

Date : January 19, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21A18-PTH01

Customer identification : Fir Needle - Siberia - 140483/1

Type : Essential oil

Source : *Abies sibirica*

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 18, 2021

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4701 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 10869:2011 - OIL OF FIR NEEDLE, SIBERIAN

| Compound | Min. % | Max. % | Observed % | Complies? |
|-------------------------|--------|--------|------------|-----------|
| α-Humulene | 0.3 | 0.9 | 0.6 | Yes |
| Borneol | 1.0 | 3.0 | 1.5 | Yes |
| Isobornyl acetate | | 0.1 | 0.1 | Yes |
| β-Caryophyllene | 0.5 | 2.0 | 1.1 | Yes |
| Bornyl acetate | 20.0 | 35.0 | 26.3 | Yes |
| β-Phellandrene | 1.5 | 5.0 | 3.1 | Yes |
| Limonene | 4.0 | 10.0 | 4.5 | Yes |
| Δ3-Carene | 9.0 | 15.0 | 12.6 | Yes |
| β-Pinene | 1.0 | 3.5 | 2.0 | Yes |
| Camphene | 15.0 | 26.0 | 22.9 | Yes |
| α-Pinene | 10.0 | 22.0 | 12.8 | Yes |
| Tricyclene | 1.5 | 3.5 | 2.4 | Yes |
| Santene | 1.5 | 3.5 | 2.6 | Yes |
| Refractive index | 1.4680 | 1.4730 | 1.4701 | Yes |

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for Siberian fir needle oil.

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 |
| Santene | 2.64 | Normonoterpene |
| Unknown | 0.03 | Normonoterpene |
| Tricyclene | 2.36 | Monoterpene |
| α -Thujene | 0.08 | Monoterpene |
| α -Pinene | 12.77 | Monoterpene |
| Camphene | 22.88 | Monoterpene |
| α -Fenchene | 0.03 | Monoterpene |
| Thuja-2,4(10)-diene | 0.02 | Monoterpene |
| meta-Cymene | 0.03 | Monoterpene |
| β -Pinene | 2.00 | Monoterpene |
| Sabinene | 0.01 | Monoterpene |
| Myrcene | 0.64 | Monoterpene |
| 2-Carene | 0.01 | Monoterpene |
| α -Phellandrene | 0.21 | Monoterpene |
| Pseudolimonene | 0.01 | Monoterpene |
| Δ^3 -Carene | 12.56 | Monoterpene |
| α -Terpinene | 0.12 | Monoterpene |
| para-Cymene | 0.08 | Monoterpene |
| β -Phellandrene | 3.11 | Monoterpene |
| Limonene | 4.52 | Monoterpene |
| (Z)- β -Ocimene | tr | Monoterpene |
| γ -Terpinene | 0.17 | Monoterpene |
| meta-Cymenene | 0.01 | Monoterpene |
| Isoterpinolene | 0.04 | Monoterpene |
| Terpinolene | 1.21 | Monoterpene |
| γ -Campholenal | 0.02 | Aliphatic alcohol |
| para-Cymenene | 0.03 | Monoterpene |
| α -Pinene oxide | 0.01 | Monoterpenic ether |
| Linalool | 0.02 | Monoterpenic alcohol |
| endo-Fenchol | 0.02 | Monoterpenic alcohol |
| cis-para-Menth-2-en-1-ol | 0.01 | Monoterpenic alcohol |
| α -Campholenal | 0.02 | Monoterpenic aldehyde |
| trans-Pinocarveol | 0.02 | Monoterpenic alcohol |
| Camphor | 0.25 | Monoterpenic ketone |
| Camphene hydrate | 0.10 | Monoterpenic alcohol |
| meta-Mentha-4,6-dien-8-ol | 0.01 | Monoterpenic alcohol |
| Isoborneol | 0.03 | Monoterpenic alcohol |
| Pinocarvone | 0.01 | Monoterpenic ketone |
| Borneol | 1.46 | Monoterpenic alcohol |
| Isopinocampone | 0.05 | Monoterpenic ketone |
| Terpinen-4-ol | 0.11 | Monoterpenic alcohol |
| Cryptone | 0.02 | Normonoterpenic ketone |
| meta-Cymen-8-ol | 0.03 | Monoterpenic alcohol |

