codex alimentarius commission

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

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TO: Codex Contact Points
Interested International Organisations

FROM: Secretary, Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy

SUBJECT: **Standard for Named Vegetable Oils – request for comments on Proposed Draft Amendment at Step 3**

The 23rd Session of the Codex Alimentarius Commission adopted the Standard for Named Vegetable Oils at Step 8 and approved as new work the inclusion of provisions for high oleic acid safflower oil and high oleic acid sunflower oil (Alinorm 99/37, para. 163 and Appendices VII and VIII). At the 16th Session of the CCFO, it was agreed that the delegations of Japan and France would prepare the relevant amendments for high oleic safflower oil and high oleic sunflower oil respectively (Alinorm 99/17, para. 33). The information provided by Japan and France in this respect is reproduced at Annex 1. On the basis of this, the UK Secretariat have prepared a Proposed Draft Amendment to the Standard at Step 3. The text of the complete Standard is appended as Annex 2 with the amendments highlighted by shading for ease of reference. Governments are invited to comment on the proposed amendments.

As part of the regular updating of the Standard, Governments and international organisations are also requested to submit any information for revision of Tables 1, 2, 3 and 4. In particular, comments are requested on the amendments to the fatty acid and cholesterol content of coconut oil which have been made following provision of data by the Philippines (see Annexes 1 and 2). Further, any comments on the inconsistency in expression of compositional data for desmethylsterols (percentage of total sterols) in Table 3 and tocohperols and tocotrienols (mg/kg) in Table 4 would be welcome.

Governments and international organisations wishing to submit comments and information should do so in writing to the Secretary, Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy, with a copy to Miss Catriona Stewart, Food Labelling, Standards and Consumer Protection Division, Food Standards Agency, PO Box 31037, London SW1P 3WG, United Kingdom (Fax: +44 20 7238 5782; E-mail: catriona.stewart@foodstandards.gsi.gov.uk) **before 31 October 2000**.

ANNEX 1

CODEX STANDARD FOR NAMED VEGETABLE OILS - INCLUSION OF PROVISIONS FOR HIGH OLEIC ACID SAFFLOWER OIL AND HIGH OLEIC ACID SUNFLOWER OIL

JAPAN – INFORMATION PROVIDED ON HIGH OLEIC ACID SAFFLOWER OIL

1. Volume of international trade

Total volume of import of high oleic safflower oil throughout the world in 1999 is estimated to be about 32,000 tons (which corresponds to 90% of total import of safflower oil as a whole, 35,000 tons) whose majority is dominated by the dealings between Japan-U.S., Japan-Australia.

2. Influence on consumers

The monounsaturated fatty acid such as oleic acid which are the principal ingredient of the olive oil is popular because of increasing interest in healthy food among consumers, and therefore, consumption has been expanding.

Regarding safflower oil, the shift of the types from high linoleic acid oil which was once dominated in the market to high oleic acid oil, has gradually been taken place since the new variety of safflower with high oleic acid was developed, thus today accounting for as much as 90% of all import.

It is anticipated that the consumers will continue to consume the high oleic safflower oil also in the future as a reasonably priced commodity in maintaining healthy body.

3. Distinguished difference in chemical composition between high oleic safflower oil and traditional linoleic acid one

The difference of chemical composition exists most remarkably in the difference in the ratio of the fatty acid composition.

This comparison could be seen in the attached table (Difference of JAS standard item, comparison of fatty acid composition, and comparison of sterol compositions).

(1) Traditional linoleic acid type of safflower oil is unsuitable for frying purpose to be used continuously because this type is oxidized easily and therefore this type has been used for direct consumption for such usage as salad oil, while the high oleic safflower oil is suitable for the heated cooking such as frying.

(2) The difference in the composition of fatty acid also affects the difference in the bio activation. Oleic acid oil has function decrease only the LDL cholesterol without changing the level of the HDL cholesterol due to the function of the oleic acid in the high oleic safflower oil, while linoleic acid in a past linoleic acid type safflower oil, the function to reduce both types of total cholesterol (the HDL cholesterol and is LDL).

4. Explanation of seed (species)

The scientific name of safflower is "Canhamus tinctrious L." and this is a annual crop that belongs to Asteraseae.

This high olein variety is created by improving traditional variety with breed (hybridization) method and the scientific name of these two varieties are the same. (Species of high olein safflower is also "*Canhamus tinctrious* L.")

INFORMATION REQUIRED

The sections of the Standard which will need to be modified and the information required for this are detailed below. In respect of compositional factors and chemical and physical criteria, evidence is needed

that the data presented has been obtained using internationally recognised methods of analysis and that it is derived using sufficient numbers of samples of known authenticity obtained from commercially grown varieties.

Standard

2.1 Product definitions

Details of any synonyms for 'high oleic acid safflower oil' are needed together with full taxonomic information of all plant species from which the oil is derived.

The scientific name of safflower is "*Canhamus tinctrious* L." and this is a annual crop that belongs to Asteraseae. This high olein variety is created by improving traditional one with breed (hybridization method and the scientific name of these two varieties are the same. (Species of high olein safflower is also named as "*Canhamus tinctrious* L.")

3. Essential composition and quality factors
3.1 GLC ranges of fatty acid composition

Fatty acid data is required for inclusion in Table I of the Standard. Ranges are needed for: C6:0; C8:0; Cl0:0; Cl2:O; C14:0; Cl6:0; C16:1; C17:0; Cl7:1; C18:0; Cl8:1; C18:2; C18:3; C20:0; C20:1; C20:2; C22:O; C22:1; C22:2; C24:0; and C24:1. The data should be expressed as percentage of total fatty acids.

C6:0 = ND; C8:0 = ND; C10:0 = ND; C12:0 = ND; C14:0 = ND-0.2: C16:0 = 3.6-6.0; C16:1 = ND-02; C17:0 = ND; C17:1 = ND; C18:0 = 1.8-2.4; C18:1 = 70.0-83.7; C18:2 = 9.0-19.9; C18:3 = ND-l.2; C20:0 = 0.3-0.6; C20:1 = 0.1-0.5; C20:2 = ND; C22:0 = 0.2-0.4; C22:1 = ND-0.3; C22:2 = ND; C24:0 = ND-0.3; C24:1 = ND-0.3

Other essential composition and quality factors.

