Date : 2024-08-05

Certificate of Analysis - GC Profiling

Sample Identification

Internal code : 24G23-PTH03
Customer Identification : Western U.S. Peppermint - USA - PF0111R
Type : Essential Oil
Source : *Mentha x piperita*
Customer : Plant Therapy

Checked an approved by:

Sylvain Mercier, M. Sc., Chimiste 2014-005

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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 : 2024-08-04

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 : 2024-07-26

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
Isobutyral	0.02	Aliphatic aldehyde
Acetic acid	tr	Aliphatic acid
Isobutanol	0.01	Aliphatic alcohol
Isovaleral	0.06	Aliphatic aldehyde
2-Methylbutyral	0.05	Aliphatic aldehyde
2-Ethylfuran	0.02	Furan
Isoamyl alcohol	0.04	Aliphatic alcohol
2-Methylbutanol	0.04	Aliphatic alcohol
Ethyl 2-methylbutyrate	0.02	Aliphatic ester
Ethyl isovalerate	0.01	Aliphatic ester
(3*Z*)-Hexenol	0.02	Aliphatic alcohol
(2*E*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.02	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.02	Furan
α-Thujene	0.05	Monoterpene
α-Pinene	0.75	Monoterpene
3-Methylcyclohexanone	0.02	Aliphatic ketone
Camphene	0.02	Monoterpene
Thuja-2,4(10)-diene	tr	Monoterpene
Benzaldehyde	0.01	Simple phenolic
Sabinene	0.52	Monoterpene
β-Pinene	1.06	Monoterpene
Octen-3-ol	0.18	Aliphatic alcohol
Octan-3-one	0.03	Aliphatic ketone
Myrcene	0.19	Monoterpene
Octan-3-ol	0.26	Aliphatic alcohol
Pseudolimonene	0.01	Monoterpene
α-Phellandrene	0.03	Monoterpene
Δ3-Carene	tr	Monoterpene
α-Terpinene	0.34	Monoterpene
Carvomenthene	tr	Aliphatic alcohol
para-Cymene	0.26	Monoterpene
1,8-Cineole	5.11	Monoterpenic ether
Limonene	1.42	Monoterpene
2-Ethylhexanol	0.01	Aliphatic alcohol
(*Z*)-β-Ocimene	0.30	Monoterpene
(*E*)-β-Ocimene	0.09	Monoterpene
γ-Terpinene	0.57	Monoterpene
cis-Sabinene hydrate	0.69	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol

Terpinolene	0.18	Monoterpene
trans-Sabinene hydrate	0.08	Monoterpenic alcohol
Linalool	0.35	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.06	Aliphatic ester
Isoamyl isovalerate	0.02	Aliphatic ester
Amyl isovalerate	0.14	Aliphatic ester
Octen-3-yl acetate	0.02	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.09	Monoterpenic alcohol
Octan-3-yl acetate	0.03	Aliphatic ester
cis-para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.04	Monoterpenic alcohol
trans-Sabinol	0.08	Monoterpenic alcohol
Isopulegol	0.07	Monoterpenic alcohol
neo-Isopulegol	0.02	Monoterpenic alcohol
Menthone	23.70	Monoterpenic ketone
Citronellal	0.01	Monoterpenic aldehyde
Menthofuran	1.43	Monoterpenic ether
Isomenthone	3.48	Monoterpenic ketone
neo-Menthol	3.61	Monoterpenic alcohol
Lavandulol	0.05	Monoterpenic alcohol
Terpinen-4-ol	1.17	Monoterpenic alcohol
Menthol	38.82	Monoterpenic alcohol
Isomenthol	0.71	Monoterpenic alcohol
para-Cymen-8-ol	tr	Monoterpenic alcohol
α-Terpineol	0.17	Monoterpenic alcohol
neoiso-Menthol	0.18	Monoterpenic alcohol
Myrtenol	0.01	Monoterpenic alcohol
cis-Piperitol	0.02	Monoterpenic alcohol
Unknown	0.01	Unknown
trans-Piperitol	0.02	Monoterpenic alcohol
Decanal	0.03	Aliphatic aldehyde
Citronellol	0.02	Monoterpenic alcohol
Pulegone	1.09	Monoterpenic ketone
Carvone	0.02	Monoterpenic ketone
(3*Z*)-Hexenyl isovalerate	0.04	Aliphatic ester
Hexyl isovalerate	0.02	Aliphatic ester
Piperitone	0.60	Monoterpenic ketone
neo-Menthyl acetate	0.23	Monoterpenic ester
Unknown	0.13	Unknown
Dihydroedulan I	0.06	Terpenic ether
Menthyl acetate	4.67	Monoterpenic ester
Dihydroedulan II	0.02	Terpenic ether
Thymol	0.04	Monoterpenic alcohol
Isomenthyl acetate	0.26	Monoterpenic alcohol
Bicycloelemene	0.02	Sesquiterpene

