Date : 2023-07-18

Certificate of Analysis - GC Profiling

Sample Identification

Internal code : 23G11-PTH04
Customer Identification : Western U.S. Peppermint - USA - PF0109R
Type : Essential Oil
Source : *Mentha x piperita*
Customer : Plant Therapy

Checked an approved by:

Alexis St-Gelais, Ph. D., Chimiste 2013-174

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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. The results only describe the samples that were submitted to the assays.

Méthode certifiée ISO 17025:2017 Certified method

Laboratoire PhytoChemia

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Gas Chromatographic Analysis

Method : PC-MAT-014 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID
ISO
Results : See analysis summary (next page)
Analyst : Alexis St-Gelais, Ph. D., Chimiste 2013-174
Date : 2023-07-18

Physicochemical data

Refractive index : 1.4602 ± 0.0003 (20 °C)
Method : PC-MAT-016 - Measure of the refractive index of a liquid.
Analyst : Cindy Caron B. Sc.
Date : 2023-07-17

Conclusion

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

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Analysis Summary - Consolidated Contents

New readers of similar reports are encouraged to read table footnotes at least once.

Identification	%	Class
Dimethylsulfide	tr	Aliphatic sulfide
Isobutyral	0.01	Aliphatic aldehyde
Isobutanol	0.01	Aliphatic alcohol
Isovaleral	0.03	Aliphatic aldehyde
2-Methylbutyral	0.02	Aliphatic aldehyde
1-Penten-3-ol	tr	Aliphatic alcohol
2-Ethylfuran	0.01	Furan
Isoamyl alcohol	0.02	Aliphatic alcohol
2-Methylbutanol	0.02	Aliphatic alcohol
Ethyl 2-methylbutyrate	0.02	Aliphatic ester
(3*Z*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.02	Furan
α-Thujene	0.04	Monoterpene
α-Pinene	0.73	Monoterpene
α-Fenchene	tr	Monoterpene
3-Methylcyclohexanone	0.05	Aliphatic ketone
Camphene	tr	Monoterpene
β-Pinene	0.94	Monoterpene
Sabinene	0.44	Monoterpene
Octen-3-ol	0.06	Aliphatic alcohol
Octan-3-one	0.03	Aliphatic ketone
Myrcene	0.19	Monoterpene
Octan-3-ol	0.27	Aliphatic alcohol
α-Phellandrene	0.02	Monoterpene
α-Terpinene	0.15	Monoterpene
para-Cymene	0.15	Monoterpene
1,8-Cineole	4.38	Monoterpenic ether
Limonene	1.66	Monoterpene
(*Z*)-β-Ocimene	0.17	Monoterpene
(*E*)-β-Ocimene	0.05	Monoterpene
γ-Terpinene	0.26	Monoterpene
cis-Sabinene hydrate	0.53	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Octanol	0.02	Aliphatic alcohol
Terpinolene	0.08	Monoterpene
para-Cymenene	0.02	Monoterpene
trans-Sabinene hydrate	0.05	Monoterpenic alcohol
Linalool	0.18	Monoterpenic alcohol
Nonan-3-ol	0.03	Aliphatic alcohol

