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**Essential oil of neroli (*Citrus aurantium* L., syn. *Citrus amara* Link, syn. *Citrus bigaradia* Loisel, syn. *Citrus vulgaris* Risso)**

*Huile essentielle de néroli bigaradier* (*Citrus aurantium* L., syn. *Citrus amara* Link, syn. *Citrus bigaradia* Loisel, syn. *Citrus vulgaris* Risso)

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 3517 was prepared by Technical Committee ISO/TC 54, *Essential oils*.

This third edition cancels and replaces the second edition (ISO 3517:2002), which has been technically revised.

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# Essential oil of neroli (*Citrus aurantium* L., syn. *Citrus amara* Link, syn. *Citrus bigaradia* Loisel, syn. *Citrus vulgaris* Risso)

## 1 Scope

This International Standard specifies certain characteristics of the essential oil of neroli (*Citrus aurantium* L., syn. *Citrus amara* Link, syn. *Citrus bigaradia* Loisel, syn. *Citrus vulgaris* Risso), cultivated principally in Tunisia, Morocco, and Egypt, in order to facilitate assessment of its quality.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TR 210, *Essential oils — General rules for packaging, conditioning and storage*

ISO/TR 211, *Essential oils — General rules for labelling and marking of containers*

ISO 212, *Essential oils — Sampling*

ISO 279, *Essential oils — Determination of relative density at 20 °C — Reference method*

ISO 280, *Essential oils — Determination of refractive index*

ISO 592, *Essential oils — Determination of optical rotation*

ISO 875, *Essential oils — Evaluation of miscibility with ethanol*

ISO 1242, *Essential oils — Determination of acid value*

ISO 11024 (all parts), *Essential oils — General guidance on chromatographic profiles*

ISO 22972, *Essential oils — Analysis by gas chromatography on chiral capillary columns — General method*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### essential oil of neroli

essential oil obtained by steam distillation or hydrodistillation of the flowers of *Citrus aurantium* L., syn. *Citrus amara* Link, syn. *Citrus bigaradia* Loisel, syn. *Citrus vulgaris* Risso, of the *Rutaceae* family

NOTE For information on the CAS number, see ISO/TR 21092.[2]

## 4 Requirements

### 4.1 Appearance

Clear mobile liquid.

## 4.2 Colour

Pale yellow to amber with a slight blue fluorescence.

## 4.3 Odour

Fresh, recalling that of orange blossom.

## 4.4 Relative density at 20 °C, $d_{20}^{20}$

Tunisia and Morocco		Egypt	
Minimum:	0,863	Minimum:	0,870
Maximum:	0,876	Maximum:	0,880

## 4.5 Refractive index at 20 °C

Tunisia and Morocco		Egypt	
Minimum:	1,464	Minimum:	1,465
Maximum:	1,474	Maximum:	1,472

## 4.6 Optical rotation at 20 °C

Tunisia and Morocco		Egypt	
Between +2° and +12°		Between +2° and +11°	

## 4.7 Miscibility with 85 % volume fraction ethanol at 20 °C

It shall not be necessary to use more than 3,5 volumes of 85 % volume fraction ethanol to obtain a clear solution with 1 volume of essential oil.

## 4.8 Acid value

Maximum: 2.

## 4.9 Chromatographic profile

Carry out the analysis of the essential oil by gas chromatography. Identify in the chromatogram obtained, the representative and characteristic components shown in Table 1. The proportions of these components, indicated by the integrator, shall be as shown in Table 1. This constitutes the chromatographic profile of the essential oil.

## 4.10 Chirality

Information on the chirality is given in Annex C.

## 4.11 Flashpoint

Information on the flashpoint is given in Annex B.

