DOUBLE FRACTIONATED OLEIN
IV65 (1 month)

Appendix 2

**PALM OLEIN – SOYA BEAN OIL BLENDS AT 15°C STORAGE FOR 2 MONTHS**

SINGLE FRACTIONATED OLEIN
IV56 (2 months)

DOUBLE FRACTIONATED OLEIN
IV60 (2 months)

DOUBLE FRACTIONATED OLEIN
IV62 (2 months)

DOUBLE FRACTIONATED OLEIN
IV65 (2 months)

## Appendix 3

### PALM OLEIN–SOYA BEAN OIL BLENDS AT 10°C STORAGE FOR 3 MONTHS

SINGLE FRACTIONATED OLEIN
IV56 – 58

DOUBLE FRACTIONATED OLEIN
IV60

DOUBLE FRACTIONATED OLEIN
IV62

Printed with Palm Oil – Based Ink by PORIM


For more information kindly contact:

**Director-General**
**PORIM**
**P. O. Box 10620**
**50720 Kuala Lumpur**
**Malaysia**