

هيئة التقييس لدول مجلس التعاون لدول الخليج العربية
GCC STANDARDIZATION ORGANIZATION (GSO)



GSO 1754-1/2015 (E)

الزيوت النباتية المعدة للطعام - الجزء الأول
Edible vegetable oils- Part 1

ICS : 67.200

Edible vegetable ohls- Part 1

Date of GSO Board of Directors' Approval : 03/08/1436h(21/05/2015)
Issuing Status : Technical regulation

Foreword

GCC Standardization Organization (GSO) is a regional Organization which consists of the National Standards Bodies of GCC member States. One of GSO main functions is to issue Gulf Standards /Technical regulations through specialized technical committees (TCs).

GSO through the technical program of committee TC No (5) "Technical committee for standards of food and agriculture products" has updated the GSO Technical regulation No. : GSO 1754-1/2012"Edible vegetable ohls- Part 1" The Draft Technical regulation has been prepared by State of Qatar .

This Technical regulation has been approved by GSO Board of Directors in its meeting No.(21), held on 03/08/1436h(21/05/2015), The approved standard will replace and supersede the standard No. GSO 1754-1/2012 .

Edible vegetable oils- Part 1

This Gulf Standard has cancelled and replaced the following Gulf Standards:

1. GSO 115 “ Edible soybean oil”
2. GSO 114 “Edible maize oil”.
3. GSO 229 “Edible palm oil”.
4. GSO 484 “Edible palm oil”.
5. GSO 947 “Edible muster seeds oil”.
6. GSO 1074 “Edible Rapeseed oil- low erucic acid”.
7. GSO 1365 “Edible safflower seed”.

Edible vegetable oils- Part 1**1. Scope and field of application:**

This Gulf Standard is concerned with edible vegetable oils mentioned in item (3).

2. Complementary references:

- 2.1 GSO 9 “Labeling of prepackaged foodstuffs”.
- 2.2 GSO 15 “Methods of sampling edible oils and fats”.
- 2.3 GSO 16 “Physical and chemical methods for testing edible oils and fats”.
- 2.4 GSO 17 “Methods of test for permitted food additives in edible oils and fats - Part 1”.
- 2.5 GSO 19 “Permitted food additives in edible oils and fats”.
- 2.6 GSO 20 “Methods for the determination of contaminating metallic elements in foodstuffs”.
- 2.7 GSO 21 “Hygienic regulations for food plants and their personnel”.
- 2.8 GSO 150-2" Expiration dates for food products - Part 2: Voluntary expiration dates".
- 2.9 GSO 382, 383 “Maximum limits for pesticides residues in agricultural food products- Parts 1,2”.
- 2.10 GSO 839 “Food packages- Part 1: General requirements”.
- 2.11 GSO 988 “Limits of radioactivity levels permitted in foodstuffs –Part 1”.
- 2.12 GSO 998" Methods for detection of permissible radionuclide's limits in food- Part 1: Gamma spectrometry analysis: A-C_s 134, C_s 137".
- 2.13 GSO 1863" Food packages- Part 2: Plastic containers: General requirements" .
- 2.14 GSO ISO 5508 “Animal and vegetable oils and fats- Part 2: Analysis by gas chromatography of methyl esters of fatty acids”.
- 2.15 GSO ISO 5509 “Animal and vegetable oils and fats- Preparation of methyl esters of fatty acids ”.
- 2.16 GSO CAC 193" General Standard for contaminants and toxics in food stuffs".
- 2.17 Gulf Standards which the Organization shall be approved concerning with:
 - 2.17.1 Methods of detection of lard in food products
 - 2.17.2 Methods for the determination of pesticide residues:
 - 2.17.2.1 CAC/GL 40 “Portion of commodities to which Codex MRLS apply and which is analysed”.
 - 2.17.2.2 CAC/GL 40 “Guidelines on good laboratory practice in pesticide residue analysis”.