Table 1 — Chromatographic profile

Component	Tunisia and Morocco		Egypt	
	min. %	max. %	min. %	max. %
$\alpha$ -Pinene	n.d. <sup>a</sup>	2,0	n.d. <sup>a</sup>	2,0
Sabinene	n.d. <sup>a</sup>	3,0	n.d. <sup>a</sup>	3,0
$\beta$ -Pinene	5,0	17,0	2,0	8,0
Myrcene	1,0	4,0	1,0	4,0
Limonene	9,0	18,0	7,0	17,0
( <i>E</i> )- $\beta$ -Ocimene	3,0	9,0	3,0	9,0
Linalol	26,0	48,0	26,0	55,0
$\alpha$ -Terpineol	2,0	5,5	2,0	8,0
Linalyl acetate	1,5	15,0	3,0	20,0
Neryl acetate	n.d. <sup>a</sup>	2,5	n.d. <sup>a</sup>	7,0
Geranyl acetate	1,0	5,0	1,0	5,0
( <i>E</i> )-Nerolidol	1,0	5,0	0,5	5,0
(2 <i>E</i> ,6 <i>E</i> )-Farnesol	0,5	4,0	0,5	4,0
Nerol	0,9	1,2	0,5	2,0
Geraniol	2,5	3,1	1,0	5,0
Indole	0,1	0,3	n.d. <sup>a</sup>	0,5
Methyl anthranilate	0,1	1,0	n.d. <sup>a</sup>	1,0
NOTE The chromatographic profile is normative, contrary to typical chromatograms given for information in Annex A.				
<sup>a</sup> Not detectable.				

## 5 Sampling

Sampling shall be performed in accordance with ISO 212.

Minimum volume of the final sample: 30 ml.

NOTE This volume allows each of the tests specified in this International Standard to be carried out at least once.

## 6 Test methods

### 6.1 Relative density at 20 °C, $d_{20}^{20}$

Determine the relative density in accordance with ISO 279.

### 6.2 Refractive index at 20 °C

Determine the refractive index in accordance with ISO 280.

### 6.3 Optical rotation at 20 °C

Determine the optical rotation in accordance with ISO 592.

### 6.4 Miscibility in ethanol, 85 % volume fraction at 20 °C

Determine the miscibility in accordance with ISO 875.

### **6.5 Acid value**

Determine the acid value in accordance with ISO 1242.

### **6.6 Chromatographic profile**

Determine the chromatographic profile in accordance with ISO 11024.

### **6.7 Chirality**

Determine the chirality in accordance with ISO 22972.

## **7 Packaging, labelling and marking**

These items shall be in accordance with ISO/TR 210 and ISO/TR 211.

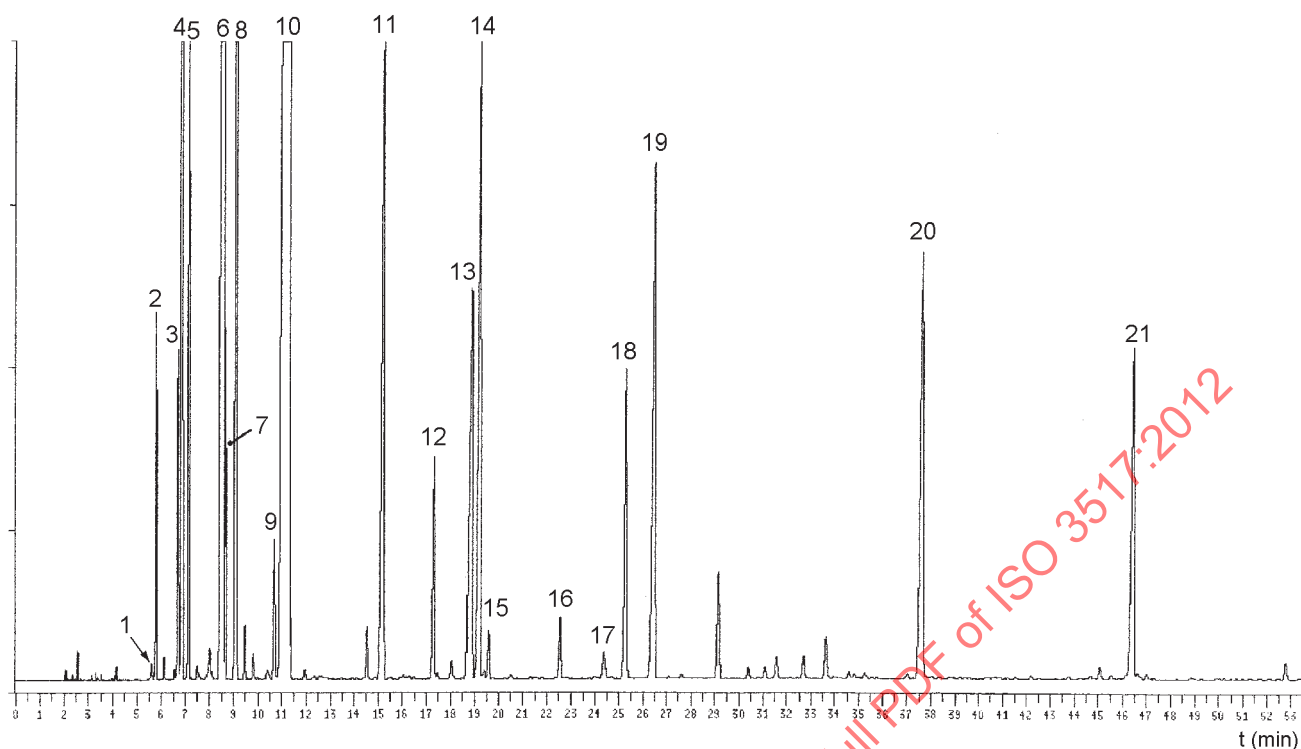
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**Annex A**  
(informative)

