International Standards for Palm Oil

J.A. CORNELIUS, Tropical Products Institute,
56/62 Gray's Inn Road, London WC1X 8LU, England

ABSTRACT AND SUMMARY

Crude oil for edible purposes has in the past mainly been sold on the basis of moisture, dirt, and free fatty acid (FFA) content. With an increasingly competitive market, user requirements with regard to quality characteristics are becoming more closely defined so that the producer can market an oil which can be refined to particular standards of color, taste, consistency, and shelflife at minimum cost to the refiner. Other tests for palm oil quality which have been developed for use over the last 20 years include the assessment of bleachability, oxidation level, and oxidative stability. With the prospect of oils with a higher unsaturated acid content from African-American hybrid palms being produced commercially and the present interest in fractionation, fatty acid composition is likely to become a more important quality factor. Progress to date on standard procedures for the assessment of crude palm oil quality is reviewed and possible standards for refined, bleached, deodorized, and fractionated palm oils are discussed. In this survey of progress to date towards international standards for palm oil, the author has endeavored to provide an overall picture of what has led to the present situation as well as to indicate aims for the future. Much has still to be done in the proper formulation of tests which are acceptable to user and producer, to buyer and seller, and also in the evolution of recognized grades of both crude oils and oils with predictable refining properties giving refined oils of acceptable quality and shelf life when incorporated in the final food products.

INTRODUCTION

Palm oil accounts for an increasing proportion of the total exports of commercial edible vegetable oil and vegetable oil equivalent from primary countries, amounting to 20.7% in 1975 (1). Hence, there is a pressing need to extend the outlets in a competitive market, and it is becoming realized that quality characteristics of the crude oil need to be more closely defined in order that the producer can provide a product which can be processed to particular standards of color, taste, consistency, and shelflife at minimum cost. Crude palm oil for edible purposes has for many years been sold on the basis of moisture, dirt, and free fatty acid (FFA) content.

In Nigeria where most of the palm oil still comes from small producers, early export supplies were usually "soft oil," so-called because the greater part of the oil was liquid at tropical temperatures, its average FFA being about 7-12%. "Hard oil," on the other hand, was prepared under conditions in which considerably more hydrolysis took place, the oil becoming solid at tropical temperatures with an FFA usually between 30-50% (2). With price incentives for the producer of low FFA oils, the quality of the product purchased by the Nigerian Produce Marketing Board between 1950 and 1965 improved dramatically, even when originating from small producers. Whereas in 1950 only about 0.2% of the total palm oil purchased by the Board had an FFA not exceeding 4.5% by 1965 over 80% of the total purchases from small producers had an FFA of not more than 3.5% (3).

However, the standards laid down in Nigeria did not prevent the illegal adulteration of the product with chemicals in order to reduce the FFA content of inferior grades or the blending of high quality low FFA oils with lower quality FFA oils.

The practice of blending high and low quality oils is not restricted to West Africa, and while the FFA of such blended oils is in direct relationship to the FFA's of the separate oils and may be within the grade limits, other vital properties such as bleachability and stability can be seriously impaired and inferior to normal unblended oils of equivalent FFA. More stringent specifications for a grade of palm oil from plantations in Zaire called Special Prime Bleachable (SPB) oil which appeared on the market as far back as the late 1950s, resulted in the availability of an oil with around 2% FFA and with other desirable properties which have since been aimed at by producers in other areas, particularly in Malaysia. Table I shows the comparison between SPB and regular grade palm oil from Zaire plantations.

BLEACHING TESTS

Refiners wish to know how the crude oil will behave on processing, and various bleaching tests have been developed over the years. These include:

1. bleaching tests on the crude oils,
   a. using earth,
   b. using heat in the absence of air,
   c. using a combination of heat plus earth;
2. bleaching tests on the neutralized oils.

All these tests involve an assessment of the color of the oils after bleaching under standardized conditions, and the results may be expressed in terms of either residual color or of the proportion of the color removed.

If oils of good and of poor bleachability are to be segrated at source, a simple sorting test is required, and only methods 1.a. and 1.b. are really amenable to this. The acceptance of any particular bleaching test by refiners as a whole has met with resistance since different refiners use different bleaching methods, and meaningful results are more likely to be achieved when the laboratory tests are akin to the large-scale process. However, the International Association of Seed Crushers (IASC) have recently accepted a bleachability test similar to one evolved at the Tropical Products Institute in the 1950s but carried out at a higher temperature.

