

ANALYSIS Verbena, Lemon Essential Oil

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Date : April 7, 2017

SAMPLE IDENTIFICATION

Internal code : 17C27-FSE1-1-DM

Customer identification : Verbena - Lot #MP15G459

Type : Essential oil

Source : Aloysia citrodora

Customer : Flowers Shining Everywhere Inc.



ANALYSIS



Method : PC-PA-001-15E06, "Analysis of the composition of a liquid essential oil by GC-FID" (in French).

Identifications double-checked by GC-MS

Analyst : Alexis St-Gelais, M. Sc., chimiste

Analysis date : 2017-03-30



Checked and approved by :

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



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| | | | | | | | |
|--|--------|------|--------|---------|------|--------|--------------------|
| Unknown (m/z = 81, 70 (88), 67 (62), 41 (49), 69 (46), 82 (39), 109 (39)... 152 (1)) | 7.74* | 1148 | [0.43] | | | | |
| Citronellal | 7.89 | 1153 | 0.18 | 0.20 | 1414 | 7.01 | Monoterp. aldehyde |
| (Z)-isocitral | 8.17 | 1163 | 0.11 | 0.11 | 1478 | 8.53 | Monoterp. aldehyde |
| δ-Terpineol | 8.40 | 1172 | 0.25 | 11.97 | 1601 | 12.72* | Monoterp. alcohol |
| Rosefuran epoxide | 8.44 | 1173 | 0.14 | 0.20 | 1525 | 9.92 | Monoterp. ether |
| Terpinen-4-ol | 8.65 | 1181 | 0.21 | 0.33 | 1528 | 10.02 | Monoterp. alcohol |
| (E)-isocitral | 8.78 | 1185 | 0.18 | 0.17 | 1511 | 9.39 | Monoterp. aldehyde |
| α-Terpineol | 9.27 | 1202 | 1.27 | 1.30 | 1622 | 13.69* | Monoterp. alcohol |
| trans-Isopiperitenol | 9.39 | 1205 | 0.07 | | | | Monoterp. alcohol |
| Citronellol | 10.26 | 1224 | 0.18 | 0.10 | 1706 | 18.08 | Monoterp. alcohol |
| Nerol | 10.41 | 1227 | 0.56 | 0.58 | 1728 | 19.45* | Monoterp. alcohol |
| trans-Carveol | 10.69 | 1234 | 0.13 | 0.39 | 1752 | 21.00 | Monoterp. alcohol |
| Neral | 11.13 | 1243 | 11.51 | [11.97] | 1601 | 12.72* | Monoterp. aldehyde |
| Carvone | 11.26 | 1246 | 0.73 | 0.68 | 1630 | 14.07 | Monoterp. ketone |
| Piperitone | 11.63 | 1254 | 0.10 | [1.30] | 1622 | 13.69* | Monoterp. ketone |
| Geraniol | 11.69 | 1256 | 0.52 | 0.54 | 1780 | 22.85 | Monoterp. alcohol |
| Geranial | 12.67 | 1278 | 15.69 | 16.27 | 1650 | 15.15* | Monoterp. aldehyde |
| Bicycloelemene | 14.72 | 1318 | 0.02 | 0.04 | 1420 | 7.15 | Sesquiterpene |
| trans-Caryyl acetate | 15.85 | 1333 | 0.07 | | | | Monoterp. ester |
| Neric acid | 16.13* | 1337 | 0.07 | 0.08 | 2198 | 42.37* | Monoterp. acid |
| Cyclosativene | 16.96 | 1350 | 0.02 | 0.04 | 1433 | 7.49 | Sesquiterpene |
| Eugenol | 17.17 | 1353 | 0.04 | 0.05 | 2059 | 38.46 | Phenylpropanoid |
| α-Copaene | 17.54* | 1359 | 0.70 | [1.14] | 1426 | 7.51 | Sesquiterpene |
| Neryl acetate | 17.54* | 1359 | [0.70] | 0.24 | 1669 | 16.14* | Monoterp. ester |
| Geranic acid | 17.76 | 1362 | 0.06 | 0.07 | 2238 | 43.37 | Monoterp. acid |
| β-Bourbonene | 17.96 | 1365 | 0.57 | 0.58 | 1446 | 7.78 | Sesquiterpene |
| 7-epi-Sesquithujene | 18.73 | 1377 | 0.20 | | | | Sesquiterpene |
| Geranyl acetate | 19.16 | 1383 | 0.80 | 0.80 | 1689 | 17.18 | Monoterp. ester |
| α-Cedrene | 20.02 | 1396 | 0.52 | 0.40 | 1492 | 8.87 | Sesquiterpene |
| β-Cedrene | 20.09 | 1397 | 0.10 | [4.14] | 1518 | 9.62* | Sesquiterpene |
| β-Caryophyllene | 20.45 | 1402 | 3.99 | [4.14] | 1518 | 9.62* | Sesquiterpene |
| β-Copaene | 21.17 | 1411 | 0.12 | [4.14] | 1518 | 9.62* | Sesquiterpene |
| Methyleugenol | 21.28 | 1412 | 0.10 | 0.05 | 1931 | 33.24 | Phenylpropanoid |
| α-Humulene | 23.12 | 1434 | 0.23 | 0.24 | 1576 | 11.82 | Sesquiterpene |
| allo-Aromadendrene | 23.40 | 1438 | 0.56 | 0.75 | 1556 | 11.04 | Sesquiterpene |
| Amorpha-4,11-diene? | 24.55* | 1451 | 0.13 | 1.59 | 1618 | 13.48* | Sesquiterpene |
| Neryl propionate | 24.55* | 1451 | [0.13] | [0.58] | 1728 | 19.45* | Monoterp. ester |
| Germacrene D | 25.33* | 1461 | 1.65 | [1.59] | 1618 | 13.48* | Sesquiterpene |
| γ-Muurolene | 25.33* | 1461 | [1.65] | [0.20] | 1607 | 12.95* | Sesquiterpene |
| α-Curcumene | 26.40 | 1474 | 4.93 | 4.91 | 1694 | 17.45 | Sesquiterpene |
| Bicyclogermacrene | 26.62 | 1476 | 1.65 | 1.66 | 1638 | 14.51 | Sesquiterpene |