Details of any other factors which specifically characterise this oil and/or differentiate it from other vegetable oils should be included. If any are to be included, the method(s) of analysis required for determination need to be identified and incorporated into section 8 of the Standard.

No specific comment.

Appendix

2. Composition characteristics

Details of any non-essential compositional factors which specifically characterise this oil and/or differentiate it from other vegetable oils should be included. If any are to be included, the method(s) of analysis required for determination need to be identified and incorporated into section 5 of the Appendix.

No specific comment.

3. Chemical and physical characteristics

Data on the following is needed for inclusion in Table 2: relative density; apparent density; refractive index; saponification value; iodine value; and, unsaponifiable matter.

relative density = 0.910-0.916 at 25°C/25°C or 0.913-0.919 at 20°C/20°C; apparent density = [awaiting data]; refractive index = 1.466-1.470 at 25°C or 1.460-1.464 at 4O°C; saponification value = 186-194; iodine value = 80-100; and, unsaponifiable matter = max 1.0%.

4. Identity characteristics

Desmethylsterol and tocol (tocopherol and tocotrienol) data are required for inclusion in Tables 3 and 4 respectively.

Desmethylsterols - ranges are needed for the following: cholesterol; brassicasterol; campesterol; stigmasterol; β-sitosterol; Δ-5-avenasterol; Δ-7-stigmastenol; Δ-7-avenasterol; other desmethylsterols; and, total desmethylsterols.

Levels of Desmethylsterols (%)

cholesterol = ND-03; brassicasterol = ND-2.6; campesterol = 9.3-20.0; stigmasterol =1.9-7.3; β-sitosterol = 42.6-54.9; Δ-5-avenasterol = 3.9-8.9; Δ-7-stigmastenol = 1.7-13.7; Δ-7-avenasterol = ND-4.1; other desmethylsterols = 4.4-26.4% respectively.

Total desmethylsterols (mg/kg Oil)

2,069 - 2,915 mg/kg Oil

Tocols - ranges are needed for α-, β -, γ-, and δ - tocopherol; α-, β -, γ-, and δ - tocotrienol; and, total tocols.

Levels of tocopherols (mg/kg oil)

α-tocopherol = 234-660; β-tocopherol = 3-13; γ-tocopherol = 3-44; δ-tocopherol = ND-6; α-tocotrienol = ND; β-tocotrienol = ND; γ-tocotrienol = ND-3; δ-tocotrienol = ND; and, total tocols = 245-660.

Total tocols

245 - 660 mg/kg oil

FRANCE – INFORMATION PROVIDED ON HIGH OLEIC ACID SUNFLOWER OIL

2. Description
2.1 Product definition

2.1.18 High oleic acid sunflower oil is prepared from varieties of sunflower seed rich in oleic acid (*Helianthus annuus* L.)

3. Essential composition and quality factors
3.1 GLC ranges of fatty acid composition (expressed as % of total fatty acids) (for Table 1)

FATTY ACID COMPOSITION (Table 1 of the standard)
High oleic sunflower oil – HOSO - GLC data - % total fatty acids

FATTY ACIDS		CODEX		[1] samples 1985-1999
Caproic Ac.	C6:0	NO DATA	ND	
Caprylic Ac.	C8:0		ND	
Capric Ac.	C10:0		ND	
Lauric Ac.	C12:0		ND	
Myristic Ac.	C14:0		ND-0.1	11
Palmitic Ac.	C16:0		3.0-4.8	169
Palmitoleic Ac.	C16:1		ND-0.1	167
Margaric Ac.	C17:0		ND-0.1	
Heptadecenoic Ac.	C17:1		ND-0.1	
Stearic Ac.	C18:0		3.0-4.5	169
Oleic Ac.	C18:1		75-85	333
Linoleic Ac.	C18:2		7-17	333

Linolenic Ac.	C18:3		ND-0.3	331
Arachidic Ac.	C20:0		0.2-0.5	168
Eicosenoic Ac.	C20:1		0.1-0.5	168
	C20:2		ND	
Behenic Ac.	C22:0		0.5-1.1	165
Erucic Ac.	C22:1		ND-0.1	
	C22:2		ND	
Lignoceric Ac.	C24:0		ND-0.5	164
Nervonic Ac.	C24:1		ND	

ND: < 0.05

Note: Lower limit for oleic acid in HOSO : 75%
Corresponding upper limit for linoleic acid in HOSO : 17%
Data 1985-1999 collected in 2000 by *ITERG* French Institute for Fats and Oils

ANNEX TO STANDARD

2. Composition characteristics

No particular characteristics to report.

3. Chemical and physical characteristics (for Table 2)

Relative density at 25°C	0.912-0.913
Refraction index (25°C)	1.467-1.469
Saponification index	188-189
Iodine index	86-90
Unsaponifiable matter (%)	0.8-1.0

4. Identity characteristics (for Tables 3 and 4)

For Table 3 - Sterol composition of high oleic acid sunflower oil (crude oil - % of total sterols)

	%
Cholesterol	ND-0.5
Brassicasterol	ND-0.3
Campesterol	5-10
Stigmasterol	4.5-11
Beta-sitosterol	42-60
Delta-5-avenasterol	1.5-4.5
Delta-7-stigmastenol	7-19
Delta-7-avenasterol	ND-9
Other sterols	3.5-9.5
Total	**(mg/kg**) 1700-5200

For Table 4 - Totol content of high oleic sunflower oil (crude oil - mg/kg)

Alpha-tocopherol	400-1090
Beta-tocopherol	10-35
Gamma-tocopherol	3-30
Delta- tocopherol	ND-17
Alpha-tocotrienol	ND
Beta-tocotrienol	ND

Gamma-tocotrienol	ND
Delta-tocotrienol	ND
Total	450-1120

Data collected in 2000 by *ITERG* French Institute for Fats and Oils

CODEX STANDARD FOR NAMED VEGETABLE OILS - AMENDMENT OF PROVISIONS FOR COCONUT OIL

PHILIPPINES

In conjunction with paragraph 163 of the report [Alinorm 99/37], attached herewith are the sets of data from the Philippines on fatty acid composition and cholesterol in coconut oil for inclusion in Table 3 of the Draft Standard for Named Vegetable Oils.

