**Date :** March 06, 2018

# *CERTIFICATE OF ANALYSIS - GC PROFILING*

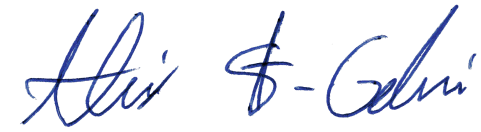
## *SAMPLE IDENTIFICATION*

**Internal code :** 18B20-PLG13-1-CC
**Customer identification :** Cinnamon Cassia
**Type :** Essential oil
**Source :** *Cinnamomum cassia*
**Customer :** Plant Guru

## *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID (in French); identifications validated by GC-MS.
**Analyst :** Sarah-Eve Tremblay, M. Sc. A., Chimiste
**Analysis date :** February 28, 2018

Checked and approved by :



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

*Note: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.*

*This report is digitally signed, it is only considered valid if the digital signature is intact.*



Laboratoire PhytoChemia
3225-A Boul. St-François, Jonquière (Qc) G7T 1A1 | www.phytochemia.com

*PHYSICOCHEMICAL DATA*

**Physical aspect:** Bright yellow liquid
**Refractive index:** 1.6068 ± 0.0003 (20 °C)

*CONCLUSION*

No adulterant, contaminant or diluent has been detected using this method.

3225-A, Boul. St-François, Jonquière (Qc) G7T 1A1 | www.phytochemia.com

*ANALYSIS SUMMARY*

| Identification | DB-5 (%) | DB-WAX (%) | Classe |
|---|---|---|---|
| Hexanal | 0.01 | 0.01 | Aliphatic aldehyde |
| Furfural | 0.01 | 0.01 | Aliphatic alcohol |
| (2*E*)-Hexenal | tr | tr | Aliphatic aldehyde |
| Ethylbenzene | tr | tr* | Simple phenolic |
| Styrene | 0.12 | 0.12 | Simple phenolic |
| α-Thujene | 0.01 | 0.01 | Monoterpene |
| α-Pinene | 0.06 | 0.06 | Monoterpene |
| Camphene | 0.04 | 0.04 | Monoterpene |
| Benzaldehyde | 0.81 | 0.84 | Simple phenolic |
| β-Pinene | 0.03* | 0.03 | Monoterpene |
| Sabinene | [0.03]* | [tr]* | Monoterpene |
| 6-Methyl-5-hepten-2-one | 0.01 | 0.01 | Aliphatic ketone |
| Benzofuran | 0.01 | | Simple phenolic |
| Octanal | tr | tr | Aliphatic aldehyde |
| Δ3-Carene | 0.01 | tr | Monoterpene |
| para-Cymene | 0.03 | 0.03 | Monoterpene |
| Limonene | 0.05* | 0.04 | Monoterpene |
| 1,8-Cineole | [0.05]* | 0.01* | Monoterpenic ether |
| β-Phellandrene | [0.05]* | [0.01]* | Monoterpene |
| Benzyl alcohol | 0.31* | 0.32* | Simple phenolic |
| Salicylaldehyde | [0.31]* | 0.29 | Simple phenolic |
| (*E*)-β-Ocimene | tr | tr | Monoterpene |
| γ-Terpinene | 0.01 | tr | Monoterpene |
| Acetophenone | 0.03 | 0.06* | Simple phenolic |
| Terpinolene | tr | tr | Monoterpene |
| ortho-Guaiacol | 0.03 | tr | Simple phenolic |
| Linalool | 0.01 | 0.01 | Monoterpenic alcohol |
| Nonanal | 0.01 | 0.01 | Aliphatic aldehyde |
| Phenylethyl alcohol | 0.63 | 0.69* | Simple phenolic |
| ortho-Vinylanisole | 0.02 | 0.04 | Simple phenolic |
| *trans*-Pinocarveol | 0.01 | 0.01 | Monoterpenic alcohol |
| 2-Methylbenzofuran | 0.03 | 0.02 | Phenylpropanoid |
| Hydrocinnamal | 0.48* | 0.42* | Phenylpropanoid |
| Unknown | [0.48]* | tr | Phenylpropanoid |
| Borneol | 0.10 | 0.12* | Monoterpenic alcohol |
| 3-Methylbenzofuran? | 0.08 | 0.08 | Phenylpropanoid |
| Terpinen-4-ol | 0.01 | 0.01 | Monoterpenic alcohol |
| para-Cymen-8-ol | 0.04 | 0.03 | Monoterpenic alcohol |
| α-Terpineol | 0.01 | [0.12]* | Monoterpenic alcohol |
| Methyl salicylate | 0.01 | [0.42]* | Phenolic ester |
| (*Z*)-Cinnamal | 0.33 | [0.32]* | Phenylpropanoid |
| Hydrocinnamyl alcohol | 0.08 | 0.15 | Phenylpropanoid |
| ortho-Anisaldehyde | 0.46 | 0.47 | Simple phenolic |
| Phenylethyl acetate | 0.07 | 0.09 | Phenolic ester |
| (*E*)-Cinnamal | 76.59 | 77.04 | Phenylpropanoid |
| (*E*)-Cinnamyl alcohol | 0.19 | 0.19 | Phenylpropanoid |
| Eugenol | 0.18* | 0.14* | Phenylpropanoid |
| Cyclosativene I | [0.18]* | 0.03 | Sesquiterpene |

