

Date : July 03, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 20F29-PTH09


Customer identification : Lemongrass - India - L8010899R

Type : Essential oil

Source : *Cymbopogon flexuosus*

Customer : Plant Therapy

ANALYSIS

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

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

Analysis date : June 30, 2020

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Yellow liquid

Refractive index: 1.4858 ± 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 | 0.01 | Aliphatic aldehyde |
| 2-Methylbutyral | tr | Aliphatic aldehyde |
| Hexanal | tr | Aliphatic aldehyde |
| 4-Heptanone | 0.01 | Aliphatic ketone |
| Tricyclene | 0.09 | Monoterpene |
| α -Pinene | 0.13 | Monoterpene |
| Camphene | 0.74 | Monoterpene |
| Sabinene | 0.01 | Monoterpene |
| β -Pinene | 0.01 | Monoterpene |
| 6-Methyl-5-hepten-2-one | 1.07 | Aliphatic ketone |
| Dehydro-1,8-cineole | 0.03 | Monoterpenic ether |
| Myrcene | 0.06 | Monoterpene |
| 6-Methyl-5-hepten-2-ol | 0.05 | Aliphatic alcohol |
| α -Phellandrene | 0.01 | Monoterpene |
| Octanal | 0.06 | Aliphatic aldehyde |
| α -Terpinene | 0.01 | Monoterpene |
| para-Cymene | 0.01 | Monoterpene |
| β -Phellandrene | 0.02 | Monoterpene |
| Limonene | 0.20 | Monoterpene |
| 1,8-Cineole | tr | Monoterpenic ether |
| Benzeneacetaldehyde | 0.01 | Simple phenolic |
| (Z)- β -Ocimene | 0.26 | Monoterpene |
| (E)- β -Ocimene | 0.16 | Monoterpene |
| 2,6-Dimethyl-5-heptenal (melonal) | 0.03 | Aliphatic aldehyde |
| γ -Terpinene | 0.01 | Monoterpene |
| cis-Linalool oxide (fur.) | 0.02 | Monoterpenic alcohol |
| 4-Nonanone | 0.84 | Aliphatic ketone |
| Terpinolene | 0.05 | Monoterpene |
| 4-Nonanol | 0.02 | Aliphatic alcohol |
| Rosefuran | 0.23 | Monoterpenic ether |
| Linalool | 1.03 | Monoterpenic alcohol |
| Perillene | 0.08 | Monoterpenic ether |
| cis-Chrysanthemal? | 0.03 | Monoterpenic aldehyde |
| Unknown | 0.01 | Unknown |
| trans-para-Mentha-2,8-dien-1-ol | 0.02 | Monoterpenic alcohol |
| Unknown | 0.12 | Unknown |
| Unknown | 0.02 | Unknown |
| trans-Chrysanthemal | 0.25 | Monoterpenic aldehyde |
| exo-Isocitral | 0.06 | Monoterpenic aldehyde |
| Citronellal | 0.25 | Monoterpenic aldehyde |
| Borneol | 0.18 | Monoterpenic alcohol |
| Isoneral | 0.52 | Monoterpenic aldehyde |
| Rosefuran oxide | 0.04 | Monoterpenic ether |
| Terpinen-4-ol | 0.21 | Monoterpenic alcohol |
| Unknown | 0.13 | Oxygenated monoterpene |

