

Date : August 06, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19H05-PTH15-1-DM

Customer identification : Thyme Thymol (Red) Org- Morocco- TO010194R

Type : Essential oil

Source : *Thymus vulgaris* ct. Thymol

Customer : Plant Therapy

ANALYSIS

Method: PC-PA-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 : Lindsay Girard, B. Sc.

Analysis date : August 06, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Yellow liquid

Refractive index: 1.5014 ± 0.0003 (20 °C)

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 | % | Classe |
|------------------------------|---------|----------------------|
| Acetone | 0.01 | Aliphatic ketone |
| Isovaleral | 0.01 | Aliphatic aldehyde |
| 2-Methylbutyral | 0.01 | Aliphatic aldehyde |
| 2-Ethylfuran | tr | Furan |
| 2-Methylbutanol | 0.01 | Aliphatic alcohol |
| Methyl 2-methylbutyrate | 0.01 | Aliphatic ester |
| Unknown | tr | Unknown |
| (3Z)-Hexenol | 0.02 | Aliphatic alcohol |
| Hashishene | 0.01 | Monoterpene |
| Tricyclene | 0.02 | Monoterpene |
| α -Thujene | 0.96 | Monoterpene |
| α -Pinene | 1.09 | Monoterpene |
| Camphene | 0.28 | Monoterpene |
| α -Fenchene | 0.01 | Monoterpene |
| Thuja-2,4(10)-diene | 0.01 | Monoterpene |
| β -Pinene | 0.40 | Monoterpene |
| Sabinene | 0.01 | Monoterpene |
| Octen-3-ol | 0.05 | Aliphatic alcohol |
| Octan-3-one | 0.08 | Aliphatic ketone |
| Myrcene | 1.68 | Monoterpene |
| Octan-3-ol | 0.03 | Aliphatic alcohol |
| α -Phellandrene | 0.20 | Monoterpene |
| Δ^3 -Carene | 0.10 | Monoterpene |
| α -Terpinene | 1.37 | Monoterpene |
| para-Cymene | 19.15 | Monoterpene |
| Limonene | 0.43 | Monoterpene |
| 1,8-Cineole | 0.35* | Monoterpenic ether |
| β -Phellandrene | [0.35]* | Monoterpene |
| Cymene analog | 0.01 | Monoterpene |
| (Z)- β -Ocimene | 0.01 | Monoterpene |
| (E)- β -Ocimene | 0.06 | Monoterpene |
| γ -Terpinene | 9.39 | Monoterpene |
| 2-Methylbutyl butyrate | 0.01 | Aliphatic ester |
| cis-Sabinene hydrate | 0.18 | Monoterpenic alcohol |
| 3-Methyl-3-butenyl butyrate? | 0.02 | Aliphatic ester |
| cis-Linalool oxide (fur.) | 0.04 | Monoterpenic alcohol |
| Octanol | 0.01 | Aliphatic alcohol |
| Terpinolene | 0.14 | Monoterpene |
| trans-Linalool oxide (fur.) | 0.05 | Monoterpenic alcohol |
| para-Cymenene | 0.06 | Monoterpene |
| Unknown | 0.02 | Monoterpene |
| Unknown | 0.01 | Unknown |
| trans-Sabinene hydrate | 0.07 | Monoterpenic alcohol |
| Linalool | 4.38 | Monoterpenic alcohol |
| Nonanal | 0.06 | Aliphatic aldehyde |
| Hotrienol | 0.02 | Monoterpenic alcohol |
| endo-Fenchol | 0.03 | Monoterpenic alcohol |

