Date : February 18, 2022

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 22B11-PTH04
Customer identification : Spearmint - USA - S301102111R
Type : Essential oil
Source : *Mentha spicata*
Customer : Plant Therapy

Analysis

Method: PC-MAT-014 ISO - Analysis of the composition of an essential oil or other volatile liquid by FAST GC-FID (in French); identifications validated by GC-MS.
Analyst : Seydou Ka, Ph. D.
Analysis date : February 16, 2022

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.4898 ± 0.0003 (20 °C; method PC-MAT-016)

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	0.03	Aliphatic aldehyde
Isobutanol	tr	Aliphatic alcohol
Isovaleral	0.06	Aliphatic aldehyde
2-Methylbutyral	0.05	Aliphatic aldehyde
2-Ethylfuran	0.02	Furan
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Methyl 2-methylbutyrate	0.02	Aliphatic ester
Ethyl 2-methylbutyrate	0.05	Aliphatic ester
(3*Z*)-Hexenol	0.02	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.05	Furan
Hashishene	0.11	Monoterpene
α-Thujene	0.05	Monoterpene
α-Pinene	0.63	Monoterpene
Camphene	0.02	Monoterpene
3-Methylcyclohexanone	0.01	Aliphatic ketone
Thuja-2,4(10)-diene	0.01	Monoterpene
Benzaldehyde	tr	Simple phenolic
β-Pinene	0.70	Monoterpene
Sabinene	0.49	Monoterpene
Octen-3-ol	tr	Aliphatic alcohol
Octan-3-one	0.01	Aliphatic ketone
6-Methyl-5-hepten-2-one	0.02	Aliphatic ketone
Myrcene	1.69	Monoterpene
Octan-3-ol	0.67	Aliphatic alcohol
α-Phellandrene	tr	Monoterpene
Pseudolimonene	0.04	Monoterpene
α-Terpinene	0.14	Monoterpene
para-Cymene	0.02	Monoterpene
1,8-Cineole	1.52	Monoterpenic ether
Limonene	13.48	Monoterpene
2-Ethylhexanol	0.01	Aliphatic alcohol
(*Z*)-β-Ocimene	0.16	Monoterpene
Unknown	0.01	Unknown
(*E*)-β-Ocimene	0.08	Monoterpene
γ-Terpinene	0.23	Monoterpene
cis-Sabinene hydrate	1.45	Monoterpenic alcohol
Octanol	0.03	Aliphatic alcohol
Terpinolene	0.08	Monoterpene
para-Cymenene	0.02	Monoterpene
trans-Sabinene hydrate	0.01	Monoterpenic alcohol
Linalool	0.07	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.02	Aliphatic ester
Nonanal	0.02	Aliphatic aldehyde