3. Definitions:

- 3.1 Edible vegetable oil: 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.
- 3.2 Cottonseed oil: is derived from the seeds of various cultivated species of *Gossypium spp*
- 3.3 Sunflower seed oil (sunflower oil): is derived from sunflower seeds (seeds of *Helianthus annuus L.*).
- 3.4 Mustard seed 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*).
- 3.5 Palm oil: is derived from the fleshy mesocarp of the fruit of the oil palm (*Elaeis guineensis*).
- 3.6 Palm kernel oil: is derived from the kernel of the fruit of the oil palm (*Elaeis guineensis*).
- 3.7 Palm olein: is the liquid fraction derived from the fractionation of palm oil
- 3.8 Palm stearin: is the high-melting fraction derived from the fractionation of palm oil.
- 3.9 Palm kernel olein: is a liquid fraction derived from fractionation of palm kernel oil
- 3.10 Palm kernel stearin: is a solid fraction derived from fractionation of palm kernel oil.
- 3.11 Palm superolein: is a liquid fraction derived from palm oil (described above produced through a specially controlled crystallization process to achieve an iodine value of 60 or higher.
- 3.12 Rapeseed oil (turnip rape oil; colza oil; ravisson oil; sarson oil: toria oil) is produced from seeds of *Brassica napus L.*, *Brassica rapa L.*, *Brassica juncea L.* and *Brassica tournefortii Gouan* species.
- 3.13 Safflower seed oil (safflower oil; carthamus oil; kurdee oil): is derived from safflower seeds (seeds of *Carthamus tinctorious L.*).
- 3.14 Safflower seed 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.*
- 3.15 Soya bean oil (soybean oil): is derived from soya beans (seeds of *Glycine max (L.) Merr.*).
- 3.16 Virgin oil: is 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.

3.17 Cold pressed oil: is 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.

4. Characteristics:

The following characteristics shall be met in edible vegetable oils:

4.1 Edible vegetable oil shall be free from pig fat and free from other animal fats and its derivatives .

4.2 Edible vegetable oil shall be free from mineral oils contaminants (organic hydrocarbons).

4.3 Edible vegetable oil taste and odors shall be normal and characteristics of the oil, and free from foreign odor and taste.

4.4 The oil shall be free from rancidity expressive of spoilage.

4.5 The production shall be carried out according to Gulf Standard mentioned in item (2.7).

4.6 It shall be produced from sound, clean, free from rancidity, impurities and contaminants fruits, seeds, grains or germs.

4.7 The appearance of the oil shall be clear and shall be free from sediments and turbidity at 40°C.

4.8 The erucic acid content in low- erucic acid rapeseed oil shall not exceed 2% (as % of total Fatty acids).

4.9 Oleic acid content in high oleic acid safflower oil shall not less than 70% oleic acid (as % of Total fatty acids).

4.10 Temperature for slip point shall be as follows:

Palm kernel olein between 21 to 26°C

Palm kernel stearin between 31 to 34°C

Palm olein not more than 24°C

Palm stearin not less than 44°C

Palm superoleim not more than 19.5°C

4.11 The physical and chemical characteristics for edible vegetable oils shall be according Table No. (1).

4.12 Food additives:

4.12.1 No food additives are permitted in virgin and cold press oils.

4.12.2 The following additives are permitted to add to edible vegetable oils:

| Item | Additive | Maximum level | INS No. |
|---|--|---|----------------------------------|
| 4.12.2.1 | Flavors | Natural or synthetic flavors are permitted to add according to Gulf Standard mentioned in item 2.5. | |
| 4.12.2.2 | Antioxidants: | | |
| | a-Ascorbyl palmitate | 500 ppm Singly or in combination | 304 |
| | b- Ascorbyl stearate | | 305 |
| | c- Tocopherol concentrate,mixed | 300 ppm singly or in compination | 307b |
| | d- Tocophermol, d- alpha- | | 307a |
| | e- Tocopherol, dl-alpha- | | 307c |
| | f- Propyl gallate | 100 ppm | 310 |
| | g- Tertiary butylated hydroxylquinone (TBHQ) | 120 ppm | 319 |
| h- Butylated hydroxyanisole (BHA) | 175 ppm | 320 | |
| 4.12.2.3 | i- Butylated hydroxytoluene (BHT) | 75 ppm | 321 |
| | Any combination of f,g,h,l | | 200 ppm within individual limits |
| | j-Dilauryl thiodipropionate | 200 ppm | 389 |
| 4.12.2.3 | Antioxidant synergists: | | |
| | -Citric acid | GMP | 330 |
| | -Sodium dihydrogen citrate | GMP | 331(i) |
| | -Trisodium citrate | GMP | 441(ii) |
| | -Isopropyl citrates | 100 ppm singly or in combination | 384 |
| -Citric and fatty acid esters of glycerol | 472c | | |
| 4.12.2.4 | Antifoaming agents: Polydimethylsiloxane | 10 ppm | 900a |