| | | | |
|---|---|---|---|
| α-Ylangene | 0.02 | 0.02 | Sesquiterpene |
| α-Copaene | 0.52* | 0.32 | Sesquiterpene |
| ortho-Methoxyhydrocinnamal? | [0.52]* | 0.07 | Phenylpropanoid |
| β-Elemene | 0.02 | 0.15* | Sesquiterpene |
| β-Caryophyllene | 0.12 | [0.15]* | Sesquiterpene |
| Coumarin | 2.25 | 2.21 | Coumarin |
| *trans*-α-Bergamotene | tr | tr | Sesquiterpene |
| (*E*)-Cinnamyl acetate | 2.93 | 2.91 | Phenylpropanoid ester |
| allo-Aromadendrene | 0.19* | [0.06]* | Sesquiterpene |
| (*Z*)-ortho-Methoxycinnamal | [0.19]* | 0.06 | Phenylpropanoid |
| (*E*)-Cinnamic acid | 0.40 | 0.02 | Phenylpropanoid |
| γ-Muurolene | 0.10 | 0.12 | Sesquiterpene |
| ar-Curcumene | 0.06 | 0.07 | Sesquiterpene |
| Viridiflorene | 0.05 | 0.04 | Sesquiterpene |
| α-Muurolene | 0.06 | 0.07 | Sesquiterpene |
| β-Bisabolene | 0.09 | 0.09 | Sesquiterpene |
| γ-Cadinene | 0.08 | 0.17* | Sesquiterpene |
| δ-Cadinene | 0.14* | [0.17]* | Sesquiterpene |
| *trans*-Calamenene | [0.14]* | 0.03 | Sesquiterpene |
| α-Calacorene | 9.58* | [0.69]* | Sesquiterpene |
| (*E*)-ortho-Methoxycinnamal | [9.58]* | 9.46 | Phenylpropanoid |
| (*E*)-Nerolidol | 0.18 | 0.19 | Sesquiterpenic alcohol |
| Spathulenol | 0.11 | 0.12 | Sesquiterpenic alcohol |
| Caryophyllene oxide | 0.07 | 0.08 | Sesquiterpenic ether |
| Humulene epoxide II | 0.01 | | Sesquiterpenic ether |
| Tetradecanal? | 0.03 | 0.01 | Aliphatic aldehyde |
| 1-epi-Cubenol | 0.03 | 0.01 | Sesquiterpenic alcohol |
| Caryophylladienol II | 0.02 | 0.02 | Sesquiterpenic alcohol |
| τ-Cadinol | 0.05 | 0.03 | Sesquiterpenic alcohol |
| α-Cadinol | 0.03 | 0.02 | Sesquiterpenic alcohol |
| (3*Z*)-Caryophylla-3,8(13)-dien-5β-ol | 0.03 | 0.02 | Sesquiterpenic alcohol |
| Mustakone? | 0.14* | | Sesquiterpenic ketone |
| Cadalene | [0.14]* | 0.05* | Sesquiterpene |
| α-Bisabolol | 0.05 | [0.05]* | Sesquiterpenic alcohol |
| Benzyl benzoate | 0.06 | 0.05 | Phenolic ester |
| Phenylethyl benzoate | 0.05 | 0.03 | Phenolic ester |
| Benzyl salicylate | 0.01 | 0.01 | Phenolic ester |
| Rimuene | tr | [0.14]* | Diterpene |
| Dolabradiene | 0.06 | 0.06 | Diterpene |
| Manoyl oxide | 0.05 | 0.04 | Diterpenic ether |
| Kaurene? | 0.01 | | Diterpene |
| Phenylethyl (*E*)-cinnamate | 0.04 | 0.01 | Phenylpropanoid ester |
| **Total identified** | **98.54%** | **98.02%** | |

