



**INTERNATIONAL  
OLIVE  
COUNCIL**

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**TRADE STANDARD APPLYING TO OLIVE OILS**  
**AND OLIVE-POMACE OILS**

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**RESOLUTION NO. RES-1/94-V/06**

**TRADE STANDARD APPLYING TO OLIVE OILS  
AND OLIVE-POMACE OILS**

**THE COUNCIL OF MEMBERS OF THE INTERNATIONAL OLIVE  
COUNCIL,**

**Having regard** to Resolution no. RES-3/89-IV/03 of 5 December 2003 whereby the Council adopted the trade standard applying to olive oils and olive-pomace oils referenced COI/T.15/NC no. 3/Rev. 1 pursuant to Decision no. DEC-7/88-IV/03 of 25 June 2003 concerning the amendment of article 26, paragraph 1 of the International Agreement on Olive Oil and Table Olives, 1986, as amended and extended, 1993, and last prolonged, 2004,

**Having regard** to the duly justified method for the *Determination of the percentage of 2-glyceryl monopalmitate* (COI/T.20/Doc. no. 23) which was proposed by the Technical Committee at its first meeting, held on the occasion of the 94<sup>th</sup> session,

**Having regard** to the recommendation of the Technical Committee to lower the limit for the stigmastadiene content of edible virgin olive oils in order to guarantee their quality,

**Having regard** to the recommendation of the Technical Committee to delete the reference to ISO standard 12228 for the *Determination of the sterol composition and total sterol content*,

**Whereas** it is necessary to amend sections 3.6, 3.7, 11.5 and 11.11 of the trade standard accordingly,

**DECIDES**

The trade standard applying to olive oils and olive-pomace oils, COI/T.15/NC no. 3/Rev. 2 of 24 November 2006, shall replace and rescind the trade standard applying to olive oils and olive-pomace oils, COI/T.15/NC no. 3/Rev. 1 of 5 December 2003.

The Members shall take whatever measures are appropriate, in the manner required by their legislation, to apply the standard adopted and shall notify the Executive Secretariat of any such measures as soon as they are taken.

The non-Member States involved in international trade in olive oils and olive-pomace oils shall be invited to take into consideration the standard adopted and to adapt their regulations to the provisions thereof.

Madrid (Spain), 24 November 2006.

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**TRADE STANDARD APPLYING TO OLIVE OILS  
AND OLIVE-POMACE OILS**

**1. SCOPE**

This standard applies to olive oils and olive-pomace oils that are the object of international trade or of concessional or food aid transactions.

**2. DESIGNATIONS AND DEFINITIONS**

**2.1.** **Olive oil** is the oil obtained solely from the fruit of the olive tree (*Olea europaea* L.), to the exclusion of oils obtained using solvents or re-esterification processes and of any mixture with oils of other kinds. It is marketed in accordance with the following designations and definitions:

**2.1.1.** **Virgin olive oils** are the oils obtained from the fruit of the olive tree solely by mechanical or other physical means under conditions, particularly thermal conditions, that do not lead to alterations in the oil, and which have not undergone any treatment other than washing, decantation, centrifugation and filtration.

**2.1.1.1.** **Virgin olive oils fit for consumption as they are include:**

(i) **Extra virgin olive oil:** virgin olive oil which has a free acidity, expressed as oleic acid, of not more than 0.8 grams per 100 grams, and the other characteristics of which correspond to those fixed for this category in this standard.

(ii) Virgin olive oil: virgin olive oil which has a free acidity, expressed as oleic acid, of not more than 2 grams per 100 grams and the other characteristics of which correspond to those fixed for this category in this standard.

(iii) Ordinary virgin olive oil: virgin olive oil which has a free acidity, expressed as oleic acid, of not more than 3.3 grams per 100 grams and the other characteristics of which correspond to those fixed for this category in this standard.<sup>1/</sup>

**2.1.1.2.** Virgin olive oil not fit for consumption as it is, designated lampante virgin olive oil, is virgin olive oil which has a free acidity, expressed as oleic acid, of more than 3.3 grams per 100 grams and/or the organoleptic characteristics and other characteristics of which correspond to those fixed for this category in this standard. It is intended for refining or for technical use.