| | | |
|--------------------------------------|-------|------------------------|
| Unknown | 0.01 | Unknown |
| Isogeranial | 0.79 | Monoterpenic aldehyde |
| α -Terpineol | 0.14 | Monoterpenic alcohol |
| Myrtenal | 0.07 | Monoterpenic aldehyde |
| <i>trans</i> -Isopiperitenol | 0.02 | Monoterpenic alcohol |
| Unknown | 0.03 | Oxygenated monoterpene |
| Decanal | 0.12 | Aliphatic aldehyde |
| <i>cis</i> -Isopiperitenol | 0.02 | Monoterpenic alcohol |
| 2,3-Epoxyneral? | 0.03 | Monoterpenic aldehyde |
| Nerol | 0.04 | Monoterpenic alcohol |
| Citronellol | 0.19 | Monoterpenic alcohol |
| Neral | 31.69 | Monoterpenic aldehyde |
| Piperitone | 0.07 | Monoterpenic ketone |
| Geraniol | 5.84 | Monoterpenic alcohol |
| Geranial | 41.41 | Monoterpenic aldehyde |
| Unknown | 0.12 | Oxygenated monoterpene |
| Bornyl acetate | 0.07 | Monoterpenic ester |
| Geranyl formate | 0.04 | Monoterpenic ester |
| Unknown | 0.10 | Unknown |
| α -Cubebene | 0.02 | Sesquiterpene |
| Citronellyl acetate | 0.07 | Monoterpenic ester |
| Cyclosativene I | 0.11 | Sesquiterpene |
| Cyclosativene II | 0.11 | Sesquiterpene |
| α -Copaene | 0.01 | Sesquiterpene |
| Geranic acid | 0.35 | Aliphatic acid |
| β -Bourbonene | 0.03 | Sesquiterpene |
| Geranyl acetate | 2.73 | Monoterpenic ester |
| β -Cubebene | 0.01 | Sesquiterpene |
| β -Elemene | 0.09 | Sesquiterpene |
| β -Longipinene | 0.02 | Sesquiterpene |
| β -Caryophyllene | 1.61 | Sesquiterpene |
| <i>trans</i> - α -Bergamotene | 0.01 | Sesquiterpene |
| α -Humulene | 0.23 | Sesquiterpene |
| (<i>E</i>)-Isoeugenol | 0.36 | Phenylpropanoid |
| Unknown | tr | Unknown |
| <i>cis</i> -Muurolo-4(15),5-diene | 0.03 | Sesquiterpene |
| <i>trans</i> -Cadina-1(6),4-diene | 0.04 | Sesquiterpene |
| Germacrene D | 0.19 | Sesquiterpene |
| γ -Amorphene | 0.03 | Sesquiterpene |
| epi-Cubebol | 0.18 | Sesquiterpenic alcohol |
| α -Selinene | 0.02 | Sesquiterpene |
| α -Muurolole | 0.10 | Sesquiterpene |
| γ -Cadinene | 1.08 | Sesquiterpene |
| Cubebol | 0.48 | Sesquiterpenic alcohol |
| δ -Cadinene | 0.31 | Sesquiterpene |
| 10-epi-Cubebol? | 0.05 | Sesquiterpenic alcohol |
| (<i>E</i>)- γ -Bisabolene | 0.10 | Sesquiterpene |
| α -Cadinene | 0.06 | Sesquiterpene |
| α -Elemol | 0.08 | Sesquiterpenic alcohol |
| Germacrene B | 0.04 | Sesquiterpene |
| Geranyl butyrate | 0.06 | Monoterpenic ester |
| Caryophyllene oxide | 0.76 | Sesquiterpenic ether |

| | | |
|----------------------------------|---------------|-------------------------|
| Caryophyllene oxide isomer | 0.04 | Sesquiterpenic ether |
| Humulene epoxide II | 0.07 | Sesquiterpenic ether |
| Selin-6-en-4 α -ol isomer | 0.01 | Sesquiterpenic alcohol |
| 1-epi-Cubenol | 0.05 | Sesquiterpenic alcohol |
| Cubenol | 0.03 | Sesquiterpenic alcohol |
| β -Eudesmol | 0.01 | Sesquiterpenic alcohol |
| Farnesal isomer | 0.02 | Sesquiterpenic aldehyde |
| (2E,6E)-Farnesal | 0.03 | Sesquiterpenic aldehyde |
| meta-Camphorene | tr | Diterpene |
| Unknown | 0.09 | Unknown |
| Dicitral | 0.06 | Diterpenic aldehyde |
| Unknown | 0.03 | Unknown |
| Unknown | 0.02 | Unknown |
| Unknown | 0.04 | Unknown |
| Consolidated total | 97.72% | |