| | | |
|-------------------------------|---------------|------------------------|
| para-Cymen-8-ol | 0.03 | Monoterpenic alcohol |
| α-Terpineol | 0.17 | Monoterpenic alcohol |
| Myrtenal | 0.01 | Monoterpenic aldehyde |
| Myrtenol | 0.02 | Monoterpenic alcohol |
| Unknown | 0.01 | Oxygenated monoterpene |
| Verbenone | 0.04 | Monoterpenic ketone |
| endo-Fenchyl acetate | 0.02 | Monoterpenic ester |
| Citronellol | 0.01 | Monoterpenic alcohol |
| Thymol methyl ether | 0.04 | Monoterpenic ether |
| Carvone | 0.01 | Monoterpenic ketone |
| Piperitone | 0.01 | Monoterpenic ketone |
| Phellandral | 0.01 | Monoterpenic aldehyde |
| Bornyl acetate | 26.29 | Monoterpenic ester |
| Isobornyl acetate | 0.10 | Monoterpenic ester |
| 2-Undecanone | 0.05 | Aliphatic ketone |
| Isohexyl isocaproate | 0.03 | Aliphatic ester |
| Unknown | 0.01 | Unknown |
| Unknown | 0.01 | Unknown |
| α-Longipinene | 0.02 | Sesquiterpene |
| α-Terpinyl acetate | 0.01 | Monoterpenic ester |
| Neryl acetate | 0.06 | Monoterpenic ester |
| α-Copaene | 0.01 | Sesquiterpene |
| Geranyl acetate | 0.25 | Monoterpenic ester |
| Longifolene | 0.11 | Sesquiterpene |
| Methyleugenol | 0.02 | Phenylpropanoid |
| Dodecanal | 0.16 | Aliphatic aldehyde |
| β-Caryophyllene | 1.13 | Sesquiterpene |
| Caryophylla-4(12),8(13)-diene | 0.01 | Sesquiterpene |
| α-Himachalene | 0.04 | Sesquiterpene |
| α-Humulene | 0.63 | Sesquiterpene |
| (E)-β-Farnesene | 0.02 | Sesquiterpene |
| γ-Himachalene | 0.02 | Sesquiterpene |
| Dodecanol | 0.04 | Aliphatic alcohol |
| Unknown | 0.04 | Sesquiterpene |
| Unknown | 0.01 | Unknown |
| β-Himachalene | 0.05 | Sesquiterpene |
| α-Murolene | 0.02 | Sesquiterpene |
| (Z)-α-Bisabolene | 0.02 | Sesquiterpene |
| β-Bisabolene | 0.16 | Sesquiterpene |
| δ-Cadinene | 0.02 | Sesquiterpene |
| (E)-α-Bisabolene | 0.01 | Sesquiterpene |
| (E)-Nerolidol | 0.03 | Sesquiterpenic alcohol |
| Caryophyllene oxide | 0.04 | Sesquiterpenic ether |
| Humulene epoxide II | 0.02 | Sesquiterpenic ether |
| Selin-6-en-4α-ol isomer | 0.04 | Sesquiterpenic alcohol |
| α-Bisabolol analog | 0.01 | Sesquiterpenic alcohol |
| epi-α-Bisabolol | 0.06 | Sesquiterpenic alcohol |
| α-Bisabolol | 0.18 | Sesquiterpenic alcohol |
| Manoyl oxide | 0.04 | Diterpenic ether |
| 13-epi-Manoyl oxide | 0.02 | Diterpenic ether |
| Manool | 0.03 | Diterpenic alcohol |
| Consolidated total | 97.94% | |