**2.1.2.** Refined olive oil is the olive oil obtained from virgin olive oils by refining methods which do not lead to alterations in the initial glyceridic structure. It has a free acidity, expressed as oleic acid, of not more than 0.3 grams per 100 grams and its other characteristics correspond to those fixed for this category in this standard.<sup>2/</sup>

**2.1.3.** Olive oil is the oil consisting of a blend of refined olive oil and virgin olive oils fit for consumption as they are. It has a free acidity, expressed as oleic acid, of not more than 1 gram per 100 grams and its other characteristics correspond to those fixed for this category in this standard.<sup>3/</sup>

**2.2.** Olive-pomace oil is the oil obtained by treating olive pomace with solvents or other physical treatments, to the exclusion of oils obtained by re-esterification processes and of any mixture with oils of other kinds. It is marketed in accordance with the following designations and definitions:

**2.2.1.** Crude olive-pomace oil is olive-pomace oil whose characteristics correspond to those fixed for this category in this standard. It is intended for refining for use for human consumption, or it is intended for technical use.

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<sup>1/</sup> This designation may only be sold direct to the consumer if permitted in the country of retail sale. If not permitted, the designation of this product shall comply with the legal provisions of the country concerned.

<sup>2/</sup> This designation may only be sold direct to the consumer if permitted in the country of retail sale.

<sup>3/</sup> The country of retail sale may require a more specific designation.

**2.2.2. Refined olive-pomace oil** is the oil obtained from crude olive-pomace oil by refining methods which do not lead to alterations in the initial glyceridic structure. It has a free acidity, expressed as oleic acid, of not more than 0.3 grams per 100 grams and its other characteristics correspond to those fixed for this category in this standard.<sup>1/</sup>

**2.2.3. Olive-pomace oil** is the oil comprising the blend of refined olive-pomace oil and virgin olive oils fit for consumption as they are. It has a free acidity of not more than 1 gram per 100 grams and its other characteristics correspond to those fixed for this category in this standard.<sup>2/</sup> In no case shall this blend be called "olive oil".

### 3. **PURITY CRITERIA**

The identity characteristics comprising the purity criteria shall be applicable to olive oils and olive-pomace oils.

The limits established for each criterion include the precision values of the attendant recommended method.

#### 3.1. **Fatty acid composition as determined by gas chromatography** (% m/m methyl esters):

- Myristic acid	≤ 0.05
- Palmitic acid	7.5 - 20.0
- Palmitoleic acid	0.3 - 3.5
- Heptadecanoic acid	≤ 0.3
- Heptadecenoic acid	≤ 0.3
- Stearic acid	0.5 - 5.0
- Oleic acid	55.0 - 83.0
- Linoleic acid	3.5 - 21.0
- Linolenic acid	≤ 1.0
- Arachidic acid	≤ 0.6
- Gadoleic acid (eicosenoic)	≤ 0.4
- Behenic acid	≤ 0.2*
- Lignoceric acid	≤ 0.2

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<sup>1/</sup> This product may only be sold direct to the consumer if permitted in the country of retail sale.

<sup>2/</sup> The country of retail sale may require a more specific designation.

\* Limit raised to ≤ 0.3 for olive-pomace oils.

**3.2. Trans fatty acid content (% *trans* fatty acids)**

	C18:1 T %	C18:2 T + C18:3 T %
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- Edible virgin olive oils	≤ 0.05	≤ 0.05
- Lampante virgin olive oil	≤ 0.10	≤ 0.10
- Refined olive oil	≤ 0.20	≤ 0.30
- Olive oil	≤ 0.20	≤ 0.30
- Crude olive-pomace oil	≤ 0.20	≤ 0.10
- Refined olive-pomace oil	≤ 0.40	≤ 0.35
- Olive-pomace oil	≤ 0.40	≤ 0.35

**3.3. Sterol and triterpene dialcohol composition**

**3.3.1. Desmethylsterol composition (% total sterols)**

- Cholesterol	≤ 0.5
- Brassicasterol	≤ 0.1 *
- Campesterol	≤ 4.0
- Stigmasterol	< campesterol in edible oils
- Delta-7-stigmastenol	≤ 0.5
- Beta-sitosterol + delta-5-avenasterol + delta-5-23-stigmastadienol + clerosterol + sitostanol + delta 5-24-stigmastadienol	≥ 93.0

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\* Limit raised to ≤ 0.2 for olive-pomace oils.