| | | |
|------------------------------------|-------|--------------------------|
| Unknown | 0.01 | Oxygenated monoterpene |
| Unknown | 0.05 | Unknown |
| <i>cis</i> -para-Menth-2-en-1-ol | 0.06 | Monoterpenic alcohol |
| Camphor | 0.05 | Monoterpenic ketone |
| <i>trans</i> -para-Menth-2-en-1-ol | 0.03 | Monoterpenic alcohol |
| <i>trans</i> -Verbenol | 0.02 | Monoterpenic alcohol |
| Camphene hydrate | 0.09 | Monoterpenic alcohol |
| Isoborneol | 0.01 | Monoterpenic alcohol |
| Unknown | 0.01 | Unknown |
| Borneol | 0.47 | Monoterpenic alcohol |
| Terpinen-4-ol | 0.81 | Monoterpenic alcohol |
| para-Cymen-8-ol | 0.02 | Monoterpenic alcohol |
| α -Terpineol | 0.05 | Monoterpenic alcohol |
| <i>cis</i> -Dihydrocarvone | 0.11 | Monoterpenic ketone |
| <i>trans</i> -Piperitol | 0.02 | Monoterpenic alcohol |
| Bornyl formate | 0.04 | Monoterpenic ester |
| Thymol methyl ether | 0.03 | Monoterpenic ether |
| Neral | 0.05 | Monoterpenic aldehyde |
| Carvacrol methyl ether | 0.20 | Monoterpenic ether |
| Geranial | 0.01 | Monoterpenic aldehyde |
| Thymol analogue I | 0.07 | Monoterpenic alcohol |
| Carvacrol | 3.99 | Monoterpenic alcohol |
| Thymol | 49.06 | Monoterpenic alcohol |
| Thymyl acetate | 0.05 | Monoterpenic ester |
| Eugenol | 0.03 | Phenylpropanoid |
| α -Copaene | 0.02 | Sesquiterpene |
| β -Bourbonene | 0.01 | Sesquiterpene |
| Geranyl acetate | 0.01 | Monoterpenic ester |
| Unknown | 0.04 | Unknown |
| Isocaryophyllene | 0.01 | Sesquiterpene |
| β -Caryophyllene | 1.21 | Sesquiterpene |
| Aromadendrene | 0.10 | Sesquiterpene |
| Unknown | 0.15 | Oxygenated monoterpene |
| α -Humulene | 0.09 | Sesquiterpene |
| (<i>E</i>)- β -Farnesene | 0.11 | Sesquiterpene |
| γ -Muurolene | 0.01 | Sesquiterpene |
| Germacrene D | 0.02 | Sesquiterpene |
| β -Selinene | 0.02 | Sesquiterpene |
| allo-Aromadendr-9-ene | 0.01 | Sesquiterpene |
| Viridiflorene | 0.07 | Sesquiterpene |
| α -Muurolene | 0.02 | Sesquiterpene |
| γ -Cadinene | 0.05 | Sesquiterpene |
| δ -Cadinene | 0.08 | Sesquiterpene |
| Caryophyllenyl alcohol | 0.05 | Sesquiterpenic alcohol |
| Spathulenol | 0.06 | Sesquiterpenic alcohol |
| Caryophyllene oxide | 0.13 | Sesquiterpenic ether |
| Unknown | 0.02 | Oxygenated sesquiterpene |
| Humulene epoxide II | 0.01 | Sesquiterpenic ether |
| Geranyl isovalerate | 0.02 | Monoterpenic ester |
| 10-epi- γ -Eudesmol | 0.02 | Sesquiterpenic alcohol |
| Isospathulenol | 0.01 | Sesquiterpenic alcohol |
| τ -Cadinol | 0.01 | Sesquiterpenic alcohol |

| | | |
|---|---------------|------------------------|
| α -Cadinol | 0.01 | Sesquiterpenic alcohol |
| (3Z)-Caryophylla-3,8(13)-dien-5 β -ol | 0.01 | Sesquiterpenic alcohol |
| Unknown | 0.02 | Unknown |
| Unknown | 0.05 | Unknown |
| Unknown | 0.07 | Unknown |
| Unknown | 0.01 | Unknown |
| Unknown | 0.02 | Unknown |
| Unknown | 0.01 | Unknown |
| Unknown | 0.02 | Unknown |
| Unknown | 0.01 | Unknown |
| Unknown | 0.01 | Unknown |
| Unknown | 0.01 | Unknown |
| Unknown | 0.06 | Unknown |
| Unknown | 0.02 | Unknown |
| Unknown | 0.01 | Unknown |
| Consolidated total | 98.87% | |

*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered [xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

