

**Date :** January 19, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 21A18-PTH07

**Customer identification :** Balsam Fir - BN0107205R

**Type :** Essential oil

**Source :** *Abies balsamea* ct. Eastern / Low thymol

**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 :** Sylvain Mercier, M. Sc., Chimiste

**Analysis date :** January 19, 2021

Checked and approved by :

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Alexis St-Gelais, M. Sc., chimiste 2013-174

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4746 \pm 0.0003$  (20 °C; method PC-MAT-016)

*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                  |
|---------------------------|-------|------------------------|
| Isovaleral                | tr    | Aliphatic aldehyde     |
| Toluene                   | 0.01  | Simple phenolic        |
| Hexanal                   | 0.02  | Aliphatic aldehyde     |
| Octane                    | 0.01  | Alkane                 |
| Santene                   | 1.22  | Normonoterpene         |
| Unknown                   | 0.01  | Normonoterpene         |
| Tricyclene                | 0.77  | Monoterpene            |
| $\alpha$ -Thujene         | 0.13  | Monoterpene            |
| $\alpha$ -Pinene          | 15.23 | Monoterpene            |
| Camphene                  | 5.05  | Monoterpene            |
| $\alpha$ -Fenchene        | 0.12  | Monoterpene            |
| Thuja-2,4(10)-diene       | 0.06  | Monoterpene            |
| meta-Cymene               | 0.03  | Monoterpene            |
| $\beta$ -Pinene           | 37.66 | Monoterpene            |
| Sabinene                  | 0.12  | Monoterpene            |
| Unknown                   | 0.02  | Monoterpene            |
| Myrcene                   | 1.80  | Monoterpene            |
| 2-Carene                  | 0.01  | Monoterpene            |
| $\alpha$ -Phellandrene    | 0.12  | Monoterpene            |
| Pseudolimonene            | 0.02  | Monoterpene            |
| $\Delta$ 3-Carene         | 7.09  | Monoterpene            |
| (3Z)-Hexenyl acetate      | 0.01  | Aliphatic ester        |
| $\alpha$ -Terpinene       | 0.12  | Monoterpene            |
| Carvomenthene             | 0.01  | Aliphatic alcohol      |
| para-Cymene               | 0.16  | Monoterpene            |
| Limonene                  | 10.69 | Monoterpene            |
| $\beta$ -Phellandrene     | 5.27  | Monoterpene            |
| $\gamma$ -Terpinene       | 0.20  | Monoterpene            |
| Unknown                   | 0.01  | Oxygenated monoterpene |
| Fenchone                  | 0.20  | Monoterpenic ketone    |
| $\gamma$ -Campholenal     | 0.03  | Aliphatic alcohol      |
| Terpinolene               | 0.66  | Monoterpene            |
| para-Cymenene             | 0.06  | Monoterpene            |
| Linalool                  | 0.09  | Monoterpenic alcohol   |
| Nonanal                   | 0.01  | Aliphatic aldehyde     |
| endo-Fenchol              | 0.08  | Monoterpenic alcohol   |
| $\alpha$ -Campholenal     | 0.03  | Monoterpenic aldehyde  |
| <i>trans</i> -Pinocarveol | 0.16  | Monoterpenic alcohol   |
| Camphor                   | 0.25  | Monoterpenic ketone    |
| Camphene hydrate          | 0.11  | Monoterpenic alcohol   |
| meta-Mentha-4,6-dien-8-ol | 0.02  | Monoterpenic alcohol   |
| Isoborneol                | 0.06  | Monoterpenic alcohol   |
| Pinocamphone              | 0.05  | Monoterpenic ketone    |
| Pinocarvone               | 0.02  | Monoterpenic ketone    |
| Borneol                   | 0.70  | Monoterpenic alcohol   |