**3.3.2. Total sterol content (mg/kg)**

- Virgin olive oils	}	$\geq 1000$
- Refined olive oil		
- Olive oil		
- Crude olive-pomace oil		$\geq 2500$
- Refined olive-pomace oil		$\geq 1800$
- Olive-pomace oil		$\geq 1600$

**3.3.3. Erythrodiol and uvaol content (% total sterols)**

- Edible virgin olive oils	$\leq 4.5$
- Lampante virgin olive oil	$\leq 4.5^{1/}$
- Refined olive oil	$\leq 4.5$
- Olive oil	$\leq 4.5$
- Crude olive-pomace oil	$> 4.5^{2/}$
- Refined olive-pomace oil	$> 4.5$
- Olive-pomace oil	$> 4.5$

**3.4. Wax content C40 + C42 + C44 + C46 (mg/kg)**

- Edible virgin olive oils	$\leq 250$
- Lampante virgin olive oil	$\leq 300^{1/}$
- Refined olive oil	$\leq 350$
- Olive oil	$\leq 350$
- Crude olive-pomace oil	$> 350^{2/}$
- Refined olive-pomace oil	$> 350$
- Olive-pomace oil	$> 350$

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<sup>1/</sup> When the oil has a wax content between 300 mg/kg and 350 mg/kg it is considered a lampante virgin olive oil if the total aliphatic alcohol content is  $\leq 350$  mg/kg or the erythrodiol + uvaol content is  $\leq 3.5\%$ .

<sup>2/</sup> When the oil has a wax content between 300 mg/kg and 350 mg/kg it is considered a crude olive-pomace oil if the total aliphatic alcohol content is  $> 350$  mg/kg and the erythrodiol + uvaol content is  $> 3.5\%$ .



**3.5. Maximum difference between the actual and theoretical ECN 42 triacylglycerol content**

- Edible virgin olive oils	0.2
- Lampante virgin olive oil	0.3
- Refined olive oil	0.3
- Olive oil	0.3
- Crude olive-pomace oil	0.6
- Refined olive-pomace oil	0.5
- Olive-pomace oil	0.5

**3.6. Stigmastadiene content (mg/kg)**

- Edible virgin olive oils	$\leq 0.10$
- Lampante virgin olive oil	$\leq 0.50$

**3.7. Content of 2-glyceryl monopalmitate**

- Edible virgin olive oils and olive oil:	
	C:16:0 $\leq 14.0\%$ ; 2P $\leq 0.9\%$
	C:16:0 $> 14.0\%$ , 2P $\leq 1.0\%$
- Non-edible virgin olive oils and refined olive oils:	
	C:16:0 $\leq 14.0\%$ ; 2P $\leq 0.9\%$
	C:16:0 $> 14.0\%$ , 2P $\leq 1.1\%$
- Olive-pomace oils	$\leq 1.2\%$
- Crude and refined olive-pomace oils	$\leq 1.4\%$

**3.8. Unsaponifiable matter (g/kg)**

- Olive oils	$\leq 15$
- Olive-pomace oils	$\leq 30$



#### 4. QUALITY CRITERIA

The limits established for each criterion and designation include the precision values of the attendant recommended method

	Extra virgin olive oil	Virgin olive oil	Ordinary virgin olive oil	Lampante virgin olive oil *	Refined olive oil	Olive oil	Crude olive-pomace oil	Refined olive-pomace oil	Olive-pomace oil
4.1. <u>Organoleptic characteristics</u>									
- odour and taste					acceptable	good		acceptable	good
- odour and taste (on a continuous scale):									
. median of defect	Me = 0	0 < Me ≤ 2.5	2.5 < Me ≤ 6.0**	Me > 6.0					
. median of the fruity attribute	Me > 0	Me > 0			light yellow	light, yellow to green		light, yellow to brownish yellow	light, yellow to green
- colour									
- aspect at 20°C for 24 hours					limpid	limpid		limpid	limpid
4.2. <u>Free acidity</u> % m/m expressed in oleic acid	≤ 0.8	≤ 2.0	≤ 3.3	> 3.3	≤ 0.3	≤ 1.0	no limit	≤ 0.3	≤ 1.0
4.3. <u>Peroxide value</u> in milleq. Peroxide oxygen per kg/oil	≤ 20	≤ 20	≤ 20	no limit	≤ 5	≤ 15	no limit	≤ 5	≤ 15