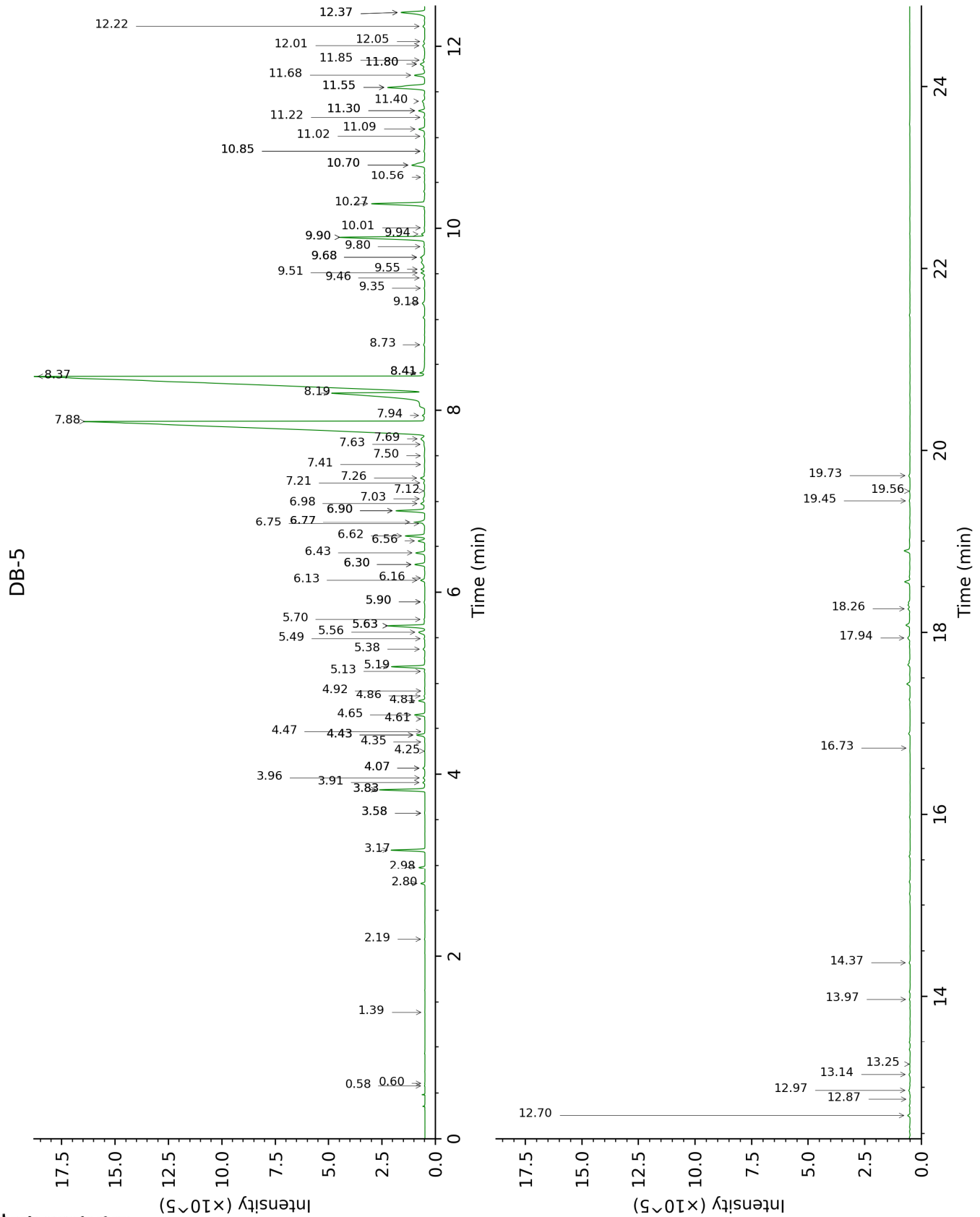
tr: The compound has been detected below 0.005% of total signal.