4.13 Fatty acids composition (% of total fatty acids) shall be as in Table No. (2).

4.14 Quality characteristics for vegetable oils shall be as follows:

| Item | Characteristics | Maximum level |
|--------|--|--|
| 4.14.1 | Matter volatile at 105°C | 0.2 % m/m |
| 4.14.2 | Insoluble impurities | 0.05% m/m |
| 4.14.3 | Soap content | 0.005% m/m |
| 4.14.4 | Iron content: Refined oils Virgin oils Cured palm kernel olein Cured palm kernel stearin | 1.5 ppm 5.0 ppm 5.0 ppm 5.0 ppm |
| 4.14.5 | Copper content: Refined oils Virgin oils | 0.1 ppm 0.4 ppm |
| 4.14.6 | Acid value: Refined oils Cold pressed and virgin oil Virgin palm oils | 0.6mg KOH/g refined oil 4.0 mg KOH/g oil 10.0 mg KOH/g oil |
| 4.14.7 | Peroxide value: Refined oils Cold pressed and virgin oil | Up to 10 mill equivalents of active oxygen/kg oil Up to 15 mill equivalents of active oxygen/kg oil |

4.15 Composition characteristics:

- 4.15.1 The Reichert value for palm kernel oil shall be in range 4-7.
- 4.15.2 The Polenske value for palm kernel oil shall be in range 8-12.
- 4.15.3 The Halphen test for cotton seed oil shall be positive.
- 4.15.4 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.
- 4.15.5 The Crismer value for low erucic acid rapeseed oil should be in the range 67- 70.
- 4.15.6 The **concentration of brassicasterol** in low erucic acid rapeseed oil should be greater than 5% of total sterols.
- 4.16 The pesticides residues shall not exceed to what mentioned in Gulf Standard stated in item (2.9).
- 4.17 The radionuclide limits in the product shall be comply to what mentioned in Gulf Standard stated in Item (2.11) .
- 4.18 Contaminant metallic elements in edible vegetable oils shall not exceed to what mentioned in Gulf standard stated in Item (2.16).
- 4.19 Levels of desmethylsterols in cured vegetable oils as % of total sterols

Shall be shown in Table (3).

- 4.20 Levels of tocopherols and tocotrienols in crude vegetable oils (mg/kg) Shall be shown in Table (4).

5. Packaging, transportation and storage:

The following shall be met during Packaging, transportation and storage:

5.1 Packaging:

The oils shall be packed in healthy containers made from harm less materials and does not affect on its characteristics< the containers shall be clean, dry, free from any foreign odor, not previously used, with tight covers and shall be comply with Gulf Standards stated in Items (2.10), (2.13).

5.2 Transportation:

The transportation shall be carried out by means protect the containers from damage and contamination.

5.3 Storage:

The containers shall be stored at room temperature (25°C) in good ventilation stores, far from direct sun light and the sources of heat and contamination.

6. Labeling:

Without prejudice to what mentioned in Gulf Standard stated in items (2.1, 2.8) the following shall be Declared on the label:

- 6.1 Kind of the vegetable oil according to the definitions mentioned in this Technical regulation.
- 6.2 Additives (it should be one of the permissible additives to edible oils and fats) and its added content.

7. Sampling:

Samples shall be taken according with Gulf Standard stated in item (2.2).