\* It is not obligatory for the criteria in 4.1, 4.2 and 4.3 to be concurrent; one is sufficient.

\*\* Or when the median of the defect is less than or equal to 2.5 and the median of the fruity attribute is equal to 0.

**4. QUALITY CRITERIA (contd.)**

	Extra virgin olive oil	Virgin olive oil	Ordinary virgin olive oil	Lampante virgin olive oil	Refined olive oil	Olive oil	Crude olive-pomace oil	Refined olive-pomace oil	Olive-pomace oil
4.4. <u>Absorbency in ultra-violet</u> (K <sup>1%</sup> <sub>1cm</sub> )									
- 270 nm	≤ 0.22	≤ 0.25	≤ 0.30 ***		≤ 1.10	≤ 0.90		≤ 2.00	≤ 1.70
- Δ K	≤ 0.01	≤ 0.01	≤ 0.01		≤ 0.16	≤ 0.15		≤ 0.20	≤ 0.18
- 232 nm*	≤ 2.50**	≤ 2.60**							
4.5. <u>Moisture and volatile matter</u> (% m/m)	≤ 0.2	≤ 0.2	≤ 0.2	≤ 0.3	≤ 0.1	≤ 0.1	≤ 1.5	≤ 0.1	≤ 0.1
4.6. <u>Insoluble impurities in light petroleum</u> % m/m	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.2	≤ 0.05	≤ 0.05		≤ 0.05	≤ 0.05
4.7. <u>Flash point</u>	-	-	-	-	-	-	≥ 120°C	-	-
4.8. <u>Trace metals</u> mg/kg									
Iron	≤ 3.0	≤ 3.0	≤ 3.0	≤ 3.0	≤ 3.0	≤ 3.0		≤ 3.0	≤ 3.0
Copper	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1	≤ 0.1		≤ 0.1	≤ 0.1

\* This determination is solely for application by commercial partners on an optional basis.

\*\* Commercial partners in the country of retail sale may require compliance with these limits when the oil is made available to the end consumer.

\*\*\* After passage of the sample through activated alumina, absorbency at 270 nm shall be equal to or less than 0.11.

**5. FOOD ADDITIVES**

**5.1. Virgin olive oils and crude olive-pomace oil:**

none permitted.

**5.2. Refined olive oil, olive oil, refined olive-pomace oil and olive-pomace oil:**  
alpha-tocopherol permitted to restore natural tocopherol lost in the refining process.

Maximum level: 200 mg/kg of total alpha-tocopherol in the final product.

**6. CONTAMINANTS**

**6.1. Heavy metals**

The products covered by 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

**6.2. Pesticide residues**

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

**6.3. Halogenated solvents**

- Maximum content of each halogenated solvent 0.1 mg/kg
- Maximum content of the sum of all halogenated solvents 0.2 mg/kg

## **7. HYGIENE**

**7.1.** It is recommended that the products intended for human consumption 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/RP 1-1969, Rev. 3 – 1997), and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

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

## **8. PACKING**

Olive oils and olive-pomace oils intended for international trade shall be packed in containers complying with the General Principles of Food Hygiene recommended by the Codex Alimentarius Commission (CAC/RCP 1 - 1969, Rev. 3 - 1997), and other relevant texts such as Codes of Hygienic Practice and Codes of Practice.

