STANDARD FOR NAMED VEGETABLE OILS

CXS 210-1999

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)

**Almond oil** is derived from the kernel of almond fruit (*Amygdalus communis* L.).

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

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

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

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

**Flaxseed (Linseed) oil** is derived from the seeds of various cultivated species of *Linum usitatissimum*

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

**Hazelnut oil** is derived from the kernel of hazelnut fruit (*Corylus avellana* L.).

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

**Mustards 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).

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

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

**Palm kernel stearin** is the solid fraction derived from fractionation of palm kernel oil (described above).

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

**Palm oil with a higher content of oleic acid** is derived from the fleshy mesocarp of hybrid palm fruit (OxG) (*Elaeis oleifera* x *Elaeis guineensis*)

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

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

**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.

**Pistachio oil** is derived from the kernel of pistachio fruit (*Pistacia vera* L.).

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

**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 rapa* L. and *Brassica juncea* L., species.

**Rice bran oil** (rice oil) is derived from the bran of rice (*Oryza sativa* L.).

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

**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 tinctorius* L.

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

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

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

**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.).
Sunflowerseed oil - mid oleic acid (mid-oleic acid sunflower oil) is produced from mid-oleic acid oil-bearing sunflower seeds (seeds of Helianthus annuus L.).

Walnut oil is derived from the kernel of walnut fruit (Juglans regia L.).

2.2 Other definitions

**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.

**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.

**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.

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

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

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

Palm oil with a higher content of oleic acid must contain not less than 48% oleic acid (as % of total fatty acids).

3.2 Slip point

- 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 superolein: not more than 19.5°C

4. FOOD ADDITIVES

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

4.1 Flavouring

The flavourings used in products covered by this standard shall comply with the *Guidelines for the Use of Flavourings* (CXG 66-2008).

4.2 Antioxidants

<table>
<thead>
<tr>
<th>INS No.</th>
<th>Additive</th>
<th>Maximum Use Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>304</td>
<td>Ascorbyl palmitate</td>
<td>500 mg/kg (Singly or in combination)</td>
</tr>
<tr>
<td>305</td>
<td>Ascorbyl stearate</td>
<td></td>
</tr>
<tr>
<td>307a</td>
<td>Tocopherol, d-alpha</td>
<td></td>
</tr>
<tr>
<td>307b</td>
<td>Tocopherol concentrate, mixed</td>
<td></td>
</tr>
<tr>
<td>307c</td>
<td>Tocopherol, dl-alpha</td>
<td></td>
</tr>
<tr>
<td>310</td>
<td>Propyl gallate</td>
<td>100 mg/kg</td>
</tr>
<tr>
<td>319</td>
<td>Tertiary butyl hydroquinone (TBHQ)</td>
<td>120 mg/kg</td>
</tr>
<tr>
<td>320</td>
<td>Butylated hydroxyanisole (BHA)</td>
<td>175 mg/kg</td>
</tr>
<tr>
<td>321</td>
<td>Butylated hydroxytoluene (BHT)</td>
<td>75 mg/kg</td>
</tr>
<tr>
<td></td>
<td>Any combination of gallates, BHA, BHT, or TBHQ not to exceed 200 mg/kg within individual limits</td>
<td></td>
</tr>
<tr>
<td>322(i)</td>
<td>Lecithin</td>
<td>GMP</td>
</tr>
<tr>
<td>389</td>
<td>Dilauryl thiodipropionate</td>
<td>200 mg/kg</td>
</tr>
</tbody>
</table>
4.3 Antioxidant synergists

<table>
<thead>
<tr>
<th>INS No.</th>
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<th>Maximum Use Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>330</td>
<td>Citric acid</td>
<td>GMP</td>
</tr>
<tr>
<td>331(i)</td>
<td>Sodium dihydrogen citrate</td>
<td>GMP</td>
</tr>
<tr>
<td>331(iii)</td>
<td>Trisodium citrate</td>
<td>GMP</td>
</tr>
<tr>
<td>332(ii)</td>
<td>Tripotassium citrate</td>
<td>GMP</td>
</tr>
<tr>
<td>333(iii)</td>
<td>Tricalcium citrate</td>
<td>GMP</td>
</tr>
<tr>
<td>384</td>
<td>Isopropyl citrates</td>
<td>GMP</td>
</tr>
<tr>
<td>472c</td>
<td>Citric and fatty acid esters of glycerol</td>
<td>100 mg/kg (Singly or in combination)</td>
</tr>
</tbody>
</table>

4.4 Anti-foaming agents (oils for deepfrying)

<table>
<thead>
<tr>
<th>INS No.</th>
<th>Additive</th>
<th>Maximum Use Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>900a</td>
<td>Polydimethylsiloxane</td>
<td>10 mg/kg</td>
</tr>
</tbody>
</table>

5. CONTAMINANTS

The products covered by this Standard shall comply with the maximum levels of the General Standard for Contaminants and Toxins in Food and Feed (CXS 193-1995).

The products covered by this Standard shall comply with the maximum residue limits for pesticides established by the Codex Alimentarius Commission.

6. HYGIENE

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 General Principles of Food Hygiene (CXC 1-1969), and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

The products should comply with any microbiological criteria established in accordance with the Principles and Guidelines for the Establishment and Application of Microbiological Criteria related to Foods (CXG 21-1997).

7. LABELLING

7.1 Name of the food

The product shall be labelled in accordance with the General Standard for the Labelling of Prepackaged Foods (CXS 1-1985). 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 ISO 5508: 1990 and 5509: 2000; or AOCS Ce 2-66 (97), Ce 1e-91 (01) or Ce 1f-96 (02).