trans-para-Mentha-2,8-dien-1-ol	0.02	Monoterpenic alcohol
allo-Ocimene	0.02	Monoterpene
Octan-3-yl acetate	0.16	Aliphatic ester
cis-Limonene oxide	0.01	Monoterpenic ether
trans-Pinocarveol	0.05	Monoterpenic alcohol
cis-para-Mentha-2,8-dien-1-ol	0.04	Monoterpenic alcohol
Camphor	0.03	Monoterpenic ketone
Isopulegol	0.03	Monoterpenic alcohol
Menthone	0.01	Monoterpenic ketone
Isomenthone	0.04	Monoterpenic ketone
neo-Menthol	0.14	Monoterpenic alcohol
Terpinen-4-ol	0.30	Monoterpenic alcohol
Menthol	0.04	Monoterpenic alcohol
Isomenthol	tr	Monoterpenic alcohol
α-Terpineol	0.23	Monoterpenic alcohol
cis-Dihydrocarvone	0.78	Monoterpenic ketone
neo-Dihydrocarveol	tr	Monoterpenic alcohol
Methylchavicol	0.13	Phenylpropanoid
Dihydrocarveol	0.03	Monoterpenic alcohol
trans-Dihydrocarvone	0.06	Monoterpenic ketone
trans-Piperitol	tr	Monoterpenic alcohol
Decanal	0.01	Aliphatic aldehyde
iso-Dihydrocarveol ?	0.02	Monoterpenic alcohol
cis-Carveol	0.23	Monoterpenic alcohol
Pulegone	0.02	Monoterpenic ketone
Carvone	65.42	Monoterpenic ketone
Piperitone	0.17	Monoterpenic ketone
cis-Carvone oxide	0.02	Monoterpenic ketone
Isopiperitenone	0.07	Monoterpenic ketone
trans-Carvone oxide	0.14	Monoterpenic ketone
Decanol	0.02	Aliphatic alcohol
2-Ethylmenthone?	0.03	Aliphatic ketone
Dihydroedulan I	0.05	Terpenic ether
Menthyl acetate	tr	Monoterpenic ester
Dihydrocarvyl acetate	0.24	Monoterpenic ester
trans-Carvyl acetate	0.02	Monoterpenic ester
α-Cubebene	0.01	Sesquiterpene
iso-Dihydrocarvyl acetate	0.07	Monoterpenic ester
cis-Carvyl acetate	0.43	Monoterpenic ester
α-Copaene	0.05	Sesquiterpene
1,5-diepi-β-Bourbonene	0.07	Sesquiterpene
β-Bourbonene	1.67	Sesquiterpene
β-Elemene	0.14	Sesquiterpene
(*Z*)-Jasmone	0.40	Jasmonate
Unknown	0.03	Sesquiterpene
Isocaryophyllene	0.02	Sesquiterpene
β-Caryophyllene	0.90	Sesquiterpene
β-Ylangene	0.21	Sesquiterpene
β-Copaene	0.18	Sesquiterpene
Isogermacrene D	0.18	Sesquiterpene
α-Humulene	0.08	Sesquiterpene
(*E*)-β-Farnesene	0.89	Sesquiterpene

Unknown	0.11	Sesquiterpene
Germacrene D	1.23	Sesquiterpene
Bicyclogermacrene	0.03	Sesquiterpene
α-Muurolene	0.08	Sesquiterpene
γ-Cadinene	0.01	Sesquiterpene
δ-Cadinene	0.05	Sesquiterpene
Caryophyllene oxide	0.02	Sesquiterpenic ether
Caryophyllene oxide isomer	0.03	Sesquiterpenic ether
Viridiflorol	0.24	Sesquiterpenic alcohol
α-Cadinol	0.01	Sesquiterpenic alcohol
para-Camphorene	tr	Diterpene
Consolidated total	**97.88%**	