8. Methods of examination and test:

The following tests shall be carried out on the representative sample taken according to item (7) to determine its complying with this Standard:

- 8.1 Detection of mineral oils, and the determination of relative density, refractive index, saponification value, acid value, iodine value, unsaponifble matter , insoluble impurities, soap content and Halphen test shall be carried out according to Gulf Standard stated in item (2.3).
- 8.2 Detection and determination of permissible additives to the oils shall be carried out according to Gulf Standard stated in item (2.4).
- 8.3 Determination of contaminant metallic elements shall be carried out according to Gulf Standard stated in item (2.6).
- 8.4 Determination of free fatty acids of the oil shall be carried out according to Gulf Standard stated in items (2.14, 2.15).

- 8.5 Determination of pesticides residues shall be carried out according to Gulf Standard stated in Item (2.17.2).
- 8.6 Determination of radiation levels shall be carried out according to Gulf Standard mentioned in Item (2.12) .
- 8.7 Detection of lard shall be carried out according to Gulf Standard mentioned in Item (2.17.1) .

Table No. (1)

Physical and chemical characteristics

| Characteristic | Cotton seed oil | Maize oil | Mustard oil | Palm oil | Palm kernel oil | Palm kernel olein | Palm kernel stearin | Palm olein | Palm stearin | Palm super olein | Rape seed oil (low erucic acid) | Safflower seed oil | Safflower seed oil (high oleic acid) | Soybean oil |
|-------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|---------------------------------|------------------------|--|------------------------|
| Relative density | 0.918-0.926 At 20°C | 0.917-0.925 At 20°C | 0.910-0.921 At 20°C | 0.891-0.899 At 50°C | 0.899-0.914 At 40°C | 0.906-0.909 At 40°C | 0.902-0.908 At 40°C | 0.899-0.920 At 40°C | 0.881-0.891 At 60°C | 0.900-0.925 At 40°C | 0.914-0.920 At 20°C | 0.922-0.927 At 20°C | 0.913-0.919 At 20°C 0.910-0.916 At 25°C | 0.919-0.925 At 25°C |
| Apparent density (g/ml) | | | | 0.889-0.895 (50°C) | | 0.904-0.907 | 0.904-0.906 | 0.896-0.898 At 40°C | 0.881-0.885 At 60°C | 0.897-0.920 | | | 0.912-0.914 At 20°C | |
| Refractive index (at 40°C) | 1.458-1.466 | 1.465-1.468 | 1.461-1.469 | 1.454-1.456 (50°C) | 1.448-1.452 | 1.451-1.453 | 1.449-1.451 | 1.458-1.460 | 1.447-1.452 At 60°C | 1.463-1.465 | 1.465-1.467 | 1.467-1.470 | 1.460-1.464 At 40°C 1.466-1.470 At 25°C | 1.466-1.470 |
| Saponification value (mg KOH/g oil) | 189-198 | 187-195 | 168-184 | 190-209 | 230-254 | 231-244 | 244-255 | 194-202 | 193-205 | 180-205 | 182-193 | 186-198 | 186-194 | 189-195 |
| Unsaponifiable matter (g/kg) | ≤ 15 | ≤ 28 | ≤ 15 | ≤ 12 | ≤ 10 | ≤ 15 | ≤ 15 | ≤ 15 | ≤ 9 | ≤ 13 | ≤ 20 | ≤ 15 | ≤ 10 | ≤ 15 |
| Iodine value | 100-123 | 103-135 | 92-125 | 50.0-55.0 | 14.1-21.0 | 20-28 | 4-8.5 | ≤ 56 | ≤ 48 | ≥ 60 | 105-126 | 136-148 | 80-100 | 124-139 |

Table No. (2)

Fatty acids composition (%of total fatty acids)