Fatty acid content of coconut oil

Saponification and extraction procedure

The method was based on: *Official Methods of Analysis*, S Williams (ed.), 14th edition, 1984, Virginia, USA: Association of Official Analytical Chemists, Inc. The samples were saponified in alcoholic KOH solution and methylated with BF, as catalyst. The resulting fatty acid methyl esters (FAME) were extracted into n-hexane.

The identity of each FAME was determined by gas-chromatography-mass spectrometry. Quantitation was done on a gas chromatograph equipped with FID detector.

Data and results

The response factor of each FAME was determined by injecting a mixture of equal amounts of C8, C10, C11, C12, C14, C16, C18:0, C18:1, C18:2 and C22 standard FAME. The RFs were used to correct the sample peak area prior to computing the % normalized composition. The results are summarized in the table below.

Table 1: % Fatty acid composition of coconut oil (measured as FAME and calculated based on individual response factors)

Component	Crude		Cochin		RBD (refined, bleached deodorized)	
	Average	SD	Average	SD	Average	SD
C6	0.2	0.00	0.2	0.01	0.2	0.04
C8	5.6	0.15	5.5	0.11	5.9	0.40
C10	5.1	0.11	5.1	0.14	5.2	0.09
C12	52.8	0.42	52.1	0.29	52.2	0.48
C14	18.5	0.06	18.5	0.09	18.2	0.03
C16	8.6	0.00	8.8	0.20	8.7	0.01
C18	2.4	0.08	2.4	0.09	2.4	0.02
C18:1	5.5	0.13	6.0	0.40	5.8	0.02
C18:2	1.2	0.02	1.3	0.07	1.3	0.05
Total	100.0		100.0		100.0	

The GC/MS analysis revealed the presence of even-numbered fatty acid from C6 to C18, including C18:1 and C18:2. The identities of C8 to C18 FAME compounds were determined from their GC retention times and confirmed by MS. The presence of C6 FAME was confirmed by MS alone.

The following FAME compounds were not detected by GC/MS down to a detection limit of 0.02%: C16:1; C17; C17:1; C18:3; C20; C20:1; C20:2; C22; C22:1; C22:2; C24; and C24:1.

Cholesterol content of coconut oil

Saponification and extraction procedure

The method was based on: *Official Methods of Analysis*, S Williams (ed.), 14th edition, 1984, Virginia, USA:

Association of Official Analytical Chemists, Inc. The samples were saponified in alcoholic KOH solution. All unsaponified materials, including cholesterol and other sterols, were extracted into diethyl ether. The ether was evaporated by rotary evaporation and finally under continuous flow of nitrogen. Three runs were performed for each sample.

The sterols were dissolved in 10 ml ethyl acetate and analyzed by gas chromatography-mass spectrometry.

Data and results

The amount of cholesterol in the sample was computed based on a calibration curve with a second degree polynomial curve fitting. The results are as follows:

Sample	Trial No	Weight of sample (g)	Concentration of cholesterol in sample (mg/kg)
Crude	3A	2.56	1.3
	3B	2.52	1.1
	3C	2.51	ND
			Average: 0.8
Cochin	1A	2.49	ND
	1B	2.54	0.9
	1C	2.57	1.1
			Average: 0.7
RBD	2A	2.52	ND
	2B	2.57	0.9
	2C	2.53	1.2
			Average: 0.7

ND = not detected

ANNEX 2

PROPOSED DRAFT AMENDMENT TO CODEX STANDARD FOR NAMED VEGETABLE OILS

(At Step 3 of the Procedure)

The Appendix to this Standard is intended for voluntary application by commercial partners and not for application by governments.

1. SCOPE

This Standard applies to the vegetable oils described in Section 2.1 presented in a state for human consumption.

2. DESCRIPTION

2.1 Product definitions

(Note: synonyms are in brackets immediately following the name of the oil)

2.1.1 **Arachis oil** (peanut oil; groundnut oil) is derived from groundnuts (seeds of *Arachis hypogaea* L.).

2.1.2 **Babassu oil** is derived from the kernel of the fruit of several varieties of the palm *Orbignya spp*.

2.1.3 **Coconut oil** is derived from the kernel of the coconut (*Cocos nucifera* L.).

2.1.4 **Cottonseed oil** is derived from the seeds of various cultivated species of *Gossypium spp.*

2.1.5 **Grapeseed oil** is derived from the seeds of the grape (*Vitis vinifera* L.).

2.1.6 **Maize oil** (corn oil) is derived from maize germ (the embryos of *Zea mays* L.).

2.1.7 **Mustardseed oil** is derived from the seeds of white mustard (*Sinapis alba* L. or *Brassica hirta Moench*), brown and yellow mustard (*Brassica juncea* (L.) Czernajew and Cossen) and of black mustard (*Brassica nigra* (L.) Koch).

2.1.8 **Palm kernel oil** is derived from the kernel of the fruit of the oil palm (*Elaeis guineensis*).

2.1.9 **Palm oil** is derived from the fleshy mesocarp of the fruit of the oil palm (*Elaeis guineensis*).

2.1.10 **Palm olein** is the liquid fraction derived from the fractionation of palm oil (described above).

2.1.11 **Palm stearin** is the high-melting fraction derived from the fractionation of palm oil (described above).