2-Methylbutyl 2-methylbutyrate	0.03	Aliphatic ester
Isoamyl isovalerate	0.01	Aliphatic ester
endo-Fenchol	0.05	Monoterpenic alcohol
Octen-3-yl acetate	0.01	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.05	Monoterpenic alcohol
Octan-3-yl acetate	0.02	Aliphatic ester
trans-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
trans-Sabinol	0.01	Monoterpenic alcohol
cis-α-Dihydroterpineol	0.04	Monoterpenic alcohol
Isopulegol	0.09	Monoterpenic alcohol
Menthone	21.40	Monoterpenic ketone
Borneol	0.04	Monoterpenic alcohol
Menthofuran	2.29	Monoterpenic ether
Isomenthone	3.22	Monoterpenic ketone
neo-Menthol	3.39	Monoterpenic alcohol
Lavandulol	0.03	Monoterpenic alcohol
Menthol	44.58	Monoterpenic alcohol
Isomenthol	0.58	Monoterpenic alcohol
para-Cymen-8-ol	0.04	Monoterpenic alcohol
α-Terpineol	0.30	Monoterpenic alcohol
neoiso-Menthol	0.28	Monoterpenic alcohol
cis-Piperitol	0.04	Monoterpenic alcohol
Unknown	0.01	Unknown
Decanal	0.02	Aliphatic aldehyde
trans-Carveol	0.02	Monoterpenic alcohol
(3*Z*)-Hexenyl 2-methylbutyrate	0.01	Aliphatic ester
Citronellol	0.03	Monoterpenic alcohol
Pulegone	1.12	Monoterpenic ketone
(3*Z*)-Hexenyl isovalerate	0.06	Aliphatic ester
Carvone	0.13	Monoterpenic ketone
Piperitone	0.59	Monoterpenic ketone
neo-Menthyl acetate	0.16	Monoterpenic ester
Decanol	0.04	Aliphatic alcohol
2-Ethylmenthone?	0.07	Aliphatic ketone
Dihydroedulan I	0.03	Terpenic ether
Menthyl acetate	4.44	Monoterpenic ester
Thymol	0.01	Monoterpenic alcohol
Isomenthyl acetate	0.14	Monoterpenic alcohol
cis-Pinocarvyl acetate	0.02	Monoterpenic alcohol
Bicycloelemene	0.05	Sesquiterpene
Piperitenone	0.01	Monoterpenic ketone
α-Cubebene	0.01	Sesquiterpene
Eugenol	0.02	Phenylpropanoid
α-Copaene	0.04	Sesquiterpene
β-Bourbonene	0.24	Sesquiterpene

β-Cubebene	0.02	Sesquiterpene
β-Elemene	0.07	Sesquiterpene
Unknown	0.03	Unknown
Unknown	0.02	Sesquiterpene
Isocaryophyllene	0.03	Sesquiterpene
β-Ylangene	0.13	Sesquiterpene
β-Caryophyllene	2.40	Sesquiterpene
β-Copaene	0.05	Sesquiterpene
trans-α-Bergamotene	0.01	Sesquiterpene
Isogermacrene D	0.02	Sesquiterpene
α-Humulene	0.08	Sesquiterpene
(*E*)-β-Farnesene	0.23	Sesquiterpene
9-epi-β-Caryophyllene	0.02	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
Germacrene D	1.16	Sesquiterpene
Menthalactone	0.01	Monoterpenic lactone
Bicyclogermacrene	0.20	Sesquiterpene
α-Muurolene	0.02	Sesquiterpene
δ-Amorphene	0.03	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
δ-Cadinene	0.05	Sesquiterpene
(*E*)-α-Bisabolene	0.02	Sesquiterpene
(*E*)-Nerolidol	0.01	Sesquiterpenic alcohol
Spathulenol	0.03	Sesquiterpenic alcohol
Caryophyllene oxide	0.10	Sesquiterpenic ether
Viridiflorol	0.15	Sesquiterpenic alcohol
Humulene epoxide II	0.01	Sesquiterpenic ether
Isospathulenol	0.02	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
α-Cadinol	0.02	Sesquiterpenic alcohol
Consolidated total	**99.48**	

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

Bracketed value ([xx]): A bracketed percent value indicate that two or more compound percentage could not be solved due to coelution.