8.2 Determination of slip point

According to ISO 6321: 2002 for all oils; AOCS Cc 3b-92 (02) for all oils except for palm oils; AOCS Cc 3-25 (97) for palm oils only.
<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>Arachis oil</th>
<th>Almond oil</th>
<th>Babassu oil</th>
<th>Coconut oil</th>
<th>Cottonseed oil</th>
<th>Flaxseed /linseed oil</th>
<th>Grape-seed oil</th>
<th>Hazelnut oil</th>
<th>Maize oil</th>
<th>Mustard - seed oil</th>
<th>Palm oil with a higher oleic acid</th>
<th>Palm kernel oil</th>
<th>Palm olein²</th>
<th>Palm kernel olein²</th>
<th>Palm kernel stearin²</th>
</tr>
</thead>
<tbody>
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<td>C6:0</td>
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<td>ND</td>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<td>ND</td>
<td>ND</td>
<td>0.05%</td>
<td>ND</td>
</tr>
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<td>ND</td>
<td>ND</td>
<td>2.6-7.3</td>
<td>4.6-10.0</td>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>C10:0</td>
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<td>ND</td>
<td>ND</td>
<td>1.2-7.6</td>
<td>5.0-8.0</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<td>ND</td>
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<td>40.0-55.0</td>
<td>45.1-53.2</td>
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<td>ND-0.1</td>
<td>11.0-27.0</td>
<td>16.8-21.0</td>
<td>0.6-1.0</td>
<td>ND-0.2</td>
<td>ND-0.3</td>
<td>ND-0.1</td>
<td>ND-1.0</td>
<td>ND-0.5</td>
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<td>ND</td>
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<td>ND</td>
</tr>
<tr>
<td>C16:0</td>
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<td>4.0-9.0</td>
<td>5.2-11.0</td>
<td>7.5-10.2</td>
<td>21.4-26.4</td>
<td>4.0-11.3</td>
<td>5.5-11.0</td>
<td>4.2-8.9</td>
<td>8.6-16.5</td>
<td>0.5-4.5</td>
<td>39.3-47.5</td>
<td>23.0-38.0</td>
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<td>6.2-10.6</td>
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<td>ND-0.1</td>
<td>ND-0.2</td>
<td>ND-0.1</td>
<td>ND-0.1</td>
<td>ND-0.1</td>
<td>ND</td>
<td>ND-0.6</td>
<td>ND-0.2</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
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<td>ND-0.1</td>
<td>ND-0.1</td>
<td>ND-0.2</td>
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<td>ND-0.2</td>
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<td>ND-0.2</td>
<td>ND</td>
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</tr>
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<td>C18:1</td>
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<td>62.0-76.0</td>
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<td>14.7-21.7</td>
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<td>74.2-86.7</td>
<td>20.0-42.2</td>
<td>8.0-23.0</td>
<td>36.0-44.0</td>
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<td>9.0-12.0</td>
<td>9.0-17.0</td>
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<td>ND-2.0</td>
<td>6.0-18.0</td>
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<td>ND-0.6</td>
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<td>C20:0</td>
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<td>5.0-13.0</td>
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<td>0.5-2.5</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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</tr>
</tbody>
</table>

ND - non detectable, defined as ≤ 0.05%

¹ Data taken from species as listed in Section 2.
² Fractionated product from palm oil.
Table 1: Fatty acid composition of vegetable oils as determined by gas liquid chromatography from authentic samples (expressed as percentage of total fatty acids) (see Section 3.1 of the Standard) (continued)