*: Two or more compounds are coeluting on this column
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total
tr: The compound has been detected below 0.005% of total signal.

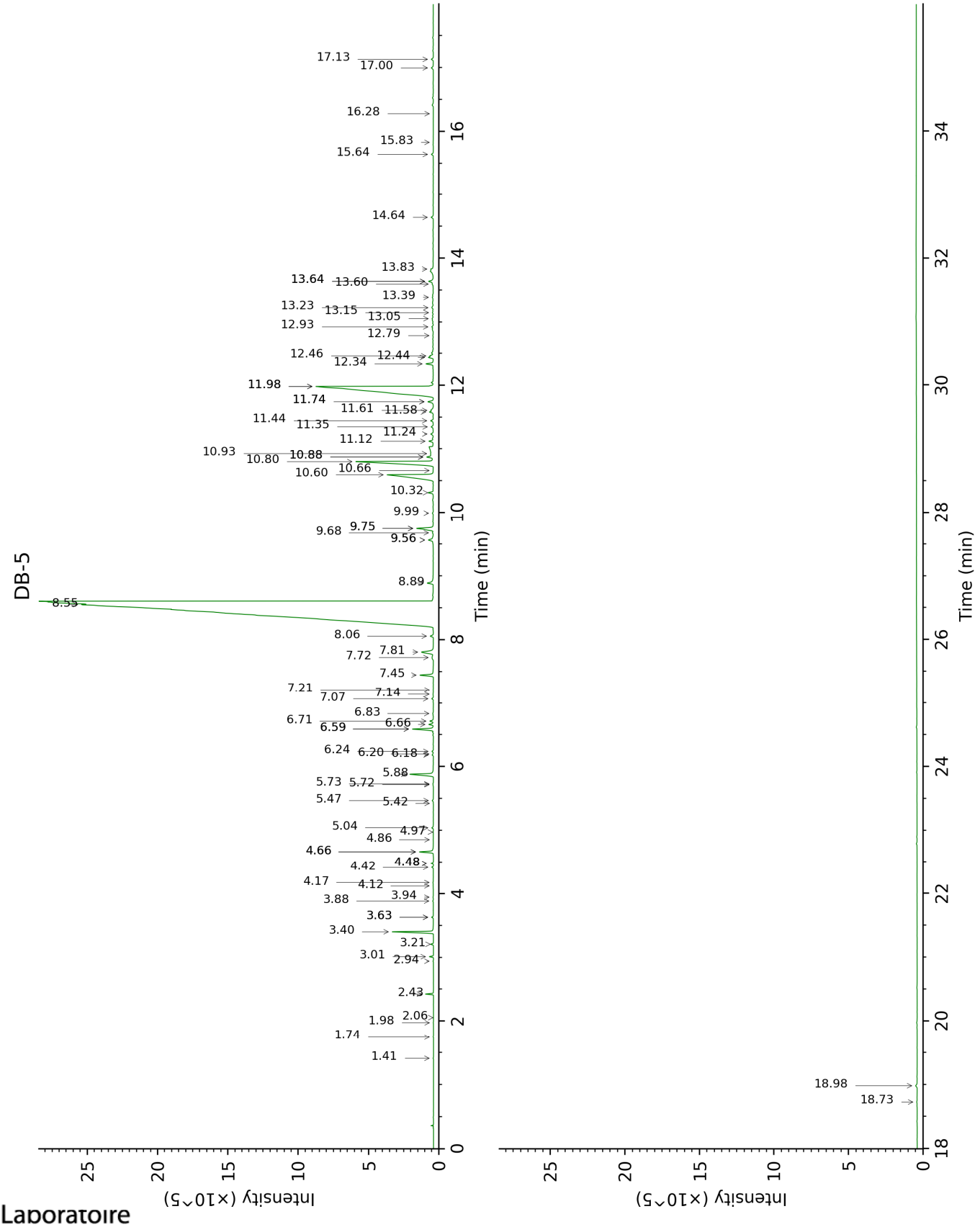