|                                      |      |                          |
|--------------------------------------|------|--------------------------|
| Isopinocampone                       | 0.04 | Monoterpenic ketone      |
| $\alpha$ -Phellandren-8-ol           | 0.06 | Monoterpenic alcohol     |
| Terpinen-4-ol                        | 0.21 | Monoterpenic alcohol     |
| Cryptone                             | 0.03 | Normonoterpenic ketone   |
| para-Cymen-8-ol                      | 0.03 | Monoterpenic alcohol     |
| Myrtenal                             | 0.09 | Monoterpenic aldehyde    |
| $\alpha$ -Terpineol                  | 0.56 | Monoterpenic alcohol     |
| Myrtenol                             | 0.08 | Monoterpenic alcohol     |
| Methylchavicol                       | 0.06 | Phenylpropanoid          |
| Verbenone                            | 0.06 | Monoterpenic ketone      |
| Unknown                              | 0.01 | Unknown                  |
| endo-Fenchyl acetate                 | 0.07 | Monoterpenic ester       |
| Thymol methyl ether                  | 0.10 | Monoterpenic ether       |
| Piperitone                           | 0.08 | Monoterpenic ketone      |
| Phellandral                          | 0.03 | Monoterpenic aldehyde    |
| Isopulegyl acetate                   | 0.03 | Monoterpenic ester       |
| Bornyl acetate                       | 6.20 | Monoterpenic ester       |
| Isobornyl acetate                    | 0.04 | Monoterpenic ester       |
| 2-Undecanone                         | 0.04 | Aliphatic ketone         |
| <i>trans</i> -Pinocarvyl acetate     | 0.01 | Monoterpenic ester       |
| Thymol                               | 0.04 | Monoterpenic alcohol     |
| Isohexyl isocaproate                 | 0.02 | Aliphatic ester          |
| Unknown                              | 0.02 | Unknown                  |
| $\alpha$ -Longipinene                | 0.08 | Sesquiterpene            |
| Citronellyl acetate                  | 0.05 | Monoterpenic ester       |
| Longicyclene                         | 0.03 | Sesquiterpene            |
| Neryl acetate                        | 0.04 | Monoterpenic ester       |
| Geranyl acetate                      | 0.03 | Monoterpenic ester       |
| $\beta$ -Elemene                     | 0.02 | Sesquiterpene            |
| $\beta$ -Longipinene                 | 0.03 | Sesquiterpene            |
| Longifolene                          | 0.45 | Sesquiterpene            |
| Methyleugenol                        | 0.03 | Phenylpropanoid          |
| $\beta$ -Caryophyllene               | 0.16 | Sesquiterpene            |
| <i>trans</i> - $\alpha$ -Bergamotene | 0.02 | Sesquiterpene            |
| $\alpha$ -Humulene                   | 0.08 | Sesquiterpene            |
| ( <i>E</i> )- $\beta$ -Farnesene     | 0.04 | Sesquiterpene            |
| $\gamma$ -Muurolene                  | 0.01 | Sesquiterpene            |
| Germacrene D                         | 0.04 | Sesquiterpene            |
| $\beta$ -Selinene                    | 0.07 | Sesquiterpene            |
| $\alpha$ -Selinene                   | 0.05 | Sesquiterpene            |
| $\beta$ -Himachalene                 | 0.03 | Sesquiterpene            |
| $\alpha$ -Muurolene                  | 0.03 | Sesquiterpene            |
| $\delta$ -Amorphene                  | 0.04 | Sesquiterpene            |
| $\beta$ -Bisabolene                  | 0.42 | Sesquiterpene            |
| $\delta$ -Cadinene                   | 0.07 | Sesquiterpene            |
| ( <i>E</i> )- $\gamma$ -Bisabolene   | 0.03 | Sesquiterpene            |
| $\alpha$ -Calacorene                 | 0.01 | Sesquiterpene            |
| ( <i>E</i> )- $\alpha$ -Bisabolene   | 0.05 | Sesquiterpene            |
| ( <i>E</i> )-Nerolidol               | 0.10 | Sesquiterpenic alcohol   |
| Caryophyllene oxide                  | 0.02 | Sesquiterpenic ether     |
| Unknown                              | 0.01 | Oxygenated sesquiterpene |
| Citronellyl caproate                 | 0.01 | Monoterpenic ester       |

|                           |               |                      |
|---------------------------|---------------|----------------------|
| Manoyl oxide              | 0.02          | Diterpenic ether     |
| Juvabione?                | 0.01          | Sesquiterpenic ester |
| Manool                    | 0.02          | Diterpenic alcohol   |
| (Z)-Abienol               | 0.05          | Diterpenic alcohol   |
| Pimaral?                  | 0.02          | Diterpenic aldehyde  |
| <b>Consolidated total</b> | <b>98.58%</b> |                      |