Piperitenone	0.01	Monoterpenic ketone
Menthofurolactone isomer II	0.01	Monoterpenic lactone
α-Cubebene	0.01	Sesquiterpene
Evodone	0.01	Monoterpenic ketone
Eugenol	0.03	Phenylpropanoid
α-Copaene	0.06	Sesquiterpene
β-Bourbonene	0.43	Sesquiterpene
1,5-diepi-β-Bourbonene	0.02	Sesquiterpene
β-Elemene	0.11	Sesquiterpene
(*Z*)-Jasmone	tr	Jasmonate
Unknown	0.03	Unknown
Isocaryophyllene	0.02	Sesquiterpene
Unknown	0.02	Unknown
β-Caryophyllene	1.98	Sesquiterpene
β-Copaene	0.06	Sesquiterpene
Isogermacrene D	0.04	Sesquiterpene
α-Humulene	0.08	Sesquiterpene
(*E*)-β-Farnesene	0.18	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
Germacrene D	1.72	Sesquiterpene
Menthalactone	0.01	Monoterpenic lactone
Bicyclogermacrene	0.31	Sesquiterpene
Viridiflorene	0.01	Sesquiterpene
α-Muurolene	0.02	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
δ-Cadinene	0.09	Sesquiterpene
(*E*)-Nerolidol	0.01	Sesquiterpenic alcohol
Spathulenol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Caryophyllene oxide	0.04	Sesquiterpenic ether
Viridiflorol	0.17	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
α-Cadinol	0.01	Sesquiterpenic alcohol
Mint sulfide	0.02	Sesquiterpenic sulfide
Benzyl benzoate	0.02	Phenolic ester
Unknown	0.01	Unknown
Consolidated total	**99.74**	