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>Palm stearin&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Palm superolein&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Pistachio oil</th>
<th>Rapeseed oil</th>
<th>Rapeseed oil (low erucic acid)</th>
<th>Rice bran oil</th>
<th>Safflower-seed oil</th>
<th>Safflower-seed oil (high oleic acid)</th>
<th>Sesame seed oil</th>
<th>Soyabean oil</th>
<th>Sunflower seed oil</th>
<th>Sunflower seed oil (high oleic acid)</th>
<th>Sunflower seed oil (mid oleic acid)</th>
<th>Walnut oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>C6:0</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<td>ND</td>
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</tr>
<tr>
<td>C8:0</td>
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<td>ND</td>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
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</tr>
<tr>
<td>C10:0</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<td>ND</td>
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</tr>
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<td>C12:0</td>
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<td>0.1-0.5</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<td>C14:0</td>
<td>1.0-2.0</td>
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<td>ND-0.2</td>
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<td>ND</td>
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<tr>
<td>C16:0</td>
<td>48.0-74.0</td>
<td>30.0-39.0</td>
<td>8.0-13.0</td>
<td>1.5-6.0</td>
<td>2.5-7.0</td>
<td>14-23</td>
<td>5.3-8.0</td>
<td>7.9-12.0</td>
<td>8.0-13.5</td>
<td>5.0-7.6</td>
<td>2.6-5.0</td>
<td>4.0-5.5</td>
<td>6.0-8.0</td>
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</tr>
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<td>ND-0.1</td>
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<td>C17:1</td>
<td>ND-0.1</td>
<td>ND-0.1</td>
<td>ND-0.1</td>
<td>ND-0.1</td>
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<td>ND</td>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>C18:0</td>
<td>3.9-6.0</td>
<td>2.8-4.5</td>
<td>0.5-3.5</td>
<td>0.8-3.0</td>
<td>0.9-4.0</td>
<td>1.9-2.9</td>
<td>1.5-2.4</td>
<td>4.5-6.7</td>
<td>2.0-5.4</td>
<td>2.7-6.5</td>
<td>2.9-6.2</td>
<td>2.1-5.0</td>
<td>1.0-3.0</td>
<td>ND</td>
</tr>
<tr>
<td>C18:1</td>
<td>15.5-36.0</td>
<td>43.0-49.5</td>
<td>50.0-70.0</td>
<td>8.0-60.0</td>
<td>38-48</td>
<td>8.4-21.3</td>
<td>70.0-83.7</td>
<td>34.4-45.5</td>
<td>17-30</td>
<td>43.1-71.8</td>
<td>90.0-120.0</td>
<td>14.0-23.0</td>
<td>14.0-23.0</td>
<td>ND</td>
</tr>
<tr>
<td>C18:2</td>
<td>3.0-10.0</td>
<td>10.5-15.0</td>
<td>8.0-34.0</td>
<td>11.0-23.0</td>
<td>15.0-30.0</td>
<td>21-42</td>
<td>67.8-83.2</td>
<td>36.9-47.9</td>
<td>48.0-59.0</td>
<td>48.3-74.0</td>
<td>2.1-17</td>
<td>18.7-45.5</td>
<td>54.0-65.0</td>
<td>ND</td>
</tr>
<tr>
<td>C18:3</td>
<td>ND-0.5</td>
<td>0.2-1.0</td>
<td>0.1-1.0</td>
<td>5.0-13.0</td>
<td>5.0-14.0</td>
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<td>ND</td>
<td>ND</td>
<td>4.5-11.0</td>
<td>ND-0.3</td>
<td>ND-0.5</td>
<td>9.0-15.4</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>C20:0</td>
<td>ND-1.0</td>
<td>ND-0.4</td>
<td>ND-0.3</td>
<td>ND-3.0</td>
<td>0.2-1.2</td>
<td>0.2-0.4</td>
<td>ND</td>
<td>ND</td>
<td>0.1-0.6</td>
<td>ND-0.5</td>
<td>ND-0.3</td>
<td>ND-0.3</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>C20:1</td>
<td>ND-0.4</td>
<td>ND-0.2</td>
<td>ND-0.6</td>
<td>3.0-15.0</td>
<td>0.1-4.3</td>
<td>0.1-0.3</td>
<td>ND</td>
<td>ND</td>
<td>0.1-0.5</td>
<td>ND-0.3</td>
<td>ND-0.3</td>
<td>ND-0.3</td>
<td>ND</td>
<td>ND</td>
</tr>
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<td>ND-0.2</td>
<td>ND-0.2</td>
<td>ND-0.1</td>
<td>ND-1.0</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<tr>
<td>C22:0</td>
<td>ND-0.2</td>
<td>ND-0.2</td>
<td>ND-2.0</td>
<td>ND-0.6</td>
<td>ND-1.0</td>
<td>ND-0.4</td>
<td>ND</td>
<td>ND</td>
<td>NN-1.1</td>
<td>ND-0.7</td>
<td>ND-0.3</td>
<td>0.3-1.5</td>
<td>0.5-1.6</td>
<td>0.6-1.1</td>
</tr>
<tr>
<td>C22:1</td>
<td>ND</td>
<td>ND</td>
<td>ND-2.0</td>
<td>ND-1.8</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>C22:2</td>
<td>ND</td>
<td>ND</td>
<td>ND-2.0</td>
<td>ND-0.1</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>C24:0</td>
<td>ND</td>
<td>ND</td>
<td>ND-2.0</td>
<td>ND-0.3</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>C24:1</td>
<td>ND</td>
<td>ND</td>
<td>ND-3.0</td>
<td>ND-0.4</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
</tbody>
</table>

ND - non detectable, defined as ≤ 0.05%

<sup>1</sup> Data taken from species as listed in Section 2.
<sup>2</sup> Fractionated product from palm oil.
OTHER QUALITY AND COMPOSITION FACTORS

These quality and composition factors are supplementary information to the essential composition and quality factors of the standard. A product, which meets the essential quality and composition factors but does not meet these supplementary factors, may still conform to the standard.

1. QUALITY CHARACTERISTICS

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.

<table>
<thead>
<tr>
<th>Matter volatile at 105°C</th>
<th>0.2 % m/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insoluble impurities</td>
<td>0.05 % m/m</td>
</tr>
<tr>
<td>Soap content</td>
<td>0.005 % m/m</td>
</tr>
</tbody>
</table>

**Iron (Fe):**

<table>
<thead>
<tr>
<th>Type</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refined oils</td>
<td>1.5 mg/kg</td>
</tr>
<tr>
<td>Virgin oils</td>
<td>5.0 mg/kg</td>
</tr>
<tr>
<td>Crude palm kernel olein</td>
<td>5.0 mg/kg</td>
</tr>
<tr>
<td>Crude palm kernel stearin</td>
<td>7.0 mg/kg</td>
</tr>
</tbody>
</table>

**Copper (Cu):**

<table>
<thead>
<tr>
<th>Type</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refined oils</td>
<td>0.1 mg/kg</td>
</tr>
<tr>
<td>Virgin oils</td>
<td>0.4 mg/kg</td>
</tr>
</tbody>
</table>

**Acid value**

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refined oils</td>
<td>0.6 mg KOH/g Oil</td>
</tr>
<tr>
<td>Cold pressed and virgin oils</td>
<td>4.0 mg KOH/g Oil</td>
</tr>
</tbody>
</table>

**Free fatty acid**

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virgin palm oil</td>
<td>5.0% (as palmitic acid)</td>
</tr>
<tr>
<td>Crude palm kernel oil</td>
<td>4.0% (as lauric acid)</td>
</tr>
<tr>
<td>Refined rice bran oil</td>
<td>0.3% (as oleic acid)</td>
</tr>
</tbody>
</table>

**Peroxide value:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refined oils</td>
<td>up to 10 milliequivalents of active oxygen/kg oil</td>
</tr>
<tr>
<td>Cold pressed and virgin oils</td>
<td>up to 15 milliequivalents of active oxygen/kg oil</td>
</tr>
</tbody>
</table>

2. COMPOSITION CHARACTERISTICS

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

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.

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

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

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

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.