The proposed test uses 5% by mass of Tonsil Standard FF bleaching earth of German origin stirred with 100 g oil at 150C for 1 hr, the color of the hot filtered oil then being measured in a 1 in. (25.4 mm) cell on a Lovibond tintometer (5). This method is now also under consideration for publication as a British Standard. However, difficulties encountered due to variations in activity and other properties of the standard bleaching earth have resulted in an European ad hoc working group, including those seeking to establish the above-mentioned test, initiating collaborative work in order to establish a reference bleaching earth. The working group is under the auspices of the Community Reference Bureau of the Commission of the European

---

[1] Paper presented at the AOCS Meeting, New York, May 1977.

TABLE I

Comparison between SPB and Regular Grade Palm Oil from Zaire Plantations (4)

	Regular grade	SPB grade
FFA (as palmitic)%	3-5	1-2.5
Moisture, %	0.1	0.1
Impurities, %	0.01	0.002
Iron, ppm	10	av. 5
Copper, ppm	0.2	av. 0.2
Iodine Value	45-56	53±1.5
Carotene, ppm	500-700	ca. 500
Tocopherol, ppm	400-600	ca. 800
Bleachability, Lovibond units, 5¼ in. cell		
Red	3.5	2.0
Yellow	35	20

TABLE II

Lovibond Tintometer Readings for Standards Slides

	Slide 1			Slide 2		
Operator	Red	Yellow	Blue	Red	Yellow	Blue
A	0.3	2.3	0.2	3	31	1.3
B	0.7	2.5	1.1	4	40	1.5
C	1.0	3.3	1.0	4	40	1.3
D	1.0	3.2	1.3	4	20	1.9
E	0.9	3.2	1.6	4	22	2.0
F	0.0	2.8	0.1	4	44	1.2
G	1.2	3.4	1.4	5	20	2.0
H	0.9	2.8	0.9	3	59	0.3
I	1.0	3.1	1.3	4	21	1.8
Actual colors	0.3	2.2	0.2	3	28	0.4

Communities, and its first meeting took place in January 1977 and included representatives from Belgium, France, Germany, Italy, The Netherlands, and the United Kingdom. At this meeting, packing, and physical and chemical characteristics of the earth, and the nature of the test oil to be used were discussed, and the organization of a ring analysis was detailed. Clearly, it will be some time before the group completes its investigations and a suitable reference earth becomes generally available.

The present method of color assessment, which is used virtually universally in the trade, involves visually comparing the color of the melted oil in a glass cell of standard path length with a combination of standard Lovibond red, yellow, and blue slides. However, this subjective method can give widely differing results with different operators.

Table II shows variation in results in one laboratory with nine operators using the same tintometer to measure the color of standard slides which had been made up of two known combinations of red, yellow, and blue units, giving colors typical of bleached palm oil.

It will be seen that only one out of the nine operators provided a nearly correct answer in both cases. The Engineering Division of Unilever Ltd. (Instrumentation, Control and Automation Section) have developed an automatic instrument designed for measuring the color of refined oils in the range 0-13 yellow and 0-3 red Lovibond units. This has been recently evaluated by the Food Research Association at Leatherhead, England (6). This equipment is shortly to be marketed by Tintometer Ltd., Salisbury, England, and as it eliminates the subjectiveness of the manual Lovibond instrument, it is expected to provide more consistent results.

THE ASSESSMENT OF OXIDATION

The ease of bleaching and general acceptability of an oil to a refiner is basically dependent on the degree and type of oxidation which has taken place. The autoxidation of lipids in general and palm oil in particular can take place in various ways and will produce a number of oxidation products; consequently, the assessment of degree of oxidation is difficult and no single method can give anything like a complete picture. It is the unsaturated fatty acid part of the palm oil glycerides that is most susceptible to oxidation, particularly the linoleic acid, which is present to the extent of up to 12% of the total fatty acids. Autoxidation of linoleic acid ester produces primary oxidation products including hydroperoxides with the double bonds conjugated. Hydroperoxides are unstable and, under the influence of heat, break down fairly readily into secondary oxidation products comprising aldehydes and ketones, which give rise to undesirable off-flavors to the product if they cannot be completely removed on refining.

The degree and type of oxidation depends in practice on the history of the oil. For example, an oil may be the product of blending good and poor quality oils at the producing end, or it may have been otherwise maltreated before reaching the producer so that it has a high content of iron or copper through the action of the FFA present in the oil on machinery, pipelines, containers, etc. The natural antioxidants may have been degraded in consequence, or alternatively by overheating. Thus the oil may be either already oxidized or its susceptibility to oxidation greatly increased, and therefore the shelflife of the products made from it is decreased. Consequently, a considerable amount of attention has been given in recent years to tests for:

1. extent and nature of oxidation by the assay of primary and secondary oxidation products and;
2. the susceptability to oxidation by the active oxygen method (AOM) stability test and tests for pro- and antioxidants.