**Typical chromatograms of the analysis by gas chromatography of the essential oil of neroli (*Citrus aurantium* L., syn. *Citrus amara* Link, syn. *Citrus bigaradia* Loisel, syn. *Citrus vulgaris* Risso)**

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**Peak identification**

- |    |                              |
|----|------------------------------|
| 1  | $\alpha$ -Thujene            |
| 2  | $\alpha$ -Pinene             |
| 3  | Sabinene                     |
| 4  | $\beta$ -Pinene              |
| 5  | Myrcene                      |
| 6  | Limonene                     |
| 7  | (Z)- $\beta$ -Ocimene        |
| 8  | (E)- $\beta$ -Ocimene        |
| 9  | $\gamma$ -Terpinene          |
| 10 | Linalol + phenylacetonitrile |
| 11 | $\alpha$ -Terpineol          |
| 12 | Nerol                        |
| 13 | Geraniol                     |
| 14 | Linalyl acetate              |
| 15 | Indole                       |
| 16 | Methyl anthranilate          |
| 17 | Terpenyl acetate             |
| 18 | Neryl acetate                |
| 19 | Geranyl acetate              |
| 20 | (E)-Nerolidol                |
| 21 | (2E,6E)-Farnesol             |

**Operating conditions**

Column: silica capillary; length 30 m; internal diameter 0,25 mm

Stationary phase: poly(dimethylsiloxane) (SE 30<sup>a</sup>)

Film thickness: 0,25  $\mu$ m

Oven temperature: temperature programming from 70 °C to 250 °C at a rate of 2 °C/min