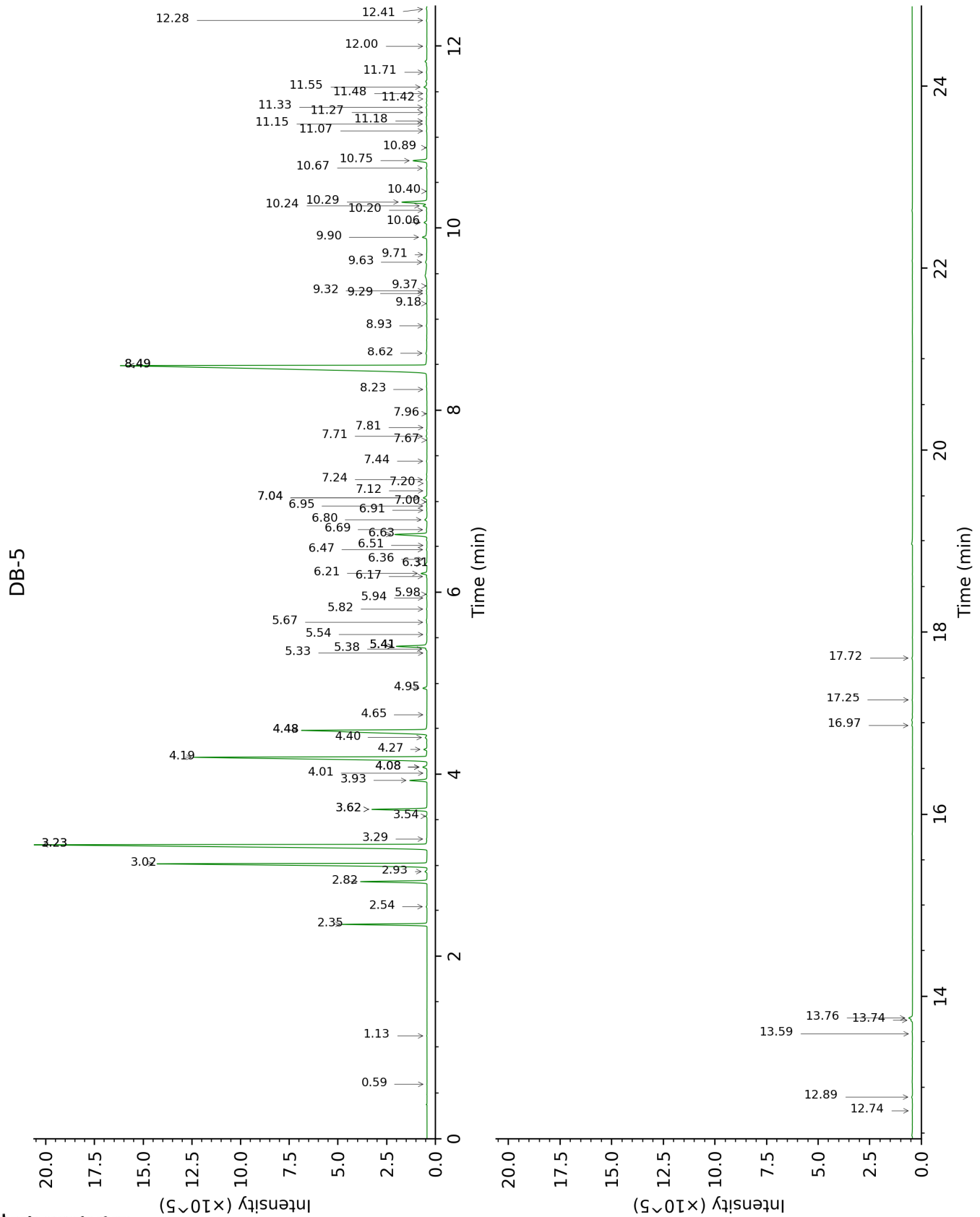
tr: The compound has been detected below 0.005% of total signal.