COLLABORATIVE WORK

In 1969, the Malaysian Oil Palm Growers' Council (OPGC) requested that the Rubber Growers' Association assist in the establishment of a standard Malaysian palm oil that would be marketed to comply with certain predetermined specifications. As a first step, the Vegetable Oils Technical Committee (VOTC) was set up, comprising representatives of producers and consumers along with independent bodies, such as the Tropical Products Institute, to ascertain:

1. the properties of palm oil for which measurements are desirable; and
2. the methods to be used for measuring these properties.

As a result of circulated questionnaires and interlaboratory tests, considerable progress in the drawing up of standard methods of analysis particularly applicable to palm oil was made. The Committee have standardized texts of methods for the determination of acidity, volatile matter, and insoluble impurities, and they are currently reviewing methods for several other tests which are of interest to

TABLE III

Results of Collaborative Tests on Crude Palm Oil
by IUPAC Oils and Fats Section Palm Oil Working Group
1972

	Sample number[a]					
	1	2	3	4	5	6
FFA (palmitic acid)%[b]	4.7-5.2	4.8-5.3	2.0-2.2	2.1-2.4	2.0-2.6	2.2-2.9
Mean	5.0	5.1	2.1	2.3	2.1	2.4
Carotene, mg/kg[b]	26.6-36	65-105	520-704	456-592	175-207	121-160
Mean	29.9	91.5	607	480	197	141
Peroxide value, meq/kg[b]	6.7-13.5	9.7-15.1	0-8.8	5.5-18.3	0.1-2.9	0-5.9
Mean	9.6	11.9	3.5	13.8	0.65	2.2
p-Anisidine value[b]	32.0-39.4	24.6-34.9	1.4-4.3	2.8-5.9	3.6-9.5	20.2-28.1
Mean	35.4	28.2	2.8	4.4	7.0	24.8
Totox value (2PV+pAV)	54.6	52.0	9.8	32.0	8.3	29.2
Copper, mg/kg[b]	0.05-0.3	0.07-0.3	0.02-0.2	0.03-0.2	0.02-0.4	0.04-0.2
Mean	0.14	0.16	0.12	0.08	0.11	0.08
Iron, mg/kg[b]	53-107	67-135	1.5-3.6	1.0-3.6	1.5-3.5	1.1-3.4
Mean	70	85	2.5	2.1	2.4	2.2

[a] Samples 1,5, and 6 were derived from 2,3, and 4, respectively, by heating under vacuum.
[b] Spread between 8 and 13 laboratories.

the palm oil trade. These include carotene content, peroxide value, p-anisidine value, tocopherol content, bleachability, copper and iron contents.

About the same time as the VOTC became active in this field, a palm oil working group was set up within the Oils and Fats Section of the International Union of Pure and Applied Chemistry (IUPAC) which carried out a number of collaborative bleaching tests using various suggested procedures together with FFA, copper, iron, carotene, and oxidation determinations. After 2 years' work, the group considered that until more is known about the compounds which resist bleaching, the assessment of primary and secondary oxidation products would be more informative with regard to palm oil quality. Hence, work in 1972 concentrated on the collaborative assessment of primary oxidation products by peroxide value and the secondary oxidation products by the p-anisidine value.

The peroxide value is a measure of the quantity of hydroperoxide present and is usually expressed in milliequivalents of oxygen per kg of oil. The p-anisidine value measures mainly the amount of alpha-beta-unsaturated aldehydes (2-alkenals) present in the oil. The method is based on the fact that in the presence of acetic acid, p-anisidine reacts with the aldehydic compounds in an oil producing yellowish reaction products. The color intensity depends not only on the amount of aldehydic compounds present but also on their structure. Thus, it has been found that the double bond in the carbon chain conjugated to the carbonyl double bond enhances the molar absorbance at 350 nm by a factor of 4 or 5. The results of collaborative tests during 1972 on six crude palm oil samples showed relatively good agreement for p-anisidine values (Table III), taking into account the unfamiliarity of the analysis.