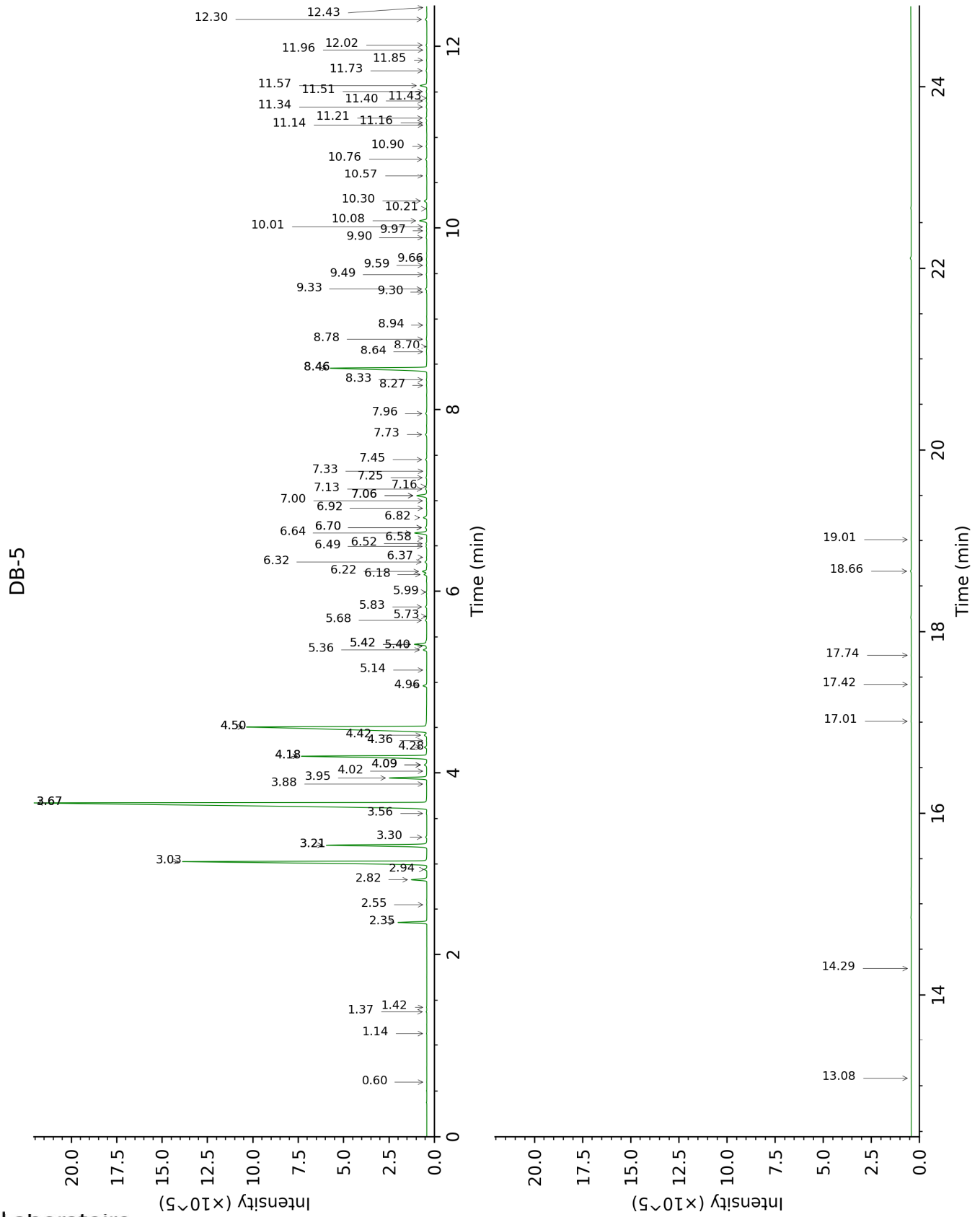
tr: The compound has been detected below 0.005% of total signal.