IDENTIFIED COMPOUNDS

| Identification | Column: BP5 | | | Column: WAX | | | Molecular Class |
|---|-------------|------|---------|-------------|------|--------|--------------------|
| | R.T. | R.I. | % | % | R.I. | R.T. | |
| Methoxyacetone | 0.38 | 635 | 0.03 | | | | Aliphatic ketone |
| 2-Methyl-3-buten-2-ol | 0.54 | 657 | 0.04 | | | | Aliphatic alcohol |
| Methyl 2-methylbutyrate | 1.40 | 770 | 0.14 | 0.14 | 915 | 1.05 | Aliphatic ester |
| Unknown (m/z = 81, 69 (70), 109 (55), 83 (54), 41 (45)...123 (1)) | 1.87 | 819 | 0.13 | | | | |
| α -Thujene | 3.30 | 922 | 0.13 | 0.15 | 953 | 1.20 | Monoterpene |
| α -Pinene | 3.41 | 928 | 1.21 | 1.18 | 942 | 1.15 | Monoterpene |
| β -Citronellene | 3.61 | 940 | 0.01 | | | | Monoterpene |
| Camphene | 3.69 | 945 | 0.02 | 0.02 | 995 | 1.44 | Monoterpene |
| Sabinene | 4.12 | 971 | 2.65 | 2.61 | 1056 | 1.97 | Monoterpene |
| β -Pinene | 4.18 | 974 | 0.18 | 0.17 | 1036 | 1.80 | Monoterpene |
| Octen-3-ol | 4.46* | 991 | 0.39 | 0.68 | 1405 | 6.80* | Aliphatic alcohol |
| Myrcene | 4.46* | 991 | [0.39] | 0.25 | 1114 | 2.53 | Monoterpene |
| 6-Methyl-5-hepten-2-one | 4.50 | 993 | 1.43 | 1.41 | 1275 | 4.77 | Aliphatic ketone |
| Octan-3-ol | 4.74 | 1007 | 0.08 | 0.09 | 1355 | 6.01* | Aliphatic alcohol |
| α -Terpinene | 4.92 | 1017 | 0.04 | 0.03 | 1120 | 2.62 | Monoterpene |
| para-Cymene | 5.11 | 1027 | 0.05 | 0.12 | 1206 | 3.76 | Monoterpene |
| Limonene | 5.19* | 1032 | 21.80 | 21.49 | 1144 | 2.93 | Monoterpene |
| β -Phellandrene | 5.19* | 1032 | [21.80] | 6.22 | 1148 | 2.98* | Monoterpene |
| 1,8-Cineole | 5.23 | 1034 | 6.05 | [6.22] | 1148 | 2.98* | Monoterp. ether |
| cis- β -Ocimene | 5.32 | 1039 | 0.13 | 0.11 | 1184 | 3.46 | Monoterpene |
| trans- β -Ocimene | 5.51 | 1049 | 1.79 | 1.76 | 1200 | 3.67 | Monoterpene |
| γ -Terpinene | 5.69* | 1059 | 0.12 | 0.10 | 1186 | 3.48 | Monoterpene |
| Bergamot | 5.69* | 1059 | [0.12] | 0.03 | 1291 | 5.00 | Aliphatic aldehyde |
| cis-Sabinene hydrate | 5.98 | 1075 | 0.38 | [0.68] | 1405 | 6.80* | Monoterp. alcohol |
| Terpinolene | 6.16 | 1085 | 0.03 | 0.03 | 1221 | 3.97 | Monoterpene |
| Rose furan | 6.37 | 1096 | 0.13 | 0.14 | 1339 | 5.75 | Monoterp. ether |
| Perillene | 6.48 | 1101 | 0.09 | [0.09] | 1355 | 6.01* | Monoterp. ether |
| Linalool | 6.59* | 1105 | 0.44 | 0.40 | 1502 | 9.14 | Monoterp. alcohol |
| Nonanal | 6.59* | 1105 | [0.44] | 0.03 | 1333 | 5.66 | Aliphatic aldehyde |
| cis-Verbenol? | 6.65 | 1108 | 0.19 | 4.14 | 1518 | 9.62* | Monoterp. alcohol |
| trans-para-Mentha-2,8-dien-1-ol | 7.08 | 1123 | 0.17 | 0.13 | 1553 | 10.91 | Monoterp. alcohol |
| cis-Limonene oxide | 7.39 | 1135 | 0.16 | 0.13 | 1381 | 6.42 | Monoterp. ether |
| cis-para-Mentha-2,8-dien-1-ol | 7.45* | 1137 | 0.36 | 0.20 | 1607 | 12.95* | Monoterp. alcohol |
| trans-Limonene oxide | 7.45* | 1137 | [0.36] | 0.11 | 1395 | 6.65 | Monoterp. ether |
| trans-Chrysanthemal | 7.74* | 1148 | 0.43 | 1.14 | 1426 | 7.31* | Monoterp. aldehyde |