Note: no correction factor was applied

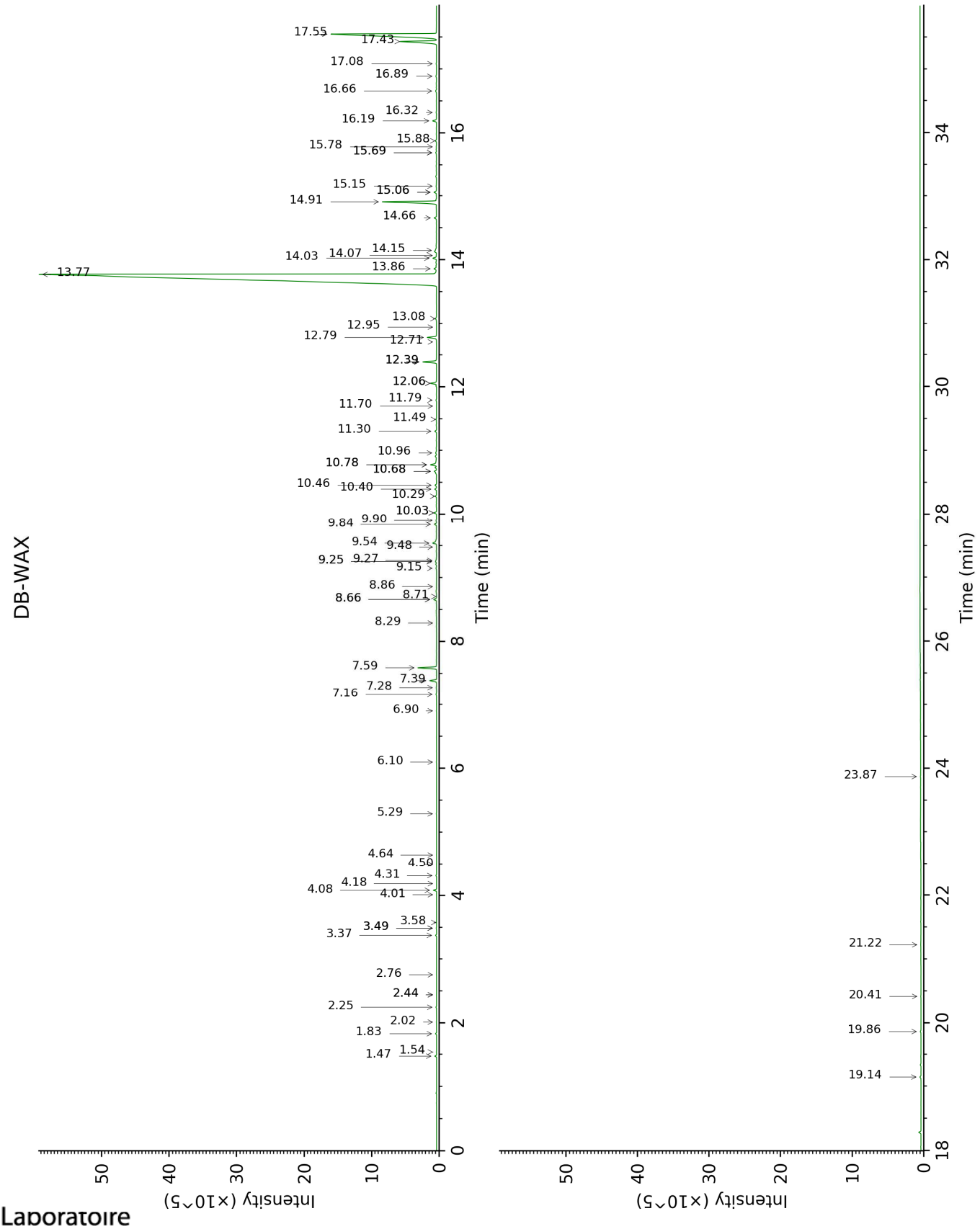


3225-A, Boul. St-François, Jonquière (Qc) G7T 1A1 | www.phytochemia.com

This page was intentionally left blank. The following pages present the complete data of the analysis.

