

**Date :** January 20, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 20L04-PTH09


**Customer identification :** Sweet Orange - O20110204R

**Type :** Essential oil

**Source :** *Citrus sinensis*

**Customer :** Plant Therapy

**ANALYSIS**

**Method:** PC-MAT-014  - Analysis of the composition of an essential oil or other volatile liquid by FAST GC-FID (in French); identifications validated by GC-MS.

**Analyst :** Fanny Charlier, B. Sc., chimiste à l'entraînement

**Analysis date :** December 07, 2020

Checked and approved by :

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Sylvain Mercier, M. Sc., chimiste 2014-005

*Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia. This report is digitally signed, it is only considered valid if the digital signature is intact. The results only describe the samples that were submitted to the assays.*

*This report is an update of the version first issued on December 10, 2020 to correct a mistake in the customer identification.*

PHYSICOCHEMICAL DATA

**Physical aspect:** Bright yellow liquid

**Refractive index:** 1.4733 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 3140:2011 - OIL OF SWEET ORANGE, OBTAINED BY PHYSICAL EXTRACTION OF THE PEEL

| Compound                | Min. % | Max. % | Observed % | Complies? |
|-------------------------|--------|--------|------------|-----------|
| β-Sinensal              | 0.01   | 0.06   | 0.03       | Yes       |
| Geranial                | 0.05   | 0.20   | 0.10       | Yes       |
| Valencene               | 0.01   | 0.40   | 0.05       | Yes       |
| Neral                   | 0.03   | 0.10   | 0.08       | Yes       |
| Linalool                | 0.15   | 0.70   | 0.40       | Yes       |
| Decanal                 | 0.1    | 0.7    | 0.3        | Yes       |
| Nonanal                 | 0.01   | 0.06   | 0.05       | Yes       |
| Octanal                 | 0.1    | 0.4    | 0.2        | Yes       |
| Limonene                | 93.0   | 96.0   | 92.1       | No        |
| Myrcene                 | 1.5    | 3.5    | 1.8        | Yes       |
| Sabinene                | 0.2    | 0.8    | 0.3        | Yes       |
| β-Pinene                | 0.02   | 0.15   | 0.03       | Yes       |
| α-Pinene                | 0.4    | 0.8    | 0.5        | Yes       |
| <b>Refractive index</b> | 1.4700 | 1.4760 | 1.4733     | Yes       |

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method.

## ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

New readers of similar reports are encouraged to read table footnotes at least once.