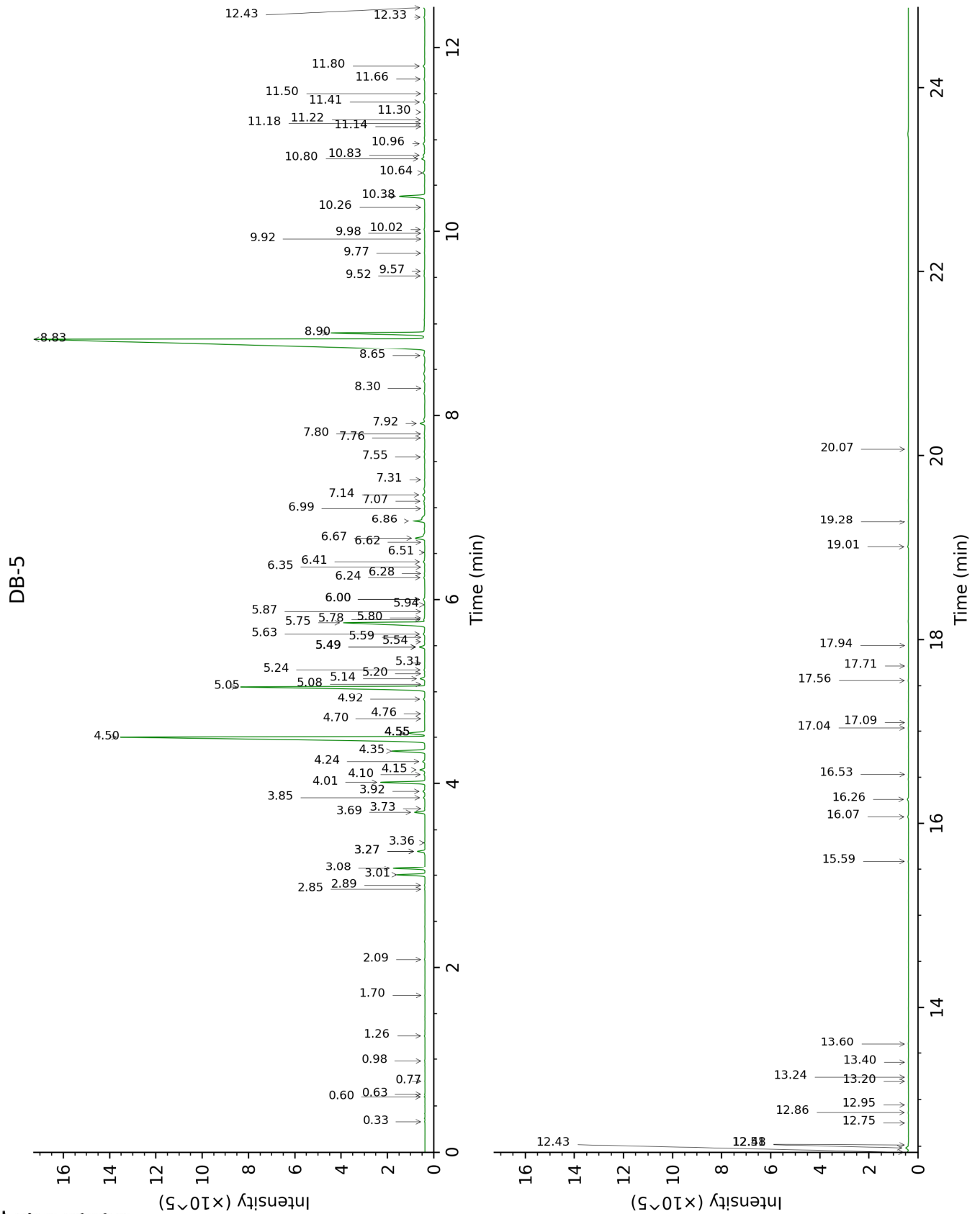
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