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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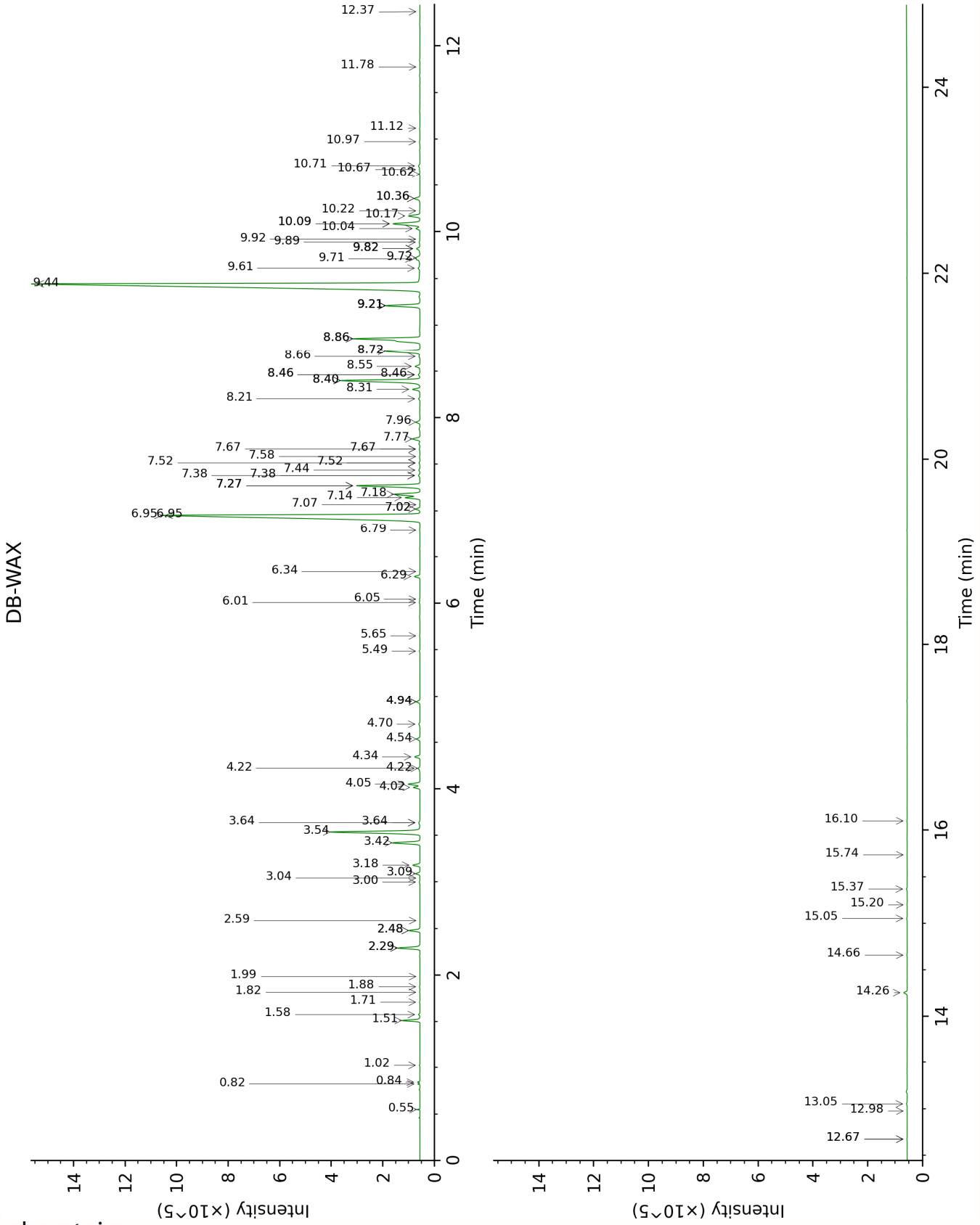
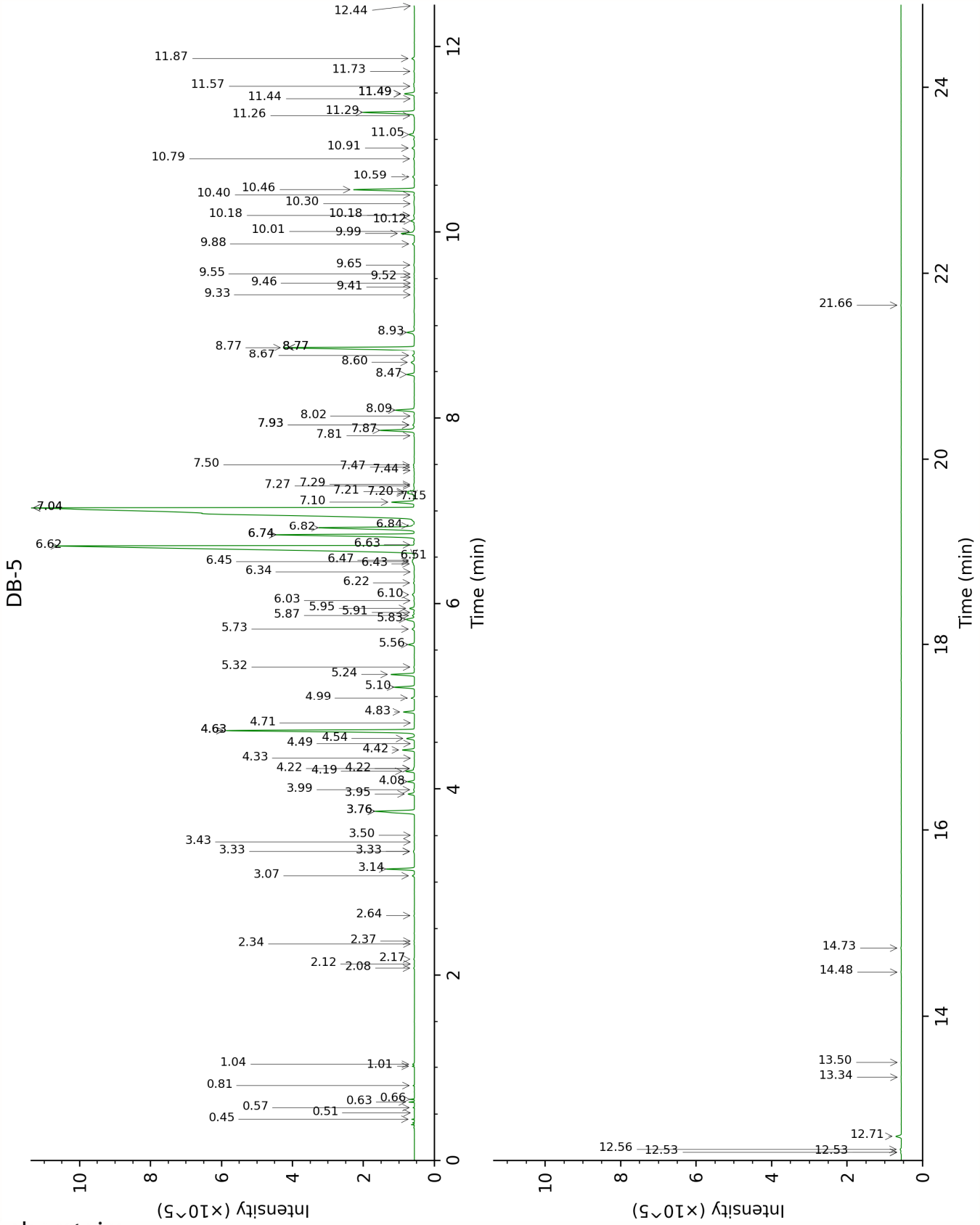