2.1.12 **Rapeseed oil** (turnip rape oil; colza oil; ravison oil; sarson oil: toria oil) is produced from seeds of *Brassica napus* L., *Brassica campestris* L., *Brassica juncea* L. and *Brassica tournefortii* Gouan species.

2.1.13 **Rapeseed oil - low erucic acid** (low erucic acid turnip rape oil; low erucic acid colza oil; canola oil) is produced from low erucic acid oil-bearing seeds of varieties derived from the *Brassica napus* L., *Brassica campestris* L. and *Brassica juncea* L., species.

2.1.14 **Safflowerseed oil** (safflower oil; carthamus oil; kurdee oil) is derived from safflower seeds (seeds of *Carthamus tinctorious* L.).

2.1.15 **Safflowerseed oil - high oleic acid** (high oleic acid safflower oil; high oleic acid carthamus oil; high oleic acid kurdee oil) is produced from high oleic acid oil-bearing seeds of varieties derived from *Carthamus tinctorious* L.

2.1.16 **Sesameseed oil** (sesame oil; gingelly oil; benne oil; ben oil; till oil; tillie oil) is derived from sesame seeds (seeds of *Sesamum indicum* L.).

2.1.17 **Soya bean oil** (soybean oil) is derived from soya beans (seeds of *Glycine max* (L.) Merr.).

2.1.18 **Sunflowerseed oil** (sunflower oil) is derived from sunflower seeds (seeds of *Helianthus annuus* L.).

2.1.19 **Sunflowerseed oil - high oleic acid** (high oleic acid sunflower oil) is produced from high oleic acid oil-bearing seeds of varieties derived from sunflower seeds (seeds of *Helianthus annuus* L.).

2.2 Other definitions

2.2.1 ***Edible vegetable oils*** are foodstuffs which are composed primarily of glycerides of fatty acids being obtained only from vegetable sources. They may contain small amounts of other lipids such as phosphatides, of unsaponifiable constituents and of free fatty acids naturally present in the fat or oil.

2.2.2 ***Virgin oils*** are obtained, without altering the nature of the oil, by mechanical procedures, e.g. expelling or pressing, and the application of heat only. They may have been purified by washing with water, settling, filtering and centrifuging only.

2.2.3 ***Cold pressed oils*** are obtained, without altering the oil, by mechanical procedures only, e.g. expelling or pressing, without the application of heat. They may have been purified by washing with water, settling, filtering and centrifuging only.

3. ESSENTIAL COMPOSITION AND QUALITY FACTORS

3.1 GLC ranges of fatty acid composition (expressed as percentages)

Samples falling within the appropriate ranges specified in Table 1 are in compliance with this Standard. Supplementary criteria, for example national geographical and/or climatic variations, may be considered, as necessary, to confirm that a sample is in compliance with the Standard.

3.2 Low-erucic acid rapeseed oil must not contain more than 2% erucic acid (as % of total fatty acids).

3.3 High oleic acid safflower oil must contain not less than 70% oleic acid (as a % of total fatty acids).

3.4 High oleic acid sunflower oil must contain not less than 75% oleic acid (as % of total fatty acids).

3.3 Slip point

Palm olein	not more than 24°C
Palm stearin	not less than 44°C

4. FOOD ADDITIVES

4.1 No food additives are permitted in virgin or cold pressed oils.

4.2 Flavours

Natural flavours and their identical synthetic equivalents, and other synthetic flavours, except those which are known to represent a toxic hazard.

4.3 Antioxidants

			Maximum Level
304	Ascorbyl palmitate	)	500 mg/kg
305	Ascorbyl stearate	)	individually or in combination
306	Mixed tocopherols concentrate		GMP
307	Alpha-tocopherol		GMP
308	Synthetic gamma-tocopherol		GMP
309	Synthetic delta-tocopherol		GMP
310	Propyl gallate		100 mg/kg
319	Tertiary butyl hydroquinone (TBHQ)		120 mg/kg
320	Butylated hydroxyanisole (BHA)		175 mg/kg
321	Butylated hydroxytoluene (BHT)		75 mg/kg
	Any combination of gallates, BHA and BHT and/or TBHQ		200 mg/kg but limits above not to be exceeded
389	Dilauryl thiodipropionate		200 mg/kg

4.4 Antioxidant synergists

330	Citric acid		GMP
331	Sodium citrates		GMP
384	Isopropyl citrates	)	100 mg/kg individually or in combination
	Monoglyceride citrate	)	

4.5 Anti-foaming agents (oils for deepfrying)

900a	Polydimethylsiloxane	10 mg/kg

5. CONTAMINANTS

5.1 Heavy metals

The products covered by the provisions of this Standard shall comply with maximum limits being established by the Codex Alimentarius Commission but in the meantime the following limits will apply:

	Maximum permissible concentration
Lead (Pb)	0.1 mg/kg
Arsenic (As)	0.1 mg/kg

5.2 Pesticide residues

The products covered by the provisions of this Standard shall comply with those maximum residue limits established by the Codex Alimentarius Commission for these commodities.

6. HYGIENE

6.1 It is recommended that the products covered by the provisions of this Standard be prepared and handled in accordance with the appropriate sections of the Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1969, Rev. 3-1997), and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

6.2 The products should comply with any microbiological criteria established in accordance with the Principles for the Establishment and Application of Microbiological Criteria for Foods (CAC/GL 21-1997).

7. LABELLING

7.1 Name of the food

The product shall be labelled in accordance with the Codex General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985, Rev. 1-1991; Codex Alimentarius, Volume 1A). The name of the oil shall conform to the descriptions given in Section 2 of this Standard.

Where more than one name is given for a product in Section 2.1, the labelling of that product must include one of those names acceptable in the country of use.

7.2 Labelling of non-retail containers

Information on the above labelling requirements shall be given either on the container or in accompanying documents, except that the name of the food, lot identification and the name and address of the manufacturer or packer shall appear on the container.

However, lot identification and the name and address of the manufacturer or packer may be replaced by an identification mark, provided that such a mark is clearly identifiable with the accompanying documents.