With more stringent precautions to exclude water from the acetic acid reagent, which have since been inserted into the text of the draft method, this agreement should be considerably improved. A standard deviation of 0.107 has been obtained in the tests by operators in the same laboratory and of 0.183 between different laboratories. Peroxide values tended to be in poor agreement, especially with samples having a low peroxide value, and we suspect that this was due to insufficient care in sampling, since the peroxide value can so easily change on melting the oil to draw the sample for analysis. Suitable precautions have again been written into the draft specifications for peroxide value determination. The results of collaborative tests emphasize the need for adequate attention to detail in specifying the standard methods for carrying them out and are a justification for the production of such methods – particularly for the testing of palm oil (rather than merely following methods which are generally applicable to crude edible oils). It has been suggested that the best available assessment of oxidation in oils and fats is given by the "Totox" value which is defined as:

$$\text{Totox value} = (2 \times \text{peroxide value}) + \text{p-anisidine value}.$$

It has been found that there is also a correlation between Totox value and conjugated diene and triene values, the relationship being:

$$\text{Totox value} = 100(a_{235} - a_{270})$$

where a_{235} and a_{270} are the specific absorbances of the oil at 235 and 270 nm, respectively.

In the opinion of the Swedish collaborator who put forward the draft text of the p-anisidine test, a crude palm oil with a Totox value of less than 10 units, such as sample 3 (Table III), would refine well. Similarly sample 2 is a very poor oil and sample 4 is intermediate in quality.

PLASTICITY

Plasticity is an important factor in the margarine and shortening industry in which palm oil is used to an increasing extent. For palm oil, this has been shown, by Loncin and Jacobsberg (7), to depend on the proportion of diglyceride present which in turn is directly dependent on the FFA of the crude oil. The diglycerides form an eutectic with the triglycerides, and an oil with minimum hardness results from the diglycerides present when the FFA of the crude oil is around 7%. These characteristics persist in the refined oils since the diglycerides remain although the FFA is removed. Thus, a refined palm oil originating from 5% FFA crude oil has a spreading threshold which is 5C lower than for oil of 2% FFA crude.

In addition to the proportion of diglycerides, the degree of unsaturation of the glycerides and their fatty acid arrangement also affect plasticity. Over 85% of the unsaturated fatty acid chains are located on the central ester bond of the glycerol radical, resulting in the oil being semisolid at normal room temperatures. This property and the melting range permit its use as a major component in margarine and shortening blends without hydrogenation (4). Investigations in West Africa indicated that the degree of unsaturation of palm oil appears to depend to some extent on climatic conditions but that varietal factors play a more important role (8). However, there are possibilities of modifying the amount of unsaturation in palm oil by breed-

TABLE IV

Component Fatty Acids, Iodine Values, and Melting Points of Mesocarp Oils from Hybrid Palms and the Parent Species (9,10)

	Elaeis guineensis	Hybrid	Elaeis oleifera
Component fatty acid, %			
Saturated			
Myristic	2.0	0.7	trace
Palmitic	46.8	32.1	22.9
Stearic	4.8	3.7	1.0
Unsaturated			
Palmitoleic	---	---	1.3
Oleic	34.6	51.0	54.8
Linoleic	11.8	12.8	20.0
Iodine value (Wijs, ½ hr)	47.0	63.5	78.5
Melting point, °C	38-45	24-34	13-14

TABLE V

Quality Characteristics Desired for Crude Palm Oil (14)

	As received by refiner		Reachable at production center
	Present	Future	
Water	max. 0.5	max. 0.5	
FFA (as palmitic acid)%	max. 3	max. 2.5	1.5-2.5
p-Anisidine value	max. 6	max. 4	2-3.5
Peroxide value, meq/kg	max. 5	max. 4	0-2
Totox value	max. 15	max. 10	2-8
Iron, mg/kg	max. 5	max. 3.5	2-3.5
Copper, mg/kg	max. 0.08	max. 0.05	0.03-0.07
AOM-stability, hr	min. 53	min. 60	60-75
Tocopherol, mg/kg			800-1,050
E1%, 1 cm @ 235 nm			70-100
E1%, 1 cm @ 270 nm			20-35

ing as well as by fractionation techniques. For example, the palm oil from the hydrids between the African *(Elaeis guineensis)* and the American *(E. oleifera)* oil palms, which might be called "AFRAM palm oil," have an unsaturation which is markedly higher than ordinary *(guineensis)* palm oil, being intermediate between that of the oils in the two species (as shown in Table IV). These hydrids are being grown experimentally in various parts of West Africa and the Far East and commercially on a small scale in South and Central America.