3225-A, Boul. St-François, Jonquière (Qc) G7T 1A1 | www.phytochemia.com


DB-5
Intensity (×10^5)
Time (min)
17.13
17.00
16.28
15.83
15.64
14.64
13.83
13.64
13.60
13.39
13.23
13.15
13.05
12.93
12.79
12.46
12.44
12.34
11.98
11.74
11.61
11.58
11.44
11.35
11.24
11.12
10.93
10.88
10.80
10.66
10.60
10.32
9.99
9.75
9.68
9.56
8.89
8.55
8.06
7.81
7.72
7.45
7.21
7.14
7.07
6.83
6.71
6.66
6.59
6.24
6.20
6.18
5.88
5.73
5.72
5.47
5.42
5.04
4.97
4.86
4.66
4.48
4.42
4.17
4.12
3.94
3.88
3.63
3.40
3.21
3.01
2.94
2.43
2.06
1.98
1.74
1.41
18.98
18.73


DB-WAX
Intensity (×10^5)
Time (min)
17.55
17.43
17.08
16.89
16.66
16.32
16.19
15.88
15.78
15.69
15.15
15.06
14.91
14.66
14.15
14.07
14.03
13.86
13.77
13.08
12.95
12.79
12.71
12.39
12.06
11.79
11.70
11.49
11.30
10.96
10.78
10.68
10.46
10.40
10.29
10.03
9.90
9.84
9.54
9.48
9.27
9.25
9.15
8.86
8.71
8.66
8.29
7.59
7.39
7.28
7.16
6.90
6.10
5.29
4.64
4.50
4.31
4.18
4.08
4.01
3.58
3.49
3.37
2.76
2.44
2.25
2.02
1.83
1.54
1.47
23.87
21.22
20.41
19.86
19.14