| Identification                  | %     | Class                 |
|---------------------------------|-------|-----------------------|
| $\alpha$ -Thujene               | tr    | Monoterpene           |
| $\alpha$ -Pinene                | 0.51  | Monoterpene           |
| Thuja-2,4(10)-diene             | 0.01  | Monoterpene           |
| Sabinene                        | 0.34  | Monoterpene           |
| $\beta$ -Pinene                 | 0.03  | Monoterpene           |
| Myrcene                         | 1.80  | Monoterpene           |
| $\alpha$ -Phellandrene          | 0.04  | Monoterpene           |
| Octanal                         | 0.25  | Aliphatic aldehyde    |
| $\Delta^3$ -Carene              | 0.15  | Monoterpene           |
| $\alpha$ -Terpinene             | 0.01  | Monoterpene           |
| Limonene                        | 92.11 | Monoterpene           |
| $\beta$ -Phellandrene           | 0.26  | Monoterpene           |
| (Z)- $\beta$ -Ocimene           | 0.02  | Monoterpene           |
| (E)- $\beta$ -Ocimene           | 0.04  | Monoterpene           |
| $\gamma$ -Terpinene             | 0.01  | Monoterpene           |
| cis-Sabinene hydrate            | 0.01  | Monoterpenic alcohol  |
| Octanol                         | 0.03  | Aliphatic alcohol     |
| Terpinolene                     | 0.03  | Monoterpene           |
| Linalool                        | 0.40  | Monoterpenic alcohol  |
| Nonanal                         | 0.05  | Aliphatic aldehyde    |
| trans-para-Mentha-2,8-dien-1-ol | 0.02  | Monoterpenic alcohol  |
| cis-Limonene oxide              | 0.02  | Monoterpenic ether    |
| trans-Limonene oxide            | 0.03  | Monoterpenic ether    |
| Citronellal                     | 0.05  | Monoterpenic aldehyde |
| Terpinen-4-ol                   | 0.01  | Monoterpenic alcohol  |
| $\alpha$ -Terpineol             | 0.06  | Monoterpenic alcohol  |
| cis-Piperitol                   | 0.01  | Monoterpenic alcohol  |
| Decanal                         | 0.26  | Aliphatic aldehyde    |
| Octyl acetate                   | 0.01  | Aliphatic ester       |
| trans-Carveol                   | 0.01  | Monoterpenic alcohol  |
| Nerol                           | 0.02  | Monoterpenic alcohol  |
| Neral                           | 0.08  | Monoterpenic aldehyde |
| Geraniol                        | 0.01  | Monoterpenic alcohol  |
| Perillaldehyde                  | 0.02  | Monoterpenic aldehyde |
| Geranial                        | 0.10  | Monoterpenic aldehyde |
| Decanol                         | 0.01  | Aliphatic alcohol     |
| Limonen-10-ol                   | 0.01  | Monoterpenic alcohol  |
| Undecanal                       | 0.02  | Aliphatic aldehyde    |
| $\alpha$ -Cubebene              | 0.01  | Sesquiterpene         |
| Neryl acetate                   | 0.01  | Monoterpenic ester    |
| $\alpha$ -Copaene               | 0.03  | Sesquiterpene         |
| Geranyl acetate                 | 0.03  | Monoterpenic ester    |
| $\beta$ -Elemene                | 0.01  | Sesquiterpene         |
| Dodecanal                       | 0.06  | Aliphatic aldehyde    |
| $\beta$ -Caryophyllene          | 0.03  | Sesquiterpene         |

|                           |               |                         |
|---------------------------|---------------|-------------------------|
| β-Copaene                 | 0.03          | Sesquiterpene           |
| α-Humulene                | 0.01          | Sesquiterpene           |
| (E)-β-Farnesene           | 0.01          | Sesquiterpene           |
| γ-Murolene                | 0.01          | Sesquiterpene           |
| Germacrene D              | 0.03          | Sesquiterpene           |
| Valencene                 | 0.05          | Sesquiterpene           |
| α-Murolene                | 0.02          | Sesquiterpene           |
| γ-Cadinene                | 0.02          | Sesquiterpene           |
| δ-Cadinene                | 0.04          | Sesquiterpene           |
| α-Elemol                  | 0.01          | Sesquiterpenic alcohol  |
| Caryophyllene oxide       | 0.01          | Sesquiterpenic ether    |
| β-Sinensal                | 0.03          | Sesquiterpenic aldehyde |
| α-Sinensal                | 0.02          | Sesquiterpenic aldehyde |
| Myristic acid             | 0.01          | Aliphatic acid          |
| Nootkatone                | 0.01          | Sesquiterpenic ketone   |
| Palmitic acid             | 0.01          | Aliphatic acid          |
| Stearic acid              | 0.03          | Aliphatic acid          |
| <b>Consolidated total</b> | <b>97.39%</b> |                         |