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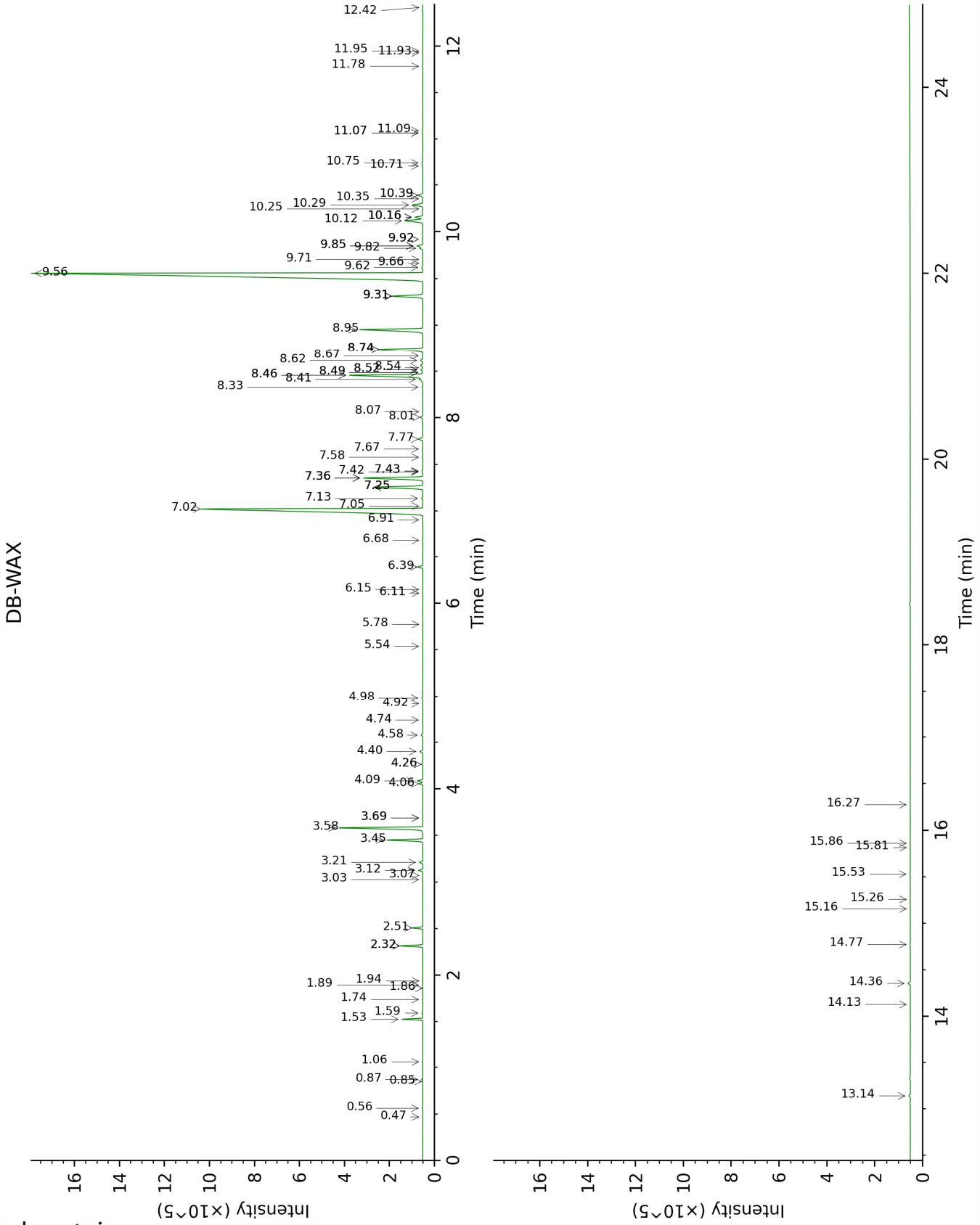
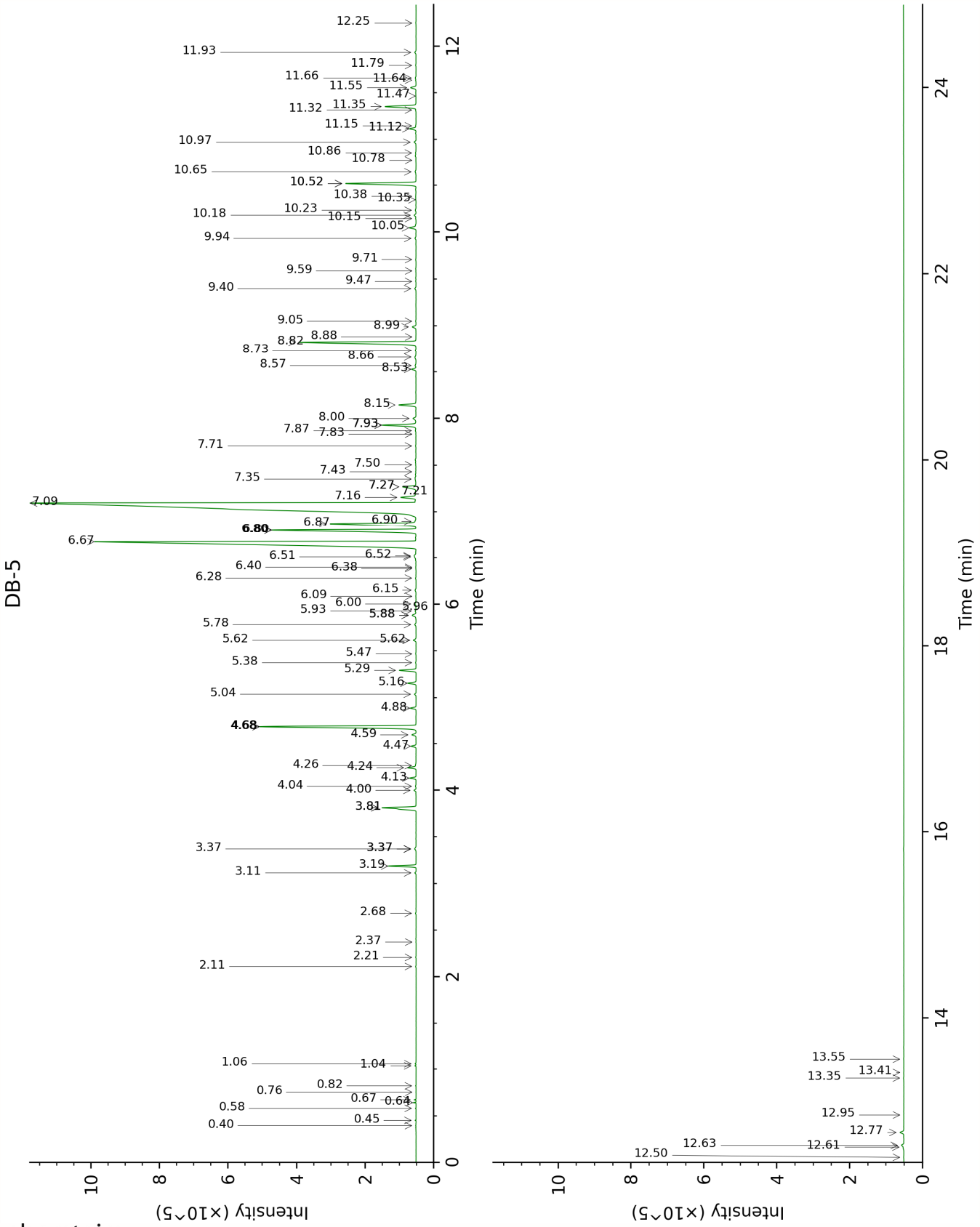