DB-WAX
Time (min)
Intensity (×10^5)
12.37
11.78
11.12
10.97
10.71
10.67
10.62
10.36
10.22
10.17
10.09
10.04
9.92
9.89
9.82
9.71
9.72
9.61
9.44
9.21
8.86
8.72
8.66
8.55
8.46
8.40
8.46
8.31
8.21
7.96
7.77
7.67
7.67
7.58
7.52
7.52
7.38
7.44
7.38
7.27
7.14
7.18
7.07
7.02
6.95
6.95
6.79
6.34
6.29
6.01
6.05
5.65
5.49
4.94
4.70
4.54
4.34
4.22
4.22
4.05
4.02
3.64
3.64
3.54
3.42
3.18
3.09
3.04
3.00
2.59
2.48
2.29
1.99
1.88
1.82
1.71
1.58
1.51
1.02
0.82
0.84
0.55
16.10
15.74
15.37
15.20
15.05
14.66
14.26
13.05
12.98
12.67


DB-5
Time (min)
Intensity (×10^5)
12.44
11.87
11.73
11.57
11.49
11.44
11.29
11.26
11.05
10.91
10.79
10.59
10.46
10.40
10.30
10.18
10.18
10.12
10.01
9.99
9.88
9.65
9.55
9.52
9.46
9.41
9.33
8.93
8.77
8.77
8.67
8.60
8.47
8.09
8.02
7.93
7.87
7.81
7.50
7.47
7.44
7.29
7.27
7.21
7.20
7.15
7.10
7.04
6.84
6.82
6.74
6.63
6.62
6.51
6.47
6.45
6.43
6.34
6.22
6.10
6.03
5.95
5.91
5.87
5.83
5.73
5.56
5.32
5.24
5.10
4.99
4.83
4.71
4.63
4.54
4.49
4.42
4.33
4.22
4.19
4.22
4.08
3.99
3.95
3.76
3.50
3.43
3.33
3.33
3.14
3.07
2.64
2.37
2.34
2.17
2.12
2.08
1.04
1.01
0.81
0.66
0.63
0.57
0.51
0.45
21.66
14.73
14.48
13.50
13.34
12.71
12.56
12.53
12.53

FULL ANALYSIS DATA

Isobutyral	Column DB-WAX			Column DB-5		
	0.55	777.8	0.05	0.44	537.3	0.02
Acetic acid	6.95*	1414.8	[23.69]	0.51	596.0	tr
Isobutanol	2.29*	1068.4	[1.08]	0.57	620.3	0.01
Isovaleral	0.84	887.1	0.06	0.63	641.3	0.06
2-Methylbutyral	0.82	880.3	0.05	0.66	651.4	0.05
2-Ethylfuran	1.02	919.1	0.02	0.81	702.4	0.02
Isoamyl alcohol	3.64*	1176.4	[0.08]	1.02	732.5	0.04
2-Methylbutanol	3.64*	1176.4	[0.08]	1.04	735.5	0.04
Ethyl 2-methylbutyrate	1.82	1023.0	0.02	2.08	849.6	0.02
Ethyl isovalerate	1.99	1039.2	0.01	2.12	853.2	0.01
(3*Z*)-Hexenol	6.05	1349.5	0.02	2.17	857.5	0.02
(2*E*)-Hexenol	6.34	1370.6	0.01	2.34	871.0	0.01
Hexanol	5.65	1321.4	0.02	2.37	873.6	0.02
trans-2,5-Diethyltetrahydrofuran	1.71	1013.0	0.02	2.64	896.3	0.02
α-Thujene	1.58	1000.3	0.06	3.07	925.9	0.05
α-Pinene	1.51	993.9	0.75	3.14	930.7	0.75
3-Methylcyclohexanone	4.94*	1270.4	[0.18]	3.33*	943.2	[0.04]
Camphene	1.88	1028.8	0.02	3.33*	943.2	[0.04]
Thuja-2,4(10)-diene	2.48*	1086.2	[0.52]	3.43	949.9	tr
Benzaldehyde	7.58	1461.3	0.03	3.50	954.7	0.01
Sabinene	2.48*	1086.2	[0.52]	3.76*	971.7	[1.58]
β-Pinene	2.29*	1068.4	[1.08]	3.76*	971.7	[1.58]
Octen-3-ol	7.02*	1419.8	[0.20]	3.95	983.9	0.18
Octan-3-one	4.22*	1219.2	[0.12]	3.99	986.9	0.03
Myrcene	3.09	1134.6	0.19	4.08	992.7	0.19
Octan-3-ol	6.29	1366.8	0.26	4.19	1000.0	0.26
Pseudolimonene	3.04	1130.9	0.01	4.22*	1002.0	[0.03]
α-Phellandrene	3.00	1127.6	0.03	4.22*	1002.0	[0.03]
Δ3-Carene				4.33	1008.9	tr
α-Terpinene	3.18	1141.5	0.34	4.42	1014.5	0.34
Carvomenthene	2.59	1096.1	tr	4.49	1018.8	tr
para-Cymene	4.34	1228.0	0.26	4.54	1022.2	0.26
1,8-Cineole	3.54	1168.7	5.11	4.63*	1027.6	[6.52]
Limonene	3.42	1159.8	1.42	4.63*	1027.6	[6.52]
2-Ethylhexanol	7.52*	1456.2	[0.05]	4.71	1032.7	0.01
(*Z*)-β-Ocimene	4.02	1204.6	0.30	4.83	1040.1	0.30
(*E*)-β-Ocimene	4.22*	1219.2	[0.12]	4.98	1049.8	0.09
γ-Terpinene	4.05	1207.1	0.57	5.10	1057.2	0.57
cis-Sabinene hydrate	7.14	1428.8	0.71	5.24	1065.8	0.69
cis-Linalool oxide (fur.)	6.79	1402.5	0.02	5.32	1070.7	0.02
Terpinolene	4.54	1241.7	0.17	5.56	1085.8	0.18