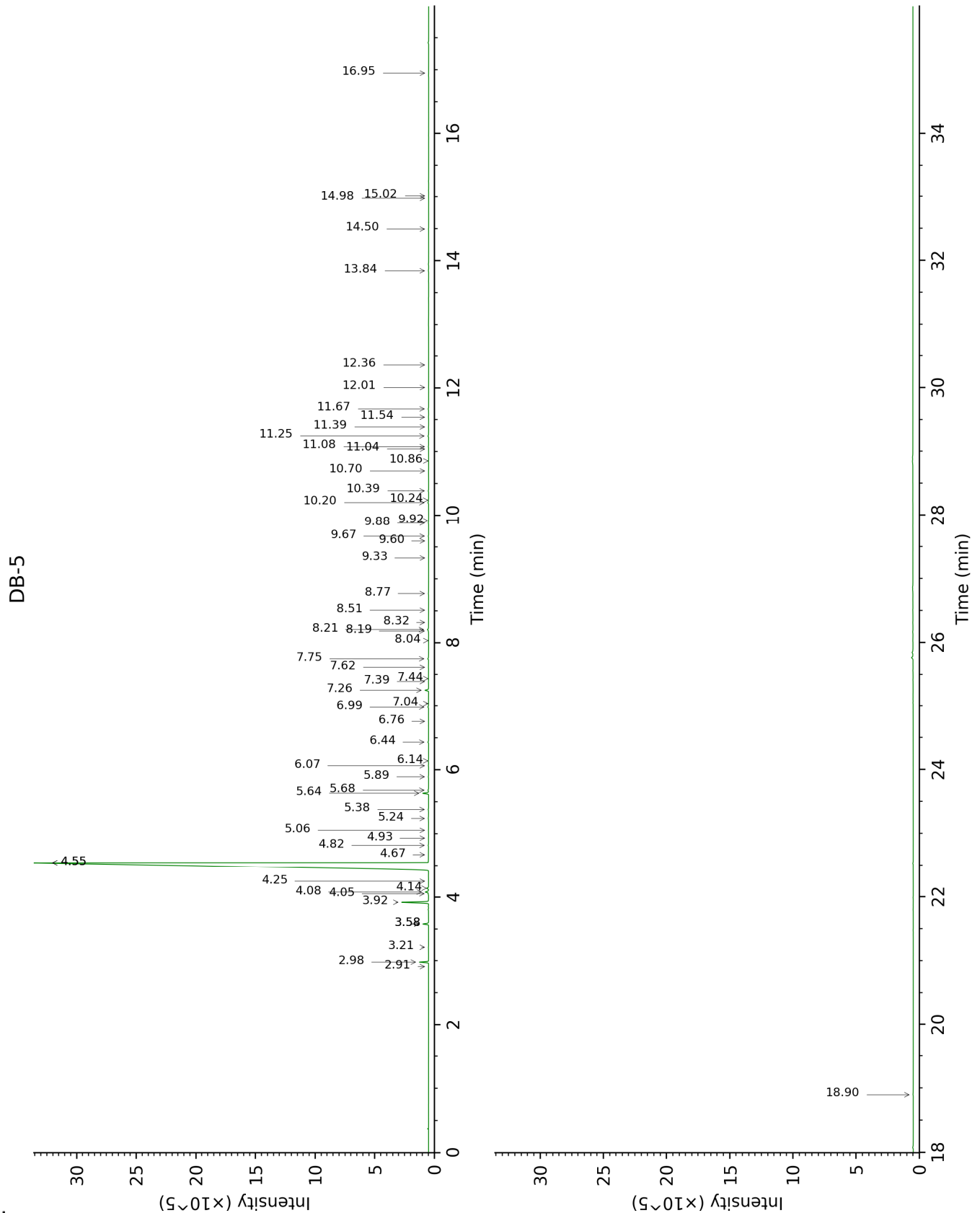
tr: The compound has been detected below 0.005% of total signal.