| Characteristic | Cotton seed oil | Maize oil | Mustard oil | Palm oil | Palm kernel oil | Palm olein | Palm kernel olein | Palm kernel stearin | Palm super olein | Rape seed oil(low erucic acid) | Safflower seed oil | Safflower seed oil (high oleic acid) | Soybean oil |
|----------------|-----------------|-----------|-------------|-----------|-----------------|------------|-------------------|---------------------|------------------|--------------------------------|--------------------|--------------------------------------|-------------|
| C6:0 | ND | ND | ND | ND | ND-0.8 | ND | ND-0.7 | ND-0.2 | ND | ND | ND | ND | ND |
| C8:0 | ND | ND | ND | ND | 2.4-6.2 | ND | 2.9-6.3 | 1.3-3.5 | ND | ND | ND | ND | ND |
| C10:0 | ND | ND | ND | ND | 2.6-5.0 | ND | 2.7-4.5 | 2.4-3.3 | ND | ND | ND | ND | ND |
| C12:0 | ND-0.2 | ND-0.3 | ND | ND-0.5 | 45.0-55.0 | 0.1-0.5 | 39.7-47.0 | 25.0-59.7 | 0.1-0.5 | ND | ND | ND-0.2 | ND-0.1 |
| C14:0 | 0.6-1.0 | 0.3 | ND-1.0 | 0.5-2.0 | 14.0-18.0 | 0.5-1.5 | 11.5-15.5 | 20.0-25.0 | 0.5-1.5 | ND-0.2 | ND-0.2 | ND-0.2 | ND-0.2 |
| C16:0 | 21.4-26.4 | 8.6-16.5 | 0.5-4.5 | 39.4-47.5 | 6.5-10.0 | 38.0-43.5 | 6.2-10.6 | 6.7-10.0 | 30.0-39.0 | 2.5-7.0 | 5.3-8.0 | 3.6-6.0 | 8.0-13.5 |
| C16:1 | ND-1.2 | ND-0.5 | ND-0.5 | ND-0.6 | ND-0.2 | ND-0.6 | ND-0.1 | ND | ND-0.5 | ND-0.6 | ND-0.2 | ND-0.2 | ND-0.2 |
| C17:0 | ND-0.1 | ND-0.1 | ND | ND-0.2 | ND | ND-0.2 | ND | ND | ND-0.1 | ND-0.3 | ND-0.1 | ND-0.1 | ND-0.1 |
| C17:1 | ND-0.1 | ND-0.1 | ND | ND | ND | ND-0.1 | ND | ND | ND | ND-0.3 | ND-0.1 | ND-0.1 | ND-0.1 |
| C18:0 | 2.1-3.3 | ND-3.3 | 0.5-2.0 | 3.5-6.0 | 1.0-3.0 | 3.5-5.0 | 1.7-3.0 | 1.0-3.0 | 2.8-4.5 | 0.8-3.0 | 1.9-2.9 | 1.5-2.4 | 2.5-5.4 |
| C18:1 | 14.7-21.7 | 20.0-42.2 | 8.0-23.0 | 36.0-44.0 | 12.0-19.0 | 39.8-46.0 | 14.4-24.6 | 4.1-8.0 | 43.0-49.5 | 51.0-70.0 | 8.4-21.3 | 70.0-83.7 | 17-30 |
| C18:2 | 46.7-58.2 | 34.0-65.6 | 10.0-24.0 | 9.0-12.0 | 1.0-3.5 | 10.0-13.5 | 2.4-4.3 | 0.5-1.5 | 10.5-15.0 | 15.0-30.0 | 67.8-83.2 | 9.0-19.9 | 48.0-59.0 |
| C18:3 | ND-0.4 | ND- | 6.0- | ND-0.5 | ND-0.2 | ND-0.6 | ND-0.3 | ND- | 0.2-1.0 | 5.0-14.0 | ND-0.1 | ND-1.2 | 4.5-11.0 |