Unsaturation is usually assessed from the iodine value or by determining the proportions of component fatty acids by gas liquid chromatography (GLC) of their methyl esters and plasticity by melting point, solid-fat index (dilatation), or wide-line nuclear magnetic resonance (NMR). Iodine values are well known to lipid analysts, and both national and international standard procedures are available which are applicable to palm oil. The AOCS(11) have published procedures for the GLC of fatty acids (Ce 1-62) and solid fat index (Cd 10-57), and texts will be published in due course by the IUPAC, the International Standards Organization (ISO), and the British Standards Institution (BSI). Solid-fat index is an empirical measure of the solid fat content as calculated from a measurement of the specific volumes of the fat at various temperatures. Wide-line NMR provides a more direct measurement of solid fat content since the instrument gives a signal which is proportional to the number of protons present in molecules existing in the liquid state. Published standard methods for the assessment of unsaturation and plasticity, which are specifically applicable to palm oil, will clearly be needed in the future. Limits for these characteristics will depend on user requirements.

It should be mentioned that in addition to the VOTC and IUPAC, various other international and national organizations are involved with drawing up standards for fat analysis which are applicable to palm oil. These include ISO and IASC, which have already been referred to with regard to a standard bleaching test, the Codex Alimentarius, and the BSI; and for bleaching earth, as already mentioned, the Community Reference Bureau of the Commission of the European Communities is involved. However, with the considerable liaison between the various bodies concerned, it is anticipated (and certainly to be hoped) that a duplication of methods for one particular test will be avoided and that satisfactory internationally recognized standard tests for the palm oil industry will be evolved.

PRESENT AND FUTURE REQUIREMENTS FOR CRUDE OIL STANDARDS

Internationally recognized grades of crude palm oil with specified limits for the various characteristics have yet to be evolved although specifications for "edible red palm oil" have been drafted by the Codex Alimentarius Commission (12). Generally at the present time characteristics are the subject of negotiations between buyer and vendor; for example, reference has already been made to SPB oil. For edible purposes, the basic requirement is that crude palm oil should be capable of being processed into a bland, stable, near-white, and edible product. Ordinary grade Malaysian palm oil is traded on a contractual basis of 5% FFA with an allowance for moisture and impurities.

Producers have been made aware that oils of high FFA lead to reduced capacity in the refinery and to increasing refining costs; hence, crude oils of lower FFA content can be purchased at a premium from certain plantations.

With recent renewed interest and activity in steam refining, by which both neutralization and deodorization can be carried out in a single step with lower refining losses,

TABLE VI

Quality Standards for Crude Palm Oils

	Edible red palm oil (12)	a	b	c
FFA (as palmitic)%, max	4.6[d]	3.0	4.0	2.5
Moisture, %, max	0.2	e	0.2	0.2
Peroxide value, meq/kg, max	10	5.0	6.0	3.0
p-Anisidine value, max	—	6.0	7.0	4.0
Iron, mg/kg, max	5.0	3.5	8.0	5.0
Copper, mg/kg, max	0.4	0.05	—	—
Iodine value, Wijs	46-56	—	—	—
Carotene content, mg/kg	500-1,600	—	—	—
AOM-stability, hr, min	—	53	—	—
Color, Lovibond red units, 1 in (25.4 mm) cell, min	—	—	19	22

[a] Karlshamns' specifications (15).
[b] Suggested by U.S. processor for regular palm oil.
[c] Suggested by U.K. processor for "SPB" palm oil.
[d] Or according to local preference.
[e] Water and insoluble impurities, max 0.50%.

TABLE VII

Quality Standards for Partially Refined Palm Oils

	Edible bleached palm oil (12)	a	b	c
FFA (as palmitic) %, max	0.3	0.2	0.1	0.1
Moisture, %, max	0.2	0.2	0.1	0.05
Peroxide value, meq/kg, max	10	5.0	—	—
Soap content, mg/kg, max	50	30	50	nil
Iron, mg/kg, max	1.5	0.7	1.5	1.5
Copper, mg/kg, max	0.1	—	0.2	0.2
Lead, mg/kg, max	0.1	—	0.5	0.5
Arsenic, mg/kg, max	0.1	—	1.0	1.0
Iodine value	46-56	—	—	—
Color, Lovibond red units, 1 in (25.4 mm) cell, max	—	17	—	12

[a] Standard for once refined oil suggested by U.S. processor.
[b] Standard for once refined oil suggested by U.K. processor.
[c] Standard for refined bleached oil suggested by U.K. processor.