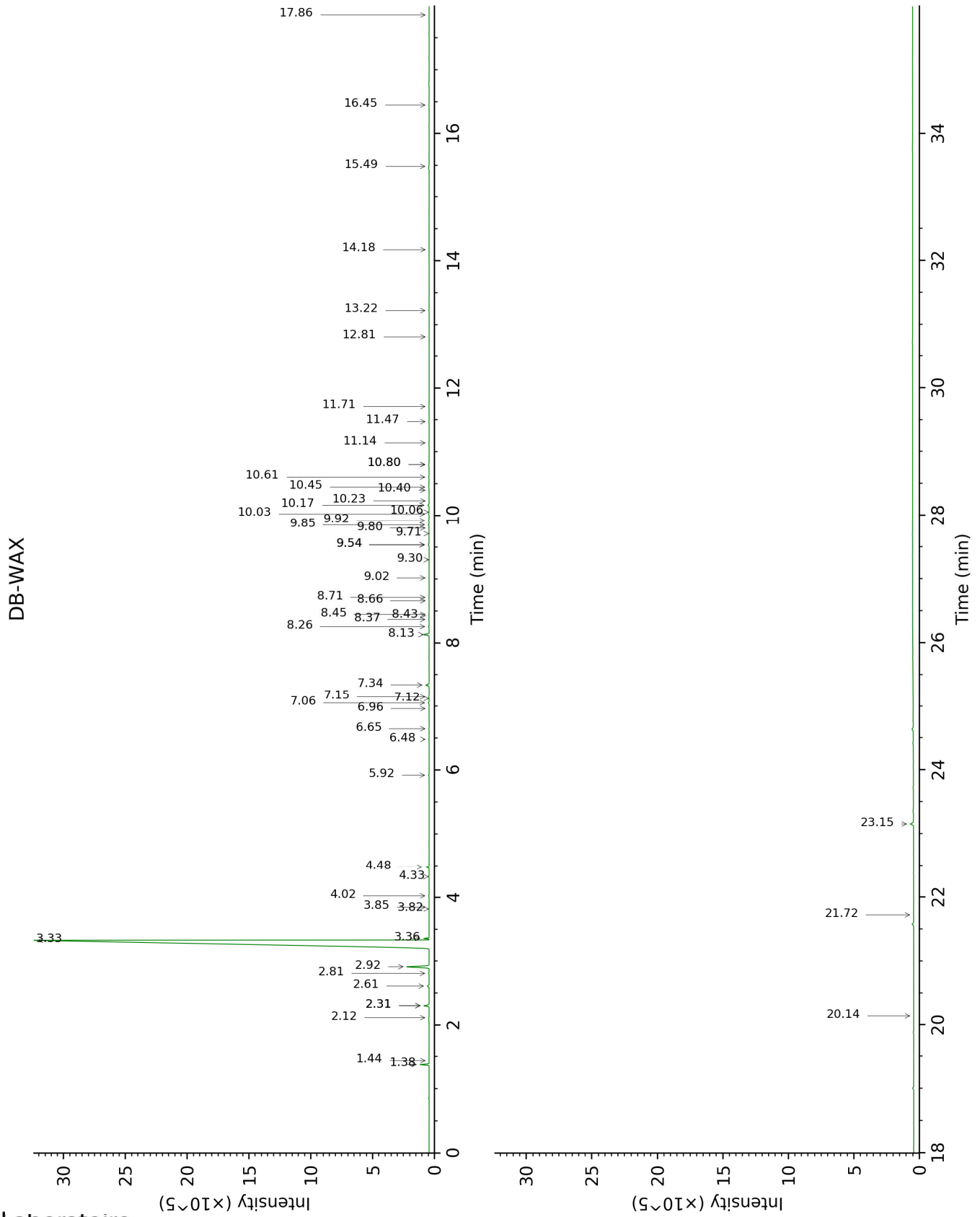
Note: no correction factor was applied

**About "consolidated" data:** The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm is set to prioritize data from the most standard DB-5 column, and smallest values so as to avoid overestimating individual content. This process is semi-automatic. Advanced users are invited to consult the "Full analysis data" table after the chromatograms in this report to access the full untreated data and perform their own calculations if needed.

**Unknowns:** Unknown compounds' mass spectral data is presented in the "Full analysis data" table. The occurrence of unknown compounds is to be expected in many samples, and does not denote particular problems unless noted otherwise in the conclusion.

