Novel Fractions and Fats from Palm and Palm Kernel Oils

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INTRODUCTION

Malaysia is presently the largest producer and exporter of palm oil in the world. The oil derived from the Tenera variety of *Elaeis guineensis* is noted for its consistent composition and properties, which have been well documented by the Palm Oil Research Institute of Malaysia (PORIM). The usage of Malaysian palm oil has been enhanced through fractionation. Other modification processes such as hydrogenation and interesterification are now available, and these will further increase the usage possibilities of Malaysian palm oil in the future.

To meet the selective requirements of some consumers, we have embarked on a series of studies to produce palm oil and palm kernel oil fractions which have hitherto not been commonly available. The present paper is intended to introduce these new fractions. It is hoped that through this introduction, we can contribute towards promoting palm oil and palm kernel oil as extremely versatile materials.

PALM OIL

The current status in terms of typical composition and properties of Malaysian palm oil is summarized in *Table 1*. Palm oil generally has an average slip melting point of 36°C and a range of 32 to 39°C. The solids between 10 and 25°C are also much higher than would be required in fat blends used for finished products in temperate countries. Through careful selection of feedstocks and processing, we have been able to produce a refined palm oil which has a low slip melting point, below 33°C. An example is shown in *Table 2* under the code number SP-33. A similar blend to SP-33 may be made with palm oil and palm olein, but on closer examination, one can note differences in iodine value, solids content and fatty acid composition. Hence, besides meeting legislative requirements on melting point, SP-33 is a good choice where there are requirements for a lower solids content and a low melting point. *Figure 1* illustrates the similarity of solids content and melting point of SP-33 to those of butter and margarines of temperate countries. Development work SP-33 as on a feedstock for these areas is being done.

PALM OLEIN

The palm olein presently available is characterized by the composition and properties shown in *Table 3*. It has limitations for use in cooking oils in cold climates because of the high solids content and therefore, the tendency to cloud or solidify in such climates. The olein may be further improved through double fractionation. As a result, palm oleins with lower cloud points and better cold stabilities are now available (*Table 4*). We are therefore now in a position to offer tailor-made oleins to meet the different specific requirements of consumers.

Of the new oleins, PL 65 should be of particular interest since it has a low cloud point and a low solids content at 5°C. Incidentally, the high concentration of oleic acid in PL 65 should help shift the focus of palm oil as being a saturated fat to one rich in monoenes, a characteristic in which it is similar to olive oil. By blending the fraction with seed oils, the oxidative stability of cooking oils for temperate climates may be considered enhanced with no detrimental effect on cold stability. In addition, PL 65 can be incorporated in a larger percentage than could be done with the existing