*FULL ANALYSIS DATA*

| Identification | Column DB-5 | | | Column DB-WAX | | |
|---|---|---|---|---|---|---|
| | R.T | R.I | % | R.T | R.I | % |
| Hexanal | 1.41 | 795 | 0.01 | 2.02 | 1047 | 0.01 |
| Furfural | 1.74 | 825 | 0.01 | 6.90 | 1413 | 0.01 |
| (2*E*)-Hexenal | 1.98 | 844 | tr | 3.58 | 1174 | tr |
| Ethylbenzene | 2.06 | 851 | tr | 2.44* | 1087 | tr |
| Styrene | 2.43 | 882 | 0.12 | 4.08 | 1211 | 0.12 |
| α-Thujene | 2.94 | 920 | 0.01 | 1.54 | 1002 | 0.01 |
| α-Pinene | 3.01 | 925 | 0.06 | 1.47 | 995 | 0.06 |
| Camphene | 3.21 | 938 | 0.04 | 1.83 | 1030 | 0.04 |
| Benzaldehyde | 3.40 | 951 | 0.81 | 7.59 | 1463 | 0.84 |
| β-Pinene | 3.63* | 966 | 0.03 | 2.25 | 1069 | 0.03 |
| Sabinene | 3.63* | 966 | [0.03] | 2.44* | 1087 | [tr] |
| 6-Methyl-5-hepten-2-one | 3.88 | 983 | 0.01 | 5.29 | 1297 | 0.01 |
| Benzofuran | 3.94 | 987 | 0.01 | | | |
| Octanal | 4.12 | 999 | tr | 4.64 | 1251 | tr |
| Δ3-Carene | 4.18 | 1002 | 0.01 | 2.76 | 1112 | tr |
| para-Cymene | 4.42 | 1017 | 0.03 | 4.31 | 1228 | 0.03 |
| Limonene | 4.48* | 1022 | 0.05 | 3.37 | 1159 | 0.04 |
| 1,8-Cineole | 4.48* | 1022 | [0.05] | 3.49* | 1167 | 0.01 |
| β-Phellandrene | 4.48* | 1022 | [0.05] | 3.49* | 1167 | [0.01] |
| Benzyl alcohol | 4.66* | 1033 | 0.31 | 12.06* | 1823 | 0.32 |
| Salicylaldehyde | 4.66* | 1033 | [0.31] | 9.54 | 1613 | 0.29 |
| (*E*)-β-Ocimene | 4.86 | 1045 | tr | 4.18 | 1219 | tr |
| γ-Terpinene | 4.98 | 1053 | 0.01 | 4.01 | 1206 | tr |
| Acetophenone | 5.04 | 1057 | 0.03 | 9.25* | 1590 | 0.06 |
| Terpinolene | 5.42 | 1081 | tr | 4.50 | 1241 | tr |
| ortho-Guaiacol | 5.47 | 1084 | 0.03 | 11.70 | 1791 | tr |
| Linalool | 5.72 | 1099 | 0.01 | 8.29 | 1516 | 0.01 |
| Nonanal | 5.73 | 1100 | 0.01 | 6.10 | 1355 | 0.01 |
| Phenylethyl alcohol | 5.88 | 1110 | 0.63 | 12.39* | 1852 | 0.69 |
| ortho-Vinylanisole | 6.18 | 1129 | 0.02 | 9.15 | 1582 | 0.04 |
| *trans*-Pinocarveol | 6.20 | 1130 | 0.01 | 9.48 | 1608 | 0.01 |
| 2-Methylbenzofuran | 6.24 | 1132 | 0.03 | 9.27 | 1591 | 0.02 |
| Hydrocinnamal | 6.59* | 1155 | 0.48 | 10.78* | 1714 | 0.42 |
| Unknown [m/z 133, 77 (86), 105 (75), 79 (68), 134 (48)] | 6.59* | 1155 | [0.48] | 12.95 | 1902 | tr |
| Borneol | 6.66 | 1159 | 0.10 | 10.02* | 1652 | 0.12 |
| 3-Methylbenzofuran? | 6.71 | 1163 | 0.08 | 10.46 | 1687 | 0.08 |
| Terpinen-4-ol | 6.83 | 1170 | 0.01 | 8.86 | 1560 | 0.01 |
| para-Cymen-8-ol | 7.07 | 1185 | 0.04 | 11.79 | 1799 | 0.03 |
| α-Terpineol | 7.14 | 1190 | 0.01 | 10.02* | 1652 | [0.12] |
| Methyl salicylate | 7.21 | 1194 | 0.01 | 10.78* | 1714 | [0.42] |
| (*Z*)-Cinnamal | 7.45 | 1210 | 0.33 | 12.06* | 1823 | [0.32] |
| Hydrocinnamyl alcohol | 7.72 | 1228 | 0.08 | 13.86 | 1985 | 0.15 |
| ortho-Anisaldehyde | 7.81 | 1234 | 0.46 | 12.78 | 1887 | 0.47 |
| Phenylethyl acetate | 8.06 | 1251 | 0.07 | 11.30 | 1758 | 0.09 |
| (*E*)-Cinnamal | 8.55 | 1284 | 76.59 | 13.77 | 1977 | 77.04 |

