Date : February 28, 2022

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 22B21-PTH03
Customer identification : Peppermint Western - USA - PF01072110R
Type : Essential oil
Source : *Mentha x piperita*
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 25, 2022

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear Liquid
Refractive index: 1.4627 ± 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	tr	Aliphatic aldehyde
Isovaleral	0.03	Aliphatic aldehyde
2-Methylbutyral	0.02	Aliphatic aldehyde
Isoamyl alcohol	0.02	Aliphatic alcohol
2-Methylbutanol	0.03	Aliphatic alcohol
(3*Z*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.02	Furan
α-Thujene	0.05	Monoterpene
α-Pinene	0.57	Monoterpene
3-Methylcyclohexanone	0.02	Aliphatic ketone
Camphene	0.02	Monoterpene
α-Fenchene	tr	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
β-Pinene	0.84	Monoterpene
Sabinene	0.44	Monoterpene
Octen-3-ol	0.09	Aliphatic alcohol
Octan-3-one	0.02	Aliphatic ketone
Myrcene	0.28	Monoterpene
Pseudolimonene	0.02	Monoterpene
Octan-3-ol	0.27	Aliphatic alcohol
α-Phellandrene	0.03	Monoterpene
α-Terpinene	0.28	Monoterpene
para-Cymene	0.11	Monoterpene
1,8-Cineole	4.58	Monoterpenic ether
Limonene	1.46	Monoterpene
(*Z*)-β-Ocimene	0.33	Monoterpene
(*E*)-β-Ocimene	0.09	Monoterpene
γ-Terpinene	0.48	Monoterpene
cis-Sabinene hydrate	1.06	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
Terpinolene	0.15	Monoterpene
para-Cymenene	0.01	Monoterpene
trans-Sabinene hydrate	0.10	Monoterpenic alcohol
Linalool	0.32	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.07	Aliphatic ester
Amyl isovalerate	0.02	Aliphatic ester
endo-Fenchol	0.09	Monoterpenic alcohol
Octen-3-yl acetate	0.02	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.07	Monoterpenic alcohol
Octan-3-yl acetate	0.05	Aliphatic ester
Isopulegol	0.16	Monoterpenic alcohol
Menthone	18.32	Monoterpenic ketone
Isomenthone	2.66	Monoterpenic ketone

Menthofuran	5.00	Monoterpenic ether
δ-Terpineol	0.15	Monoterpenic alcohol
neo-Menthol	3.15	Monoterpenic alcohol
Terpinen-4-ol	1.00	Monoterpenic alcohol
Menthol	40.88	Monoterpenic alcohol
Isomenthol	0.59	Monoterpenic alcohol
para-Cymen-8-ol	0.01	Monoterpenic alcohol
neoiso-Menthol	0.19	Monoterpenic alcohol
Myrtenal	0.02	Monoterpenic aldehyde
α-Terpineol	0.14	Monoterpenic alcohol
Myrtenol	0.02	Monoterpenic alcohol
Methylchavicol	0.02	Phenylpropanoid
trans-Isopiperitenol	0.01	Monoterpenic alcohol
Unknown	0.01	Unknown
trans-Piperitol	0.01	Monoterpenic alcohol
Decanal	0.02	Aliphatic aldehyde
cis-Isocarveol	0.03	Monoterpenic alcohol
Citronellol	0.02	Monoterpenic alcohol
Pulegone	1.74	Monoterpenic ketone
Carvone	0.02	Monoterpenic ketone
Piperitone	0.39	Monoterpenic ketone
neo-Menthyl acetate	0.25	Monoterpenic ester
Decanol	0.01	Aliphatic alcohol
2-Ethylmenthone?	0.05	Aliphatic ketone
Dihydroedulan I	0.04	Terpenic ether
Menthyl acetate	4.95	Monoterpenic ester
Isomenthyl acetate	0.25	Monoterpenic alcohol
Unknown	0.02	Unknown
Bicycloelemene	0.01	Sesquiterpene
Piperitenone	0.01	Monoterpenic ketone
α-Cubebene	0.02	Sesquiterpene
α-Copaene	0.05	Sesquiterpene
β-Bourbonene	0.32	Sesquiterpene
β-Elemene	0.10	Sesquiterpene
Unknown	0.05	Unknown
Unknown	tr	Sesquiterpene
Isocaryophyllene	0.04	Sesquiterpene
β-Caryophyllene	2.24	Sesquiterpene
β-Ylangene	0.18	Sesquiterpene
β-Copaene	0.05	Sesquiterpene
Isogermacrene D	0.03	Sesquiterpene
α-Humulene	0.11	Sesquiterpene
Muurola-4,11-diene	0.03	Sesquiterpene
(*E*)-β-Farnesene	0.45	Sesquiterpene
Germacrene D	2.33	Sesquiterpene
Menthalactone	0.01	Monoterpenic lactone
Viridiflorene	0.03	Sesquiterpene
Bicyclogermacrene	0.32	Sesquiterpene
α-Muurolene	0.10	Sesquiterpene
γ-Cadinene	0.04	Sesquiterpene
δ-Cadinene	0.11	Sesquiterpene
Spathulenol	0.03	Sesquiterpenic alcohol