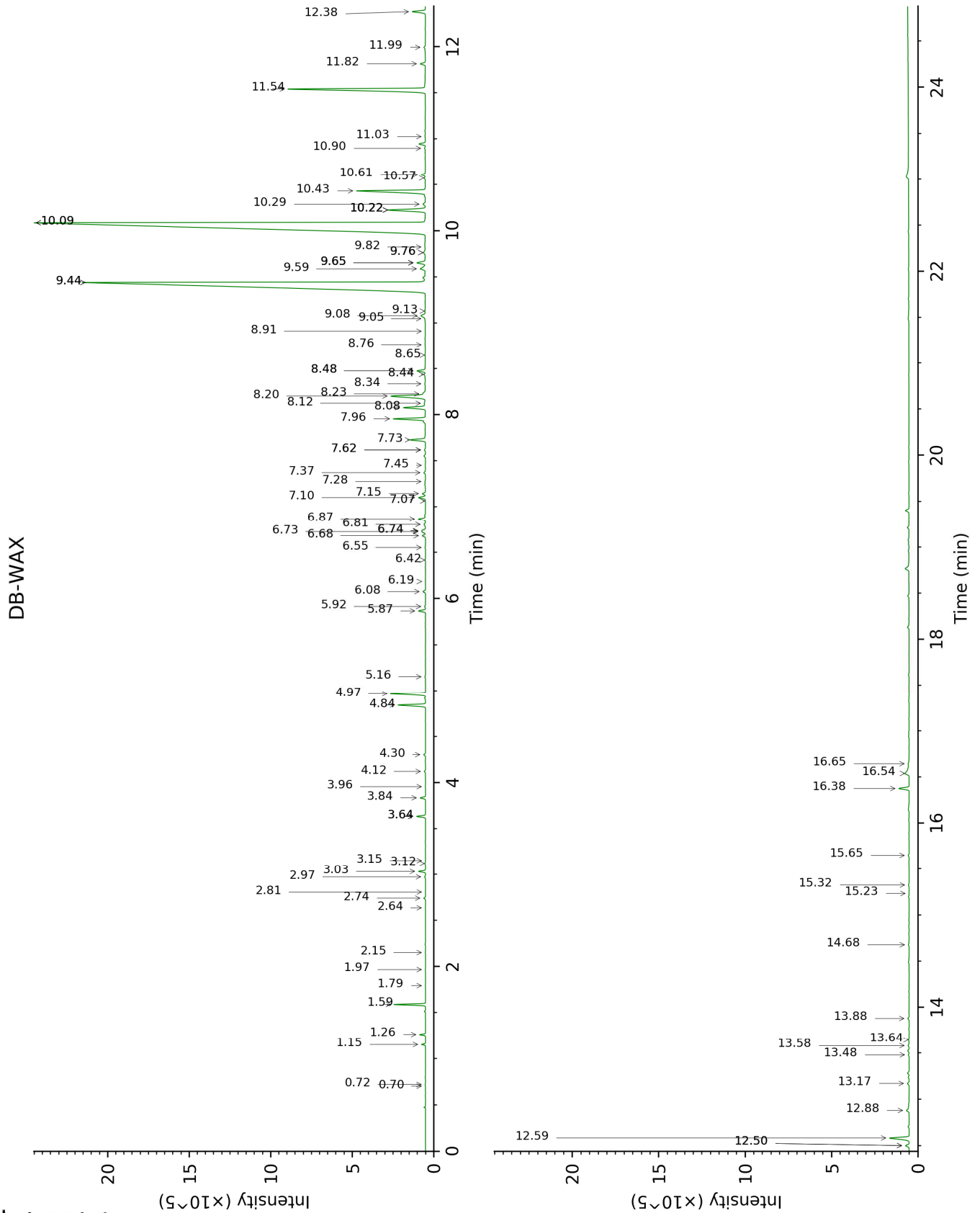
Note: no correction factor was applied

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 | 0.58 | 639 | 0.01 | 0.72 | 887 | 0.01 |
| 2-Methylbutyral | 0.60 | 651 | tr | 0.70 | 879 | tr |
| Hexanal | 1.39 | 804 | tr | 1.80 | 1044 | tr |
| 4-Heptanone | 2.19 | 871 | 0.01 | | | |
| Tricyclene | 2.80 | 918 | 0.09 | 1.15 | 967 | 0.09 |
| α -Pinene | 2.98 | 930 | 0.13 | 1.26 | 987 | 0.13 |
| Camphene | 3.17 | 943 | 0.74 | 1.59 | 1023 | 0.74 |
| Sabinene | 3.58* | 969 | 0.01 | 2.15 | 1082 | 0.01 |
| β -Pinene | 3.58* | 969 | [0.01] | 1.97 | 1063 | 0.01 |
| 6-Methyl-5-hepten-2-one | 3.83* | 986 | 1.07 | 4.97 | 1298 | 1.07 |
| Dehydro-1,8-cineole | 3.83* | 986 | [1.07] | 2.97 | 1150 | 0.03 |
| Myrcene | 3.91 | 992 | 0.06 | 2.74 | 1131 | 0.05 |
| 6-Methyl-5-hepten-2-ol | 3.96 | 995 | 0.05 | 6.81 | 1432 | 0.06 |
| α -Phellandrene | 4.07* | 1002 | 0.06 | 2.64 | 1123 | 0.01 |
| Octanal | 4.07* | 1002 | [0.06] | 4.30 | 1249 | 0.06 |
| α -Terpinene | 4.25 | 1014 | 0.01 | 2.81 | 1136 | 0.01 |
| para-Cymene | 4.35 | 1020 | 0.01 | 3.96 | 1224 | 0.01 |
| β -Phellandrene | 4.43*† | 1025 | 0.23 | 3.12 | 1162 | 0.02 |
| Limonene | 4.43*† | 1025 | [0.23] | 3.03 | 1154 | 0.20 |