8. METHODS OF ANALYSIS AND SAMPLING

8.1 Determination of GLC ranges of fatty acid composition

According to IUPAC 2.301, 2.302 and 2.304 or ISO 5508: 1990/5509: 1999.

8.2 Determination of slip point

According to ISO 6321: 1991 and Amendment 1: 1998 for all oils, or AOCS Cc 3-25 (97) for Palm Oils only.

8.3 Determination of arsenic

According to AOAC 952.13, IUPAC 3.136, AOAC 942.17, or AOAC 985.16.

8.4 Determination of lead

According to IUPAC 2.632, AOAC 994.02 or ISO 12193: 1994.

Table 1: Fatty acid composition of vegetable oils as determined by gas liquid chromatography from authentic samples [1] (expressed as percentage of total fatty acids) (see Section 3.1 of the Standard)

Fatty acid	Arachis oil	Babassu oil	Coconut oil	Cottonseed oil	Grapeseed oil	Maize oil	Mustardseed oil	Palm oil	Palm kernel oil	Palm olein
C6:0	ND	ND	ND-0.6	ND	ND	ND	ND	ND	ND-0.8	ND
C8:0	ND	2.6-7.3	4.6-10.0	ND	ND	ND	ND	ND	2.4-6.2	ND
C10:0	ND	1.2-7.6	~~5.5~~ 5.0-8.0	ND	ND	ND	ND	ND	2.6-5.0	ND
C12:0	ND-0.1	40.0-55.0	45.1- 53.2 ~~50.3~~	ND-0.2	ND-0.5	ND-0.3	ND	ND-0.5	45.0-55.0	0.1-0.5
C14:0	ND-0.1	11.0-27.0	16.8-21.0	0.6-1.0	ND-0.3	ND-0.3	ND-1.0	0.5-2.0	14.0-18.0	0.5-1.5
C16:0	8.0-14.0	5.2-11.0	7.5-10.2	21.4-26.4	5.5-11.0	8.6-16.5	0.5-4.5	39.3-47.5	6.5-10.0	38.0-43.5
C16:1	ND-0.2	ND	ND	ND-1.2	ND-1.2	ND-0.5	ND-0.5	ND-0.6	ND-0.2	ND-0.6
C17:0	ND-0.1	ND	ND	ND-0.1	ND-0.2	ND-0.1	ND	ND-0.2	ND	ND-0.2
C17:1	ND-0.1	ND	ND	ND-0.1	ND-0.1	ND-0.1	ND	ND	ND	ND-0.1
C18:0	1.0-4.5	1.8-7.4	2.0-4.0	2.1-3.3	3.0-6.5	ND-3.3	0.5-2.0	3.5- 6.0	1.0-3.0	3.5-.5.0
C18:1	35.0-67.0	9.0-20.0	5.0-10.0	14.7-21.7	12.0-28.0	20.0-42.2	8.0-23.0	36.0-44.0	12.0-19.0	39.8-46.0
C18:2	13.0-43.0	1.4-6.6	1.0-2.5	46.7-58.2	58.0-78.0	34.0-65.6	10.0-24.0	9.0-12.0	1.0-3.5	10.0-13.5
C18:3	ND-0.3	ND	ND ~~0.2~~	ND-0.4	ND-1.0	ND-2.0	6.0-18.0	ND-0.5	ND-0.2	ND-0.6
C20:0	1.0-2.0	ND	ND ~~0.2~~	0.2-0.5	ND-1.0	0.3-1.0	ND-1.5	ND-1.0	ND-0.2	ND-0.6
C20:1	0.7-1.7	ND	ND ~~0.2~~	ND-0.1	ND-0.3	0.2-0.6	5.0-13.0	ND-0.4	ND-0.2	ND-0.4
C20:2	ND	ND	ND	ND-0.1	ND	ND-0.1	ND-1.0	ND	ND	ND
C22:0	1.5-4.5	ND	ND	ND-0.6	ND-0.5	ND-0.5	0.2-2.5	ND-0.2	ND-0.2	ND-0.2
C22:1	ND-0.3	ND	ND	ND-0.3	ND-0.3	ND-0.3	22.0-50.0	ND	ND	ND
C22:2	ND	ND	ND	ND-0.1	ND	ND	ND-1.0	ND	ND	ND
C24:0	0.5-2.5	ND	ND	ND-0.1	ND-0.2	ND-0.5	ND-0.5	ND	ND	ND
C24:1	ND-0.3	ND	ND	ND	ND	ND	0.5-2.5	ND	ND	ND

ND - non detectable, defined as 0.05%

[1] Data taken from species as listed in Section 2.

Table 1: Fatty acid composition of vegetable oils as determined by gas liquid chromatography from authentic samples [1] (expressed as percentage of total fatty acids) (see Section 3.1 of the Standard) (continued)