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

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

The **Baudouin test** should be positive for sesame seed oil.
The gamma oryzanols in crude rice bran oil should be in the range of 0.9-2.1 %.
For the fatty acid range of crude rice bran oil not intended for direct human consumption the ranges as given for rice bran oil in Table 1 apply.

3. CHEMICAL AND PHYSICAL CHARACTERISTICS
Chemical and Physical Characteristics are given in Table 2.

4. IDENTITY CHARACTERISTICS
Levels of desmethylsterols in vegetable oils as a percentage of total sterols are given in Table 3.
Levels of tocopherols and tocotrienols in vegetable oils are given in Table 4.

5. METHODS OF ANALYSIS AND SAMPLING
Determination of moisture and volatile matter at 105°C
Determination of insoluble impurities
Determination of soap content
According to BS 684 Section 2.5; or AOCS Cc 17-95 (97).
Determination of copper and iron
According to ISO 8294: 1994; or AOAC 990.05; or AOCS Ca 18b-91 (03)
Determination of relative density
According to IUPAC 2.101, with the appropriate conversion factor.
Determination of apparent density
According to ISO 6883: 2000, with the appropriate conversion factor; or AOCS Cc 10c-95 (02)
Determination of refractive index
According to ISO 6320: 2000; or AOCS Cc 7-25 (02)
Determination of saponification value (SV)
According to ISO 3657: 2002; or AOCS Cd 3-25 (03)
Determination of iodine value (IV)
Wijs - ISO 3961: 1996; or AOAC 993.20; or AOCS Cd 1d-1992 (97); or NMKL 39(2003)
The method to be used for specific named vegetable oils is stipulated in the Standard
Determination of unsaponifiable matter
According to ISO 3596: 2000; or ISO 18609: 2000; or AOCS Ca 6b-53 (01)
Determination of peroxide value (PV)
According to AOCS Cd 8b-90 (03); or ISO 3960: 2001
Determination of total carotenoids
According to BS 684 Section 2.20.
Determination of acidity
According to ISO 660: 1996, amended 2003; or AOCS Cd 3d-63 (03), or AOCS Ca 5a-40
Determination of free fatty acids
According to ISO 660: 1996, amended 2003; or AOCS Ca 5a-40
Determination of sterol content
According to ISO 12228: 1999; or AOCS Ch 6-91 (97)
Determination of tocopherol content
According to ISO 9936: 1997; or AOCS Ce 8-89 (97)

Halphen test
According to AOCS Cb 1-25 (97).

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

Baudouin test (modified Villavecchia test or sesame seed oil test)
According to AOCS Cb 2-40 (97).

Reichert value and Polenske value
According to AOCS Cd 5-40 (97)

Determination of gamma oryzanol content
Definition
This method is used to determine gamma oryzanol content (%) in oils from spectrophotometer absorption measurements at the wavelength of maximum absorption near 315nm.

Scope
Applicable to crude rice bran oil.

Apparatus
- Spectrophotometer - for measuring extinction in the ultraviolet between 310 and 320 nm.
- Rectangular quartz cuvettes - having an optical light path of 1 cm.
- Volumetric flask - 25mL.
- Filter paper - Whatman no.2, or equivalent.

Reagents
- n-Heptane - Spectrophotometrically pure.

Procedure
(i) Before using, the spectrophotometer should be properly adjusted to a zero reading filling both the sample cuvette and the reference cuvette with n-Heptane.
(ii) Filter the oil sample through filter paper at ambient temperature.
(iii) Weigh accurately approximately 0.02g of the sample so prepared into a 25mL volumetric flask, make up to the mark with n-Heptane.
(iv) Fill a cuvette with the solution obtained and measure the extinction at the wavelength of maximum absorption near 315nm, using the same solvent as a reference.
(v) The extinction values recorded must lie within the range 0.3-0.6. If not, the measurements must be repeated using more concentrated or more diluted solutions as appropriate.

Calculation
Calculate gamma oryzanol content as follows:

\[
\text{Gamma oryzanol content, } \% = 25 \times \left( \frac{1}{W} \right) \times A \times \left( \frac{1}{E} \right)
\]

Where
\[
W = \text{mass of sample, g}
\]
\[
A = \text{extinction (absorbance) of the solution}
\]
\[
E = \text{specific extinction } E_{1\%1cm} = 359
\]
Table 2: Chemical and physical characteristics of crude vegetable oils (see Appendix of the Standard)