| | | | | | | | |
|-------------------------------|--------|------|---------------|---------------|------|--------|---------------------|
| 4-epi-Cubebol | 27.02 | 1481 | 0.10 | 0.14 | 1799 | 24.12 | Sesquiterp. alcohol |
| α -Zingiberene | 27.39 | 1486 | 0.31 | [16.27] | 1650 | 15.15 | Sesquiterpene |
| α -Murolene | 27.54 | 1487 | 0.40 | [16.27] | 1650 | 15.15* | Sesquiterpene |
| γ -Cadinene | 28.34 | 1497 | 0.23 | 1.15 | 1665 | 15.93* | Sesquiterpene |
| β -Curcumene | 28.74* | 1502 | 1.15 | [1.15] | 1665 | 15.93* | Sesquiterpene |
| δ -Cadinene | 28.74* | 1502 | [1.15] | [0.24] | 1669 | 16.14* | Sesquiterpene |
| Cubebol | 29.01 | 1506 | 0.29 | 0.30 | 1848 | 27.63 | Sesquiterp. alcohol |
| α -Cadinene | 30.45 | 1526 | 0.07 | 0.07 | 1698 | 17.66 | Sesquiterpene |
| Caryophyllene oxide | 33.55* | 1569 | 5.32 | 2.67 | 1845 | 27.38 | Sesquiterp. ether |
| Spathulenol | 33.55* | 1569 | [5.32] | 1.67 | 2016 | 37.05 | Sesquiterp. alcohol |
| Caryophyllene oxide epimer | 33.55* | 1569 | [5.32] | 0.36 | 1839 | 26.95 | Sesquiterp. alcohol |
| (E)-Nerolidol | 33.55* | 1569 | [5.32] | 0.54 | 1985 | 35.67* | Sesquiterp. alcohol |
| α -Turmerol | 34.45 | 1582 | 0.26 | | | | Sesquiterp. alcohol |
| α -Cedrol | 35.00 | 1589 | 0.14 | [0.54] | 1985 | 35.67* | Sesquiterp. alcohol |
| β -Cadinol | 37.19 | 1635 | 0.41 | 0.41 | 2068 | 38.75 | Sesquiterp. alcohol |
| Total Identified | | | 95.71% | 94.66% | | | |

* Two or more compounds are coeluting on this column

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

Note: no correction factor was applied

OTHER DATA

Physical aspect : Yellow liquid

Refractive index : 1.4835 \pm 0.0003 (20 °C)

CONCLUSION

No adulterant, contaminant or diluent were detected using this method.