DB-WAX
Time (min)
Intensity (×10^5)
12.42
11.95
11.93
11.78
11.07
11.09
10.75
10.71
10.35
10.39
10.25
10.29
10.12
10.16
9.92
9.85
9.82
9.71
9.66
9.62
9.56
9.31
8.95
8.74
8.67
8.62
8.54
8.52
8.49
8.46
8.41
8.33
8.07
8.01
7.77
7.67
7.58
7.43
7.42
7.36
7.25
7.13
7.05
7.02
6.91
6.68
6.39
6.15
6.11
5.78
5.54
4.98
4.92
4.74
4.58
4.40
4.26
4.09
4.06
3.69
3.58
3.45
3.21
3.12
3.07
3.03
2.51
2.32
1.94
1.89
1.86
1.74
1.59
1.53
1.06
0.87
0.85
0.56
0.47
16.27
15.86
15.81
15.53
15.26
15.16
14.77
14.36
14.13
13.14


DB-5
Time (min)
Intensity (×10^5)
12.25
11.93
11.79
11.66
11.64
11.55
11.47
11.32
11.35
11.15
11.12
10.97
10.86
10.78
10.65
10.52
10.38
10.35
10.23
10.18
10.15
10.05
9.94
9.71
9.59
9.47
9.40
9.05
8.99
8.88
8.82
8.73
8.66
8.57
8.53
8.15
8.00
7.93
7.87
7.83
7.71
7.50
7.43
7.35
7.27
7.21
7.16
7.09
6.90
6.87
6.80
6.67
6.52
6.51
6.40
6.38
6.28
6.15
6.09
6.00
5.96
5.93
5.88
5.78
5.62
5.62
5.47
5.38
5.29
5.16
5.04
4.88
4.68
4.59
4.47
4.26
4.24
4.13
4.04
4.00
3.81
3.37
3.37
3.19
3.11
2.68
2.37
2.21
2.11
1.06
1.04
0.82
0.76
0.67
0.64
0.58
0.45
0.40
13.55
13.41
13.35
12.95
12.77
12.63
12.61
12.50

FULL ANALYSIS DATA

	Column DB-WAX			Column DB-5		
Dimethylsulfide	0.47	712.6	tr	0.40	499.8	tr
Isobutyral	0.56	780.5	0.01	0.45	535.6	0.01
Isobutanol	2.32*	1065.4	[0.95]	0.58	619.8	0.01
Isovaleral	0.87	890.0	0.03	0.64	640.3	0.03
2-Methylbutyral	0.85	882.8	0.02	0.67	650.6	0.02
1-Penten-3-ol	3.07	1128.7	0.01	0.76	678.0	tr
2-Ethylfuran	1.06	919.5	0.01	0.82	701.0	0.01
Isoamyl alcohol	3.69*	1176.4	[0.02]	1.04	732.4	0.02
2-Methylbutanol	3.69*	1176.4	[0.02]	1.06	735.5	0.02
Ethyl 2-methylbutyrate	1.89	1025.2	0.02	2.11	849.3	0.02
(3*Z*)-Hexenol	6.15	1350.7	0.01	2.21	857.3	0.01
Hexanol	5.78	1323.8	0.01	2.37	870.7	0.01
trans-2,5-Diethyltetrahydrofuran	1.74	1010.5	0.02	2.68	895.9	0.02
α-Thujene	1.59	996.6	0.03	3.11	926.0	0.04
α-Pinene	1.53	989.9	0.74	3.19	930.8	0.73
α-Fenchene	1.86	1021.9	tr	3.37*	942.9	[0.07]
3-Methylcyclohexanone	4.98	1271.9	0.05	3.37*	942.9	[0.07]
Camphene	1.94	1029.4	tr	3.37*	942.9	[0.07]
β-Pinene	2.32*	1065.4	[0.95]	3.81*	971.9	[1.38]
Sabinene	2.51	1083.8	0.44	3.81*	971.9	[1.38]
Octen-3-ol	7.13	1422.3	0.08	4.00	984.2	0.06
Octan-3-one	4.26*	1219.4	[0.07]	4.04	987.0	0.03
Myrcene	3.12	1132.8	0.18	4.13	992.8	0.19
Octan-3-ol	6.39	1368.0	0.26	4.24	1000.2	0.27
α-Phellandrene	3.03	1125.2	0.02	4.26	1001.7	0.02
α-Terpinene	3.21	1139.5	0.15	4.47	1014.7	0.15
para-Cymene	4.40	1229.4	0.14	4.59	1022.3	0.15
1,8-Cineole	3.58	1168.2	4.38	4.68*	1027.8	[6.02]
Limonene	3.45	1158.0	1.66	4.68*	1027.8	[6.02]
(*Z*)-β-Ocimene	4.06	1204.1	0.17	4.88	1040.2	0.17
(*E*)-β-Ocimene	4.26*	1219.4	[0.07]	5.04	1050.0	0.05
γ-Terpinene	4.09	1206.4	0.26	5.16	1057.4	0.26
cis-Sabinene hydrate	7.26*	1431.2	[2.82]	5.29	1066.0	0.53
cis-Linalool oxide (fur.)	6.90	1405.3	0.01	5.38	1071.1	0.02
Octanol	8.54	1527.7	0.01	5.47	1076.9	0.02
Terpinolene	4.58	1242.2	0.08	5.62*	1086.1	[0.10]
para-Cymenene	6.68	1388.5	0.02	5.62*	1086.1	[0.10]
trans-Sabinene hydrate	8.33	1511.6	0.05	5.78	1096.6	0.05
Linalool	8.41	1518.1	0.18	5.88*	1102.8	[0.18]
Nonan-3-ol	7.67	1461.6	0.03	5.88*	1102.8	[0.18]