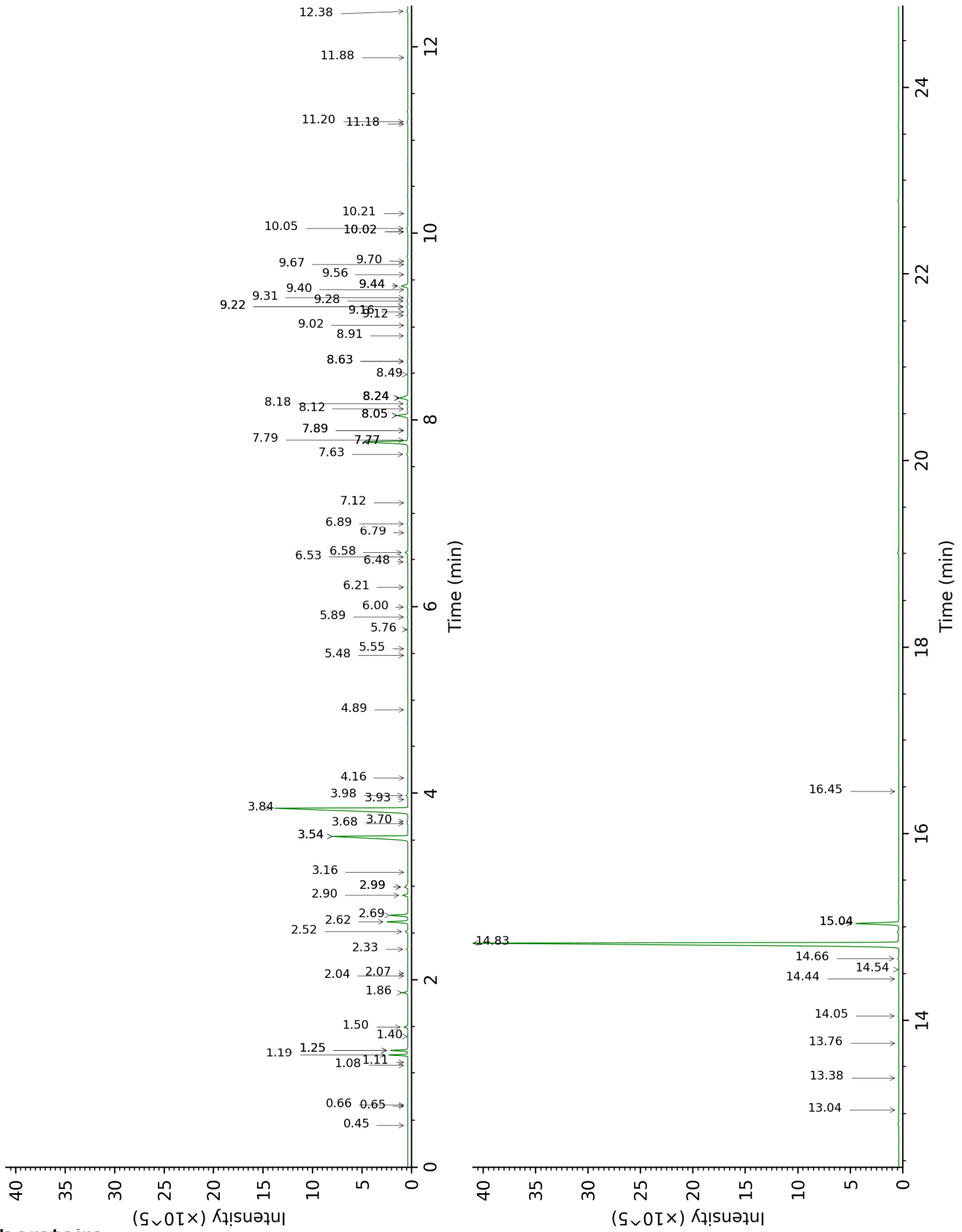
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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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DB-WAX