| 1,8-Cineole | 4.47† | 1027 | [0.23] | 3.16 | 1164 | tr |
| Benzeneacetaldehyde | 4.61 | 1036 | 0.01 | 8.65 | 1572 | 0.02 |
| (Z)- β -Ocimene | 4.65 | 1039 | 0.26 | 3.64* | 1201 | 0.26 |
| (E)- β -Ocimene | 4.81 | 1048 | 0.16 | 3.84 | 1216 | 0.15 |
| 2,6-Dimethyl-5-heptenal (melonal) | 4.86 | 1052 | 0.03 | 5.16 | 1311 | 0.02 |
| γ -Terpinene | 4.92 | 1055 | 0.01 | 3.64* | 1201 | [0.26] |
| cis-Linalool oxide (fur.) | 5.14 | 1069 | 0.02 | 6.42 | 1403 | 0.01 |
| 4-Nonanone | 5.19 | 1072 | 0.84 | 4.84 | 1288 | 0.86 |
| Terpinolene | 5.38 | 1084 | 0.05 | 4.12 | 1236 | 0.04 |
| 4-Nonanol | 5.49 | 1092 | 0.02 | | | |
| Rosefuran | 5.56 | 1096 | 0.23 | 5.87 | 1363 | 0.22 |
| Linalool | 5.63* | 1100 | 1.06 | 7.96 | 1518 | 1.03 |
| Perillene | 5.63* | 1100 | [1.06] | 6.08 | 1378 | 0.08 |
| cis-Chrysanthemal? | 5.70 | 1105 | 0.03 | 5.92 | 1366 | 0.03 |
| Unknown [m/z 81, 79 (19), 41 (12), 92 (8), 77 (8)...] | 5.90* | 1117 | 0.03 | 6.19 | 1386 | 0.01 |
| trans-para-Mentha-2,8-dien-1-ol | 5.90* | 1117 | [0.03] | 8.76 | 1581 | 0.02 |
| Unknown [m/z 81, 70 (98), 67 (63), 82 (53), 41 (46), 69 (46), 109 (43)...] | 6.13 | 1133 | 0.12 | 6.68 | 1423 | 0.11 |
| Unknown [m/z 95, 67 (86), 41 (68), 82 (64), | 6.16 | 1134 | 0.02 | 7.45 | 1480 | 0.01 |