Fatty acid	Palm stearin	Rapeseed oil	Rapeseed oil (low erucic acid)	Safflowerseed oil	Safflowerseed oil (high oleic acid)	Sesameseed oil	Soyabean oil	Sunflowerseed oil	Sunflowerseed oil (high oleic acid)
C6:0	ND	ND	ND	ND	ND	ND	ND	ND	ND
C8:0	ND	ND	ND	ND	ND	ND	ND	ND	ND
C10:0	ND	ND	ND	ND	ND	ND	ND	ND	ND
C12:0	0.1-0.5	ND	ND	ND	ND	ND	ND-0.1	ND-0.1	ND
C14:0	1.0-2.0	ND-0.2	ND-0.2	ND-0.2	ND-0.2	ND-0.1	ND-0.2	ND-0.2	ND-0.1
C16:0	48.0-74.0	1.5-6.0	2.5-7.0	5.3-8.0	3.6-6.0	7.9-10.2	8.0-13.5	5.0-7.6	3.0-4.8
C16:1	ND-0.2	ND-3.0	ND-0.6	ND-0.2	ND-0.2	0.1- 0.2	ND-0.2	ND-0.3	ND-0.1
C17:0	ND-0.2	ND-0.1	ND-0.3	ND-0.1	ND	ND-0.2	ND-0.1	ND-0.2	ND-0.1
C17:1	ND-0.1	ND-0.1	ND-0.3	ND-0.1	ND	ND-0.1	ND-0.1	ND-0.1	ND-0.1
C18:0	3.9-6.0	0.5-3.1	0.8-3.0	1.9-2.9	1.8-2.4	4.8-6.1	2.0-5.4	2.7-6.5	3.0-4.5
C18:1	15.5-36.0	8.0-60.0	51.0-70.0	8.4-21.3	70.0-83.7	35.9-42.3	17.7-28.0	14.0-39.4	75-85
C18:2	3.0-10.0	11.0-23.0	15.0-30.0	67.8-83.2	9.0-19.9	41.5-47.9	49.8-59.0	48.3-74.0	7-17
C18:3	ND-0.5	5.0-13.0	5.0-14.0	ND-0.1	ND-1.2	0.3-0.4	5.0-11.0	ND-0.3	ND-0.3
C20:0	ND-1.0	ND-3.0	0.2-1.2	0.2- 0.4	0.3-0.6	0.3-0.6	0.1-0.6	0.1-0.5	0.2-0.5
C20:1	ND-0.4	3.0-15.0	0.1-4.3	0.1- 0.3	0.1-0.5	ND-0.3	ND-0.5	ND-0.3	0.1-0.5
C20:2	ND	ND-1.0	ND-0.1	ND	ND	ND	ND-0.1	ND	ND
C22:0	ND-0.2	ND-2.0	ND-0.6	ND-1.0	0.2-0.4	ND-0.3	ND-0.7	0.3-1.5	0.5-1.1
C22:1	ND	> 2.0-60.0	ND-2.0	ND-1.8	ND-0.3	ND	ND-0.3	ND-0.3	ND-0.1
C22:2	ND	ND-2.0	ND-0.1	ND	ND	ND	ND	ND-0.3	ND

[1] Data taken from species as listed in Section 2.

C24: 0	ND	ND-2.0	ND-0.3	ND-0.2	ND-0.3	ND-0.3	ND-0.5	ND-0.5	ND-0.5
C24:1	ND	ND-3.0	ND-0.4	ND-0.2	ND-0.3	ND	ND	ND	ND

ND - non detectable, defined as ≤ 0.05%

APPENDIX

OTHER QUALITY AND COMPOSITION FACTORS

This text is intended for voluntary application by commercial partners and not for application by governments.

1. QUALITY CHARACTERISTICS

1.1 The **colour, odour and taste** of each product shall be characteristic of the designated product. It shall be free from foreign and rancid odour and taste.

		Maximum level
1.2	**Matter volatile at 105°C**	0.2 % m/m
1.3	**Insoluble impurities**	0.05 % m/m
1.4	**Soap content**	0.005 % m/m
1.5	**Iron (Fe):**	
	Refined oils	1.5 mg/kg
	Virgin oils	5.0 mg/kg
1.6	**Copper (Cu)**	
	Refined oils	0.1 mg/kg
	Virgin oils	0.4 mg/kg
1.7	**Acid value**	
	Refined oils	0.6 mg KOH/g Oil
	Cold pressed and virgin oils	4.0 mg KOH/g Oil
	Virgin palm oils	10.0 mg KOH/g Oil
1.8	**Peroxide value:**	
	Refined oils	up to 10 milliequivalents of active oxygen/kg oil
	Cold pressed and virgin oils	up to 15 milliequivalents of active oxygen/kg oil

2. COMPOSITION CHARACTERISTICS

2.1 The **arachidic and higher fatty acid content** of arachis oil should not exceed 48g/kg.

2.2 The **Reichert values** for coconut, palm kernel and babassu oils should be in the ranges 6-8.5, 4-7 and 4.5-6.5, respectively.

2.3 The **Polenske values** for coconut, palm kernel and babassu oils should be in the ranges 13-18, 8-12 and 8-10, respectively.

2.4 The **Halphen test** for cottonseed oil should be positive.

2.5 The **erythrodiol content** of grapeseed oil should be more than 2% of the total sterols.

2.6 The **total carotenoids** (as beta-carotene) for unbleached palm oil, unbleached palm olein and unbleached palm stearin should be in the range 500-2000, 550-2500 and 300-1500 mg/kg, respectively.

2.7 The **Crismer value** for low erucic acid rapeseed oil should be in the range 67-70.

2.8 The **concentration of brassicasterol** in low erucic acid rapeseed oil should be greater than 5% of

total sterols.

2.9 The **Baudouin test** should be positive for sesameseed oil.

3. CHEMICAL AND PHYSICAL CHARACTERISTICS

Chemical and Physical Characteristics are given in Table 2.

4. IDENTITY CHARACTERISTICS

4.1 **Levels of desmethylsterols** in vegetable oils as a percentage of total sterols are given in Table 3.

4.2 **Levels of tocopherols and tocotrienols** in vegetable oils are given in Table 4.

5. METHODS OF ANALYSIS AND SAMPLING

5.1 Determination of matter volatile at 105°C

According to IUPAC 2.601 or ISO 662: 1988.

5.2 Determination of insoluble impurities

According to IUPAC 2.604 or ISO 663: 1999.

5.3 Determination of soap content

According to BS 684 Section 2.5.

5.4 Determination of copper and iron

According to ISO 8294: 1994, IUPAC 2.631 or AOAC 990.05.

5.5 Determination of relative density

According to IUPAC 2.101, with the appropriate conversion factor.

5.6 Determination of apparent density

According to ISO 6883: 1995, with the appropriate conversion factor.

5.7 Determination of refractive index

According to IUPAC 2.102 or ISO 6320: 1995.

5.8 Determination of saponification value (SV)

According to IUPAC 2.202 or ISO 3657: 1988.