TABLE VIII

Quality Standards for Fully Refined Palm Oils, Hardened Palm Oil and Palm Olein

Product	a	b	c	d	e
FFA (as palmitic) %, max	0.05	0.1	0.05	0.1	0.05
Moisture, %, max	0.02	0.1	0.	0.1	0.02
Peroxide value, meq/kg, max	0.4	—	1.0	—	—
Soap content, mg/kg, max	nil	—	not detectable	—	—
Iron, mg/kg, max	1.5	—	0.3	—	1.5
Copper, mg/kg, max	0.2	—	—	—	0.2
Lead, mg/kg, max	0.5	—	—	—	0.5
Arsenic, mg/kg, max	1.0	—	—	—	1.0
Lauric acid, %, max	—	2.0	—	—	—
Iodine value	—	46-60	—	25-40	over 58
Induction period (AOM), min hr,	18		35	f	—
Ash, mg/kg, max	—	200	—	200	—
Cloud point, °C	—	—	—	—	below 13

[ab] Fully refined palm oils (U.K.).
[c] Fully refined palm oil (U.S.).
[d] Hardened palm oil, 49/51 c (U.K.).
[e] Palm olein (U.K.).
[f] Equivalent to not less than 6 months storage at ambient temperature.

it is likely that in the future there will be an increasing demand for oils not only for lower FFA but also of low total oxidation and good bleachability since such oils are said to respond well to the steam refining method of processing (13). Johansson (14) has indicated, from the point of view of a Swedish refiner, the quality characteristics of crude palm oil which his firm expects at present and the improvement that he believes should be possible in the future. Table V indicates these characteristics together with what he considers to be reachable at production centers with sufficient attention to fruit harvesting, handling, and processing to produce the crude palm oil.

Table VI shows quality standards for crude palm oils including those given in the draft Codex Alimentarius for "edible red palm oil," the Swedish (Karlshamn) specifications (15), and those proposed by a U.S. processor for "Regular" and for "SPB" palm oil. The Codex Alimentarius specification is intended to apply to virgin palm oil which may be consumed as such in the producing country and the FFA limit (equivalent to an acid value of 10 mg KOH/g fat)

TABLE IX

Characteristics and Percentage Fatty Acid Compositions of Crude Oleins and Stearins (16)

	Bernardini			Alfa-Laval		Tirtiaux		
		Stearin						
	Olein	1	2	Olein	Stearin	Olein	Stearin	Double fract. olein
FFA %	4.2	2.6	2.8	4.1	3.6	2.7	1.8	—
Iodine value, Hanus	58.1	35.6	45.0	58.7	43.6	57.5	41.5	59.2
Slip melting point, °C	20.2	53.4	39.3	18.2	46.7	18.4	50.9	19.2
Cloud test (AOCS Cc 6-25)	8.6	—	—	6.9	—	7.9	—	7.1
Fraction of original oil %	65	15	20	70	30	65	35	—
C 12	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
C 14	1.1	1.3	1.1	1.2	1.4	0.9	1.2	1.1
C 16	38.4	55.2	47.5	39.2	50.8	38.6	52.3	38.3
C 18	4.3	5.3	5.2	4.3	5.1	4.7	5.1	4.5
C 18:1	42.9	29.5	35.8	42.7	33.2	43.2	32.4	42.8
C 18:2	12.5	8.0	9.5	11.9	8.6	11.9	8.3	12.5
C 18:3	0.3	0.2	0.2	0.3	0.2	0.3	0.2	0.3
C 20	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3

will not necessarily apply in all localities as some West African tribes prefer the taste of an oil of much higher FFA. The suggested limits for peroxide and p-anisidine values for "SPB" type oil, giving a maximum Totox value of 10, comply with the characteristics considered desirable by Johansson in both these respects and also the FFA and moisture; but it does not comply with regard to iron content.

Table VII shows suggested quality standards for partically refined palm oils including "Edible bleached palm oil," from the draft Codex Alimentarius, once refined oils according to both U.K. and U.S. processors and refined bleached oil according to a U.K. processor. The limits for lead and arsenic are statutory requirements in the U.K.

Table VIII shows quality standards for fully refined palm oils, hardened palm oil, and palm olein. Products b and d are user specifications rather than processor specifications. With regard to FFA, the table indicates that all are agreed that it should be 0.1% or less and indeed three of the samples are below 0.05%. The soap content should be nil or not detectable at this stage. The significance of the lauric acid limit for product b is that appreciable levels indicate contamination or adulteration with palm kernel, coconut, or other lauric oils. The iodine value for the product d – hardened palm oil – depends, of course, on the degree of hydrogenation which has taken place, and in the case of e, the iodine value depends upon the efficiency of separation.