| | | | | | | |
|---|--------|------|--------|--------|------|---------|
| 123 (62)... | | | | | | |
| <i>trans</i> -Chrysanthemal | 6.30* | 1144 | 0.29 | 7.10 | 1454 | 0.25 |
| exo-Isocitral | 6.30* | 1144 | [0.29] | 7.37 | 1474 | 0.06 |
| Citronellal | 6.43 | 1152 | 0.25 | 6.87 | 1436 | 0.25 |
| Borneol | 6.56 | 1160 | 0.18 | 9.65* | 1653 | 0.33 |
| Isoneral | 6.62 | 1164 | 0.52 | 7.73 | 1501 | 0.54 |
| Rosefuran oxide | 6.75 | 1173 | 0.04 | 8.44 | 1556 | 0.05 |
| Terpinen-4-ol | 6.77* | 1174 | 0.34 | 8.48* | 1559 | 0.28 |
| Unknown [m/z 84, 83 (74), 137 (56), 41 (47), 93 (43), 108 (40)... 152 (2)] | 6.77* | 1174 | [0.34] | 9.44* | 1636 | 31.61 |
| Unknown [m/z 69, 41 (65), 109 (36), 67 (16), 84 (11), 43 (10), 55 (9)... | 6.90* | 1182 | 0.80 | | | |
| Isogeranial | 6.90* | 1182 | [0.80] | 8.08 | 1528 | 0.79 |
| α -Terpineol | 6.98 | 1188 | 0.14 | 9.59 | 1648 | 0.27 |
| Myrtenal | 7.03 | 1191 | 0.07 | 8.48* | 1559 | [0.28] |
| <i>trans</i> -Isopiperitenol | 7.12 | 1197 | 0.02 | 10.22* | 1700 | 1.47 |
| Unknown [m/z 84, 41 (83), 83 (79), 91 (76), 93 (67), 119 (64), 137 (63), 109 (54), 108 (54)... 152 (4)] | 7.21 | 1202 | 0.03 | | | |
| Decanal | 7.26 | 1206 | 0.12 | 7.15 | 1457 | 0.11 |
| <i>cis</i> -Isopiperitenol | 7.41 | 1216 | 0.02 | 10.22* | 1700 | [1.47] |
| 2,3-Epoxyneral? | 7.50 | 1223 | 0.03 | | | |
| Nerol | 7.63 | 1231 | 0.04 | 10.90 | 1757 | 0.04 |
| Citronellol | 7.69 | 1235 | 0.19 | 10.61 | 1732 | 0.14 |
| Neral | 7.88 | 1248 | 31.69 | 9.44* | 1636 | [31.61] |
| Piperitone | 7.94 | 1253 | 0.07 | 9.76* | 1662 | 0.12 |
| Geraniol | 8.19 | 1270 | 5.84 | 11.54 | 1812 | 5.88 |
| Geranial | 8.37 | 1282 | 41.41 | 10.09* | 1688 | 41.37 |
| Unknown [m/z 43, 69 (77), 41 (70), 109 (54)... 152 (6)] | 8.41* | 1285 | 0.18 | 12.88 | 1932 | 0.12 |
| Bornyl acetate | 8.41* | 1285 | [0.18] | 8.12 | 1532 | 0.07 |
| Geranyl formate | 8.73 | 1307 | 0.04 | 9.76* | 1662 | [0.12] |
| Unknown [m/z 82, 59 (44), 41 (43), 95 (31), 43 (29), 81 (24)... | 9.18 | 1334 | 0.10 | 12.50* | 1897 | 0.13 |
| α -Cubebene | 9.34 | 1346 | 0.02 | 6.56 | 1413 | 0.02 |
| Citronellyl acetate | 9.46 | 1354 | 0.07 | 6.74* | 1427 | 0.13 |
| Cyclosativene I | 9.51 | 1358 | 0.11 | 6.73 | 1426 | 0.09 |
| Cyclosativene II | 9.55 | 1361 | 0.11 | 6.74* | 1427 | [0.13] |
| α -Copaene | 9.68*† | 1370 | 0.42 | 7.07 | 1451 | 0.01 |
| Geranic acid | 9.68*† | 1370 | [0.42] | 16.54 | 2292 | 0.35 |
| β -Bourbonene | 9.80 | 1378 | 0.03 | 7.28 | 1467 | 0.02 |
| Geranyl acetate | 9.90* | 1386 | 2.77 | 10.43 | 1717 | 2.73 |
| β -Cubebene | 9.90* | 1386 | [2.77] | 7.62* | 1492 | 0.03 |
| β -Elemene | 9.94 | 1388 | 0.09 | 8.23 | 1539 | 0.10 |