The containers used may be:

**8.1.** tanks, containers, vats, which permit the transportation in bulk of olive oils and olive-pomace oils;

**8.2.** metal drums, in good condition, hermetically-sealed, which should be internally covered with a suitable varnish;

**8.3.** metal tins and cans, lithographed, new, hermetically-sealed, which should be internally covered with a suitable varnish;

**8.4.** demi-johns, glass bottles or bottles made of suitable macromolecular material.

## **9. CONTAINER FILLING TOLERANCE**

The volume occupied by the contents shall under no circumstances be less than 90% of the capacity of the container, except in the case of tin containers with a capacity of, or less than, 1 litre in which the volume occupied shall under no circumstances be less than 80% of the capacity of the container; this capacity is equal to the volume of distilled water at 20°C which the container can hold when full.

## **10. LABELLING**

In addition to sections 2, 3, 7 and 8 of the Codex General Standard for the Labelling of Pre-packaged Foods (CODEX STAN 1-1985, Rev.1 - 1991) and the guidelines applying to food not intended for direct sale to consumers, the specific provisions providing the following information shall be applied:

### **10.1. On containers intended for direct sale to consumers**

#### **10.1.1. Name of the product**

The labelling on each container shall indicate the specific designation of the product contained, complying in every way with the relevant provisions of this standard.

##### **10.1.1.1. Designations of olive oils:**

- Extra virgin olive oil
- Virgin olive oil
- Ordinary virgin olive oil<sup>1/</sup>
- Refined olive oil<sup>1/</sup>
- Olive oil<sup>2/</sup>

##### **10.1.1.2. Designations of olive-pomace oils:**

- Refined olive-pomace oil<sup>1/</sup>
- Olive-pomace oil<sup>2/</sup>

#### **10.1.2. Net contents**

The net contents shall be declared by volume in the metric system ("Système International" units).

#### **10.1.3. Name and address**

The name and address of the manufacturer, packer, distributor, importer, exporter or seller shall be declared.

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<sup>1/</sup> This product may only be sold direct to the consumer if permitted in the country of retail sale.

<sup>2/</sup> The country of retail sale may require a more specific designation.

#### **10.1.4. Country of origin**

The name of the country of origin shall be declared. When the product undergoes substantial processing in a second country, the country in which such processing is carried out shall be considered as the country of origin for labelling purposes.

#### **10.1.5. Indications of source and appellations of origin**

##### **10.1.5.1. Indications of source**

The labels of virgin olive oils may indicate their source (country, region or locality) when they have been empowered to do so by their country of origin and when such virgin olive oils have been produced, packed and originate exclusively in the country, region or locality mentioned.

##### **10.1.5.2. Appellations of origin**

The labels of extra virgin olive oils may indicate their appellation of origin (country, region or locality) when they have been awarded such an appellation, in accordance with the terms provided under the regulations of their country of origin and when such extra virgin olive oil has been produced, packed and originates exclusively in the country, region or locality mentioned.

#### **10.1.6. Lot identification**

Each container shall be embossed or otherwise permanently marked in code or in clear to identify the producing factory and the lot.

#### **10.1.7. Date marking and storage conditions**

##### **10.1.7.1. Date of minimum durability**

In the case of pre-packaged products intended for the end consumer, the date of minimum durability (preceded by the words "best before end") shall be declared by the month and year in uncoded numerical sequence. The month may be indicated by letters in those countries where such use will not confuse the consumer; if the shelf life of the product is valid to December, the expression "end (stated year)" may be used as an alternative.

##### **10.1.7.2. Storage instructions**

Any special conditions for storage shall be declared on the label if the validity of the date of minimum durability depends thereon.



**10.2.** On forwarding packs of oils intended for human consumption

In addition to the details noted under section 10.1., the following inscription shall appear:

- number and type of containers held in pack.

**10.3.** On containers allowing the transportation in bulk of olive oils and olive-pomace oils

The labelling on each container shall include:

**10.3.1.** Name of the product

The name shall indicate the specific designation of the product contained, complying in every way with the provisions of this standard.

**10.3.2.** Net contents

The net contents shall be declared by weight or volume in the metric system ("Système International" units).

**10.3.3.** Name and address

The name and address of the manufacturer, distributor or exporter shall be declared.

**10.3.4.** Country of origin

The name of the exporting country shall be declared.

**11.** **METHODS OF ANALYSIS AND SAMPLING**

The methods of analysis and sampling given below are international referee methods. The latest version of these methods should be used.