5.9 Determination of iodine value (IV)

Wijs - according to IUPAC 2.205/1, ISO 3961: 1996, AOAC 993.20, or AOCS Cd 1d-92 (97), or by calculation - AOCS Cd 1b-87 (97). The method to be used for specific named vegetable oils is stipulated in the Standard.

5.10 Determination of unsaponifiable matter

According to IUPAC 2.401 (part 1-5) or ISO 3596-1: 1988 and Amendment 1 1997, and ISO 3596-2: 1988 and Amendment 1 1999.

5.11 Determination of peroxide value (PV)

According to IUPAC 2.501 (as amended), AOCS Cd 8b - 90 (97) or ISO 3961: 1998.

5.12 Determination of total carotenoids

According to BS 684 Section 2.20.

5.13 Determination of acidity

According to IUPAC 2.201 or ISO 660: 1996.

5.14 Determination of sterol content

According to ISO 6799: 1991, or IUPAC 2.403.

5.15 Determination of tocopherol content

According to IUPAC 2.432 or ISO 9936: 1997.

5.16 Halphen test

According to AOCS Cb 1-25 (97).

5.17 Crismer value

According to AOCS Cb 4-35 (97) and AOCS Ca 5a-40 (97).

5.18 Baudouin test (modified villavecchia test or sesameseed oil test)

According to AOCS Cb 2-40 (97).

5.19 Reichert value and polenske value

According to IUPAC 2.204.

Table 2: Chemical and physical characteristics of crude vegetable oils (see Appendix of the Standard)

	Arachis oil	Babassu oil	Coconut oil	Cottonseed oil	Grapeseed oil	Maize oil	Mustardseed oil	Palm oil	Palm kernel
Relative density (x°C/water at 20°C)	0.914-0.917 x=20°C	0.914-0.917 x=25°C	0.908-0.921 x=40°C	0.918-0.926 x=20°C	0.923-0.926 x=20°C	0.917-0.925 x=20°C	0.910-0.921 x=20°C	0.891-0.899 x=50°C	0.899-0.914 x=40°C
Apparent density (g/ml)								0.889-0.895 (50°C)	
Refractive index (ND 40°C)	1.460-1.465	1.448-1.451	1.448-1.450	1.458-1.466	1.473-1.477	1.465-1.468	1.461-1.469	1.454- 1.456 at 50°C	1.448-1.452
Saponification value (mg KOH/g oil)	187-196	245-256	248-265	189-198	188-194	187-195	168-184	190-209	230-254
Iodine value*	86-107	10-18	6.3-10.6	100-115	130-138	107-135	92-125	50.0-55.0	14.1-21.0
Unsaponifiable matter (g/kg)	≤ 10	≤ 12	≤ 15	≤ 15	≤ 20	≤ 28	≤ 15	≤ 12	≤ 10
Stable carbon isotope ratio **						-13.71 to -16.36			

* Iodine values shown in the Table were calculated from the fatty acid composition with the exception of those for palm oil, palm kernel oil, palm olein, palm stearin (Wijs method)

** See the following publications:

Woodbury SP, Evershed RP and Rossell JB (1998). Purity assessments of major vegetable oils based on gamma 13C values of individual fatty acids. *JAOCS*, **75** (3), 371-379.

Woodbury SP, Evershed RP and Rossell JB (1998). Gamma 13C analysis of vegetable oil, fatty acid components, determined by gas chromatography-combustion-isotope ratio mass spectrometry, after saponification or regiospecific hydrolysis. *Journal of Chromatography* A, **805**, 249-257.

Woodbury SP, Evershed RP, Rossell JB, Griffith R and Farnell P (1995). Detection of vegetable oil adulteration using gas chromatography combustion / isotope ratio mass spectrometry. *Analytical Chemistry* **67** (15), 2685-2690.

Ministry of Agriculture, Fisheries and Food (1996). Authenticity of single seed vegetable oils. Working Party on Food Authenticity, MAFF, UK.

Table 2: Chemical and physical characteristics of crude vegetable oils (see Appendix of the Standard) (continued)

	Palm olein	Palm stearin	Rapeseed oil	Rapeseed oil (low erucic acid)	Safflowerseed oil	Safflowerseed oil (high oleic acid)	Sesameseed oil	Soyabean oil	Sunflowerseed oil	Sunflowerseed oil (high oleic acid)
Relative density (x° C/water at 20°C)	0.899-0.920 x=40°C	0.881-0.891 x=60°C	0.910-0.920 x=20°C	0.914-0.920 x=20°C	0.922-0.927 x=20°C	0.913-0.919 x=20°C; 0.910-0.916 x=25°C	0.915-0.923 x=20°C	0.919-0.925 x=20°C	0.918-0.923 x=20°C	0.912-0.913 x=25°C
Apparent density (g/ml)	0896-0.898 at 40°C	0.881-0.885 at 60°C				[awaiting data from Japan]				
Refractive index (ND 40°C)	1.458-1.460	1.447-1.452 at 60°C	1.465-1.469	1.465-1.467	1.467-1.470	1.460-1.464 at 40°C; 1.466-1.470 at 25°C	1.465-1.469	1.466-1.470	1.461- 1.468	1.467-1.469 at 25°C
Saponification value (mg KOH/g oil)	194-202	193-205	168-181	182-193	186-198	186-194	187-195	189-195	188-194	188-189
Iodine value *	≥ 56	≤ 48	94-120	105-126	136-148	80-100	104-120	124-139	118-141	86-90
Unsaponifiable matter (g/kg)	≤ 13	≤ 9	≤ 20	≤ 20	≤ 15	≤ 10	≤ 20	≤ 15	≤ 15	8-10

* Iodine values shown in the Table were calculated from the fatty acid composition with the exception of those for palm oil, palm kernel oil, palm olein, palm stearin (Wijs method)

Table 3: Levels of desmethylsterols in crude vegetable oils from authentic samples[3] as a percentage of total sterols (see Appendix 1 of the Standard)