Table IX shows characteristics of crude oleins and stearins produced by fractionation of crude oils by the three main commercial processes (16); namely, the Bernardini process using hexane solvent, the Alfa-Laval process using a detergent and centrifugal fractionation, and the Tirtiaux process using straight cooling of the oil under controlled conditions. All three processes can provide an oil which on refining will comply with the suggested requirements shown on Table VIII. Also shown in Table IX are the component fatty acid compositions of the oleins and stearins separated by the same processes.

REFERENCES

1. Anon., Trop. Prod. Q. 17:426 (1975).
2. Hartley, C.W.S., "The Oil Palm," Longmans Green, London, 1967.
3. Iwuchukwu, A.N., "The Oil Palm," Papers presented at the Tropical Products Institute Conference, Tropical Products Institute, London, 1965, p. 73.
4. Loncin, M., B. Jacobsberg, and G. Everard, "Palm Oil – A Major Tropical Product," Tropical Products Sales s.a., Brussells, 1970.
5. Hoffman, G., T. Nijzink, and J.H. Recourt, Rev. Fr. Corps Gras 22:511 (1975).
6. Ffinch, D.M., and S.J. Poke, "An Evaluation of the Unilever Automatic Colorimeter as an Alternative Instrument for the Determination of the Colour of Oils and Fats," Leatherhead Food R.A. Technical Circular No. 634, February, 1977.
7. Loncin, M., and B. Jacobsberg, JAOCS 40:18 (1963).
8. Anon., "Variation des Caractéristiques de Certaines Huiles de Palme," Ser. Sci., Institut de Recherches pour les Huiles et Oléagineux, Paris. No. 9, 1956.
9. Macfarlane, N., A. Swetman, and J.A. Cornelius, J. Sci. Food Agric. 26:1293 (1975).
10. Cornelius, J.A., Oil Palm News 19:12 (1975).
11. "Official and Tentative Methods of the American Oil Chemists' Society," Vol. I & II, Third Edition, AOCS, Champaign, IL, 1973 (with additions and revisions yearly).
12. Anon., Codex Alimentarius Commission, 11th Session, Rome, March 29 – April 9, ALINORM 76/19, pp. 21 and 25, 1976.
13. Pritchard, J.L.R., Oil Palm News 20:5 (1975).
14. Johansson, G., Chem. Ind. 21:902 (1975).
15. Johansson, G., and P.-O. Pehlergard, "Aspects on Quality of Palm Oil," Malaysian International Symposium on Palm Oil Processing and Marketing, Paper No. 14, Kuala Lumpur, 1976.
16. Kreulen, H.P., JAOCS 53:393 (1976).

[Received July 11, 1977]

10th Cosmetic Congress in Australia

"Cosmetic Horizons" will be the theme for the 10th International Congress of Cosmetic Chemists scheduled for Oct. 24-28, 1978, in Sydney, Australia, the first time the meeting will be held in the southern hemisphere.

Original papers on technological and scientific advances in cosmetics and toiletries will be presented, with an international jury evaluating the papers. Author of the best paper will receive a prize of 4,000 Swiss francs; two runners-up will receive 500 Swiss francs each. To be eligible for the judging, authors must submit a title and 400-word abstract of their papers to Dr. R.O. Hellyer, scientific program director, 10th IFSCC Congress, Box 2609, G.P.O., Sydney, New South Wales, Australia 2001. Titles and abstracts must be received in Australia by Jan. 25, 1978, for the paper to be eligible for the competition.

Further information about the meeting is available from: 10th International Congress of Cosmetic Chemists, Office of the Secretariat, at the address listed above, or from the IFSCC office, 56 Kingsway, London, WC2b 6DX, England.

Peter Strasser of Albright & Wilson in Boxhill, Australia, will be president of the federation during 1978. He was among the speakers during the World Conference on Soaps and Detergents held during October in Switzerland. ●

Supply of edible vegetable oils rising

World production of edible vegetable oils for 1978 is estimated at 35.7 million metric tons, according to the October issue of *World Agricultural Situation*, a USDA publication, an increase from 1977 supplies caused mainly by more soybeans from the United States, Brazil, and Argentina.

Oil consumption in 1978 is estimated at 35.1 million tons, with a 6 percent increase in developing nations.

Production estimates for 1977 were 31.4 million metric tons, and consumption was estimated at 32.6 million tons in the report.