| Characteristic | Cotton seed oil | Maize oil | Mustard oil | Palm oil | Palm kernel oil | Palm olein | Palm kernel olein | Palm kernel stearin | Palm super olein | Rape seed oil(low erucic acid) | Safflower seed oil | Safflower seed oil (high oleic acid) | Soybean oil |
|----------------|-----------------|-----------|-------------|----------|-----------------|------------|-------------------|---------------------|------------------|--------------------------------|--------------------|--------------------------------------|-------------|
| C20:0 | 0.2-0.5 | 0.2-1.0 | ND-1.0 | ND-1.0 | ND-0.2 | ND-0.6 | ND-0.5 | ND-1.0 | ND-0.4 | 0.2-1.2 | 0.2-0.4 | 0.3-0.6 | 0.1-0.6 |
| C20:1 | ND-0.1 | 0.2-0.6 | 5.0-13.0 | ND-0.4 | ND-0.2 | ND-0.4 | ND-0.2 | ND-0.4 | ND0.2 | 0.1-4.3 | 0.1-0.3 | 0.1-0.5 | ND-0.5 |
| C20:2 | ND-0.1 | ND-0.1 | ND-1.0 | ND | ND | ND | ND | ND | ND | ND-0.1 | ND | ND | ND-0.1 |
| C22:0 | ND-0.6 | ND-0.5 | 0.2-2.5 | ND-0.2 | ND-0.2 | ND-0.2 | ND | ND-0.2 | ND-0.2 | ND-0.6 | ND-1.0 | ND-0.4 | ND-0.7 |
| C22:1 | ND-0.3 | ND-0.3 | 22.0-50.0 | ND | ND | ND | ND | ND | ND | ND-2.0 | ND-1.8 | ND-0.3 | ND-0.3 |
| C22:2 | ND-0.1 | ND | ND-0.1 | ND | ND | ND | ND | ND | ND | ND-0.1 | ND | ND | ND |
| C24:0 | ND-0.1 | ND-0.5 | ND-0.5 | ND | ND | ND | ND | ND | ND | ND-0.3 | ND-0.2 | ND-0.3 | ND-0.5 |
| C24:1 | ND | ND | 0.5-2.5 | ND | ND | ND | ND | ND | ND | ND-0.4 | ND-0.2 | ND-0.3 | ND |

Table (3)

Levels of desmethylsterols in cured vegetable oils as % of total sterols

| | Cotton seed oil | Maize oil | Palm oil | Palm kernel oil | Palm olein | Palm kernel olein | Palm kernel stearin | Palm stearin | Palm super olein | Rapeseed oil(low erucic acid) | Safflower seed oil | Safflower seed oil (high oleic acid) | Soybean oil |
|----------------------|-----------------|-----------|-----------|-----------------|------------|-------------------|---------------------|--------------|------------------|-------------------------------|--------------------|--------------------------------------|-------------|
| Cholesterol | 0.7-3.2 | 0.2-0.6 | 2.6-6.7 | 0.6-3.7 | 2.6-7.0 | 1.5-1.9 | 1.4-1.7 | 2.5-5.0 | 2.0-3.5 | ND-1.3 | ND-0.7 | ND-0.5 | 0.2-1.4 |
| Brassicasterol | 0.1-0.3 | ND-0.2 | ND | ND-0.8 | ND | ND-0.2 | ND-2.2 | ND | ND | 5.0-13.0 | ND-0.4 | ND-2.2 | ND-0.3 |
| Campesterol | 6.4-14.5 | 16.0-24.1 | 18.7-27.5 | 8.4-12.7 | 12.5-39.0 | 7.9-9.1 | 8.2-9.7 | 15.0-26.0 | 22.0-26.0 | 24.7-38.6 | 9.2-13.3 | 8.9-19.9 | 15.8-24.2 |
| Stigmasterol | 2.1-6.8 | 4.3-8.0 | 8.5-13.9 | 12.0-16.6 | 7.0-18.9 | 13.4-14.7 | 14.1-15.0 | 9.0-15.0 | 18.2-20.0 | 0.2-1.0 | 4.5-9.6 | 0.2-8.9 | 14.9-19.1 |
| Beta-sitosterol | 76.0-87.1 | 54.8-66.6 | 50.2-62.1 | 62.6-73.1 | 45.0-71.0 | 67.1-69.2 | 67.0-70.0 | 50.0-60.0 | 55.0-70.0 | 45.1-57.9 | 40.2-50.6 | 40.1-66.9 | 47.0-60.0 |
| Delta-5-avenasterol | 1.8-7.3 | 1.5-8.2 | ND-2.8 | 1.4-9.0 | ND-0.3 | 3.3-4.6 | 3.3-4.1 | ND-3.0 | | 2.5-6.6 | 0.8-4.8 | 0.2-8.9 | 1.5-3.7 |
| Delta-7-stigmasterol | ND-1.4 | 0.2-4.2 | 0.2-2.4 | ND-2.1 | ND-0.3 | ND-0.6 | ND-0.3 | ND-3.0 | 0-0.3 | ND-1.3 | 13.7-24.6 | 3.4-16.4 | 1.4-5.2 |
| Delta-7-avenasterol | 0.8-3.3 | 0.3-2.7 | ND-5.1 | ND-1.4 | ND-0.6 | ND-0.5 | ND-0.3 | ND-3.0 | 0-0.3 | ND-0.8 | 2.2-6.3 | ND-8.3 | 1.0-4.6 |