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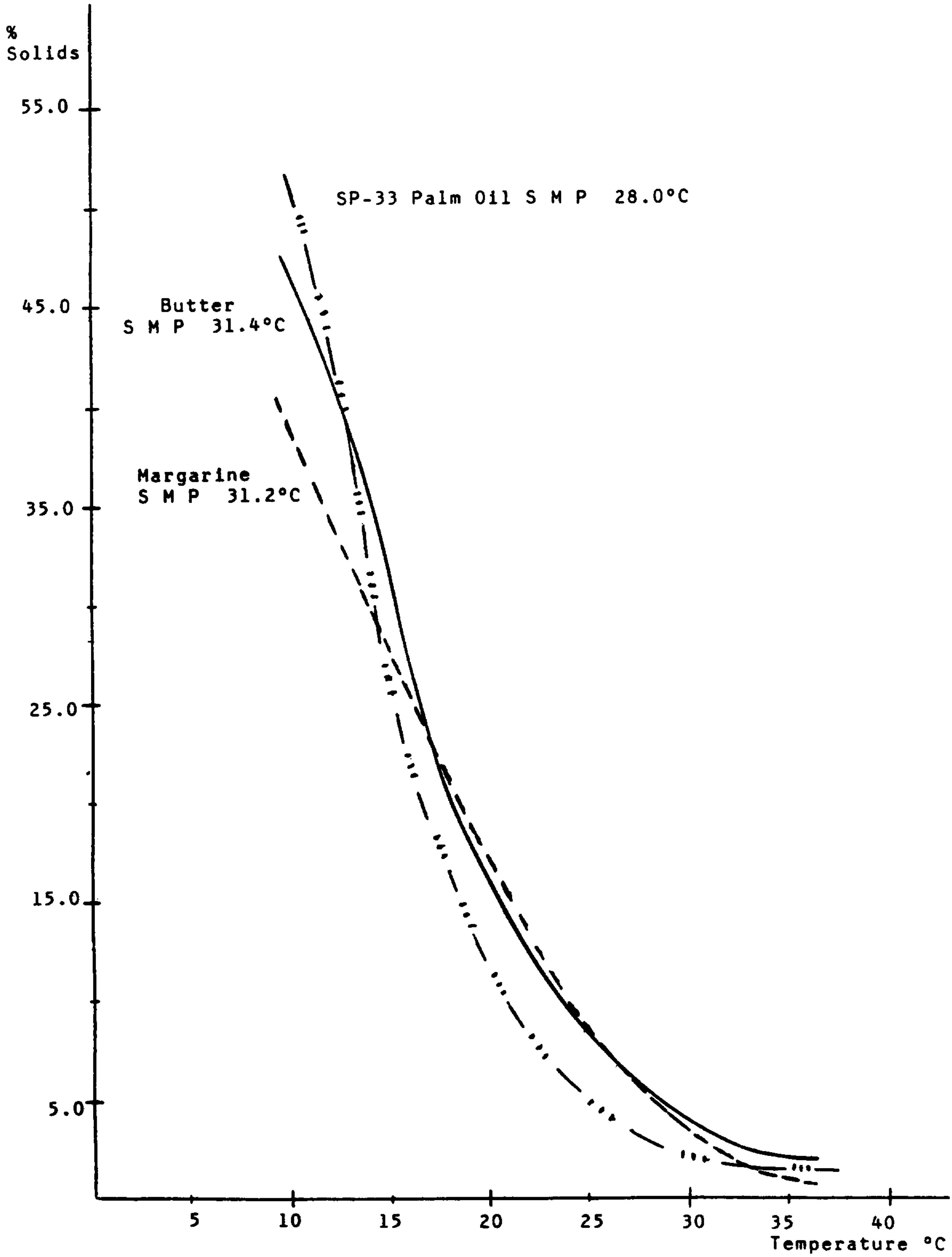

Figure 1. SP-33 Palm Oil in relation to Margarine and Butter

TABLE 1.PALM OIL - PRESENT STATUS [a]

	Range	Mean
Iodine value (Wijs)	50 - 55	53
Slip melting point (SMP, °C)	32 - 39	36
Solid fat content (SFC, %)		
10°C	47.5-56.4	50.3
20°C	19.6-27.0	23.2
25°C	11.3-16.3	13.7
30°C	6.3-10.5	8.5
35°C	4.0-8.0	5.8
40°C	1.8-5.9	3.5
Fatty acid composition (%)		
12 : 0	0.1-1.0	0.2
14 : 0	0.9-1.5	1.1
16 : 0	41.8-46.8	44.0
16 : 1	0.1-0.3	0.1
18 : 0	4.2-5.1	4.5
18 : 1	37.3-40.8	39.2
18 : 2	9.1-11.0	10.1
18 : 3	0-0.6	0.4
20 : 0	0.2-0.7	0.4

[a]Tan and Oh (1981).