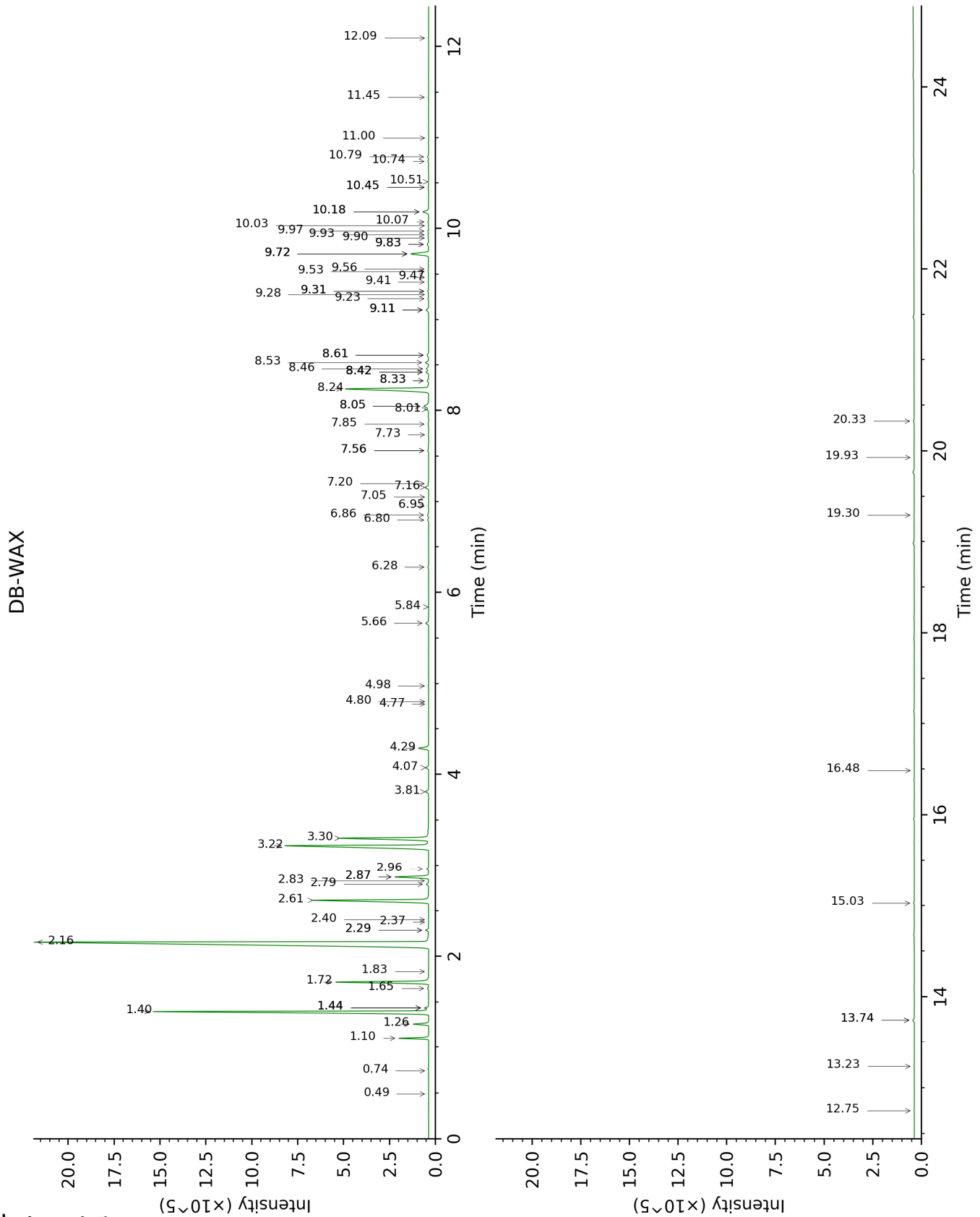
Note: no correction factor was applied

**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.

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FULL ANALYSIS DATA

| Identification  | Column DB-5 |      |         | Column DB-WAX |      |         |
|---|-------------|------|---------|---------------|------|---------|
|   | R.T         | R.I  | %       | R.T           | R.I  | %       |
| Isovaleral  | 0.60        | 640  | tr      | 0.74          | 887  | tr      |
| Toluene   | 1.14        | 763  | 0.01    | 1.44*†        | 1003 | [15.37] |
| Hexanal   | 1.37        | 797  | 0.02    | 1.83          | 1042 | 0.02    |
| Octane  | 1.42        | 804  | 0.01    | 0.49          | 785  | tr      |
| Santene   | 2.35        | 882  | 1.22    | 1.10          | 952  | 1.23    |
| Unknown [m/z<br>79, 93 (66), 94<br>(52), 91 (39), 77<br>(37), 122 (31)]                       | 2.55        | 898  | 0.01    | 1.44*†        | 1003 | [15.37] |
| Tricyclene  | 2.82        | 917  | 0.77    | 1.26          | 977  | 0.76    |
| α-Thujene   | 2.94        | 925  | 0.13    | 1.44*†        | 1003 | [15.37] |
| α-Pinene  | 3.03        | 931  | 15.23   | 1.40†         | 999  | 15.37   |
| Camphene  | 3.21*       | 943  | 5.17    | 1.72          | 1031 | 5.05    |
| α-Fenchene  | 3.21*       | 943  | [5.17]  | 1.65†         | 1024 | [15.37] |
| Thuja-2,4(10)-<br>diene   | 3.30        | 949  | 0.06    | 2.29*         | 1087 | 0.18    |
| meta-Cymene   | 3.56        | 966  | 0.03    | 2.87*         | 1135 | 1.83    |
| β-Pinene  | 3.67*       | 974  | 38.01   | 2.16          | 1074 | 37.66   |
| Sabinene  | 3.67*       | 974  | [38.01] | 2.29*         | 1087 | [0.18]  |
| Unknown [m/z<br>91, 119 (65), 109<br>(51), 134 (47)]  | 3.88        | 987  | 0.02    |               |      |         |