<table>
<thead>
<tr>
<th></th>
<th>Arachis oil</th>
<th>Almond oil</th>
<th>Babassu oil</th>
<th>Coconut oil</th>
<th>Cotton seed oil</th>
<th>Flaxseed linseed oil</th>
<th>Grape-seed oil</th>
<th>Hazelnut oil</th>
<th>Maize oil</th>
<th>Mustard -seed oil</th>
<th>Palm oil</th>
<th>Palm oil with a higher oleic acid</th>
<th>Palm kernel oil</th>
<th>Palm kernel olein²</th>
<th>Palm kernel stearin²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative density</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[x (°C)/water at 20°C]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(x°C/water at 20°C)</td>
<td>0.909-0.920</td>
<td>0.911-0.929</td>
<td>0.914-0.921</td>
<td>0.908-0.926</td>
<td>0.925-0.935</td>
<td>0.920-0.926</td>
<td>0.892-0.935</td>
<td>0.898-0.915</td>
<td>0.917-0.921</td>
<td>0.891-0.919</td>
<td>0.896-0.910</td>
<td>0.896-0.909</td>
<td>0.906-0.908</td>
<td>0.902-0.900</td>
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</tr>
<tr>
<td>x=20°C</td>
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<td></td>
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<td>ND</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>x=25°C</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0.889-0.895</td>
<td>0.904-0.907</td>
<td>0.904-0.906</td>
<td></td>
</tr>
<tr>
<td>x=25°C/water 25°C;</td>
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<td>ND</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Apparent density</strong></td>
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<td>ND</td>
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<td></td>
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<tr>
<td>(g/ml)</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>ND</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(mg KOH/g oil)</td>
<td>187-196</td>
<td>183-207</td>
<td>245-256</td>
<td>248-265</td>
<td>189-198</td>
<td>185-197</td>
<td>188-194</td>
<td>187-195</td>
<td>168-184</td>
<td>190-209</td>
<td>189-199</td>
<td>230-254</td>
<td>231-244</td>
<td>244-255</td>
<td></td>
</tr>
<tr>
<td><strong>Iodine value</strong></td>
<td>77-107</td>
<td>85-109</td>
<td>10-18</td>
<td>6.3-10.6</td>
<td>100-123</td>
<td>170-211</td>
<td>128-150</td>
<td>81-95</td>
<td>103-135</td>
<td>92-125</td>
<td>50.0-55.0</td>
<td>58-75</td>
<td>14.1-21.0</td>
<td>20.28-4.85</td>
<td></td>
</tr>
<tr>
<td>≤ 10</td>
<td>≤ 10</td>
<td>≤ 12</td>
<td>≤ 15</td>
<td>≤ 15</td>
<td>≤ 15</td>
<td>≤ 20</td>
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<td>≤ 10</td>
<td>≤ 10</td>
<td>≤ 10</td>
<td>&lt;15</td>
<td>&lt;15</td>
<td></td>
</tr>
<tr>
<td>Unsaponifiable matter (g/kg)</td>
<td>≤10</td>
<td>≤20</td>
<td>≤12</td>
<td>≤15</td>
<td>≤15</td>
<td>≤20</td>
<td>≤15</td>
<td>≤20</td>
<td>≤10</td>
<td>≤10</td>
<td>≤10</td>
<td>≤10</td>
<td>&lt;15</td>
<td>&lt;15</td>
<td></td>
</tr>
<tr>
<td>Stable carbon isotope ratio *</td>
<td>-13.71 to 16.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* See the following publications:

² Fractionated product from palm oil.
Table 2: Chemical and physical characteristics of crude vegetable oils (see Appendix of the Standard) (continued)

<table>
<thead>
<tr>
<th>Relative density (x² C/water at 20°C)</th>
<th>Palm olein²</th>
<th>Palm stearin ²</th>
<th>Palm super -olein²</th>
<th>Pistachio oil</th>
<th>Rape-seed oil</th>
<th>Rape-seed oil (low erucic acid)</th>
<th>Rice bran oil</th>
<th>Safflower -seed oil</th>
<th>Safflower -seed oil (high oleic acid)</th>
<th>Sesame -seed oil</th>
<th>Soya-bean oil</th>
<th>Sunflower -seed oil</th>
<th>Sunflower -seed oil (high oleic acid)</th>
<th>Sunflower -seed oil (mid-oleic acid)</th>
<th>Walnut oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.899-0.900 x=40º C</td>
<td>0.881-0.891 x=60º C</td>
<td>0.900-0.920 x=60º C</td>
<td>0.915-0.920 15.5°C</td>
<td>0.910-0.920 x=20º C</td>
<td>0.914-0.920 x=20º C</td>
<td>0.910-0.920 x=20º C</td>
<td>0.910-0.927 x=20º C</td>
<td>0.913-0.919 x=20º C</td>
<td>0.919-0.923 x=20º C</td>
<td>0.918-0.923 x=20º C</td>
<td>0.918-0.915 x=20º C</td>
<td>0.924-0.925 x=25º C</td>
<td>0.923-0.925 x=25º C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.898-0.900 at 40º C</td>
<td>0.885-0.890 at 60º C</td>
<td>0.900-0.910 at 60º C</td>
<td>1.458-1.459 15.5°C</td>
<td>1.467-1.470 x=25º C</td>
<td>1.465-1.466 x=25º C</td>
<td>1.467-1.470 x=25º C</td>
<td>1.467-1.470 x=25º C</td>
<td>1.467-1.470 x=25º C</td>
<td>1.467-1.471 x=25º C</td>
<td>1.467-1.471 x=25º C</td>
<td>1.467-1.471 x=25º C</td>
<td>1.467-1.471 x=25º C</td>
<td>1.472-1.475 at 25º C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.460-1.460 at 60º C</td>
<td>1.459-1.470 at 60º C</td>
<td>1.467-1.470 at 60º C</td>
<td>1.465-1.466 x=25º C</td>
<td>1.465-1.466 x=25º C</td>
<td>1.465-1.470 x=25º C</td>
<td>1.465-1.470 x=25º C</td>
<td>1.465-1.470 x=25º C</td>
<td>1.465-1.470 x=25º C</td>
<td>1.465-1.470 x=25º C</td>
<td>1.465-1.470 x=25º C</td>
<td>1.465-1.470 x=25º C</td>
<td>1.465-1.470 x=25º C</td>
<td>1.467-1.471 at 40º C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>184-98</td>
<td>94-120</td>
<td>105-126</td>
<td>126-115</td>
<td>136-148</td>
<td>80-100</td>
<td>104-120</td>
<td>124-139</td>
<td>118-141</td>
<td>78-90</td>
<td>94-122</td>
<td>132-162</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>48</td>
<td>60</td>
<td>84-98</td>
<td>94-120</td>
<td>105-126</td>
<td>126-115</td>
<td>136-148</td>
<td>80-100</td>
<td>104-120</td>
<td>124-139</td>
<td>118-141</td>
<td>78-90</td>
<td>94-122</td>
<td>132-162</td>
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</tr>
<tr>
<td>13</td>
<td>9</td>
<td>13</td>
<td>≤ 30</td>
<td>≤ 20</td>
<td>≤ 20</td>
<td>≤ 65</td>
<td>≤ 15</td>
<td>≤ 10</td>
<td>≤ 20</td>
<td>≤ 15</td>
<td>≤ 15</td>
<td>≤ 15</td>
<td>≤ 15</td>
<td>≤ 15</td>
<td>≤ 20</td>
</tr>
</tbody>
</table>