| | | | | | | |
|---|--------|------|--------|--------|------|---------|
| β-Longipinene | 10.01 | 1393 | 0.02 | 7.62* | 1492 | [0.03] |
| β-Caryophyllene | 10.27 | 1412 | 1.61 | 8.20 | 1538 | 1.56 |
| trans-α-Bergamotene | 10.56 | 1434 | 0.01 | 8.34 | 1548 | 0.04 |
| α-Humulene | 10.70* | 1444 | 0.56 | 9.08 | 1606 | 0.23 |
| (E)-Isoeugenol | 10.70* | 1444 | [0.56] | 16.38 | 2275 | 0.36 |
| Unknown coelution I | 10.85* | 1456 | 0.03 | 8.91 | 1593 | tr |
| cis-Muurolo-4(15),5-diene | 10.85* | 1456 | [0.03] | 9.13 | 1610 | 0.03 |
| trans-Cadina-1(6),4-diene | 11.02 | 1468 | 0.04 | 9.05 | 1604 | 0.03 |
| Germacrene D | 11.09 | 1474 | 0.19 | 9.65* | 1653 | [0.33] |
| γ-Amorphene | 11.22 | 1483 | 0.03 | 9.65* | 1653 | [0.33] |
| epi-Cubebol | 11.30* | 1489 | 0.18 | 11.82 | 1836 | 0.18 |
| α-Selinene | 11.30* | 1489 | [0.18] | 9.82 | 1667 | 0.02 |
| α-Muurolole | 11.40 | 1496 | 0.10 | 10.09* | 1688 | [41.37] |
| γ-Cadinene | 11.55* | 1508 | 1.55 | 10.22* | 1700 | [1.47] |
| Cubebol | 11.55* | 1508 | [1.55] | 12.38 | 1886 | 0.48 |
| δ-Cadinene | 11.68 | 1518 | 0.31 | 10.22* | 1700 | [1.47] |
| 10-epi-Cubebol? | 11.80* | 1528 | 0.17 | 13.58 | 1997 | 0.05 |
| (E)-γ-Bisabolene | 11.80* | 1528 | [0.17] | 10.29 | 1705 | 0.10 |
| α-Cadinene | 11.85 | 1532 | 0.06 | 10.57 | 1729 | 0.04 |
| α-Elemol | 12.01 | 1544 | 0.08 | 13.88 | 2025 | 0.05 |
| Germacrene B | 12.05 | 1548 | 0.04 | 11.03 | 1767 | 0.02 |
| Geranyl butyrate | 12.22 | 1561 | 0.06 | 11.99 | 1852 | 0.06 |
| Caryophyllene oxide | 12.37* | 1573 | 0.83 | 12.58 | 1905 | 0.76 |
| Caryophyllene oxide isomer | 12.37* | 1573 | [0.83] | 12.50* | 1897 | [0.13] |
| Humulene epoxide II | 12.70 | 1598 | 0.07 | 13.17 | 1959 | 0.07 |
| Selin-6-en-4α-ol isomer | 12.87 | 1612 | 0.01 | 14.68 | 2102 | 0.03 |
| 1-epi-Cubebol | 12.97 | 1620 | 0.05 | 13.64 | 2003 | 0.03 |
| Cubebol | 13.14 | 1635 | 0.03 | 13.48 | 1987 | 0.03 |
| β-Eudesmol | 13.25 | 1644 | 0.01 | 15.32 | 2167 | 0.03 |
| Farnesal isomer | 13.97 | 1703 | 0.02 | | | |
| (2E,6E)-Farnesal | 14.37 | 1738 | 0.03 | 15.65 | 2200 | 0.04 |
| meta-Camphorene | 16.73 | 1951 | tr | 15.23 | 2158 | 0.01 |
| Unknown [m/z 93, 69 (95), 135 (76), 107 (53), 41 (53), 109 (50)... 235 (10)...] | 17.94 | 2070 | 0.09 | | | |
| Dicitral | 18.26 | 2101 | 0.06 | 16.65 | 2303 | 0.06 |
| Unknown [m/z 94, 43 (56), 123 (55), 69 (53), 95 (42), 79 (39)...] | 19.45 | 2225 | 0.03 | | | |
| Unknown [m/z 93, 69 (79), 43 (70), 137 (53), 41 (41), 119 (37)... 289 (33)...] | 19.56 | 2236 | 0.02 | | | |
| Unknown [m/z 123, 94 (100), 43 (86), 69 (75), 95 (47), 41 (47), 93 (45)...] | 19.73 | 2255 | 0.04 | | | |

| | | |
|-------------------------|---------------|---------------|
| Total identified | 97.28% | 96.76% |
| Total reported | 97.71% | 97.01% |

*: 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