| Myrcene   | 3.95        | 992  | 1.80    | 2.87*         | 1135 | [1.83]  |
| 2-Carene  | 4.02        | 997  | 0.01    | 2.37          | 1096 | tr      |
| α-Phellandrene  | 4.09*       | 1001 | 0.15    | 2.79          | 1129 | 0.12    |
| Pseudolimonene  | 4.09*       | 1001 | [0.15]  | 2.83          | 1132 | 0.02    |
| Δ3-Carene   | 4.18*       | 1007 | 7.15    | 2.61          | 1115 | 7.09    |
| (3Z)-Hexenyl<br>acetate   | 4.18*       | 1007 | [7.15]  | 4.80          | 1283 | 0.01    |
| α-Terpinene   | 4.28        | 1014 | 0.12    | 2.96          | 1142 | 0.12    |
| Carvomenthene   | 4.36        | 1018 | 0.01    | 2.40          | 1098 | 0.01    |
| para-Cymene   | 4.42        | 1022 | 0.16    | 4.07          | 1228 | 0.17    |
| Limonene  | 4.50*       | 1028 | 16.12   | 3.22          | 1163 | 10.69   |
| β-Phellandrene  | 4.50*       | 1028 | [16.12] | 3.30          | 1169 | 5.27    |
| γ-Terpinene   | 4.96        | 1057 | 0.20    | 3.81          | 1209 | 0.22    |
| Unknown [m/z<br>79, 93 (60), 43<br>(40), 94 (35), 137<br>(33), 77 (26), 91<br>(20), 152 (18)] | 5.14        | 1068 | 0.01    | 4.77          | 1280 | 0.01    |
| Fenchone  | 5.36        | 1082 | 0.20    | 5.66          | 1342 | 0.20    |
| γ-Campholenal   | 5.40        | 1084 | 0.03    | 4.98          | 1296 | 0.03    |
| Terpinolene   | 5.42*†      | 1086 | 0.74    | 4.29          | 1244 | 0.66    |
| para-Cymenene   | 5.42*†      | 1086 | [0.74]  | 6.28          | 1386 | 0.06    |
| Linalool  | 5.68        | 1103 | 0.09    | 8.01          | 1515 | 0.10    |
| Nonanal   | 5.73        | 1106 | 0.01    | 5.84          | 1355 | 0.01    |
| endo-Fenchol  | 5.83        | 1112 | 0.08    | 8.33*         | 1540 | 0.12    |
| α-Campholenal   | 5.99        | 1123 | 0.03    | 6.95          | 1436 | 0.04    |