² Fractionated product from palm oil.
Table 3: Levels of desmethylsterols in crude vegetable oils from authentic samples\(^1\) as a percentage of total sterols (see Appendix 1 of the Standard)

<table>
<thead>
<tr>
<th></th>
<th>Arachis oil</th>
<th>Almond oil</th>
<th>Babassu oil</th>
<th>Coconut oil</th>
<th>Cottonseed oil</th>
<th>Flaxseed/linseed oil</th>
<th>Grape-seed oil</th>
<th>Hazelnut oil</th>
<th>Maize oil</th>
<th>Palm oil</th>
<th>Palm oil with a higher oleic acid</th>
<th>Palm kernel oil</th>
<th>Palm kernel olein(^2)</th>
<th>Palm kernel stearin(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol</td>
<td>ND-3.8</td>
<td>ND - 1.0</td>
<td>ND-3.0</td>
<td>0.7-2.3</td>
<td>ND</td>
<td>ND-0.5</td>
<td>ND - 1.1</td>
<td>0.2-0.6</td>
<td>2.6-6.7</td>
<td>1.7-4.7</td>
<td>2.6-7.0</td>
<td>0.6-3.7</td>
<td>1.5-1.9</td>
<td>1.4-1.7</td>
</tr>
<tr>
<td>Brassicasterol</td>
<td>ND-0.2</td>
<td>ND - 0.3</td>
<td>ND-0.3</td>
<td>0.1 - 0.3</td>
<td>ND - 1.0</td>
<td>ND-0.2</td>
<td>ND</td>
<td>ND-0.2</td>
<td>ND-0.4</td>
<td>ND-0.8</td>
<td>ND-2.2</td>
<td>ND-0.2</td>
<td>ND-0.2</td>
<td>ND-2.2</td>
</tr>
<tr>
<td>Campesterol</td>
<td>12.0-19.8</td>
<td>2.0 - 5.0</td>
<td>17.7-18.7</td>
<td>6.0-11.2</td>
<td>6.4 - 14.5</td>
<td>25.0 - 31.0</td>
<td>7.5-14.0</td>
<td>3.0 - 6.2</td>
<td>16.0 - 24.1</td>
<td>18.7-27.5</td>
<td>16.6-21.9</td>
<td>12.5-39.0</td>
<td>8.4-12.7</td>
<td>7.9-9.1</td>
</tr>
<tr>
<td>Stigmasterol</td>
<td>5.4-13.2</td>
<td>0.4 - 4.0</td>
<td>8.7-9.2</td>
<td>11.4-15.6</td>
<td>2.1 - 6.8</td>
<td>7.0 - 9.0</td>
<td>7.5-12.0</td>
<td>ND - 2.0</td>
<td>4.3-8.0</td>
<td>8.5-13.9</td>
<td>11.2-15.5</td>
<td>7.0-18.9</td>
<td>12.0-16.6</td>
<td>13.4-14.7</td>
</tr>
<tr>
<td>Beta-sitosterol</td>
<td>47.4-69.0</td>
<td>73.0 - 86.0</td>
<td>48.2-53.9</td>
<td>32.6-50.7</td>
<td>76.0 - 87.1</td>
<td>45.0 - 53.0</td>
<td>64.0-70.0</td>
<td>76.45 - 96.0</td>
<td>54.8-66.6</td>
<td>50.2-62.1</td>
<td>57.2-67.0</td>
<td>45.0-71.0</td>
<td>62.6-73.1</td>
<td>67.1-69.2</td>
</tr>
<tr>
<td>Delta-5-avenasterol</td>
<td>5.0-18.8</td>
<td>5.0 - 14.0</td>
<td>16.9-20.4</td>
<td>20.0-40.7</td>
<td>1.8 - 7.3</td>
<td>8.0 - 12.0</td>
<td>1.0-3.5</td>
<td>1.0 - 5.1</td>
<td>1.5-8.2</td>
<td>ND-2.8</td>
<td>ND-1.9</td>
<td>ND-3.0</td>
<td>1.4-9.0</td>
<td>3.3-4.6</td>
</tr>
<tr>
<td>Delta-7-stigmasterol</td>
<td>ND-5.1</td>
<td>ND - 3.0</td>
<td>ND</td>
<td>ND-3.0</td>
<td>ND-1.4</td>
<td>ND</td>
<td>ND-0.5</td>
<td>ND-4.3</td>
<td>0.2-4.2</td>
<td>ND-0.2</td>
<td>ND-3.0</td>
<td>ND-6.0</td>
<td>ND-2.1</td>
<td>ND-0.6</td>
</tr>
<tr>
<td>Delta-7-avenasterol</td>
<td>ND-5.5</td>
<td>ND - 3.0</td>
<td>0.4-1.0</td>
<td>ND-3.0</td>
<td>0.8-3.3</td>
<td>ND</td>
<td>ND-1.6</td>
<td>0.3-2.7</td>
<td>ND-5.1</td>
<td>ND-1.0</td>
<td>ND-6.0</td>
<td>ND-1.4</td>
<td>ND-0.5</td>
<td>ND-0.3</td>
</tr>
<tr>
<td>Others</td>
<td>ND-1.4</td>
<td>ND - 6.0</td>
<td>ND-3.6</td>
<td>ND-1.5</td>
<td>ND-5.1</td>
<td>ND</td>
<td>ND-2.4</td>
<td>ND-3.8</td>
<td>ND-10.4</td>
<td>ND-2.7</td>
<td>2.9-3.7</td>
<td>1.0-3.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sterols (mg/kg)</td>
<td>900-2900</td>
<td>1590 - 4590</td>
<td>500-800</td>
<td>400-1200</td>
<td>2700-6400</td>
<td>2300-6900</td>
<td>2000-7000</td>
<td>1200-1800</td>
<td>700-2210</td>
<td>300-700</td>
<td>519-1723</td>
<td>270-800</td>
<td>700-1400</td>
<td>816-1339</td>
</tr>
</tbody>
</table>