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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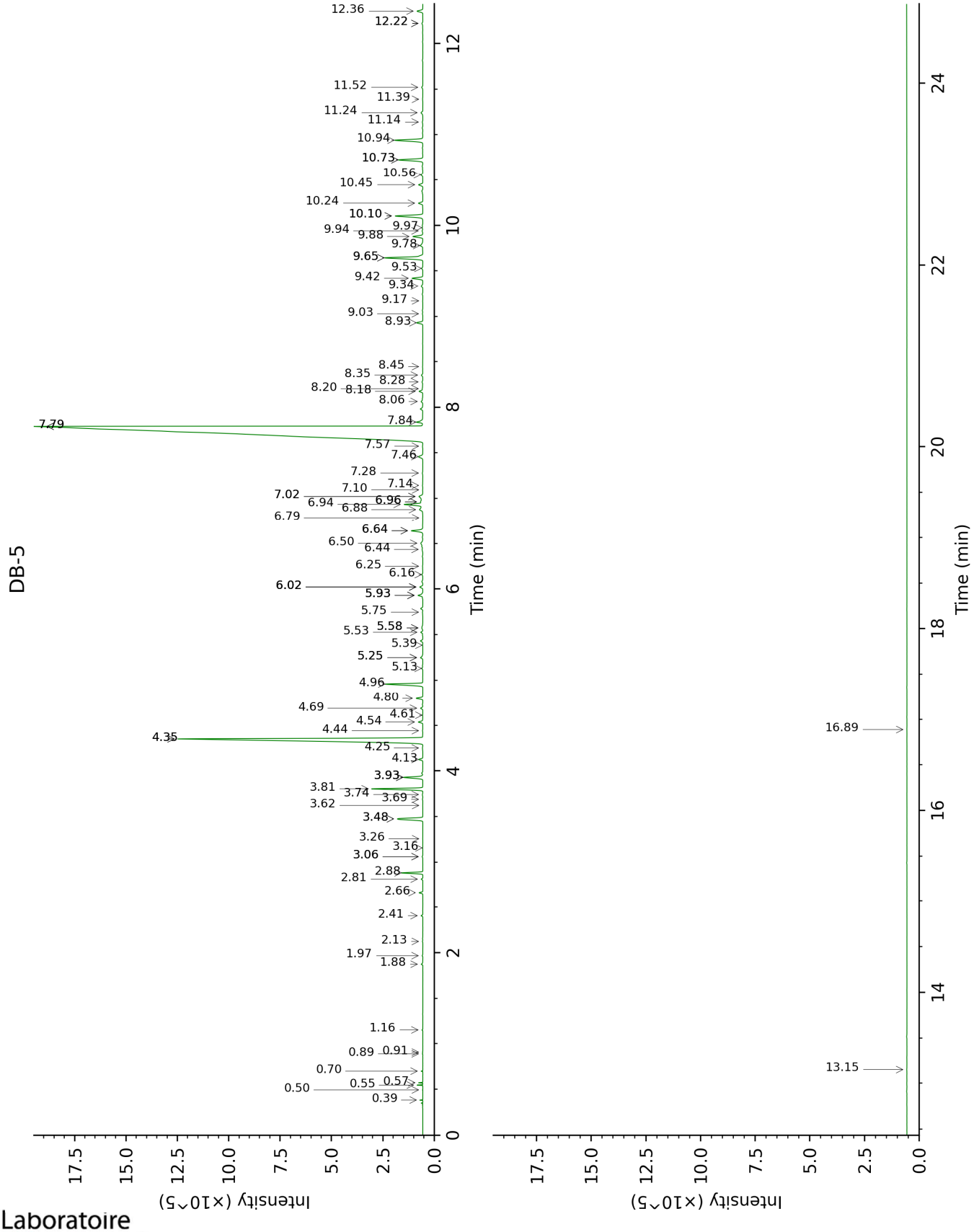
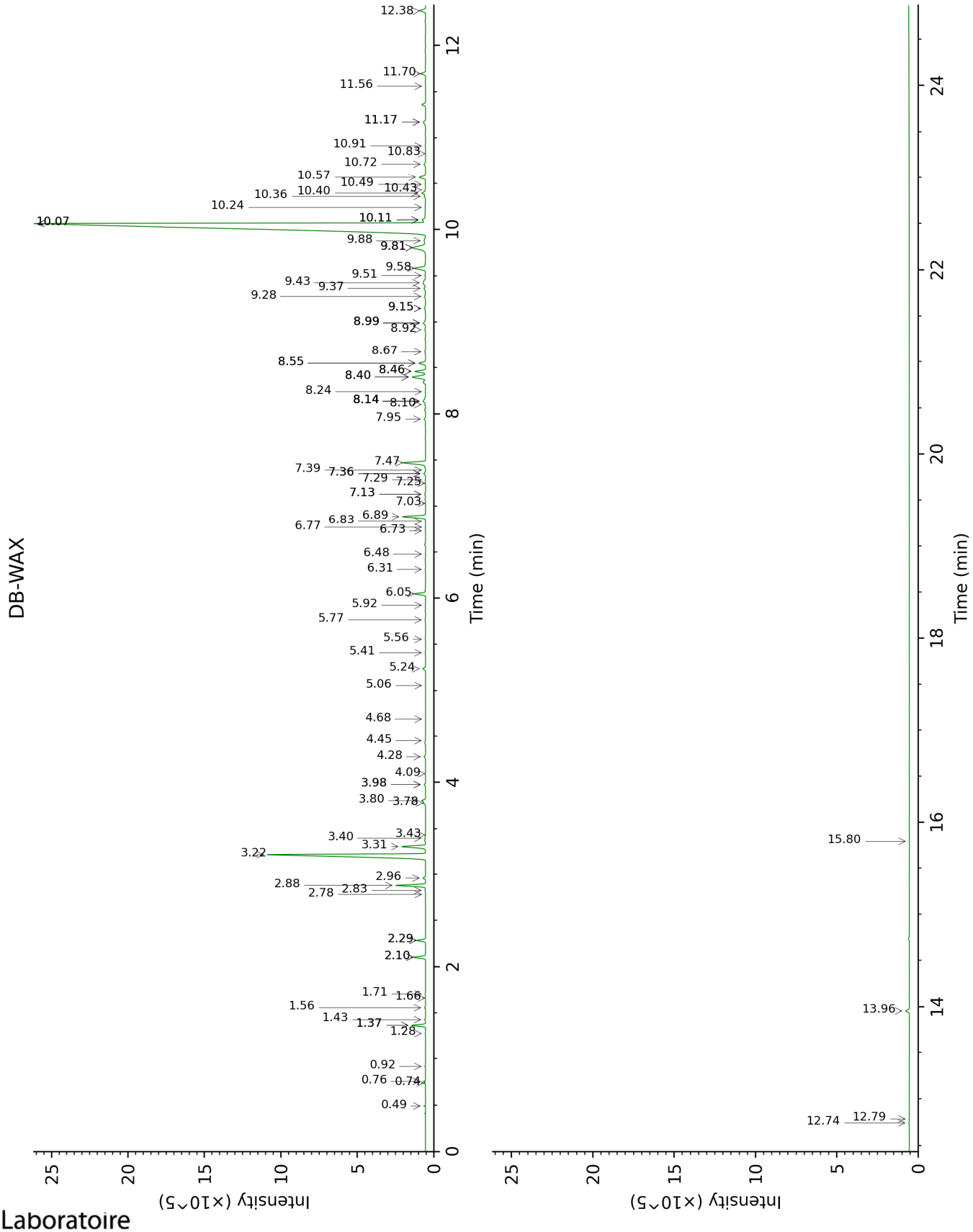

