

Date : January 24, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19A15-PTH05-1-CC

Customer identification : Marjoram Organic - Egypt - MJ010382R

Type : Essential oil

Source : *Origanum majorana*

Customer : Plant Therapy

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 : Lindsay Girard, B. Sc.

Analysis date : January 22, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: clear liquid

Refractive index: 1.4715 ± 0.0003 (20 °C)

CONCLUSION

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Isovaleral	tr	tr	Aliphatic aldehyde
2-Methylbutyral	tr	0.01	Aliphatic aldehyde
2-Ethylfuran	tr	tr	Furan
Methyl 2-methylbutyrate	0.03	0.03	Aliphatic ester
(2E)-Hexenal	0.01	0.02	Aliphatic aldehyde
(3Z)-Hexenol	0.01	0.03*	Aliphatic alcohol
Hexanol	0.01	0.01	Aliphatic alcohol
Hashishene	0.02	1.35*	Monoterpene
α -Thujene	0.57	0.55	Monoterpene
α -Pinene	0.80	[1.35]*	Monoterpene
Camphene	0.03	0.03	Monoterpene
β -Pinene	8.70*	0.45	Monoterpene
Sabinene	[8.70]*	8.07	Monoterpene
3-Methylpentyl acetate	0.02		Aliphatic ester
Octan-3-one	0.06	0.06*	Aliphatic ketone
Myrcene	2.15	2.10	Monoterpene
α -Phellandrene	0.34*	0.27	Monoterpene
Pseudolimonene	[0.34]*	0.06	Monoterpene
Δ^3 -Carene	0.01		Monoterpene
α -Terpinene	7.53	7.37	Monoterpene
Carvomenthene	0.01	0.01	Aliphatic alcohol
para-Cymene	1.30	1.29	Monoterpene
Limonene	4.08	2.16	Monoterpene
1,8-Cineole	[4.08]*	1.84*	Monoterpenic ether
β -Phellandrene	[4.08]*	[1.84]*	Monoterpene
(Z)- β -Ocimene	0.04	12.12*	Monoterpene
(E)- β -Ocimene	0.06	[0.06]*	Monoterpene
γ -Terpinene	12.33	[12.12]*	Monoterpene
cis-Sabinene hydrate	3.78	3.83	Monoterpenic alcohol
para-Cymenene	2.84*	0.02	Monoterpene
Terpinolene	[2.84]*	2.76	Monoterpene
Unknown	19.18*	[0.03]*	Oxygenated monoterpene
trans-Sabinene hydrate	[19.18]*	19.31	Monoterpenic alcohol
Linalool	0.87	0.87	Monoterpenic alcohol
Unknown	0.03	1.99*	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	1.55	3.28*	Monoterpenic alcohol
α -Campholenal	0.05	0.03*	Monoterpenic aldehyde
trans-Pinocarveol	0.07	0.08*	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.85	0.85	Monoterpenic alcohol
Unknown	0.01	0.02	Unknown
1,4-Dimethyl-4-acetylcyclohexene	0.05	0.03	Monoterpenic ketone
Pinocavone	0.02	0.02	Monoterpenic ketone
Isomenthone	0.01	0.02	Monoterpenic ketone
Borneol	0.06	3.07*	Monoterpenic alcohol
δ -Terpineol	0.02	0.02	Monoterpenic alcohol
Terpinen-4-ol	21.89*	21.77*	Monoterpenic alcohol
Cryptone	[21.89]*	[0.08]*	Normoterpenic ketone
para-Cymen-8-ol	0.05	0.03	Monoterpenic alcohol

α -Terpineol	3.02	[3.07]*	Monoterpenic alcohol
<i>cis</i> -Piperitol	0.34*	0.31	Monoterpenic alcohol
Methylchavicol	[0.34]*	0.10*	Phenylpropanoid
Unknown	0.01	0.01	Unknown
<i>trans</i> -Piperitol	0.42	0.42	Monoterpenic alcohol
<i>trans</i> -Carveol	0.02	0.02	Monoterpenic alcohol
Nerol	0.04	0.06	Monoterpenic alcohol
Citronellol	0.02	0.03	Monoterpenic alcohol
Unknown	0.02	0.02	Oxygenated monoterpene
Neral	0.01	0.01	Monoterpenic aldehyde
<i>trans</i> -Sabinene hydrate acetate	0.04	0.03	Monoterpenic ester
Geraniol	1.81*	0.07	Monoterpenic alcohol
Linalyl acetate	[1.81]*	[3.28]*	Monoterpenic ester
<i>trans</i> -Ascaridole glycol	0.09*	0.03	Monoterpenic alcohol
Geranial	[0.09]*	1.07*	Monoterpenic aldehyde
Bornyl acetate	0.02*	0.01	Monoterpenic ester
Citronellyl formate	[0.02]*	0.01	Monoterpenic ester
<i>cis</i> -Ascaridole glycol?	0.06	0.16*	Monoterpenic alcohol
Terpinen-4-yl acetate	0.05	0.03	Monoterpenic ester
Unknown	0.03		Monoterpenic alcohol
Unknown	0.07	0.08	Monoterpenic alcohol
Bicycloelemene	0.03	[0.03]*	Sesquiterpene
Eugenol	0.06	[0.16]*	Phenylpropanoid
Neryl acetate	0.05	0.04	Monoterpenic ester
α -Copaene	0.01	0.01	Sesquiterpene
β -Elemene	0.07*	[1.99]*	Sesquiterpene
Geranyl acetate	[0.07]*	0.06	Monoterpenic ester
β -Caryophyllene	1.96	[1.99]*	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.02*	[1.99]*	Sesquiterpene
Aromadendrene	[0.02]*	[21.77]*	Sesquiterpene
α -Humulene	0.09	[0.10]*	Sesquiterpene
Germacrene D	0.04	[3.07]*	Sesquiterpene
(1S,2S,4S)-para-Menthane-1,2,4-triol	0.01		Monoterpenic alcohol
Viridiflorene	1.07*	0.05	Sesquiterpene
Bicyclogermacrene	[1.07]*	[1.07]*	Sesquiterpene
γ -Cadinene	0.04	0.03	Sesquiterpene
δ -Cadinene	0.01	0.02	Sesquiterpene
Spathulenol	0.05	0.05	Sesquiterpenic alcohol
Caryophyllene oxide	0.07*	0.06	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.07]*	0.01	Sesquiterpenic ether
10-epi- γ -Eudesmol	0.01	0.09	Sesquiterpenic alcohol
Isospathulenol	0.05	0.06	Sesquiterpenic alcohol
τ -Cadinol	0.01	0.01	Sesquiterpenic alcohol
Unknown	0.02	0.02	Diterpene
Total identified	98.99%	98.65%	