**11.1.** Sampling

According to ISO 5555, "Animal and vegetable fats and oils - Sampling".

**11.2. Preparation of the test sample**

According to ISO 661, "Animal and vegetable fats and oils - Preparation of the test sample".

**11.3. Determination of the fatty acid composition**

According to COI/T.20/Doc. no. 24, "Preparation of the fatty acid methyl esters from olive oil and olive-pomace oil", and ISO 5508, "Analysis by gas chromatography of methyl esters of fatty acids" or AOCS Ch 2-91.

**11.4. Determination of the *trans* fatty acid content**

According to COI/T.20/Doc. no. 17, "Determination of *trans* unsaturated fatty acids by capillary column gas chromatography", or ISO 15304 or AOCS Ce 1f-96.

**11.5. Determination of the sterol composition and total sterol content**

According to COI/T.20/Doc. no. 10, "Determination of the composition and content of sterols by capillary-column gas chromatography", or AOCS Ch 6-91.

**11.6. Determination of the content of erythrodiol + uvaol**

According to IUPAC no. 2.431, "Determination of the erythrodiol content". Capillary columns are recommended.

**11.7. Determination of the wax content**

According to COI/T.20/Doc. no. 18/Rev. 2 "Determination of wax content by capillary-column gas chromatography" or AOCS Ch 8-02.

**11.8. Determination of the aliphatic alcohol content**

According to COI/T.20/Doc. no. 26 "Determination of aliphatic alcohols content by capillary gas chromatography".

**11.9. Determination of the difference between the actual and theoretical ECN 42 triacylglycerol content**

According to COI/T.20/Doc. no. 20, "Determination of the difference between actual and theoretical content of triacylglycerols with ECN 42", or AOCS 5b-89.

**11.10. Determination of the stigmastadiene content**

According to COI/T.20/Doc. no. 11, "Determination of stigmastadienes in vegetable oils", or COI/T.20/Doc. no. 16, "Determination of sterenes in refined vegetable oils", or ISO 15788-1 or AOCS Cd 26-96.

**11.11. Determination of the content of 2-glyceryl monopalmitate**

According to COI/T.20/Doc. no. 23, "Determination of the percentage of 2-glyceryl monopalmitate".

**11.12. Determination of the unsaponifiable matter**

According to ISO 3596, "Determination of the unsaponifiable matter – Method using diethyl ether extraction", or AOCS Ca 6b-53 or ISO 18609.

The results should be expressed in g/unsaponifiable matter per kg/oil.

**11.13. Determination of the organoleptic characteristics**

According to COI/T.20/Doc. no. 15, "Organoleptic assessment of virgin olive oil".

**11.14. Determination of the free acidity**

According to ISO 660, "Determination of acid value and acidity", or AOCS Cd 3d-63.

**11.15. Determination of the peroxide value**

According to ISO 3960, "Determination of the peroxide value", or AOCS Cd 8b-90.

**11.16. Determination of the absorbency in ultra-violet**

According to COI/T.20/Doc. no. 19, "Spectrophotometric investigation in the ultraviolet", or ISO 3656 or AOCS Cg 5-91.

**11.17. Determination of the moisture and volatile matter**

According to ISO 662, "Determination of the moisture and volatile matter".

**11.18. Determination of the insoluble impurities in light petroleum**

According to ISO 663, "Determination of the insoluble impurities".

**11.19. Determination of the flash point**

According to the FOSFA International method.

**11.20. Detection of trace metals**

According to ISO 8294, "Determination of copper, iron and nickel by direct graphite furnace atomic absorption spectrometry".

**11.21. Determination of the alpha-tocopherol**

According to ISO 9936, "Determination of tocopherols and tocotrienols contents – Method using high-performance liquid chromatography".

**11.22. Determination of traces of heavy metals**

- Determination of lead: according to ISO 12193 or AOCS Ca 18c-91 or AOAC 994.02.
- Determination of arsenic: according to AOAC 952.13 or AOAC 942.17 or AOAC 985.16.

**11.23. Detection of traces of halogenated solvents**

According to COI/T.20/Doc. no. 8 "Determination of tetrachloroethylene in olive oils by gas-liquid chromatography".

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