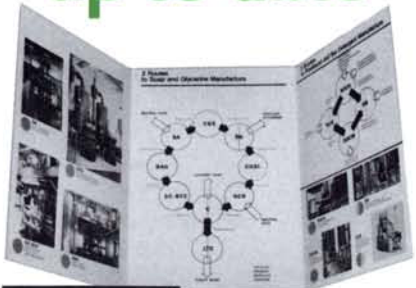
Downward pressure on prices for edible fats and oils during this marketing year were anticipated by a University of Illinois economist, Thomas A. Hieronymous, earlier this fall as harvesting of 1977 oilseed crops was beginning.

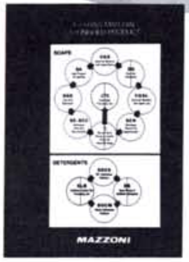
Harvest weather for the Soviet sunflower crop was reported good through the end of September. Hieronymous estimated that Canada's rapeseed crop would be up significantly from 1976. In late September, edible oil prices were reported falling in India as prospects for a good peanut harvest improved. In Argentina, soybean acreage being planted in the fall 1977 was expected to be about 3.42 million hectares, 15 percent higher than 1976 and 34 percent above 1975 acreage. Brazil soybean acreage was expected to rise 7 percent, the Wall Street Journal reported this fall, to 7.4 million hectares, but a decline from the more rapid expansion rate during the past decade. Brazil ended its soybean export tax and subsidy to domestic oil producers in August, meaning more Brazilian beans may be exported.

The USDA's World Food and Agricultural Outlook and Situation Board forecast soy oil prices would range from 15 to 21 cents per pound in Decatur, IL (about $331 to $463 per metric ton) for the 1977/78 marketing year that began Oct. 1. Comparable prices for the 1976/77 crop were 24 cents a pound and $529 per metric ton. The forecasts were in the board's Agricultural Supply & Demand Estimates of Oct. 13, 1977.

Total U.S. soybean crop production was estimated at 1,647 million bushels (44.8 million metric tons). Domestic crushings were estimated at 845 million bushels (23 million metric tons); exports at 610 million bushels (16.6 million metric tons). Soybean oil production was estimated at 9,125 million pounds (4,139 thousand metric tons) with 7,550 million pounds for domestic use and 1,300 million pounds for export. The latest soybean crop estimate is above the earlier estimates of 1,602 million bushels, but the figures on usage of oil and meal were only slightly altered in the latest outlook, meaning most of the anticipated increase is expected to go into carry-over stocks of beans, meal, and oil.

In a development that might influence price of soy meal, the Wall Street Journal reported in mid-September that Peru's anchovy catch was on the small side, casting doubt that the nation's 1977 fishmeal exports could reach the 500,000 metric tons forecast by the government. One source in Chile estimated Peruvian exports might total 300,000 metric tons, the newspaper said. The problem is that fishermen have been unable to locate the large schools of anchovy fish, primary raw material for Peru's fishmeal industry. ●





AOAC meeting draws 1,190

Approximately 1,190 persons attended the Association of Official Analytical Chemists meeting during October in Washington, DC, at which the major news was the announcement that AOAC would institute a $10 membership fee.

William W. Wright, new president of the group, announced the fee in his presidential speech. Dr. David MacLean, who joined AOAC as deputy executive director in September, has been tabbed successor to Dr. William Horwitz as AOAC executive director. That change is 12 to 18 months away. Horwitz is a deputy associate director in FDA's Bureau of Foods and is not an AOAC employee. MacLean is an AOAC employee and the change was viewed by *Food Chemical News* as part of AOAC's effort to establish administrative independence from federal agencies.

AOAC also began publishing this past fall a bimonthly newsletter, *The Referee,* for its members. ●

the latest in Lipids

NOVEMBER 1977

- Ultracentrifugation of Pulmonary Surfactant Fractions
- Ethionine, Phenobarbital, and Phosphatidylcholines of Liver
- Hydrocarbon Gases from Lipid Peroxidation
- GC-MS of Autoxidized Fats: I
- GC-MS of Autoxidized Fats: II
- Conjugated Diene Assay
- ε-Lithocholyl Lysine in Liver
- Lung Substrate Metabolism
- VLDL Secretion in Monkeys
- Soy Forms Oxoepoxyoctadecenoic Acid
- Free Radicals in Spinal Cord Trauma with Ethanol
- Fatty Acid Balance – Heart Lesions
- Ketones for Brain Lipids
- Fatty Acid Adsorption Sites on Silica
- Autoxidation of Fatty Acid Monolayers
- TCA-PTA and TLC of Gangliosides
- A Convenient Synthesis of Dialuric Acid