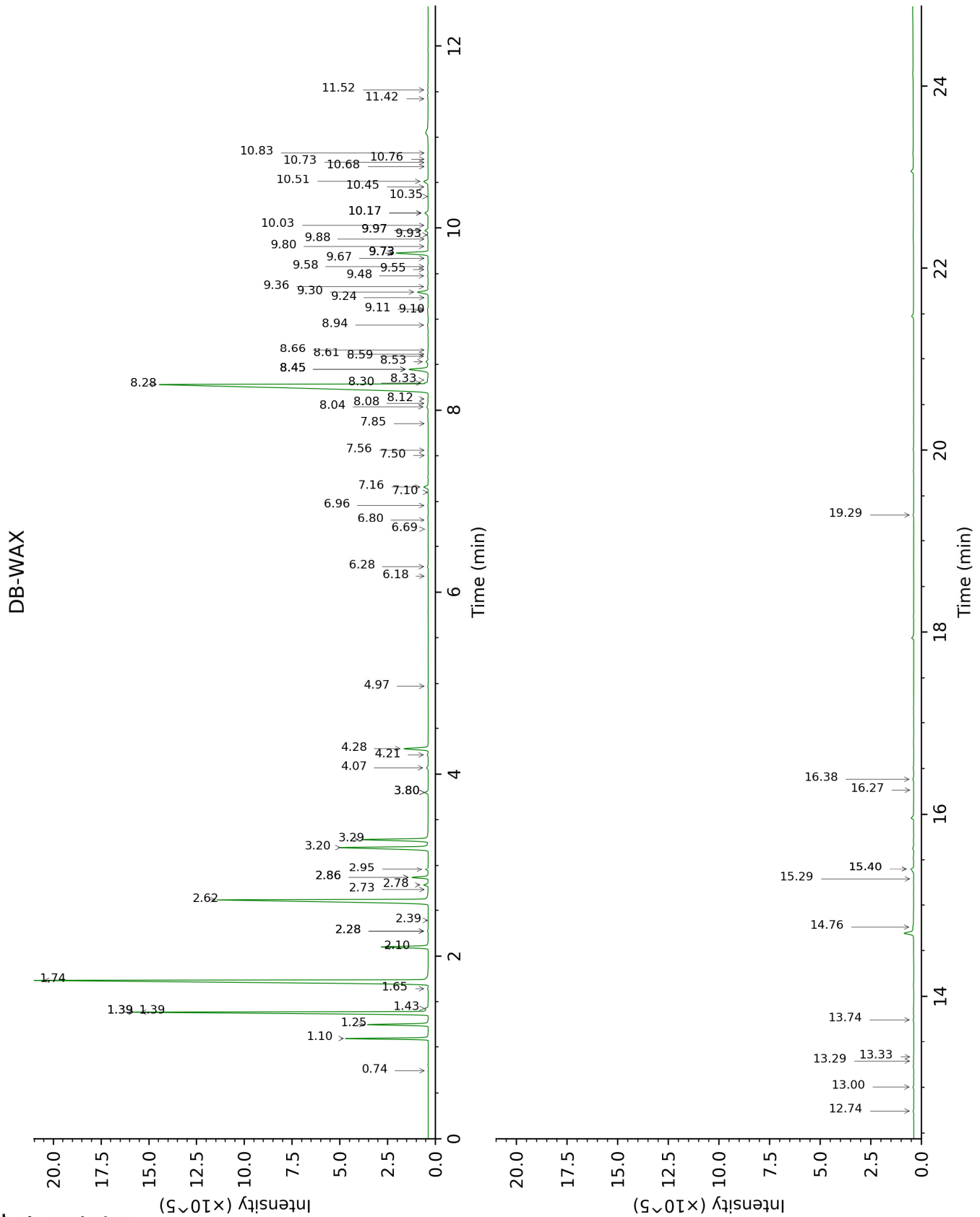
Note: no correction factor was applied

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 | % |
| Isovaleral | 0.60 | 637 | tr | 0.74 | 888 | tr |
| Toluene | 1.13 | 764 | 0.01 | 1.39*† | 1001 | 12.81 |
| Santene | 2.35 | 884 | 2.64 | 1.10 | 954 | 2.63 |
| Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)] | 2.54 | 900 | 0.03 | 1.39*† | 1001 | [12.81] |
| Tricyclene | 2.82 | 919 | 2.36 | 1.25 | 979 | 2.30 |
| α-Thujene | 2.93 | 926 | 0.08 | 1.43† | 1005 | [12.81] |
| α-Pinene | 3.02 | 932 | 12.77 | 1.39*† | 1001 | [12.81] |
| Camphene | 3.23* | 946 | 23.18 | 1.74 | 1035 | 22.88 |
| α-Fenchene | 3.23* | 946 | [23.18] | 1.64 | 1026 | 0.03 |
| Thuja-2,4(10)- diene | 3.29 | 950 | 0.02 | 2.28* | 1088 | 0.03 |
| meta-Cymene | 3.54 | 966 | 0.03 | 2.86* | 1136 | 0.69 |
| β-Pinene | 3.62* | 971 | 2.03 | 2.10 | 1071 | 2.00 |
| Sabinene | 3.62* | 971 | [2.03] | 2.28* | 1088 | [0.03] |
| Myrcene | 3.93 | 992 | 0.64 | 2.86* | 1136 | [0.69] |
| 2-Carene | 4.01 | 997 | 0.01 | 2.39 | 1100 | 0.01 |
| α-Phellandrene | 4.08* | 1002 | 0.19 | 2.78 | 1130 | 0.21 |
| Pseudolimonene | 4.08* | 1002 | [0.19] | 2.73 | 1126 | 0.01 |
| Δ3-Carene | 4.19 | 1008 | 12.56 | 2.62 | 1117 | 12.46 |
| α-Terpinene | 4.27 | 1014 | 0.12 | 2.95 | 1143 | 0.12 |