Caryophyllene oxide	0.05	Sesquiterpenic ether
Viridiflorol	0.27	Sesquiterpenic alcohol
τ-Cadinol	0.02	Sesquiterpenic alcohol
Consolidated total	**99.30%**	

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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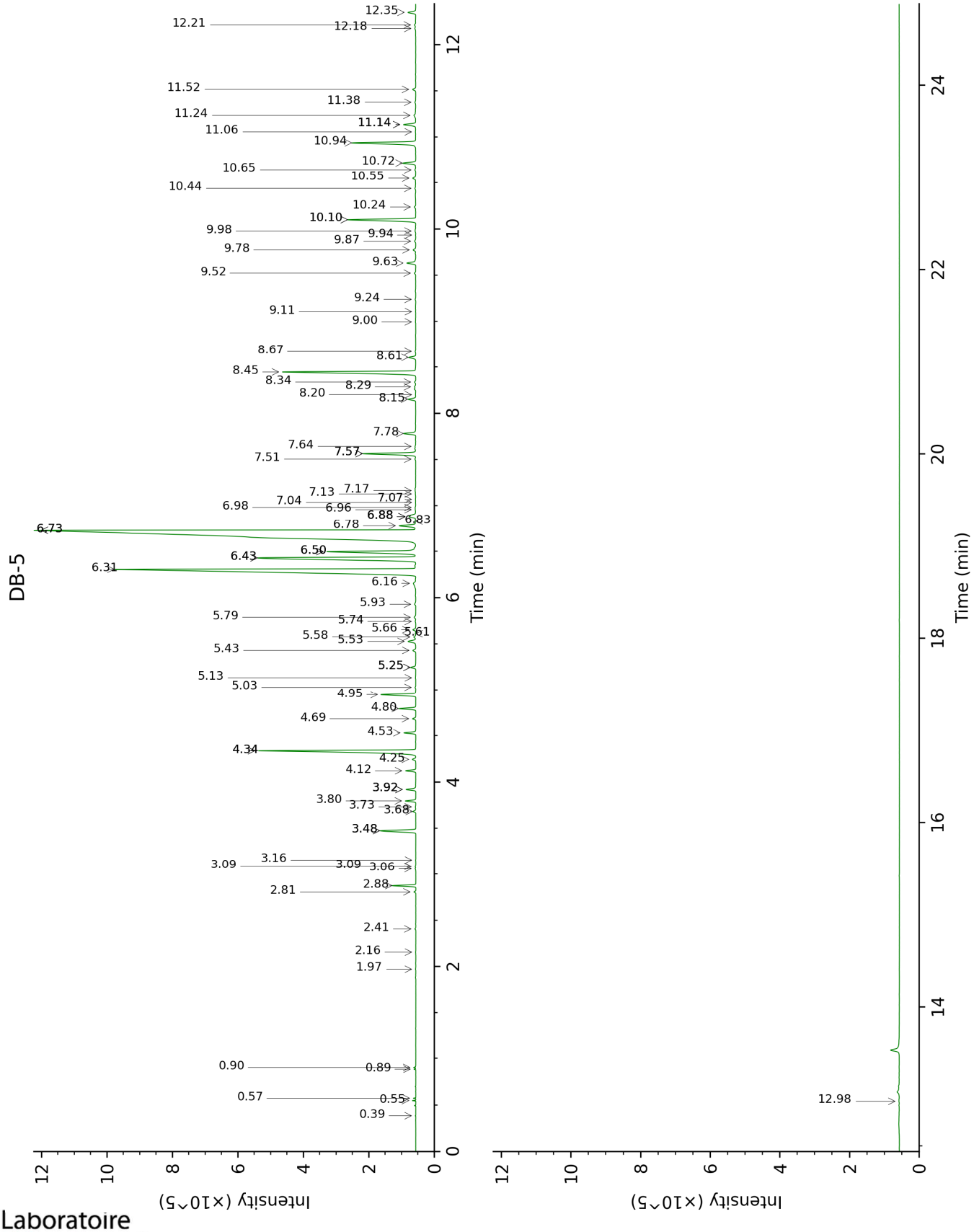
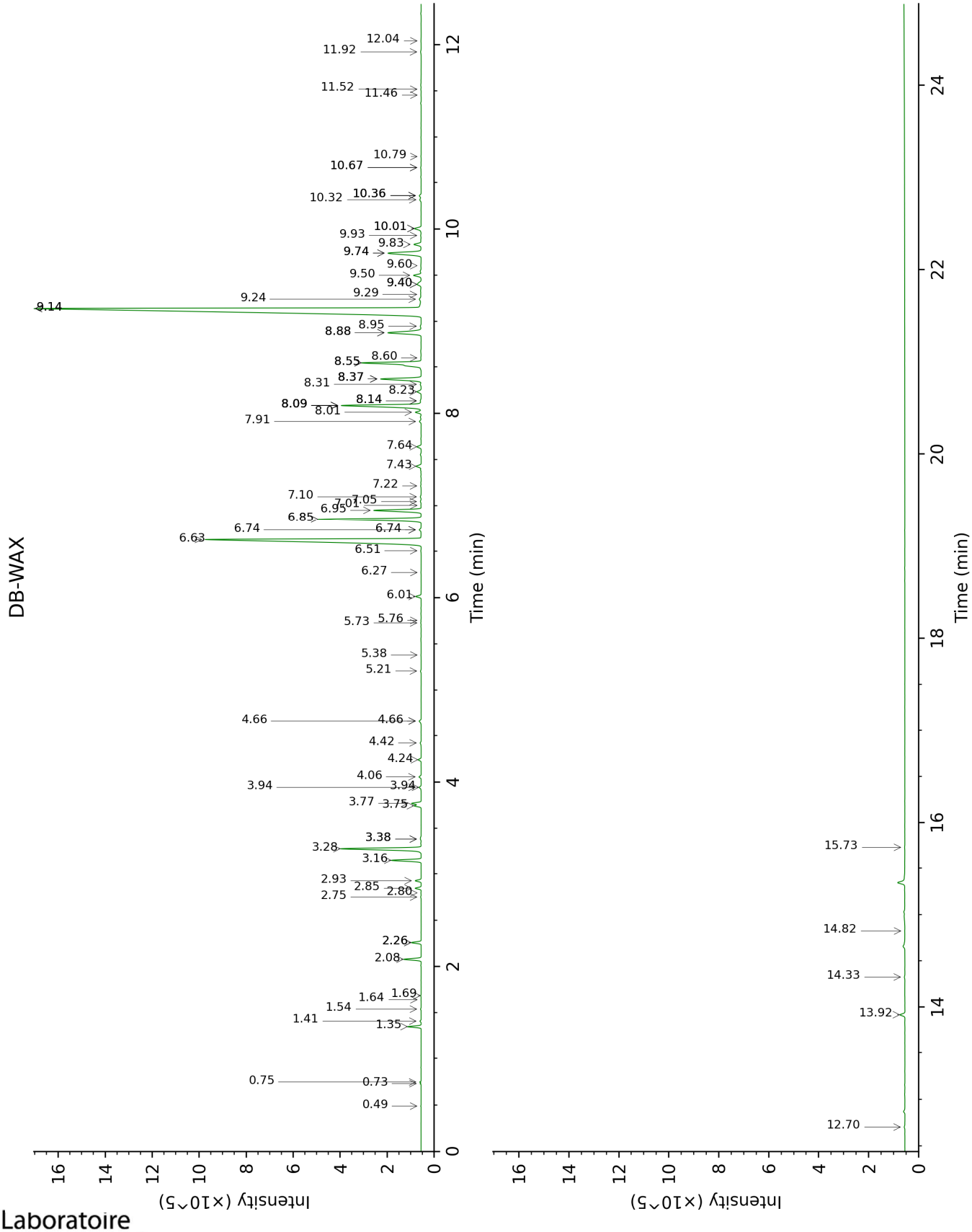

DB-5
Time (min)
Intensity (×10^5)
12.35
12.21
12.18
11.52
11.38
11.24
11.14
11.06
10.94
10.72
10.65
10.55
10.44
10.24
10.10
9.98
9.94
9.87
9.78
9.63
9.52
9.24
9.11
9.00
8.67
8.61
8.45
8.34
8.29
8.20
8.15
7.78
7.64
7.57
7.51
7.17
7.13
7.07
7.04
6.98
6.96
6.88
6.83
6.78
6.73
6.50
6.43
6.31
6.16
5.93
5.79
5.74
5.66
5.61
5.58
5.53
5.43
5.25
5.13
5.03
4.95
4.80
4.69
4.53
4.34
4.25
4.12
3.92
3.80
3.73
3.68
3.48
3.16
3.09
3.09
3.06
2.88
2.81
2.41
2.16
1.97
0.90
0.89
0.57
0.55
0.39
12.98