TABLE 2.LOW MELTING PALM OIL

	Present Palm Oil	SP-33	Palm Olein: Palm Oil Blend (60:40)
Iodine value (Wijs)	51.0	51.7	54.4
Slip melting point °C	36.8	28.0	29.1
Solid fat content %			
10°C	58.6	51.4	45.5
15°C	40.3	27.5	27.0
20°C	25.8	12.1	10.8
25°C	14.5	4.7	5.6
30°C	8.1	2.2	4.1
35°C	5.5	–	1.8
40°C	2.5		–
Fatty acid composition (%)			
12 : 0	0.2	0.2	0.2
14 : 0	1.2	1.4	1.1
16 : 0	43.3	42.9	40.9
18 : 0	4.2	4.2	4.1
18 : 1	40.6	40.5	42.6
18 : 2	9.7	10.2	10.4
18 : 3	0.2	0.3	–
20 : 0	0.4	0.3	0.6
Others	0.2		

TABLE 3 PALM OLEIN - PRESENT STATUS [a]

	Range	Mean
Iodine value (Wijs)	56.1-60.6	58.0
Slip melting point °C	19.4-23.5	21.6
Cloud point °C	6.0-11.5	8.8
Solid fat content (%)		
5°C	43.6-61.0	51.1
10°C	28.1-51.8	37.0
15°C	13.3-24.9	19.2
20°C	2.9-8.6	5.9
25°C	–	–
Fatty acid composition (%)		
12 : 0	0.1-1.1	0.2
14 : 0	0.9-1.4	1.0
16 : 0	37.9-41.7	39.8
16 : 1	0.1-0.4	0.2
18 : 0	4.0-4.8	4.4
18 : 1	40.7-43.9	42.5
18 : 2	10.4-13-4	11.2
18 : 3	0.1-0.6	0.4
20 : 0	0.2-0.5	0.4

[a] Tan and Oh (1981a)

TABLE 4 NEW PALM OLEINS

	Standard PL 56	PL 60	New PL 62	PL 65
Iodine value (Wijs)	57.6	60.8	62.9	66.4
Slip melting point °C	18.2	15.6	14.5	12.0
Cloud point °C	7.2	5.6	5.0	2.2
Cold stability at 15°C (hr)	8	36	Still clear after 138 hr	Still clear after 138 hr
10°C (hr)	<1	<1.5	<6	<18
Solid fat content (%)				
5°C	46.7	27.9	2.5	1.4
10°C	35.7	19.5	0.5	–
15°C	16.2	1.3	–	
20°C	1.1	0.5		
25°C	–	–		
Fatty acid composition (%)				
12 : 0	0.3	0.3	0.3	0.4
14 : 0	1.1	1.1	1.1	1.1
16 : 0	38.4	36.1	34.7	31.5
18 : 0	4.0	3.8	3.7	3.2
18 : 1	44.0	45.4	46.1	49.2
18 : 2	11.4	12.5	13.1	13.7
18 : 3	0.2	0.2	0.3	0.3
20 : 0	0.4	0.4	0.4	0.4
Others	0.2	0.2	0.2	0.2

palm oleins. Two examples are illustrated for blends with soyabean and cottonseed oils respectively *(Table 5)*.

PL 65 can also be selectively hardened to give a high *trans* acid content, making it suitable for use as a non-lauric cocoa butter replacer.

PALM STEARIN

Due to the different fractionation processes used in Malaysia, the palm stearins produced vary considerably in composition and properties (*Table 6*). Through selective fractionation, specific types of palm stearin may be obtained. We have categorized these types into two groups, namely hard stearins and soft stearins.

Table 7 shows the characteristics of two types of hard stearins presently available to consumers. The demand for these stearins results from the need either for a high melting characteristic or for a certain palmitic acid content. Both HS-22 and HS-32 fit these selective requirements well. The hard stearin constitutes a good feedstock for interesterification with a lauric oil to give a product which is sharp melting. An example from this area of application is shown *Figure 2*: the production of a cream fat.