| para-Cymene | 4.40 | 1022 | 0.08 | 4.07 | 1227 | 0.08 |
| β-Phellandrene | 4.48* | 1027 | 7.70 | 3.29 | 1169 | 3.11 |
| Limonene | 4.48* | 1027 | [7.70] | 3.20 | 1162 | 4.52 |
| (Z)-β-Ocimene | 4.65 | 1037 | tr | 3.80* | 1208 | 0.17 |
| γ-Terpinene | 4.95 | 1056 | 0.17 | 3.80* | 1208 | [0.17] |
| meta-Cymenene | 5.33 | 1080 | 0.01 | 6.18 | 1378 | 0.01 |
| Isoterpinolene | 5.38 | 1083 | 0.04 | 4.21 | 1237 | 0.05 |
| Terpinolene | 5.41* | 1085 | 1.25 | 4.28 | 1242 | 1.21 |
| γ-Campholenal | 5.41* | 1085 | [1.25] | 4.97 | 1292 | 0.02 |
| para-Cymenene | 5.41* | 1085 | [1.25] | 6.28 | 1386 | 0.03 |
| α-Pinene oxide | 5.54 | 1093 | 0.01 | | | |
| Linalool | 5.67 | 1101 | 0.02 | 8.08 | 1520 | 0.02 |
| endo-Fenchol | 5.82 | 1110 | 0.02 | 8.33 | 1539 | 0.03 |
| cis-para-Menth-2- en-1-ol | 5.94 | 1118 | 0.01 | 8.12 | 1523 | 0.01 |
| α-Campholenal | 5.98 | 1121 | 0.02 | 6.96 | 1436 | 0.02 |
| trans-Pinocarveol | 6.17 | 1133 | 0.02 | 9.11 | 1600 | 0.03 |
| Camphor | 6.21 | 1135 | 0.25 | 7.16 | 1451 | 0.24 |
| Camphene hydrate | 6.31 | 1142 | 0.10 | 8.45* | 1548 | 1.17 |
| meta-Mentha-4,6- dien-8-ol | 6.36 | 1145 | 0.01 | 9.24 | 1611 | 0.01 |
| Isoborneol | 6.47 | 1152 | 0.03 | 9.36 | 1620 | 0.04 |
| Pinocarvone | 6.51 | 1155 | 0.01 | 7.85 | 1502 | 0.01 |
| Borneol | 6.63 | 1162 | 1.46 | 9.73* | 1650 | 1.68 |