2-Methylbutyl 2-methylbutyrate	4.74	1254.1	0.03	5.93	1105.7	0.03
Isoamyl isovalerate	4.92	1267.1	0.01	5.96	1107.8	0.01
endo-Fenchol	8.67	1537.7	0.04	6.00	1110.5	0.05
Octen-3-yl acetate	6.11	1347.8	0.01	6.09	1115.7	0.01
cis-para-Menth-2-en-1-ol	8.49*	1523.7	[0.04]	6.15	1120.0	0.05
Octan-3-yl acetate	5.54	1306.8	0.02	6.28	1128.2	0.02
trans-para-Menth-2-en-1-ol	9.31*	1587.2	[1.73]	6.38	1134.7	0.01
trans-Sabinol	10.16*	1655.0	[0.41]	6.40	1135.6	0.01
cis-α-Dihydroterpineol	8.52*	1526.0	[0.11]	6.51	1142.7	0.04
Isopulegol	8.52*	1526.0	[0.11]	6.52	1143.4	0.09
Menthone	7.02	1413.9	21.39	6.67	1153.1	21.40
Borneol	10.16*	1655.0	[0.41]	6.80*	1161.1	[5.55]
Menthofuran	7.26*	1431.2	[2.82]	6.80*	1161.1	[5.55]
Isomenthone	7.36*	1438.6	[3.30]	6.80*	1161.1	[5.55]
neo-Menthol	8.95	1559.6	3.87	6.87	1165.6	3.39
Lavandulol	9.92*	1636.0	[0.05]	6.90	1167.3	0.03
Menthol	9.56	1606.8	43.89	7.09	1179.9	44.58
Isomenthol	9.31*	1587.2	[1.73]	7.16	1183.8	0.58
para-Cymen-8-ol	11.93	1802.6	0.01	7.21	1187.1	0.04
α-Terpineol	10.16*	1655.0	[0.41]	7.27*	1191.0	[0.58]
neoiso-Menthol	9.85*	1630.4	[0.32]	7.27*	1191.0	[0.58]
cis-Piperitol	9.85*	1630.4	[0.32]	7.35	1196.3	0.04
Unknown MEPI V [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]				7.43	1201.3	0.01
Decanal	7.58	1455.1	0.02	7.50	1206.2	0.02
trans-Carveol	11.78	1790.0	0.03	7.71	1219.7	0.02
(3*Z*)-Hexenyl 2-methylbutyrate	7.42	1443.4	0.03	7.83	1228.1	0.01
Citronellol	11.09	1732.1	0.04	7.87	1230.6	0.03
Pulegone	9.31*	1587.2	[1.73]	7.93*	1234.6	[1.18]
(3*Z*)-Hexenyl isovalerate	7.43*	1444.1	[0.04]	7.93*	1234.6	[1.18]
Carvone	10.39*	1673.8	[0.30]	8.00	1239.4	0.13
Piperitone	10.29	1665.5	0.59	8.15	1249.0	0.59
neo-Menthyl acetate	8.01	1486.8	0.15	8.53	1274.6	0.16
Decanol	11.07*	1729.9	[0.04]	8.57	1277.2	0.04
2-Ethylmenthone?				8.66	1283.4	0.07
Dihydroedulan I	7.36*	1438.6	[3.30]	8.73	1288.2	0.03
Menthyl acetate	8.46*	1521.5	[4.45]	8.82	1294.3	4.44
Thymol	15.53	2133.7	0.04	8.88	1298.1	0.01