Whereas the slip melting point of the typical stearin ranges from 48 to 52°C, soft stearins with melting points below 45°C are now available. Examples of these soft types are given in *Table 8*. Stearins in this category have a specific glyceride composition and differ from straight blends obtained from palm oil and palm stearin. The difference is apparent from the comparison made in *Figure 3*. We see a potential usage of these stearins directly in shortenings and margarines, whereas in the past blends of palm oil and palm stearin have had to be used.

PALM MID-FRACTION

Palm mid-fractions are obtained from a two-stage or double fractionation of palm oil. The fractionation process used may be 'dry', or may employ detergents or solvents. For selective enrichment of the POP triglycerides[a], a solvent process is normally used. Because of selective demands based on usage requirements, two grades of palm mid-fraction are now commercially available (*Table 9*). PMF 34 is a product enriched in POP triglycerides : it may be used to substitute cocoa butter partially in confectionery applications, or it may be blended with a an SOS-rich[b] fat such as Illipe to make a true cocoa butter equivalent. PMF 50 on the other hand serves as a valuable feedstock for POP enrichment by a solvent process.

PALM KERNEL OIL

As with palm oil, Malaysian palm kernel oils have also been subjected to fractionation in order to derive value-added fractions. The fractionation process used may be 'dry', 'detergent' or 'solvent'. Depending on the type of process and conditions used, fractions of different composition and physical properties will result, as exemplified by the data for palm kernel oleins and palm kernel stearins in *Table 10* and *11* respectively. Palm kernel oleins are normally used for the cheaper coating fats while the stearins are used for the production of high quality cocoa butter substitutes (CBS). Selection of the right stearin feedstock is critical in order to achieve a high quality lauric CBS of good heat resistance and excellent melting characteristics. *Table 12* highlights the differences observed in the solids profile for two CBS obtained from two different grades of palm kernel stearin.

THE FUTURE

To increase the cold stability of palm oil and its fractions, it is hoped to see the production of a palm oil having a higher iodine value. In this respect the oil from the hybrid between *Elaeis oleifera* and *Elaeis guineensis* may offer a good prospect. The characteristics of such an oil obtained from a small commercial trial in Malaysia are shown in *Table 13*. Although iodine values of above 70 have been reported for individual palms, a value of around 60 would be more realistic should suitable palms be obtained for commercialization.

TABLE 5 BLENDS OF PL 65 WITH SEED OILS (70:30)

	PL 65: Soyabean	PL 65: Cottonseed
Iodine value (Wijs)	85.9	80.4
Slip melting point °C	Liquid	10.3
Cloud point °C	-1.4	1.8
Solid fat content (%)		
5°C	–	0.6
10°C		0.4
15°C		
Fatty acid composition (%)		
12 : 0	0.3	0.2
14 : 0	0.8	1.0
16 : 0	25.2	29.1
16 : 1	–	0.2
18 : 0	3.4	3.1
18 : 1	41.0	37.8
18 : 2	26.1	27.7
18 : 3	2.6	0.5
20 : 0	0.4	0.3
Others	0.2	0.1

TABLE 6 PALM STEARIN - PRESENT STATUS [a]

	Range	Typical
Iodine value (Wijs)	21.6-49.4	39.9
Slip melting point °C	44.5-56.2	51.3
Solid fat content (%)		
10°C	54.2-91.1	75.9
20°C	31.3-87.4	56.7
25°C	20.2-81.9	43.9
30°C	16.4-73.5	33.4
35°C	12.5-65.0	26.2
40°C	7.0-56.6	19.4
45°C	2.7-48.6	13.4
50°C	0-39.7	6.6
55°C	0-19.3	
Fatty acid composition (%)		
12 : 0	0.1-0.6	0.1
14 : 0	1.1-1.9	1.3
16 : 0	47.2-73.8	54.0
16 : 1	0.05-0.2	
18 : 0	4.4-5.6	4.7
18 : 1	15.6-37.0	32.3
18 : 2	3.2-9.8	7.0
18 : 3	0.1-0.6	0.1
20 : 0	0.1-0.6	0.4

[a] Tan and Oh (1981a)

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