| | | | | | | |
|---|---|---|---|---|---|---|
| (*E*)-Cinnamyl alcohol | 8.89 | 1306 | 0.19 | 16.19 | 2214 | 0.19 |
| Eugenol | 9.56* | 1354 | 0.18 | 15.06* | 2101 | 0.14 |
| Cyclosativene I | 9.56* | 1354 | [0.18] | 7.16 | 1432 | 0.03 |
| α-Ylangene | 9.68 | 1362 | 0.02 | 7.28 | 1440 | 0.02 |
| α-Copaene | 9.75* | 1367 | 0.52 | 7.39 | 1448 | 0.32 |
| ortho-Methoxyhydrocinnamal? | 9.75* | 1367 | [0.52] | 14.15 | 2013 | 0.07 |
| β-Elemene | 9.99 | 1384 | 0.02 | 8.66* | 1544 | 0.15 |
| β-Caryophyllene | 10.32 | 1407 | 0.12 | 8.66* | 1544 | [0.15] |
| Coumarin | 10.60 | 1428 | 2.25 | 17.43 | 2345 | 2.21 |
| *trans*-α-Bergamotene | 10.66 | 1433 | tr | 8.70 | 1548 | tr |
| (*E*)-Cinnamyl acetate | 10.80 | 1444 | 2.93 | 14.91 | 2086 | 2.91 |
| allo-Aromadendrene | 10.88* | 1449 | 0.19 | 9.25* | 1590 | [0.06] |
| (*Z*)-ortho-Methoxycinnamal | 10.88* | 1449 | [0.19] | 15.88 | 2182 | 0.06 |
| (*E*)-Cinnamic acid | 10.93 | 1453 | 0.40 | 21.22 | 2787 | 0.02 |
| γ-Muurolene | 11.12 | 1467 | 0.10 | 9.84 | 1637 | 0.12 |
| ar-Curcumene | 11.24 | 1476 | 0.06 | 10.96 | 1729 | 0.07 |
| Viridiflorene | 11.35 | 1484 | 0.05 | 9.90 | 1642 | 0.04 |
| α-Muurolene | 11.44 | 1491 | 0.06 | 10.29 | 1673 | 0.07 |
| β-Bisabolene | 11.58 | 1501 | 0.09 | 10.40 | 1682 | 0.09 |
| γ-Cadinene | 11.61 | 1503 | 0.08 | 10.68*† | 1705 | 0.17 |
| δ-Cadinene | 11.74* | 1514 | 0.14 | 10.68*† | 1705 | [0.17] |
| *trans*-Calamenene | 11.74* | 1514 | [0.14] | 11.49 | 1774 | 0.03 |
| α-Calacorene | 11.98* | 1533 | 9.58 | 12.39* | 1852 | [0.69] |
| (*E*)-ortho-Methoxycinnamal | 11.98* | 1533 | [9.58] | 17.55 | 2358 | 9.46 |
| (*E*)-Nerolidol | 12.34 | 1560 | 0.18 | 14.03 | 2001 | 0.19 |
| Spathulenol | 12.44 | 1568 | 0.11 | 14.66 | 2062 | 0.12 |
| Caryophyllene oxide | 12.46 | 1570 | 0.07 | 13.08 | 1914 | 0.08 |
| Humulene epoxide II | 12.79 | 1596 | 0.01 | | | |
| Tetradecanal? | 12.93 | 1607 | 0.03 | 12.72 | 1881 | 0.01 |
| 1-epi-Cubenol | 13.05 | 1618 | 0.03 | 14.07 | 2005 | 0.01 |
| Caryophylladienol II | 13.15 | 1625 | 0.02 | 16.32 | 2228 | 0.02 |
| τ-Cadinol | 13.23 | 1632 | 0.05 | 15.15 | 2110 | 0.03 |
| α-Cadinol | 13.39 | 1645 | 0.03 | 15.78 | 2173 | 0.02 |
| (3*Z*)-Caryophylla-3,8(13)-dien-5β-ol | 13.60 | 1662 | 0.03 | 17.08 | 2308 | 0.02 |
| Mustakone? | 13.64* | 1666 | 0.14 | | | |
| Cadalene | 13.64* | 1666 | [0.14] | 15.69* | 2163 | 0.05 |
| α-Bisabolol | 13.83 | 1681 | 0.05 | 15.69* | 2163 | [0.05] |
| Benzyl benzoate | 14.64 | 1750 | 0.06 | 19.14 | 2537 | 0.05 |
| Phenylethyl benzoate | 15.64 | 1838 | 0.05 | 19.86 | 2621 | 0.03 |
| Benzyl salicylate | 15.83 | 1856 | 0.01 | 20.42 | 2687 | 0.01 |
| Rimuene | 16.28 | 1896 | tr | 15.06* | 2101 | [0.14] |
| Dolabradiene | 17.00 | 1964 | 0.06 | 16.66 | 2263 | 0.06 |
| Manoyl oxide | 17.13 | 1977 | 0.05 | 16.89 | 2287 | 0.04 |
| Kaurene? | 18.73 | 2135 | 0.01 | | | |
| Phenylethyl (*E*)-cinnamate | 18.98 | 2161 | 0.04 | 23.87 | 3138 | 0.01 |
| **Total identified** | | **98.54%** | | | **98.02%** | |

| | | |
|---|---|---|
| **Total reported** | **98.54%** | **98.02%** |

*: Two or more compounds are coeluting on this column
[xx]: Duplicate percentage due to coelutions, not taken account in the identified 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

3225-A, Boul. St-François, Jonquière (Qc) G7T 1A1 | www.phytochemia.com