| | | | | | | |
|--|-------|------|---------|--------|------|--------|
| Isopinocampnone | 6.69 | 1166 | 0.05 | 7.56 | 1480 | 0.02 |
| Terpinen-4-ol | 6.80 | 1173 | 0.11 | 8.53 | 1555 | 0.10 |
| Cryptone | 6.90 | 1180 | 0.02 | 9.10 | 1599 | 0.03 |
| meta-Cymen-8-ol | 6.95 | 1183 | 0.03 | 11.42 | 1793 | 0.02 |
| para-Cymen-8-ol | 7.00 | 1186 | 0.03 | 11.52 | 1801 | 0.03 |
| α -Terpineol | 7.04* | 1188 | 0.19 | 9.73* | 1650 | [1.68] |
| Myrtenal | 7.04* | 1188 | [0.19] | 8.66 | 1565 | 0.01 |
| Myrtenol | 7.12 | 1194 | 0.02 | 10.83 | 1742 | 0.01 |
| Unknown [m/z 109, 91 (100), 81 (88), 94 (75), 119 (74), 96 (73), 41 (63)... 150 (2)] | 7.20 | 1199 | 0.01 | 10.76 | 1736 | 0.01 |
| Verbenone | 7.24 | 1201 | 0.04 | 9.58 | 1638 | 0.05 |
| endo-Fenchyl acetate | 7.44 | 1215 | 0.02 | 6.80 | 1424 | 0.02 |
| Citronellol | 7.67 | 1230 | 0.01 | 10.68 | 1729 | 0.01 |
| Thymol methyl ether | 7.72 | 1233 | 0.04 | 8.45* | 1548 | [1.17] |
| Carvone | 7.81 | 1240 | 0.01 | 9.98* | 1670 | 0.18 |
| Piperitone | 7.96 | 1250 | 0.01 | 9.88 | 1663 | 0.01 |
| Phellandral | 8.23 | 1268 | 0.01 | 9.93 | 1666 | 0.05 |
| Bornyl acetate | 8.49* | 1286 | 27.03 | 8.28 | 1536 | 26.29 |
| Isobornyl acetate | 8.49* | 1286 | [27.03] | 8.30 | 1537 | 0.10 |
| 2-Undecanone | 8.62 | 1295 | 0.05 | 8.59 | 1560 | 0.04 |
| Isohexyl isocaproate | 8.93 | 1314 | 0.03 | 7.50 | 1476 | 0.01 |
| Unknown [m/z 135, 91 (76), 43 (59), 77 (39), 93 (33)...] | 9.18 | 1331 | 0.01 | | | |
| Unknown [m/z 121, 93 (84), 43 (81), 79 (48), 117 (40), 56 (37)...] | 9.29 | 1339 | 0.01 | | | |
| α -Longipinene | 9.32 | 1341 | 0.02 | 6.69 | 1416 | 0.01 |
| α -Terpinyl acetate | 9.37 | 1345 | 0.01 | 9.67 | 1646 | 0.01 |
| Neryl acetate | 9.63 | 1363 | 0.06 | 10.17* | 1686 | 0.22 |
| α -Copaene | 9.71 | 1369 | 0.01 | 7.10 | 1446 | 0.01 |
| Geranyl acetate | 9.90 | 1382 | 0.25 | 10.51 | 1715 | 0.28 |
| Longifolene | 10.06 | 1393 | 0.11 | 8.04 | 1517 | 0.10 |
| Methyleugenol | 10.20 | 1403 | 0.02 | 13.29 | 1961 | 0.02 |
| Dodecanal | 10.24 | 1407 | 0.16 | 9.98* | 1670 | [0.18] |
| β -Caryophyllene | 10.29 | 1410 | 1.13 | 8.45* | 1548 | [1.17] |
| Caryophylla- 4(12),8(13)-diene | 10.40 | 1418 | 0.01 | 8.61 | 1561 | 0.01 |
| α -Himachalene | 10.67 | 1438 | 0.04 | 8.94 | 1587 | 0.05 |
| α -Humulene | 10.75 | 1444 | 0.63 | 9.30 | 1616 | 0.63 |
| (<i>E</i>)- β -Farnesene | 10.89 | 1454 | 0.02 | 9.48 | 1630 | 0.04 |
| γ -Himachalene | 11.07 | 1468 | 0.02 | 9.55 | 1636 | 0.03 |
| Dodecanol | 11.15 | 1474 | 0.04 | 13.00 | 1935 | 0.04 |