This page was intentionally left blank. The following pages present the complete data of the analysis.





FULL ANALYSIS DATA

| Identification                  | Column DB-5 |      |         | Column DB-WAX |      |        |
|---------------------------------|-------------|------|---------|---------------|------|--------|
|                                 | R.T         | R.I  | %       | R.T           | R.I  | %      |
| α-Thujene                       | 2.91        | 926  | tr      | 1.44          | 997  | 0.01   |
| α-Pinene                        | 2.98        | 930  | 0.51    | 1.38          | 990  | 0.51   |
| Thuja-2,4(10)-diene             | 3.22        | 946  | 0.01    | 2.31*         | 1084 | 0.36   |
| Sabinene                        | 3.58*       | 970  | 0.38    | 2.31*         | 1084 | [0.36] |
| β-Pinene                        | 3.58*       | 970  | [0.38]  | 2.12          | 1065 | 0.03   |
| Myrcene                         | 3.92        | 992  | 1.80    | 2.92          | 1134 | 1.79   |
| α-Phellandrene                  | 4.05        | 1001 | 0.04    | 2.81          | 1126 | 0.04   |
| Octanal                         | 4.08        | 1003 | 0.25    | 4.48          | 1252 | 0.23   |
| Δ3-Carene                       | 4.14        | 1007 | 0.15    | 2.61          | 1110 | 0.13   |
| α-Terpinene                     | 4.25        | 1014 | 0.01    |               |      |        |
| Limonene                        | 4.55*       | 1032 | 93.52   | 3.33          | 1166 | 92.11  |
| β-Phellandrene                  | 4.55*       | 1032 | [93.52] | 3.36          | 1168 | 0.26   |
| (Z)-β-Ocimene                   | 4.67        | 1040 | 0.02    | 3.82†         | 1204 | 0.02   |
| (E)-β-Ocimene                   | 4.82        | 1049 | 0.04    | 4.02          | 1219 | 0.03   |
| γ-Terpinene                     | 4.93        | 1057 | 0.01    | 3.85†         | 1206 | [0.02] |
| cis-Sabinene hydrate            | 5.06        | 1064 | 0.01    | 6.96          | 1431 | 0.01   |
| Octanol                         | 5.24        | 1076 | 0.03    | 8.26          | 1528 | 0.05   |
| Terpinolene                     | 5.38        | 1085 | 0.03    | 4.32          | 1240 | 0.03   |
| Linalool                        | 5.64        | 1101 | 0.40    | 8.13          | 1518 | 0.41   |
| Nonanal                         | 5.68        | 1104 | 0.05    | 5.92          | 1355 | 0.05   |
| trans-para-Mentha-2,8-dien-1-ol | 5.89        | 1118 | 0.02    | 9.02          | 1586 | 0.02   |
| cis-Limonene oxide              | 6.07        | 1129 | 0.02    | 6.48          | 1395 | 0.02   |
| trans-Limonene oxide            | 6.14        | 1134 | 0.03    | 6.65          | 1407 | 0.02   |
| Citronellal                     | 6.44        | 1152 | 0.05    | 7.06          | 1438 | 0.06   |
| Terpinen-4-ol                   | 6.76        | 1174 | 0.01    | 8.66          | 1559 | 0.01   |
| α-Terpineol                     | 6.99        | 1188 | 0.06    | 9.85          | 1654 | 0.07   |
| cis-Piperitol                   | 7.04        | 1192 | 0.01    |               |      |        |
| Decanal                         | 7.26        | 1206 | 0.26    | 7.34          | 1459 | 0.25   |
| Octyl acetate                   | 7.40        | 1215 | 0.01    | 7.12          | 1442 | 0.01   |
| trans-Carveol                   | 7.44        | 1218 | 0.01    | 11.47         | 1788 | 0.02   |
| Nerol                           | 7.62        | 1231 | 0.02    | 11.14         | 1760 | 0.02   |
| Neral                           | 7.75        | 1240 | 0.08    | 9.54*         | 1628 | 0.09   |
| Geraniol                        | 8.04        | 1259 | 0.01    | 11.71         | 1809 | 0.02   |
| Perillaldehyde                  | 8.18        | 1270 | 0.02    | 10.80*        | 1732 | 0.07   |
| Geranial                        | 8.21        | 1271 | 0.10    | 10.17         | 1679 | 0.10   |
| Decanol                         | 8.32        | 1279 | 0.01    | 10.80*        | 1732 | [0.07] |
| Limonen-10-ol                   | 8.51        | 1292 | 0.01    | 13.22         | 1944 | 0.03   |
| Undecanal                       | 8.77        | 1305 | 0.02    | 8.71          | 1563 | 0.02   |
| α-Cubebene                      | 9.33        | 1345 | 0.01    |               |      |        |
| Neryl acetate                   | 9.60        | 1364 | 0.01    | 10.24         | 1684 | 0.01   |
| α-Copaene                       | 9.67        | 1369 | 0.03    | 7.15          | 1444 | 0.03   |
| Geranyl acetate                 | 9.88        | 1384 | 0.03    | 10.61         | 1715 | 0.05   |