trans-Sabinene hydrate	8.20	1507.6	0.07	5.73	1096.2	0.08
Linalool	8.31	1515.4	0.36	5.83	1102.8	0.35
2-Methylbutyl 2-methylbutyrate	4.70	1253.1	0.07	5.87	1105.4	0.06
Isoamyl isovalerate	4.94*	1270.4	[0.18]	5.91	1107.5	0.02
Amyl isovalerate	4.94*	1270.4	[0.18]	5.95	1110.3	0.14
Octen-3-yl acetate	6.01	1346.9	0.03	6.03	1115.6	0.02
cis-para-Menth-2-en-1-ol	8.40*	1522.7	[4.76]	6.10	1119.7	0.09
Octan-3-yl acetate	5.49	1309.7	0.03	6.22	1127.7	0.03
cis-para-Mentha-2,8-dien-1-ol	9.72	1625.8	0.12	6.34	1135.2	0.01
trans-para-Menth-2-en-1-ol	9.21*	1585.0	[1.83]	6.43	1140.8	0.04
trans-Sabinol	10.09*	1655.1	[1.75]	6.45	1142.2	0.08
Isopulegol	8.46*	1527.5	[0.09]	6.47	1143.2	0.07
neo-Isopulegol	8.46*	1527.5	[0.09]	6.51	1145.7	0.02
Menthone	6.95*	1414.8	[23.69]	6.62	1153.1	23.70
Citronellal	7.27*	1438.2	[3.49]	6.63	1153.8	0.01
Menthofuran	7.18	1431.5	1.43	6.74*	1160.7	[4.91]
Isomenthone	7.27*	1438.2	[3.49]	6.74*	1160.7	[4.91]
neo-Menthol	8.86*	1557.7	[4.51]	6.82	1165.5	3.61
Lavandulol	9.89	1639.2	0.04	6.84	1167.2	0.05
Terpinen-4-ol	8.86*	1557.7	[4.51]	7.04*	1179.6	[39.99]
Menthol	9.44	1603.4	38.82	7.04*	1179.6	[39.99]
Isomenthol	9.21*	1585.0	[1.83]	7.10	1183.5	0.71
para-Cymen-8-ol	11.78	1795.9	0.02	7.15	1186.8	tr
α-Terpineol	10.04	1651.0	0.19	7.20	1189.7	0.17
neoiso-Menthol	9.71	1624.8	0.21	7.21	1190.7	0.18
Myrtenol	11.12	1740.3	0.02	7.27	1194.6	0.01
cis-Piperitol	9.82*	1633.7	[0.18]	7.29	1195.7	0.02
Unknown MEPI V [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]				7.44	1205.3	0.01
trans-Piperitol	10.62	1698.6	0.02	7.47	1207.7	0.02
Decanal	7.52*	1456.2	[0.05]	7.50	1209.3	0.03
Citronellol	10.97	1728.1	0.03	7.81	1230.3	0.02
Pulegone	9.21*	1585.0	[1.83]	7.87	1234.1	1.09
Carvone	10.22	1666.2	0.02	7.93*	1238.0	[0.06]
(3*Z*)-Hexenyl isovalerate	7.38*	1446.3	[0.08]	7.93*	1238.0	[0.06]
Hexyl isovalerate	7.02*	1419.8	[0.20]	8.02	1244.4	0.02
Piperitone	10.17	1661.8	0.59	8.09	1248.6	0.60