DB-5
Time (min)
Intensity (×10^5)
12.36
12.22
11.52
11.39
11.24
11.14
10.94
10.73
10.56
10.45
10.24
10.10
9.97
9.94
9.88
9.78
9.65
9.53
9.42
9.34
9.17
9.03
8.93
8.45
8.35
8.28
8.20
8.18
8.06
7.84
7.79
7.57
7.46
7.28
7.14
7.10
7.02
6.96
6.94
6.88
6.79
6.64
6.50
6.44
6.25
6.16
6.02
5.93
5.75
5.58
5.53
5.39
5.25
5.13
4.96
4.80
4.69
4.61
4.54
4.44
4.35
4.25
4.13
3.93
3.81
3.74
3.69
3.62
3.48
3.26
3.16
3.06
2.88
2.81
2.66
2.41
2.13
1.97
1.88
1.16
0.91
0.89
0.70
0.57
0.55
0.50
0.39
16.89
13.15


DB-WAX
Time (min)
Intensity (×10^5)
12.38
11.70
11.56
11.17
10.91
10.83
10.72
10.57
10.49
10.43
10.40
10.36
10.24
10.11
10.07
9.88
9.81
9.58
9.51
9.43
9.37
9.28
9.15
8.99
8.92
8.67
8.55
8.46
8.40
8.24
8.14
8.10
7.95
7.47
7.39
7.36
7.29
7.25
7.13
7.03
6.89
6.83
6.77
6.73
6.48
6.31
6.05
5.92
5.77
5.56
5.41
5.24
5.06
4.68
4.45
4.28
4.09
3.98
3.80
3.78
3.43
3.40
3.31
3.22
2.96
2.88
2.83
2.78
2.29
2.10
1.71
1.66
1.56
1.43
1.37
1.28
0.92
0.76
0.74
0.49
15.80
13.96
12.79
12.74