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| Others | ND-1.5 | ND-2.4 | ND | ND-2.7 | ND-10.4 | 2.9-3.7 | 1.0-3.0 | ND-5.0 | 0-2.0 | ND-4.2 | 0.5-6.4 | 44.4-11.9 | ND-1.8 |
|-----------------------|-----------|------------|---------|----------|---------|----------|----------|---------|-------|------------|-----------|-----------|-----------|
| Total sterols (mg/kg) | 2700-6400 | 7000-22100 | 300-700 | 700-1400 | 270-800 | 816-1339 | 775-1086 | 250-500 | 100 | 4500-11300 | 2100-4600 | 2000-4100 | 1800-4500 |

ND; Non-detectable, defined as 0.05%

Table (4)

Levels of tocopherols and tocotrienols in crude vegetable oils (mg/kg)

| | Cotton seed oil | Maize oil | Palm oil | Palm olein | Palm kernel oil | Palm kernel olein | Palm kernel stearin | Palm stearin | Palm superolein | Rapeseed oil(low erucic acid) | Safflower seed oil | Soyabean oil |
|-------------------|-----------------|-----------|----------|------------|-----------------|-------------------|---------------------|--------------|-----------------|--------------------------------|--------------------|--------------|
| Alpha-tocopherol | 136-674 | 23-573 | 4-193 | 30-280 | ND-44 | ND-11 | ND-10 | ND-100 | 130-240 | 100-386 | 234-660 | 9-352 |
| Beta-tocopherol | ND-29 | ND-356 | ND-234 | ND-250 | ND-248 | ND-6 | ND-2 | ND-50 | ND-40 | ND-140 | ND-13 | ND-36 |
| Gamma-tocopherol | 138-746 | 268-2468 | ND-526 | ND-100 | ND-248 | ND-3 | ND-1 | ND-50 | ND-40 | 189-753 | ND-44 | 89-2307 |
| Delta-tocopherol | ND-21 | 23-75 | ND-123 | ND-100 | ND | ND-4 | ND | ND-50 | ND-30 | ND-22 | ND-6 | 154-932 |
| Alpha-tocotrienol | ND | ND-239 | 4-336 | 50-500 | ND | ND-70 | ND-73 | 20-150 | 170-300 | ND | ND | ND-69 |
| Gamma-tocotrienol | ND | ND-450 | 14-710 | 20-700 | ND-60 | 1-10 | ND-8 | 10-500 | 230-420 | ND | ND-10 | ND-103 |
| Delta-tocotrienol | ND | ND-20 | 14-710 | 40-120 | ND | ND-2 | ND-1 | 5-150 | 60-120 | ND | ND | ND |
| Total (mg/kg) | 380-1200 | 330-3720 | 150-1500 | 300-1800 | ND-260 | ND-90 | ND-89 | 100-700 | 400-1400 | 430-2680 | 240-670 | 600-3370 |

ND - Non-detectable.

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

References

Codex Alimentarius Commission
CAC210:1999
Amendment 2005, 2011, 2013
Named vegetable oils

Corrigenda 1 :

Page 10, table 1 :

- **Replace Unsaponifiable matter of Plam olein ≤ 15 with the following :**
Unsaponifiable matter of Plam olein ≤ 13
- **Replace Iodine value of Palm olein ≤ 56 with the following :**
Iodine value of Palm olein ≥ 56
- **Replace Relative density of soybean oil (0.199 - 0.925 At 25 °C) with the following :**
Relative density of soybean oil (0.199-0.925 At 20 °C)