|  |       |      |        |        |      |        |
|--|-------|------|--------|--------|------|--------|
| <i>trans</i> -Pinocarveol  | 6.18  | 1136 | 0.16   | 9.11*  | 1600 | 0.21   |
| Camphor  | 6.22  | 1138 | 0.25   | 7.16   | 1451 | 0.26   |
| Camphene hydrate   | 6.32  | 1145 | 0.11   | 8.42*† | 1547 | 0.37   |
| meta-Mentha-4,6-dien-8-ol  | 6.37  | 1148 | 0.02   | 9.28   | 1614 | 0.02   |
| Isoborneol   | 6.49  | 1155 | 0.06   | 9.31*  | 1617 | 0.08   |
| Pinocamphone   | 6.52  | 1157 | 0.05   | 7.20   | 1454 | 0.05   |
| Pinocarvone  | 6.58  | 1161 | 0.02   | 7.85   | 1503 | 0.05   |
| Borneol  | 6.64  | 1164 | 0.70   | 9.72*  | 1650 | 1.35   |
| Isopinocampheol  | 6.70* | 1168 | 0.10   | 7.56*  | 1481 | 0.06   |
| α-Phellandren-8-ol   | 6.70* | 1168 | [0.10] | 10.07  | 1678 | 0.06   |
| Terpinen-4-ol  | 6.82  | 1176 | 0.21   | 8.52   | 1555 | 0.21   |
| Cryptone   | 6.92  | 1182 | 0.03   | 9.11*  | 1600 | [0.21] |
| para-Cymen-8-ol  | 7.00  | 1187 | 0.03   | 11.44  | 1794 | 0.03   |
| Myrtenal   | 7.06* | 1191 | 0.66   | 8.61*  | 1561 | 0.13   |
| α-Terpineol  | 7.06* | 1191 | [0.66] | 9.72*  | 1650 | [1.35] |
| Myrtenol   | 7.13  | 1195 | 0.08   | 10.79  | 1739 | 0.08   |
| Methylchavicol   | 7.16  | 1197 | 0.06   | 9.23   | 1610 | 0.05   |
| Verbenone  | 7.26  | 1203 | 0.06   | 9.56   | 1637 | 0.06   |
| Unknown [m/z 93, 121 (98), 79 (64), 91 (41), 77 (35), 124 (24)...] | 7.33  | 1208 | 0.01   | 11.00  | 1756 | 0.01   |
| endo-Fenchyl acetate   | 7.45  | 1216 | 0.07   | 6.86   | 1429 | 0.09   |
| Thymol methyl ether  | 7.73  | 1234 | 0.10   | 8.42*† | 1547 | [0.37] |
| Piperitone   | 7.96  | 1250 | 0.08   | 9.83*  | 1659 | 0.12   |
| Phellandral  | 8.27  | 1270 | 0.03   | 9.90   | 1664 | 0.04   |
| Isopulegyl acetate   | 8.33  | 1274 | 0.03   | 8.05*  | 1518 | 0.45   |
| Bornyl acetate   | 8.46* | 1282 | 6.31   | 8.24   | 1533 | 6.20   |
| Isobornyl acetate  | 8.46* | 1282 | [6.31] | 8.33*  | 1540 | [0.12] |
| 2-Undecanone   | 8.64  | 1294 | 0.04   | 8.61*  | 1561 | [0.13] |
| <i>trans</i> -Pinocarvyl acetate                                   | 8.70  | 1298 | 0.01   | 9.11*  | 1600 | [0.21] |
| Thymol   | 8.78  | 1304 | 0.04   | 15.02  | 2130 | 0.04   |
| Isohexyl isocaproate   | 8.94  | 1315 | 0.02   | 7.56*  | 1481 | [0.06] |
| Unknown [m/z 121, 93 (84), 43 (81), 79 (48), 117 (40), 56 (37)...] | 9.30  | 1340 | 0.02   |        |      |        |
| α-Longipinene  | 9.33  | 1342 | 0.08   | 6.80   | 1425 | 0.07   |
| Citronellyl acetate  | 9.49  | 1353 | 0.05   | 9.41   | 1625 | 0.05   |
| Longicyclene   | 9.59  | 1360 | 0.03   | 7.05   | 1443 | 0.01   |
| Neryl acetate  | 9.66  | 1365 | 0.04   | 10.18* | 1687 | 0.45   |
| Geranyl acetate  | 9.90  | 1382 | 0.03   | 10.51  | 1715 | 0.05   |
| β-Elemene  | 9.97  | 1387 | 0.02   | 8.42*† | 1547 | [0.37] |
| β-Longipinene  | 10.01 | 1390 | 0.03   | 7.73   | 1494 | 0.02   |