	Arachis oil	Babassu oil	Coconut oil	Cottonseed oil	Grapeseed oil	Maize oil	Palm oil	Palm kernel oil
Cholesterol	ND-3.8	1.2-1.7	~~0.6~~ ND-3.0	0.7-2.3	0.4	0.2-0.6	2.6-6.7	0.6-3.7
Brassicasterol	ND-0.2	ND-0.3	ND-0.3	0.1- 0.3	0.2	ND-0.2	ND	ND-0.8
Campesterol	12.0-19.8	17.7-18.7	7.5-11.2	6.4-14.5	10.2	18.6-24.1	18.7-27.5	8.4-12.7
Stigmasterol	5.4-13.2	8.7-9.2	11.4-15.6	2.1-6.8	10.9	4.3-7.7	8.5-13.9	12.0-16.6
Beta-sitosterol	47.4-64.7	48.2-53.9	32.6-50.7	76.0-87.1	67.4	54.8-66.6	50.2-62.1	62.6-73.1
Delta-5-avenasterol	8.3-18.8	16.9-20.4	20.0-40.7	1.8-7.3	3.0	4.2-8.2	ND-2.8	1.4-9.0
Delta-7-stigmastenol	ND-5.1	ND	ND-3.0	ND-1.4	1.0-3.5	1.0-4.2	0.2-2.4	ND-2.1
Delta-7-avenasterol	ND-5.5	0.4-1.0	ND-3.0	0.8-3.3	0.7	0.7-2.7	ND-5.1	ND-1.4
Others	ND-1.4	ND	ND-3.6	ND-1.5	5.1	ND-2.4	ND	ND-2.7
Total sterols (mg/kg)	900-2900	500-800	400-1200	2700-6400	5800	8000-22100	300-700	700-1400

	RAPESEED OIL (LOW ERUCIC ACID)	Safflowerseed oil	Safflowerseed oil (high oleic acid)	Sesameseed oil	Soyabean oil	Sunflowerseed oil	Sunflowerseed oil (high oleic acid)
Cholesterol	0.5-1.3	ND- 0.7	ND-0.3	0.1-0.2	0.6-1.4	≤ 0.7	ND-0.5
Brassicasterol	5.0-13.0	ND-0.4	ND-2.6	0.1-0.2	ND-0.3	ND-0.2	ND-0.3
Campesterol	24.7-38.6	9.2-13.3	9.3-20.0	10.1-20.0	15.8-24.2	7.4-12.9	5.0-10.0
Stigmasterol	≤ 0.9	4.5-9.6	1.9-7.3	3.4-6.4	14.9-19.1	7.0-11.5	4.5-11.0
Beta-sitosterol	45.1-57.9	40.2-50.6	42.6-54.9	57.7-61.9	51-60	56.2-65.0	42.0-60.0
Delta-5-avenasterol	3.1-6.6	0.8-4.8	3.9-8.9	6.2-7.8	1.9-3.7	ND-6.9	1.5-4.5
Delta-7-stigmastenol	ND-1.3	13.7-24.6	1.7-13.7	1.8-7.6	1.4-5.2	7.0-24.0	7.0-19.0
Delta-7-avenasterol	ND-0.8	2.2-6.3	ND-4.1	1.2-5.6	1.0-4.6	3.1-6.5	ND-9.0
Others	ND-4.2	0.5-6.4	4.4-26.4	0.7-9.2	ND-1.8	ND-5.3	3.5-9.5
Total sterols (mg/kg)	4800-11300	2100-4600	2069-2915	4500-19000	1800- 4100	2400-4600	1700-5200

ND - Non-detectable, defined as ≤ 0.05%

[3] Data taken from species as listed in Section 2.

Table 4: Levels of tocopherols and tocotrienols in crude vegetable oils from authentic samples[4] (mg/kg) (see Appendix 1 of the Standard)

	Arachis oil	Babassu oil	Coconut oil	Cottonseed oil	Grapeseed oil	Maize oil	Palm oil	Palm kernel oil
Alpha-tocopherol	49-373	ND	ND-17	136-674	16-38	23-573	4-193	ND-44
Beta-tocopherol	ND-41	ND	ND-11	ND-29	ND-89	ND-356	ND-234	ND-248
Gamma-tocopherol	88-389	ND	ND-14	138-746	ND-73	268-2468	ND-526	ND-257
Delta-tocopherol	ND-22	ND	ND	ND-21	ND-4	23-75	ND-123	ND
Alpha-tocotrienol	ND	25-46	ND-44	ND	18-107	ND-239	4-336	ND
Gamma-tocotrienol	ND	32-80	ND-1	ND	115-205	ND-450	14-710	ND-60
Delta-tocotrienol	ND	9-10	ND	ND	ND-3.2	ND-20	ND-377	ND
Total (mg/kg)	170-1300	60-130	ND-50	380-1200	240-410	330-3720	150-1500	ND-260

	Rapeseed oil (low erucic acid)	Safflowerseed oil	Safflowerseed oil (high oleic acid)	Sesameseed oil	Soyabean oil	Sunflowerseed oil	Sunflowerseed oil (high oleic acid)
Alpha-tocopherol	100-386	234-660	234-660	ND-3.3	9-352	403-935	400-1090
Beta-tocopherol	ND-140	ND-17	3-13	ND	ND-36	ND-45	10-35
Gamma-tocopherol	189-753	ND-12	3-44	521-983	89-2307	ND-34	3-30
Delta-tocopherol	ND-22	ND	ND-6	4-21	154-932	ND-7.0	ND-17
Alpha-tocotrienol	ND	ND	ND	ND	ND-69	ND	ND
Gamma-tocotrienol	ND	ND-12	ND-3	ND-20	ND-103	ND	ND
Delta-tocotrienol	ND	ND	ND	ND	ND	ND	ND
Total (mg/kg)	430-2680	240-670	245-660	330-1010	600-3370	440-1520	450-1120

ND - Non-detectable.
Note: Maize oil also contains ND-52 mg/kg beta tocotrienol.

[4] Data taken from species as listed in Section 2.