Injector temperature: 250 °C

Detector temperature: 250 °C

Detector: flame ionization type

Carrier gas: hydrogen

Volume injected: 0,3  $\mu$ l

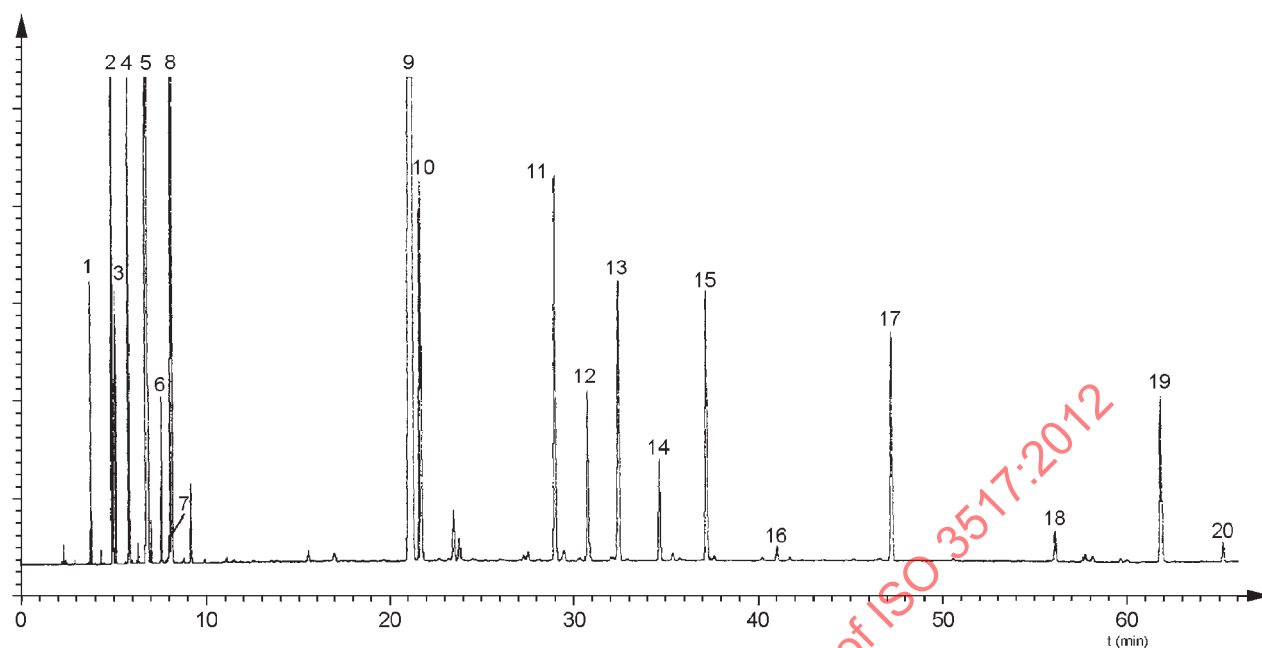
Carrier gas flow rate: 1 ml/min

Split ratio: 1/100

*t*            time

<sup>a</sup> SE 30 is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

**Figure A.1 — Typical chromatogram taken on an apolar column**

**Peak identification**

- |    |  |
|----|--|
| 1  | $\alpha$ -Thujene + $\alpha$ -pinene   |
| 2  | $\beta$ -Pinene                        |
| 3  | Sabinene                               |
| 4  | Myrcene                                |
| 5  | Limonene                               |
| 6  | (Z)- $\beta$ -Ocimene                  |
| 7  | $\gamma$ -Terpinene                    |
| 8  | (E)- $\beta$ -Ocimene                  |
| 9  | Linalol                                |
| 10 | Linalyl acetate                        |
| 11 | $\alpha$ -Terpineol + Terpenyl acetate |
| 12 | Neryl acetate                          |
| 13 | Geranyl acetate                        |
| 14 | Nerol                                  |
| 15 | Geraniol                               |
| 16 | Phenylacetonitrile                     |
| 17 | (E)-Nerolidol                          |
| 18 | Methyl anthranilate                    |
| 19 | (2E,6E)-Farnesol                       |
| 20 | Indole                                 |

**Operating conditions**

Column: silica capillary; length 30 m; internal diameter 0,25 mm  
 Stationary phase: poly(ethyleneglycol) 10 000 (Supelcowax 10<sup>a</sup>)  
 Film thickness: 0,25  $\mu$ m  
 Oven temperature: temperature programming from 70 °C to 250 °C at a rate of 2 °C/min  
 Injector temperature: 250 °C  
 Detector temperature: 250 °C  
 Detector: flame ionization type  
 Carrier gas: nitrogen  
 Volume injected: 0,3  $\mu$ l  
 Carrier gas flow rate: 1 ml/min  
 Split ratio: 1/100

*t*            time

<sup>a</sup> Supelcowax 10 is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

**Figure A.2 — Typical chromatogram taken on a polar column**

## **Annex B** (informative)

### **Flashpoint**

#### **B.1 General information**

For safety reasons, transport companies, insurance companies, and people in charge of safety services require information on the flashpoints of essential oils, which in most cases are flammable products.

A comparative study on the relevant methods of analysis (see ISO/TR 11018<sup>[1]</sup>) concluded that it was difficult to recommend a single apparatus for standardization purposes, given that:

- there is a wide variation in the chemical composition of essential oils;
- the volume of the sample needed in certain requirements would be too costly for high-priced essential oils;
- as there are several different types of equipment which can be used for the determination, users cannot be expected to use one specified type only.

Consequently, it was decided to give a mean value for the flashpoint annexed to each International Standard, for information, in order to meet the requirements of the interested parties.

The equipment with which this value was obtained has to be specified.

For further information, see ISO/TR 11018.<sup>[1]</sup>

#### **B.2 Flashpoint of the essential oil of neroli**

The indicative value is +61 °C.

NOTE Obtained with "Luchoire"<sup>1)</sup> equipment.

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1) Equipment available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.