DB-WAX
Intensity (×10^5)
Time (min)
12.04
11.92
11.52
11.46
10.79
10.67
10.32
10.36
10.01
9.93
9.83
9.74
9.60
9.50
9.40
9.24
9.29
9.14
8.95
8.88
8.60
8.55
8.37
8.31
8.23
8.14
8.09
8.01
7.91
7.64
7.43
7.22
7.10
7.05
7.01
6.95
6.85
6.74
6.74
6.63
6.51
6.27
6.01
5.76
5.73
5.38
5.21
4.66
4.66
4.42
4.24
4.06
3.94
3.94
3.77
3.75
3.38
3.28
3.16
2.93
2.85
2.80
2.75
2.26
2.08
1.69
1.64
1.54
1.41
1.35
0.75
0.73
0.49
15.73
14.82
14.33
13.92
12.70

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutyral	0.39	536	tr	0.49	784	0.01
Isovaleral	0.55	640	0.03	0.75	888	0.03
2-Methylbutyral	0.57	650	0.02	0.73	881	0.02
Isoamyl alcohol	0.89	731	0.02	3.38*	1176	0.06
2-Methylbutanol	0.90	734	0.03	3.38*	1176	[0.06]
(3*Z*)-Hexenol	1.97	858	0.01	5.73	1349	0.02
Hexanol	2.16	874	0.01	5.38	1324	0.01
trans-2,5-Diethyltetrahydrofuran	2.41	896	0.02	1.54	1014	0.02
α-Thujene	2.81	925	0.05	1.41	1001	0.05
α-Pinene	2.88	929	0.57	1.35	992	0.57
3-Methylcyclohexanone	3.06	942	0.02	4.66*	1273	0.12
Camphene	3.09*	944	0.02	1.69	1028	0.02
α-Fenchene	3.09*	944	[0.02]	1.64	1024	tr
Thuja-2,4(10)-diene	3.16	948	0.01	2.26*	1084	0.45
β-Pinene	3.48*	970	1.30	2.08	1067	0.84
Sabinene	3.48*	970	[1.30]	2.26*	1084	[0.45]
Octen-3-ol	3.68	984	0.09	6.74*	1422	0.12
Octan-3-one	3.73	988	0.02	3.94*	1220	0.11
Myrcene	3.80	992	0.28	2.85	1134	0.28
Pseudolimonene	3.92*	1000	0.29	2.80	1130	0.02
Octan-3-ol	3.92*	1000	[0.29]	6.01	1369	0.27
α-Phellandrene	3.92*	1000	[0.29]	2.75	1126	0.03
α-Terpinene	4.12	1013	0.28	2.93	1140	0.28
para-Cymene	4.25	1021	0.11	4.06	1228	0.11
1,8-Cineole	4.34*	1027	6.08	3.28	1168	4.58
Limonene	4.34*	1027	[6.08]	3.16	1158	1.46
(*Z*)-β-Ocimene	4.53	1039	0.33	3.74	1205	0.33
(*E*)-β-Ocimene	4.69	1049	0.09	3.94*	1220	[0.11]
γ-Terpinene	4.80	1056	0.48	3.77	1207	0.49
cis-Sabinene hydrate	4.95	1066	1.06	6.85*	1430	6.05
cis-Linalool oxide (fur.)	5.03	1071	0.02	6.51	1405	0.02
Octanol	5.14	1077	0.01	8.14*	1526	0.05
Terpinolene	5.25*	1084	0.16	4.24	1242	0.15
para-Cymenene	5.25*	1084	[0.16]	6.27	1388	0.01
trans-Sabinene hydrate	5.43	1096	0.10	7.91	1509	0.10
Linalool	5.53	1102	0.32	8.01	1517	0.30
2-Methylbutyl 2-methylbutyrate	5.58	1105	0.07	4.42	1255	0.06
Amyl isovalerate	5.61	1108	0.02	4.66*	1273	[0.12]
endo-Fenchol	5.66	1110	0.09	8.37*	1545	2.44
Octen-3-yl acetate	5.74	1116	0.02	5.76	1351	0.01
cis-para-Menth-2-en-1-ol	5.79	1119	0.07	8.09*	1523	5.12
Octan-3-yl acetate	5.93	1128	0.05	5.21	1311	0.04
Isopulegol	6.16	1142	0.16	8.09*	1523	[5.12]