neo-Menthyl acetate	7.96	1488.6	0.20	8.47	1274.2	0.23
Unknown MEPI VI [m/z 119, 79 (94), 91 (0), 84 (80), 93 (68)...]				8.60	1282.9	0.13
Dihydroedulan I	7.38*	1446.3	[0.08]	8.67	1287.8	0.06
Menthyl acetate	8.40*	1522.7	[4.76]	8.76*	1293.9	[4.62]
Dihydroedulan II	7.66*	1467.2	[0.04]	8.76*	1293.9	[4.62]
Thymol	15.37	2129.1	0.04	8.76*	1293.9	[4.62]
Isomenthyl acetate	8.55	1534.4	0.26	8.93	1305.0	0.26
Bicycloelemene	7.27*	1438.2	[3.49]	9.33	1333.3	0.02
Piperitenone	12.37	1848.2	0.01	9.41	1339.0	0.01
Menthofurolactone isomer II				9.46	1342.0	0.01
α-Cubebene	7.07	1423.2	0.01	9.52	1346.5	0.01
Evodone	12.67*	1875.0	[0.02]	9.55	1349.0	0.01
Eugenol	15.05	2097.7	0.03	9.65	1355.7	0.03
α-Copaene	7.44	1450.5	0.06	9.88	1371.6	0.06
β-Bourbonene	7.77	1475.2	0.42	9.99	1379.5	0.43
1,5-diepi-β-Bourbonene	7.66*	1467.2	[0.04]	10.01	1381.0	0.02
β-Elemene	8.72*	1547.1	[2.02]	10.12	1389.0	0.11
(*Z*)-Jasmone	12.67*	1875.0	[0.02]	10.18*	1393.1	[0.04]
Unknown MEPI VII [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]				10.18*	1393.1	[0.04]
Isocaryophyllene	8.46*	1527.5	[0.09]	10.30	1401.9	0.02
Unknown MEPI X [m/z 109, 95 (88), 69 (66), 135 (56), 82 (54), 41 (45)...]				10.40	1408.8	0.02
β-Caryophyllene	8.72*	1547.1	[2.02]	10.46	1413.1	1.98
β-Copaene	8.66	1542.7	0.05	10.59	1423.3	0.06
Isogermacrene D	9.21*	1585.0	[1.83]	10.79	1438.2	0.04
α-Humulene	9.61	1616.9	0.07	10.91	1446.8	0.08
(*E*)-β-Farnesene	9.82*	1633.7	[0.18]	11.06	1457.6	0.18
γ-Muurolene	9.82*	1633.7	[0.18]	11.26	1472.6	0.02
Germacrene D	10.09*	1655.1	[1.75]	11.29	1475.3	1.72
Menthalactone	16.10	2202.5	0.02	11.44	1486.1	0.01
Bicyclogermacrene	10.36*	1676.9	[0.33]	11.49*	1490.1	[0.32]
Viridiflorene	9.92	1641.8	0.01	11.49*	1490.1	[0.32]
α-Muurolene	10.36*	1676.9	[0.33]	11.57	1496.1	0.02
γ-Cadinene	10.67	1702.8	0.03	11.73	1508.3	0.02
δ-Cadinene	10.71	1706.1	0.10	11.87	1519.2	0.09
(*E*)-Nerolidol				12.44	1563.8	0.01

Spathulenol	14.66	2059.5	0.02	12.53*	1570.9	[0.03]
Caryophyllene oxide isomer	12.98	1902.1	0.01	12.53*	1570.9	[0.03]
Caryophyllene oxide	13.05	1909.2	0.04	12.56	1573.4	0.04
Viridiflorol	14.26	2020.9	0.17	12.70	1584.4	0.17
τ-Cadinol	15.20	2112.2	0.01	13.34	1635.9	0.01
α-Cadinol	15.74	2165.5	0.02	13.50	1649.0	0.01
Mint sulfide				14.48	1730.9	0.02
Benzyl benzoate				14.74	1753.4	0.02
Unknown MEPI XII [m/z 311, 312 (23), 135 (4), 368 (3), 313 (3)...]				21.66	2449.9	0.01
Total reported		99.23%			99.61%	

*: 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