| | | | | | | |
|---|-------|---------------|------|--------|---------------|--------|
| Unknown [m/z 91, 93 (92), 105 (71), 77 (69), 79 (68), 133 (63)... 204 (32)] | 11.18 | 1476 | 0.04 | 9.80 | 1656 | 0.04 |
| Unknown [m/z 43, 58 (75), 57 (58), 71 (55), 41 (41), 59 (31)...] | 11.27 | 1483 | 0.01 | | | |
| β-Himachalene | 11.33 | 1488 | 0.05 | 9.73* | 1650 | [1.68] |
| α-Muurolene | 11.42 | 1494 | 0.02 | 10.03 | 1675 | 0.03 |
| (Z)-α-Bisabolene | 11.48 | 1499 | 0.02 | 10.35 | 1701 | 0.02 |
| β-Bisabolene | 11.55 | 1504 | 0.16 | 10.17* | 1686 | [0.22] |
| δ-Cadinene | 11.72 | 1517 | 0.02 | 10.45 | 1710 | 0.03 |
| (E)-α-Bisabolene | 12.00 | 1539 | 0.01 | 10.73 | 1733 | 0.01 |
| (E)-Nerolidol | 12.28 | 1561 | 0.03 | 13.74 | 2004 | 0.03 |
| Caryophyllene oxide | 12.41 | 1572 | 0.04 | 12.74 | 1911 | 0.03 |
| Humulene epoxide II | 12.74 | 1598 | 0.02 | 13.33 | 1966 | 0.02 |
| Selin-6-en-4α-ol isomer | 12.89 | 1610 | 0.04 | 14.76 | 2103 | 0.04 |
| α-Bisabolol analog | 13.59 | 1668 | 0.01 | 15.29 | 2157 | 0.01 |
| epi-α-Bisabolol | 13.74 | 1680 | 0.06 | 15.40* | 2168 | 0.23 |
| α-Bisabolol | 13.76 | 1682 | 0.18 | 15.40* | 2168 | [0.23] |
| Manoyl oxide | 16.97 | 1973 | 0.04 | 16.38 | 2271 | 0.05 |
| 13-epi-Manoyl oxide | 17.25 | 2000 | 0.02 | 16.27 | 2258 | 0.01 |
| Manool | 17.72 | 2046 | 0.03 | 19.29 | 2600 | 0.03 |
| Total identified | | 98.77% | | | 97.62% | |
| Total reported | | 98.90% | | | 97.67% | |

*: 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