Menthone	6.31	1152	18.32	6.63	1414	18.18
Isomenthone	6.43*	1160	7.66	6.95	1438	2.66
Menthofuran	6.43*	1160	[7.66]	6.85*	1430	[6.05]
δ-Terpineol	6.50*	1165	3.45	9.40*	1626	0.34
neo-Menthol	6.50*	1165	[3.45]	8.55*	1558	4.15
Terpinen-4-ol	6.73*	1179	41.88	8.55*	1558	[4.15]
Menthol	6.73*	1179	[41.88]	9.14*	1605	40.91
Isomenthol	6.78	1183	0.59	8.88*	1584	2.34
para-Cymen-8-ol	6.83	1186	0.01	11.46	1797	0.01
neoiso-Menthol	6.88*	1189	0.35	9.40*	1626	[0.34]
Myrtenal	6.88*	1189	[0.35]	8.60	1562	0.02
α-Terpineol	6.88*	1189	[0.35]	9.74*	1653	2.47
Myrtenol	6.96	1194	0.02	10.79	1740	0.01
Methylchavicol	6.98	1196	0.02	9.29	1617	0.03
trans-Isopiperitenol	7.04	1199	0.01	10.36*	1704	0.12
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.07	1201	0.01			
trans-Piperitol	7.13	1205	0.01	10.36*	1704	[0.12]
Decanal	7.17	1208	0.02	7.22	1457	0.03
cis-Isocarveol	7.51	1230	0.03	11.92	1838	0.05
Citronellol	7.57*	1234	1.76	10.67*	1730	0.03
Pulegone	7.57*	1234	[1.76]	8.88*	1584	[2.34]
Carvone	7.64	1240	0.02	9.93	1669	0.03
Piperitone	7.78	1249	0.39	9.83	1661	0.43
neo-Menthyl acetate	8.15	1274	0.25	7.64	1489	0.23
Decanol	8.20	1277	0.01	10.67*	1730	[0.03]
2-Ethylmenthone?	8.29	1283	0.05			
Dihydroedulan I	8.34	1286	0.04	7.05	1445	0.05
Menthyl acetate	8.45	1294	4.95	8.09*	1523	[5.12]
Isomenthyl acetate	8.61	1304	0.25	8.23	1534	0.25
Unknown [m/z 43, 136 (55), 121 (55), 107 (48), 93 (48), 81 (30), 79 (29)...]	8.67	1309	0.02			
Bicycloelemene	9.00	1332	0.01	7.01	1442	0.02
Piperitenone	9.11	1340	0.01	12.04	1849	0.02
α-Cubebene	9.24	1349	0.02	6.74*	1422	[0.12]
α-Copaene	9.52	1369	0.05	7.10	1448	0.06
β-Bourbonene	9.63	1377	0.32	7.43	1473	0.29
β-Elemene	9.78	1387	0.10	8.37*	1545	[2.44]
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	9.87	1394	0.05			
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	9.94	1398	tr	11.52	1802	0.02
Isocaryophyllene	9.98	1401	0.04	8.14*	1526	[0.05]
β-Caryophyllene	10.10*	1410	2.43	8.37*	1545	[2.44]

β-Ylangene	10.10*	1410	[2.43]	8.09*	1523	[5.12]
β-Copaene	10.24	1421	0.05	8.31	1540	0.06
Isogermacrene D	10.44	1436	0.03	8.95	1590	0.05
α-Humulene	10.55	1444	0.11	9.24	1613	0.15
Muurola-4,11-diene	10.65	1451	0.03	9.14*	1605	[40.91]
(*E*)-β-Farnesene	10.72	1456	0.45	9.50	1634	0.43
Germacrene D	10.94	1473	2.33	9.74*	1653	[2.47]
Menthalactone	11.06	1482	0.01	15.74	2203	0.02
Viridiflorene	11.14*	1488	0.44	9.60	1642	0.03
Bicyclogermacrene	11.14*	1488	[0.44]	10.01*	1675	0.42
α-Muurolene	11.24	1495	0.10	10.01*	1675	[0.42]
γ-Cadinene	11.38	1506	0.04	10.32	1700	0.10
δ-Cadinene	11.52	1517	0.11	10.36*	1704	[0.12]
Spathulenol	12.18	1568	0.03	14.33	2062	0.03
Caryophyllene oxide	12.21	1572	0.05	12.70	1908	0.03
Viridiflorol	12.35	1582	0.27	13.92	2022	0.27
τ-Cadinol	12.98	1633	0.02	14.82	2111	0.01
Total identified		**99.49%**			**99.01%**	
Total reported		**99.57%**			**99.03%**	

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