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutyral	0.39	537	0.03	0.49	779	0.03
Isobutanol	0.50	620	tr	2.10*	1064	0.70
Isovaleral	0.55	641	0.06	0.76	884	0.06
2-Methylbutyral	0.57	651	0.05	0.74	878	0.05
2-Ethylfuran	0.70	701	0.02	0.92	917	0.02
Isoamyl alcohol	0.89	732	0.01	3.43	1176	0.01
2-Methylbutanol	0.91	735	0.01	3.40	1173	0.04
Methyl 2-methylbutyrate	1.16	774	0.02	1.28	975	0.02
Ethyl 2-methylbutyrate	1.88	850	0.05	1.66	1021	0.01
(3*Z*)-Hexenol	1.97	858	0.02	5.77	1345	0.02
Hexanol	2.13	872	0.01	5.41	1319	0.02
trans-2,5-Diethyltetrahydrofuran	2.41	897	0.05	1.56	1011	0.05
Hashishene	2.66	915	0.11	1.37*	989	0.73
α-Thujene	2.81	926	0.05	1.43	998	0.05
α-Pinene	2.88	930	0.63	1.37*	989	[0.73]
Camphene	3.06*	943	0.02	1.71	1025	0.02
3-Methylcyclohexanone	3.06*	943	[0.02]	4.68	1270	0.01
Thuja-2,4(10)-diene	3.16	949	0.01	2.28*	1082	0.50
Benzaldehyde	3.26	956	tr	7.39	1464	0.01
β-Pinene	3.48*	971	1.20	2.10*	1064	[0.70]
Sabinene	3.48*	971	[1.20]	2.28*	1082	[0.50]
Octen-3-ol	3.62	981	tr	6.84	1422	0.01
Octan-3-one	3.69	985	0.01	3.98*	1218	0.09
6-Methyl-5-hepten-2-one	3.74	989	0.02	5.06	1298	0.01
Myrcene	3.81	993	1.69	2.88	1132	1.67
Octan-3-ol	3.93*	1002	0.74	6.05	1365	0.67
α-Phellandrene	3.93*	1002	[0.74]	2.78	1125	tr
Pseudolimonene	3.93*	1002	[0.74]	2.83	1128	0.04
α-Terpinene	4.13	1014	0.14	2.96	1138	0.14
para-Cymene	4.25	1022	0.02	4.10	1227	0.02
1,8-Cineole	4.35*	1029	15.07	3.31	1166	1.52
Limonene	4.35*	1029	[15.07]	3.22	1159	13.48
2-Ethylhexanol	4.44	1034	0.01	7.29	1456	0.02
(*Z*)-β-Ocimene	4.54	1040	0.16	3.78	1203	0.14
Unknown [m/z 57, 73 (49), 115 (34), 93 (27), 43 (28)...]	4.61	1045	0.01			
(*E*)-β-Ocimene	4.69	1050	0.08	3.98*	1218	[0.09]
γ-Terpinene	4.80	1057	0.23	3.80	1205	0.24
cis-Sabinene hydrate	4.96	1067	1.45	6.89	1426	1.45
Octanol	5.13	1078	0.03	8.24	1528	0.02
Terpinolene	5.25*	1086	0.10	4.28	1240	0.08
para-Cymenene	5.25*	1086	[0.10]	6.31	1384	0.02