Isomenthyl acetate	8.62	1533.7	0.14	8.99	1305.4	0.14
cis-Pinocarvyl acetate	9.71	1618.8	0.02	9.05	1309.7	0.02
Bicycloelemene	7.36*	1438.6	[3.30]	9.40	1334.2	0.05
Piperitenone	12.42	1845.3	0.01	9.48	1339.6	0.01
α-Cubebene	7.05	1416.2	0.02	9.59	1347.5	0.01
Eugenol	15.16	2097.2	0.01	9.71	1356.1	0.02
α-Copaene	7.43*	1444.1	[0.04]	9.94	1372.0	0.04
β-Bourbonene	7.77	1469.5	0.26	10.05	1379.9	0.24
β-Cubebene	8.07	1491.3	0.01	10.15	1386.9	0.02
β-Elemene	8.74*	1543.2	[2.53]	10.18	1389.3	0.07
Unknown MEPI VII [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]				10.24	1393.1	0.03
Unknown MEPI VIII [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	11.95	1804.4	0.01	10.35	1400.9	0.02
Isocaryophyllene	8.49*	1523.7	[0.04]	10.38	1403.5	0.03
β-Ylangene	8.46*	1521.5	[4.45]	10.52*	1413.7	[2.53]
β-Caryophyllene	8.74*	1543.2	[2.53]	10.52*	1413.7	[2.53]
β-Copaene	8.74*	1543.2	[2.53]	10.65	1423.6	0.05
trans-α-Bergamotene	8.74*	1543.2	[2.53]	10.78	1432.7	0.01
Isogermacrene D	9.31*	1587.2	[1.73]	10.86	1438.6	0.02
α-Humulene	9.62	1611.9	0.08	10.97	1447.2	0.08
(*E*)-β-Farnesene	9.82	1628.3	0.16	11.12	1457.9	0.23
9-epi-β-Caryophyllene	9.66	1615.4	0.02	11.15	1460.2	0.02
γ-Muurolene	9.92*	1636.0	[0.05]	11.32	1472.8	0.02
Germacrene D	10.12	1651.9	1.15	11.35	1475.5	1.16
Menthalactone	16.28	2207.7	0.01	11.47	1483.9	0.01
Bicyclogermacrene	10.39*	1673.8	[0.30]	11.56	1490.6	0.20
α-Muurolene	10.35	1670.8	0.03	11.64	1496.6	0.02
δ-Amorphene	10.25	1662.1	0.02	11.66	1498.3	0.03
γ-Cadinene	10.71	1700.2	0.05	11.79	1508.6	0.02
δ-Cadinene	10.75	1703.0	0.06	11.93	1519.5	0.05
(*E*)-α-Bisabolene	11.07*	1729.9	[0.04]	12.25	1544.1	0.02
(*E*)-Nerolidol	14.13	1999.9	0.01	12.50	1563.8	0.01
Spathulenol	14.77	2060.4	0.02	12.61	1572.4	0.03
Caryophyllene oxide	13.14	1909.3	0.09	12.63	1573.9	0.10
Viridiflorol	14.36	2021.2	0.13	12.77	1584.8	0.15
Humulene epoxide II				12.95	1599.5	0.01
Isospathulenol	15.81	2161.5	0.01	13.35	1632.0	0.02
τ-Cadinol	15.26	2107.1	0.01	13.41	1636.9	0.01
α-Cadinol	15.86	2166.1	0.01	13.55	1648.6	0.02
Total reported		98.79%			99.43%	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, only the first one is 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

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