|  |       |               |      |        |               |        |
|--|-------|---------------|------|--------|---------------|--------|
| Longifolene  | 10.08 | 1395          | 0.45 | 8.05*  | 1518          | [0.45] |
| Methyleugenol  | 10.21 | 1404          | 0.03 | 13.23  | 1956          | 0.02   |
| $\beta$ -Caryophyllene   | 10.30 | 1410          | 0.16 | 8.46†  | 1550          | [0.37] |
| <i>trans</i> - $\alpha$ -Bergamotene                             | 10.57 | 1431          | 0.02 | 8.42*† | 1547          | [0.37] |
| $\alpha$ -Humulene   | 10.76 | 1445          | 0.08 | 9.31*  | 1617          | [0.08] |
| ( <i>E</i> )- $\beta$ -Farnesene                                 | 10.90 | 1455          | 0.04 | 9.47   | 1629          | 0.03   |
| $\gamma$ -Murolene   | 11.14 | 1473          | 0.01 | 9.53   | 1634          | 0.05   |
| Germacrene D   | 11.16 | 1475          | 0.04 | 9.72*  | 1650          | [1.35] |
| $\beta$ -Selinene  | 11.22 | 1478          | 0.07 | 9.83*  | 1659          | [0.12] |
| $\alpha$ -Selinene   | 11.34 | 1488          | 0.05 | 9.93   | 1667          | 0.05   |
| $\beta$ -Himachalene   | 11.40 | 1492          | 0.03 | 9.72*  | 1650          | [1.35] |
| $\alpha$ -Murolene   | 11.43 | 1495          | 0.03 | 10.03  | 1675          | 0.03   |
| $\delta$ -Amorphene  | 11.51 | 1500          | 0.04 | 9.97   | 1670          | 0.06   |
| $\beta$ -Bisabolene  | 11.57 | 1505          | 0.42 | 10.18* | 1687          | [0.45] |
| $\delta$ -Cadinene   | 11.73 | 1518          | 0.07 | 10.45* | 1710          | 0.07   |
| ( <i>E</i> )- $\gamma$ -Bisabolene                               | 11.85 | 1527          | 0.03 | 10.45* | 1710          | [0.07] |
| $\alpha$ -Calacorene   | 11.96 | 1536          | 0.01 | 12.09  | 1852          | 0.02   |
| ( <i>E</i> )- $\alpha$ -Bisabolene                               | 12.02 | 1540          | 0.05 | 10.74  | 1735          | 0.06   |
| ( <i>E</i> )-Nerolidol   | 12.30 | 1562          | 0.10 | 13.74* | 2004          | 0.10   |
| Caryophyllene oxide  | 12.43 | 1573          | 0.02 | 12.75  | 1911          | 0.02   |
| Unknown [m/z 41, 91 (78), 67 (76), 119 (70), 55 (61)... 220 (7)] | 13.08 | 1625          | 0.01 | 13.74* | 2004          | [0.10] |
| Citronellyl caproate   | 14.29 | 1727          | 0.01 |        |               |        |
| Manoyl oxide   | 17.01 | 1978          | 0.02 | 16.48  | 2281          | 0.01   |
| Juvabione?   | 17.42 | 2019          | 0.01 | 19.93  | 2677          | 0.02   |
| Manool   | 17.74 | 2051          | 0.02 | 19.30  | 2600          | 0.02   |
| ( <i>Z</i> )-Abienol   | 18.66 | 2147          | 0.05 | 20.33  | 2726          | 0.05   |
| Pimaral?   | 19.01 | 2184          | 0.02 |        |               |        |
| <b>Total identified</b>  |       | <b>99.05%</b> |      |        | <b>98.31%</b> |        |
| <b>Total reported</b>  |       | <b>99.13%</b> |      |        | <b>98.33%</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