FULL ANALYSIS DATA

| Identification | Column DB-5 | | | Column DB-WAX | | |
|---|-------------|------|--------|---------------|------|--------|
| | R.T | R.I | % | R.T | R.I | % |
| Acetone | 0.33 | 517 | 0.01 | 0.44 | 788 | tr |
| Isovaleral | 0.60 | 639 | 0.01 | 0.66 | 887 | 0.01 |
| 2-Methylbutyral | 0.63 | 650 | 0.01 | 0.65 | 880 | 0.01 |
| 2-Ethylfuran | 0.77 | 704 | tr | | | |
| 2-Methylbutanol | 0.98 | 737 | 0.01 | 3.16 | 1178 | 0.01 |
| Methyl 2-methylbutyrate | 1.26 | 775 | 0.01 | 1.11 | 977 | 0.01 |
| Unknown [m/z 81, 69 (80), 41 (65), 83 (52), 109 (48), 55 (47)...] | 1.70 | 824 | tr | | | |
| (3Z)-Hexenol | 2.09 | 855 | 0.02 | 5.48 | 1350 | 0.02 |
| Hashishene | 2.85 | 915 | 0.01 | 1.25* | 1000 | 0.98 |
| Tricyclene | 2.89 | 918 | 0.02 | 1.08 | 971 | 0.01 |
| α -Thujene | 3.01 | 925 | 0.96 | 1.25* | 1000 | [0.98] |
| α -Pinene | 3.08 | 930 | 1.09 | 1.19 | 991 | 1.12 |
| Camphene | 3.27* | 942 | 0.29 | 1.50 | 1026 | 0.28 |
| α -Fenchene | 3.27* | 942 | [0.29] | 1.40 | 1016 | 0.01 |
| Thuja-2,4(10)-diene | 3.36 | 948 | 0.01 | 2.04 | 1084 | 0.02 |
| β -Pinene | 3.69† | 970 | 0.40 | 1.86 | 1065 | 0.40 |
| Sabinene | 3.73† | 973 | [0.40] | 2.07 | 1087 | 0.01 |
| Octen-3-ol | 3.85 | 980 | 0.05 | 6.48 | 1423 | 0.06 |
| Octan-3-one | 3.92 | 985 | 0.08 | 3.68 | 1218 | 0.06 |
| Myrcene | 4.02 | 992 | 1.68 | 2.62 | 1134 | 1.70 |
| Octan-3-ol | 4.10 | 997 | 0.03 | 5.76 | 1370 | 0.03 |
| α -Phellandrene | 4.15 | 1000 | 0.20 | 2.52 | 1126 | 0.19 |
| Δ^3 -Carene | 4.24 | 1006 | 0.10 | 2.33 | 1110 | 0.09 |
| α -Terpinene | 4.35 | 1013 | 1.37 | 2.69 | 1140 | 1.39 |
| para-Cymene | 4.50 | 1023 | 19.15 | 3.84 | 1231 | 19.30 |
| Limonene | 4.55* | 1026 | 0.78 | 2.90 | 1157 | 0.43 |
| 1,8-Cineole | 4.55* | 1026 | [0.78] | 2.99* | 1164 | 0.36 |
| β -Phellandrene | 4.55* | 1026 | [0.78] | 2.99* | 1164 | [0.36] |
| Cymene analog | 4.70 | 1035 | 0.01 | 4.16 | 1255 | 0.01 |
| (Z)- β -Ocimene | 4.76 | 1039 | 0.01 | 3.54* | 1208 | 9.44 |
| (E)- β -Ocimene | 4.92 | 1049 | 0.06 | 3.70 | 1220 | 0.06 |
| γ -Terpinene | 5.06 | 1058 | 9.39 | 3.54* | 1208 | [9.44] |
| 2-Methylbutyl butyrate | 5.08 | 1059 | 0.01 | 3.93 | 1238 | 0.01 |
| cis-Sabinene hydrate | 5.14 | 1063 | 0.18 | 6.58 | 1430 | 0.23 |
| 3-Methyl-3-butenyl butyrate? | 5.20 | 1067 | 0.02 | 4.89 | 1307 | 0.01 |
| cis-Linalool oxide (fur.) | 5.24 | 1069 | 0.04 | 6.21 | 1403 | 0.03 |
| Octanol | 5.31 | 1074 | 0.01 | 7.89* | 1529 | 0.03 |
| Terpinolene | 5.49* | 1085 | 0.23 | 3.98 | 1241 | 0.14 |