trans-Sabinene hydrate	5.39	1094	0.01	7.94	1505	0.09
Linalool	5.53	1103	0.07	8.10	1518	0.04
2-Methylbutyl 2-methylbutyrate	5.58*	1106	0.03	4.45	1253	0.02
Nonanal	5.58*	1106	[0.03]	5.92	1356	0.02
trans-para-Mentha-2,8-dien-1-ol	5.75	1117	0.02	8.99*	1587	0.20
allo-Ocimene	5.93*	1129	0.20	5.56	1330	0.02
Octan-3-yl acetate	5.93*	1129	[0.20]	5.24	1307	0.16
cis-Limonene oxide	5.93*	1129	[0.20]	6.48	1396	0.01
trans-Pinocarveol	6.02*	1135	0.12	9.15*	1599	0.09
cis-para-Mentha-2,8-dien-1-ol	6.02*	1135	[0.12]	9.50	1628	0.04
Camphor	6.02*	1135	[0.12]	7.25	1453	0.03
Isopulegol	6.16	1144	0.03	8.14*	1520	0.27
Menthone	6.25	1150	0.01	6.73	1415	0.01
Isomenthone	6.44	1162	0.04	7.03	1437	0.02
neo-Menthol	6.50	1166	0.14	8.55*	1552	0.44
Terpinen-4-ol	6.64*	1175	0.48	8.55*	1552	[0.44]
Menthol	6.64*	1175	[0.48]	9.15*	1599	[0.09]
Isomenthol	6.79	1184	tr	8.92	1581	0.06
α-Terpineol	6.88	1190	0.23	9.81*	1652	1.49
cis-Dihydrocarvone	6.94	1194	0.78	8.46*†	1545	[2.01]
neo-Dihydrocarveol	6.96*	1196	0.13	10.11*	1676	0.33
Methylchavicol	6.96*	1196	[0.13]	9.37	1616	0.13
Dihydrocarveol	7.02*	1199	0.26	10.43	1703	0.03
trans-Dihydrocarvone	7.02*	1199	[0.26]	8.67	1562	0.06
trans-Piperitol	7.10	1204	tr	10.40	1700	0.26
Decanal	7.14	1207	0.01	7.36*	1461	0.12
iso-Dihydrocarveol ?	7.28	1216	0.02	10.83	1737	0.01
cis-Carveol	7.46	1228	0.23	11.70	1811	0.32
Pulegone	7.57	1236	0.02	8.99*	1587	[0.20]
Carvone	7.79*†	1251	66.24	10.07*	1673	65.51
Piperitone	7.79*†	1251	[66.24]	9.88	1658	0.17
cis-Carvone oxide	7.84†	1254	[66.24]	10.91	1744	0.02
Isopiperitenone	8.06	1269	0.07	11.17*	1766	0.22
trans-Carvone oxide	8.18	1276	0.14	11.17*	1766	[0.22]
Decanol	8.20	1278	0.02	10.72	1727	0.11
2-Ethylmenthone?	8.28	1283	0.03			
Dihydroedulan I	8.35	1288	0.05	7.13*	1444	0.05
Menthyl acetate	8.45	1294	tr	8.14*	1520	[0.27]
Dihydrocarvyl acetate	8.93	1329	0.24	9.43	1621	0.34
trans-Carvyl acetate	9.03	1336	0.02	10.24	1687	0.04
α-Cubebene	9.17	1346	0.01	6.77	1418	0.02
iso-Dihydrocarvyl acetate	9.34	1357	0.07			
cis-Carvyl acetate	9.42	1363	0.43	10.57	1715	0.45
α-Copaene	9.53	1371	0.05	7.13*	1444	[0.05]
1,5-diepi-β-Bourbonene	9.65*	1379	1.74	7.36*	1461	[0.12]
β-Bourbonene	9.65*	1379	[1.74]	7.47	1470	1.67

β-Elemene	9.78	1388	0.14	8.46*†	1545	[2.01]
(*Z*)-Jasmone	9.88	1396	0.40	12.38	1872	0.40
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	9.94	1400	0.03	11.56	1799	0.01
Isocaryophyllene	9.98	1402	0.02	8.14*	1520	[0.27]
β-Caryophyllene	10.10*	1412	1.23	8.40*†	1541	2.01
β-Ylangene	10.10*	1412	[1.23]	8.14*	1520	[0.27]
β-Copaene	10.24	1422	0.18	8.40*†	1541	[2.01]
Isogermacrene D	10.45	1437	0.18	8.99*	1587	[0.20]
α-Humulene	10.56	1446	0.08	9.28	1609	0.08
(*E*)-β-Farnesene	10.73*	1458	1.00	9.58	1634	0.89
Unknown [m/z 161, 105 (56), 91 (50), 93 (36), 119 (33), 79 (31)...204 (5)]	10.73*	1458	[1.00]			
Germacrene D	10.94	1474	1.23	9.81*	1652	[1.49]
Bicyclogermacrene	11.14	1489	0.03	10.11*	1676	[0.33]
α-Muurolene	11.24	1497	0.08	10.07*	1673	[65.51]
γ-Cadinene	11.39	1508	0.01	10.36	1697	0.09
δ-Cadinene	11.52	1518	0.05	10.49	1708	0.04
Caryophyllene oxide	12.22*	1574	0.04	12.79	1908	0.02
Caryophyllene oxide isomer	12.22*	1574	[0.04]	12.74	1904	0.03
Viridiflorol	12.36	1584	0.24	13.96	2017	0.24
α-Cadinol	13.15	1649	0.01			
para-Camphorene	16.89	1983	tr	15.80	2199	tr
Total identified		**99.01%**			**98.67%**	
Total reported		**99.04%**			**98.68%**	

*: 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