\(^1\) Data taken from species as listed in Section 2.
\(^2\) Fractionated product from palm oil.
<table>
<thead>
<tr>
<th></th>
<th>Palm stearin(^2)</th>
<th>Palm superolein(^2)</th>
<th>Pistachio oil</th>
<th>Rapeseed oil (low erucic acid)</th>
<th>Rice bran oil</th>
<th>Safflower-seed oil</th>
<th>Safflower-seed oil (high oleic acid)</th>
<th>Sesame-seed oil</th>
<th>Soyabean oil</th>
<th>Sunflower-seed oil</th>
<th>Sunflower-seed oil (high oleic acid)</th>
<th>Sunflower-seed oil (mid-oleic acid)</th>
<th>Walnut oil</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cholesterol</strong></td>
<td>2.5-5.0</td>
<td>2.0-3.5</td>
<td>ND – 1.0</td>
<td>ND-1.3</td>
<td>ND-0.7</td>
<td>ND-0.5</td>
<td>0.1-0.5</td>
<td>0.2-1.4</td>
<td>ND-0.7</td>
<td>ND-0.5</td>
<td>0.1-0.2</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Brassicasterol</strong></td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>5.0-13.0</td>
<td>ND-0.3</td>
<td>ND-0.4</td>
<td>ND-2.2</td>
<td>0.1-0.2</td>
<td>ND-0.3</td>
<td>ND-0.2</td>
<td>ND-0.3</td>
<td>ND-0.1</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Campesterol</strong></td>
<td>15.0-26.0</td>
<td>22.0-26.0</td>
<td>4.0 - 6.5</td>
<td>24.7-38.6</td>
<td>11.0 – 35.0</td>
<td>9.2-13.3</td>
<td>8.9-19.9</td>
<td>10.1-20.0</td>
<td>15.8-24.2</td>
<td>6.5-13.0</td>
<td>5.0-13.0</td>
<td>9.1-9.6</td>
<td>4.0 - 6.5</td>
</tr>
<tr>
<td><strong>Stigmasterol</strong></td>
<td>9.0-15.0</td>
<td>18.2-20.0</td>
<td>0.5 - 7.5</td>
<td>0.2-1.0</td>
<td>6.0 – 40.0</td>
<td>4.5-9.6</td>
<td>2.9-8.9</td>
<td>3.4-12.0</td>
<td>14.9-19.1</td>
<td>6.0-13.0</td>
<td>4.5-13.0</td>
<td>9.0-9.3</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Beta-sitosterol</strong></td>
<td>50.0-60.0</td>
<td>55.0-70.0</td>
<td>75.0 – 94.0</td>
<td>45.1-57.9</td>
<td>25.0 – 67.0</td>
<td>40.2-50.6</td>
<td>40.1-66.9</td>
<td>57.7-61.9</td>
<td>47.0-60</td>
<td>50-70</td>
<td>42.0-70</td>
<td>56-58</td>
<td>70.0 - 92.0</td>
</tr>
<tr>
<td><strong>Delta-5-avenasterol</strong></td>
<td>ND-3.0</td>
<td>0-1.0</td>
<td>6.0 - 8.0</td>
<td>2.5-6.6</td>
<td>ND – 9.9</td>
<td>0.8-4.8</td>
<td>0.2-8.9</td>
<td>6.2-7.8</td>
<td>1.5-3.7</td>
<td>ND-6.9</td>
<td>1.5-6.9</td>
<td>4.8-5.3</td>
<td>0.5 - 6.0</td>
</tr>
<tr>
<td><strong>Delta-7-stigmastenol</strong></td>
<td>ND-3.0</td>
<td>0-0.3</td>
<td>ND - 0.7</td>
<td>ND-1.3</td>
<td>ND – 14.1</td>
<td>13.7-24.6</td>
<td>3.4-16.4</td>
<td>0.5-7.6</td>
<td>1.4-5.2</td>
<td>6.5-24.0</td>
<td>6.5-24.0</td>
<td>7.7-7.9</td>
<td>ND - 3.0</td>
</tr>
<tr>
<td><strong>Delta-7-avenasterol</strong></td>
<td>ND-3.0</td>
<td>0-0.3</td>
<td>ND - 0.5</td>
<td>ND-0.8</td>
<td>ND – 4.4</td>
<td>2.2-6.3</td>
<td>ND-8.3</td>
<td>1.2-5.6</td>
<td>1.0-4.6</td>
<td>3.0-7.5</td>
<td>ND-9.0</td>
<td>4.3-4.4</td>
<td>ND - 2.0</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>ND-5.0</td>
<td>0-2.0</td>
<td>ND</td>
<td>ND-4.2</td>
<td>7.5-12.8</td>
<td>0.5-6.4</td>
<td>4.4-11.9</td>
<td>0.7-9.2</td>
<td>ND-1.8</td>
<td>ND-5.3</td>
<td>3.5-9.5</td>
<td>5.4-5.8</td>
<td>ND</td>
</tr>
<tr>
<td><strong>Total sterols</strong></td>
<td>250-500</td>
<td>100</td>
<td>1840 - 4500</td>
<td>4500-11300</td>
<td>10500-31000</td>
<td>2100-4600</td>
<td>2000-4100</td>
<td>4500-1900(^*)</td>
<td>1800-4500</td>
<td>2400-5000</td>
<td>1700-5200</td>
<td>500 – 1760</td>
<td>ND</td>
</tr>
</tbody>
</table>

ND - Non-detectable, defined as ≤ 0.05%

\(^1\) Data taken from species as listed in Section 2.