|                         |       |               |      |       |               |        |
|-------------------------|-------|---------------|------|-------|---------------|--------|
| β-Elemene               | 9.92  | 1387          | 0.01 | 8.45  | 1543          | 0.01   |
| Dodecanal               | 10.20 | 1408          | 0.06 | 10.03 | 1668          | 0.05   |
| β-Caryophyllene         | 10.24 | 1410          | 0.03 | 8.43  | 1541          | 0.02   |
| β-Copaene               | 10.39 | 1421          | 0.03 | 8.37  | 1536          | 0.03   |
| α-Humulene              | 10.70 | 1445          | 0.01 | 9.30  | 1609          | 0.01   |
| (E)-β-Farnesene         | 10.86 | 1456          | 0.01 | 9.54* | 1628          | [0.09] |
| γ-Murolene              | 11.04 | 1470          | 0.01 | 9.71  | 1642          | 0.02   |
| Germacrene D            | 11.08 | 1473          | 0.03 | 9.80  | 1649          | 0.03   |
| Valencene               | 11.25 | 1486          | 0.05 | 9.92  | 1659          | 0.06   |
| α-Murolene              | 11.39 | 1496          | 0.02 | 10.06 | 1670          | 0.03   |
| γ-Cadinene              | 11.54 | 1508          | 0.02 | 10.40 | 1698          | 0.02   |
| δ-Cadinene              | 11.67 | 1518          | 0.04 | 10.45 | 1702          | 0.06   |
| α-Elemol                | 12.01 | 1545          | 0.01 | 14.18 | 2033          | 0.01   |
| Caryophyllene oxide     | 12.36 | 1572          | 0.01 | 12.81 | 1907          | 0.01   |
| β-Sinensal              | 13.84 | 1694          | 0.03 | 15.49 | 2162          | 0.03   |
| α-Sinensal              | 14.50 | 1750          | 0.02 | 16.45 | 2259          | 0.02   |
| Myristic acid           | 14.98 | 1792          | 0.01 | 20.14 | 2672          | 0.01   |
| Nootkatone              | 15.02 | 1795          | 0.01 | 17.86 | 2410          | 0.01   |
| Palmitic acid           | 16.95 | 1972          | 0.01 | 21.72 | 2868          | 0.02   |
| Stearic acid            | 18.90 | 2166          | 0.03 | 23.15 | 3056          | 0.31   |
| <b>Total identified</b> |       | <b>98.54%</b> |      |       | <b>97.70%</b> |        |
| <b>Total reported</b>   |       | <b>98.54%</b> |      |       | <b>97.70%</b> |        |

\*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

†: Peaks apexes were resolved, but peaks overlapped and were summed for analysis

tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index