| | | | | | | |
|--|-------|------|--------|--------|------|--------|
| <i>trans</i> -Linalool oxide (fur.) | 5.49* | 1085 | [0.23] | 6.53 | 1427 | 0.05 |
| para-Cymenene | 5.49* | 1085 | [0.23] | 6.00 | 1387 | 0.06 |
| Unknown [m/z 105, 77 (62), 136 (37), 123 (29), 81 (29), 51 (20)] | 5.54 | 1089 | 0.02 | | | |
| Unknown [m/z 123, 81 (78), 79 (39), 41 (31), 67 (28), 150 (27)...] | 5.59 | 1092 | 0.01 | | | |
| <i>trans</i> -Sabinene hydrate | 5.63 | 1094 | 0.07 | 7.63 | 1510 | 0.11 |
| Linalool | 5.75 | 1102 | 4.38 | 7.77* | 1520 | 4.38 |
| Nonanal | 5.78 | 1104 | 0.06 | 5.55 | 1355 | 0.01 |
| Hotrienol | 5.80 | 1105 | 0.02 | 8.49 | 1576 | 0.02 |
| endo-Fenchol | 5.87 | 1109 | 0.03 | 8.12 | 1548 | 0.05 |
| Unknown [m/z 109, 91 (57), 93 (47), 81 (44), 77 (40)... 154 (1)] | 5.94 | 1114 | 0.01 | | | |
| Unknown [m/z 81, 79 (19), 41 (12), 92 (8), 77 (8)...] | 6.00* | 1118 | 0.08 | 5.89 | 1380 | 0.05 |
| <i>cis</i> -para-Menth-2-en-1-ol | 6.00* | 1118 | [0.08] | 7.79 | 1522 | 0.06 |
| Camphor | 6.24 | 1133 | 0.05 | 6.89 | 1454 | 0.06 |
| <i>trans</i> -para-Menth-2-en-1-ol | 6.28 | 1136 | 0.03 | 8.63* | 1587 | 0.05 |
| <i>trans</i> -Verbenol | 6.35 | 1141 | 0.02 | 9.16 | 1630 | 0.02 |
| Camphene hydrate | 6.41 | 1144 | 0.09 | 8.18 | 1552 | 0.08 |
| Isoborneol | 6.51 | 1151 | 0.01 | 9.02 | 1618 | 0.01 |
| Unknown [m/z 123, 81 (46), 43 (45), 95 (34), 166 (30)] | 6.62 | 1158 | 0.01 | 8.63* | 1587 | [0.05] |
| Borneol | 6.67 | 1161 | 0.47 | 9.44* | 1652 | 0.67 |
| Terpinen-4-ol | 6.86 | 1174 | 0.81 | 8.24* | 1556 | 0.98 |
| para-Cymen-8-ol | 6.99 | 1183 | 0.02 | 11.18 | 1798 | 0.02 |
| α-Terpineol | 7.07 | 1188 | 0.05 | 9.44* | 1652 | [0.67] |
| <i>cis</i> -Dihydrocarvone | 7.14 | 1192 | 0.11 | 8.24* | 1556 | [0.98] |
| <i>trans</i> -Piperitol | 7.31 | 1203 | 0.02 | 10.02* | 1700 | 0.03 |
| Bornyl formate | 7.55 | 1220 | 0.04 | 7.77* | 1520 | [4.38] |
| Thymol methyl ether | 7.76 | 1234 | 0.03 | 8.05* | 1542 | 1.14 |
| Neral | 7.80 | 1237 | 0.05 | 9.12 | 1627 | 0.06 |
| Carvacrol methyl ether | 7.92 | 1245 | 0.20 | 8.24* | 1556 | [0.98] |
| Geranial | 8.30 | 1272 | 0.01 | 9.70 | 1674 | 0.01 |