\(^2\) Fractionated product from palm oil.
Table 4: Levels of tocopherols and tocotrienols in crude vegetable oils from authentic samples \(^1\) (mg/kg) (see Appendix 1 of the Standard)

<table>
<thead>
<tr>
<th></th>
<th>Arachis oil</th>
<th>Almond oil</th>
<th>Babassu oil</th>
<th>Coconut oil</th>
<th>Cottonseed oil</th>
<th>Flaxseed/linseed oil</th>
<th>Grape-seed oil</th>
<th>Hazelnut oil</th>
<th>Maize oil</th>
<th>Palm oil</th>
<th>Palm oil with a higher oleic acid</th>
<th>Palm kernel oil</th>
<th>Palm kernel oil(^2)</th>
<th>Palm kernel stearin(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha-tocopherol</td>
<td>49-373</td>
<td>20 - 545</td>
<td>ND</td>
<td>ND-17</td>
<td>136-674</td>
<td>2 - 265</td>
<td>16-38</td>
<td>100 - 420</td>
<td>23-573</td>
<td>4-193</td>
<td>49-188</td>
<td>30-280</td>
<td>ND-11</td>
<td>ND-10</td>
</tr>
<tr>
<td>Beta-tocopherol</td>
<td>ND-41</td>
<td>ND - 10</td>
<td>ND</td>
<td>ND-11</td>
<td>ND-29</td>
<td>ND</td>
<td>ND-89</td>
<td>6 - 12</td>
<td>ND-356</td>
<td>ND</td>
<td>ND-234</td>
<td>ND-250</td>
<td>ND-6</td>
<td>ND-2</td>
</tr>
<tr>
<td>Gamma-tocopherol</td>
<td>88-389</td>
<td>ND -104</td>
<td>ND-14</td>
<td>138-746</td>
<td>100 - 712</td>
<td>18 - 194</td>
<td>268-2468</td>
<td>ND-526</td>
<td>4-138</td>
<td>ND-100</td>
<td>ND-257</td>
<td>ND-3</td>
<td>ND-1</td>
<td></td>
</tr>
<tr>
<td>Delta-tocopherol</td>
<td>ND-22</td>
<td>ND - 5</td>
<td>ND</td>
<td>ND-21</td>
<td>ND - 14</td>
<td>ND - 10</td>
<td>23-75</td>
<td>ND-123</td>
<td>ND-31</td>
<td>ND-100</td>
<td>ND-4</td>
<td>ND-4</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Alpha-tocotrienol</td>
<td>ND</td>
<td>ND</td>
<td>25-46</td>
<td>ND-44</td>
<td>ND</td>
<td>ND</td>
<td>18-107</td>
<td>ND-239</td>
<td>4-336</td>
<td>74-256</td>
<td>50-500</td>
<td>ND-70</td>
<td>ND-73</td>
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<td>14-710</td>
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<td>20-700</td>
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<td>Delta-tocotrienol</td>
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<td>ND</td>
<td>9-10</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND-3.2</td>
<td>ND-20</td>
<td>33-86</td>
<td>40-120</td>
<td>ND-2</td>
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<tr>
<td>Total (mg/kg)</td>
<td>170-1300</td>
<td>20 - 600</td>
<td>60-130</td>
<td>ND-50</td>
<td>380-1200</td>
<td>150 - 905</td>
<td>240-410</td>
<td>200 - 600</td>
<td>330-3720</td>
<td>150-1500</td>
<td>562-1417</td>
<td>300-1800</td>
<td>ND-90</td>
<td>ND-8</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Palm stearin(^2)</th>
<th>Palm superolein(^2)</th>
<th>Pistachio oil</th>
<th>Rapeseed oil (low erucic acid)</th>
<th>Rice bran oil</th>
<th>Safflower-seed oil (high oleic acid)</th>
<th>Sesame seed oil</th>
<th>Soyabean oil</th>
<th>Sunflower-seed oil</th>
<th>Sunflower-seed oil (high oleic acid)</th>
<th>Sunflower-seed oil (mid-oleic acid)</th>
<th>Walnut oil</th>
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<tbody>
<tr>
<td>Alpha-tocopherol</td>
<td>ND-100</td>
<td>130-240</td>
<td>10 - 330</td>
<td>100-386</td>
<td>49-583</td>
<td>234-660</td>
<td>ND-3.3</td>
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<td>403-935</td>
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<td>ND</td>
<td>ND-36</td>
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<td>89-2307</td>
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<td>ND - 50</td>
<td>ND-22</td>
<td>ND-31</td>
<td>ND-6</td>
<td>4-21</td>
<td>154-932</td>
<td>ND-7.0</td>
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<td>ND-1.6</td>
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<td>ND-69</td>
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</table>

\(^1\) Data taken from species as listed in Section 2.

\(^2\) Fractionated product from palm oil.
Data taken from species as listed in Section 2.

Fractionated product from palm oil.

<table>
<thead>
<tr>
<th>Total (mg/kg)</th>
<th>100-700</th>
<th>400-1400</th>
<th>100-600</th>
<th>430-2680</th>
<th>191-2349</th>
<th>240-670</th>
<th>250-700</th>
<th>330-1010</th>
<th>600-3370</th>
<th>440-1520</th>
<th>450-1120</th>
<th>509-741</th>
<th>309-455</th>
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<tbody>
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</tbody>
</table>

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