| | | | | | | |
|---|-------|------|-------|---------|------|--------|
| Thymol analogue I | 8.65 | 1296 | 0.07 | 14.66 | 2122 | 0.10 |
| Carvacrol | 8.90 | 1308 | 3.99 | 15.04*† | 2160 | 4.05 |
| Thymol | 8.83 | 1309 | 49.06 | 14.83 | 2139 | 48.97 |
| Thymyl acetate | 9.52 | 1352 | 0.05 | 11.20 | 1800 | 0.06 |
| Eugenol | 9.57 | 1356 | 0.03 | 14.44 | 2101 | 0.02 |
| α-Copaene | 9.77 | 1370 | 0.02 | 6.79 | 1446 | 0.01 |
| β-Bourbonene | 9.92 | 1380 | 0.01 | 7.12 | 1471 | 0.01 |
| Geranyl acetate | 9.98 | 1385 | 0.01 | 10.21 | 1716 | 0.01 |
| Unknown [m/z 148, 133 (66), 105 (46), 43 (33), 77 (15)...] | 10.02 | 1388 | 0.04 | | | |
| Isocaryophyllene | 10.26 | 1405 | 0.01 | 7.89* | 1529 | [0.03] |
| β-Caryophyllene | 10.38 | 1414 | 1.21 | 8.05* | 1542 | [1.14] |
| Aromadendrene | 10.64 | 1433 | 0.10 | 8.24* | 1556 | [0.98] |
| Unknown [m/z 151, 166 (40), 105 (26)...] | 10.80 | 1445 | 0.15 | | | |
| α-Humulene | 10.83 | 1448 | 0.09 | 8.91 | 1609 | 0.04 |
| (E)-β-Farnesene | 10.96 | 1457 | 0.11 | 9.22* | 1634 | 0.10 |
| γ-Murolene | 11.14 | 1471 | 0.01 | 9.31 | 1642 | 0.02 |
| Germacrene D | 11.18 | 1473 | 0.02 | 9.40 | 1649 | 0.01 |
| β-Selinene | 11.22 | 1476 | 0.02 | 9.56 | 1662 | 0.02 |
| allo-Aromadendr-9-ene | 11.30 | 1482 | 0.01 | 9.22* | 1634 | [0.10] |
| Viridiflorene | 11.41 | 1490 | 0.07 | 9.28 | 1639 | 0.09 |
| α-Murolene | 11.50 | 1497 | 0.02 | 9.67 | 1671 | 0.02 |
| γ-Cadinene | 11.66 | 1509 | 0.05 | 10.02* | 1700 | [0.03] |
| δ-Cadinene | 11.80 | 1520 | 0.08 | 10.05 | 1702 | 0.10 |
| Caryophyllenyl alcohol | 12.33 | 1562 | 0.05 | 13.38 | 1998 | 0.04 |
| Spathulenol | 12.43 | 1570 | 0.06 | 14.05 | 2062 | 0.07 |
| Caryophyllene oxide | 12.48 | 1574 | 0.13 | 12.38 | 1905 | 0.12 |
| Unknown [m/z 109, 43 (95), 81 (81), 93 (76), 69 (75), 95 (74), 107 (71)... 204 (22), 220 (6)] | 12.51 | 1577 | 0.02 | | | |
| Humulene epoxide II | 12.75 | 1595 | 0.01 | 13.04 | 1966 | 0.01 |
| Geranyl isovalerate | 12.86 | 1604 | 0.02 | 11.88 | 1861 | 0.04 |
| 10-epi-γ-Eudesmol | 12.94 | 1611 | 0.02 | 13.76 | 2034 | 0.02 |
| Isospathulenol | 13.20 | 1632 | 0.01 | 15.04*† | 2160 | [4.05] |
| τ-Cadinol | 13.24 | 1636 | 0.01 | 14.54 | 2111 | 0.01 |
| α-Cadinol | 13.40 | 1649 | 0.01 | | | |
| (3Z)- | 13.60 | 1665 | 0.01 | 16.45 | 2306 | 0.02 |

| | | | |
|--|-------|------|------|
| Caryophylla-3,8(13)-dien-5β-ol | | | |
| Unknown [m/z 81, 136 (68), 135 (58), 150 (44), 93 (34), 121 (30)...] | 15.59 | 1838 | 0.02 |
| Unknown [m/z 81, 136 (62), 135 (56), 150 (39), 93 (33), 121 (24)...] | 16.07 | 1881 | 0.05 |
| Unknown [m/z 136, 81 (96), 135 (76), 93 (48), 150 (47), 121 (43), 137 (28)...] | 16.26 | 1899 | 0.07 |
| Unknown [m/z 136, 81 (81), 150 (74), 135 (52), 93 (46), 121 (42)...] | 16.53 | 1924 | 0.01 |
| Unknown [m/z 201, 159 (37), 148 (27), 173 (22), 41 (20)... 284 (16)] | 17.04 | 1972 | 0.02 |
| Unknown [m/z 135, 150 (61), 81 (45), 69 (37), 41 (24), 136 (21), 93 (19)...] | 17.10 | 1977 | 0.01 |
| Unknown [m/z 135, 150 (66), 43 (38), 109 (27), 93 (25), 137 (20)...] | 17.56 | 2022 | 0.02 |
| Unknown [m/z 135, 43 (51), 150 (36), 109 (30), 93 (27), 95 (21)...] | 17.72 | 2038 | 0.01 |
| Unknown [m/z 173, 159 (29), 216 (27), 286 (15)] | 17.94 | 2060 | 0.01 |
| Unknown [m/z 267, 282 (24), 268 (21), 117 (16), 126 (11)...] | 19.01 | 2168 | 0.06 |
| Unknown [m/z 175, 163 (78), 161 (33), 41 (32)... 286 (18)] | 19.28 | 2196 | 0.02 |
| Unknown [m/z 135, 81 (77), 150 | 20.07 | 2281 | 0.01 |

| | | |
|---|---------------|---------------|
| (74), 95 (73), 109 (65), 149 (59)... | | |
| Total identified | 98.25% | 98.29% |
| Total reported | 98.81% | 98.34% |

*: 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