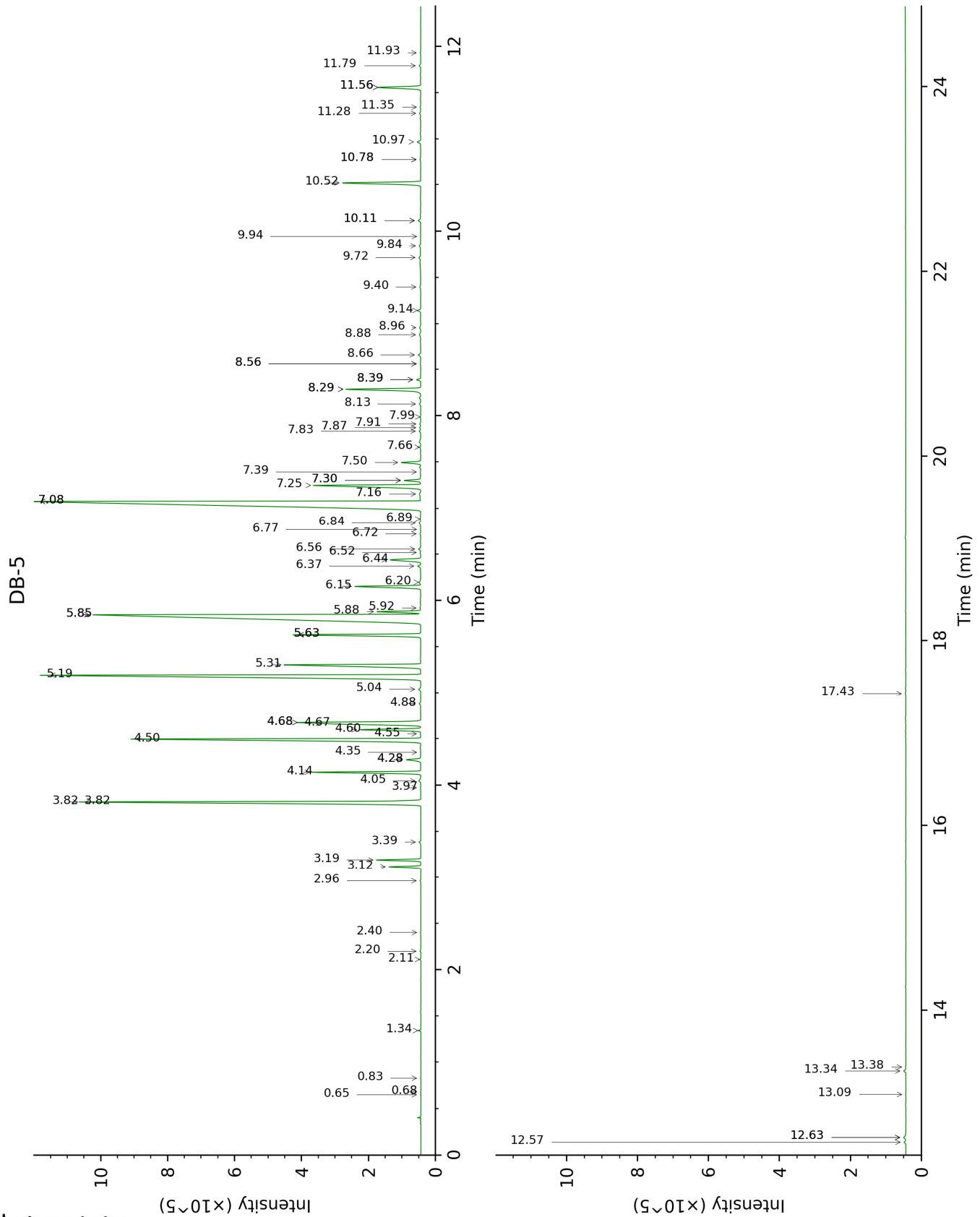
*: Two or more compounds are coeluting on this column

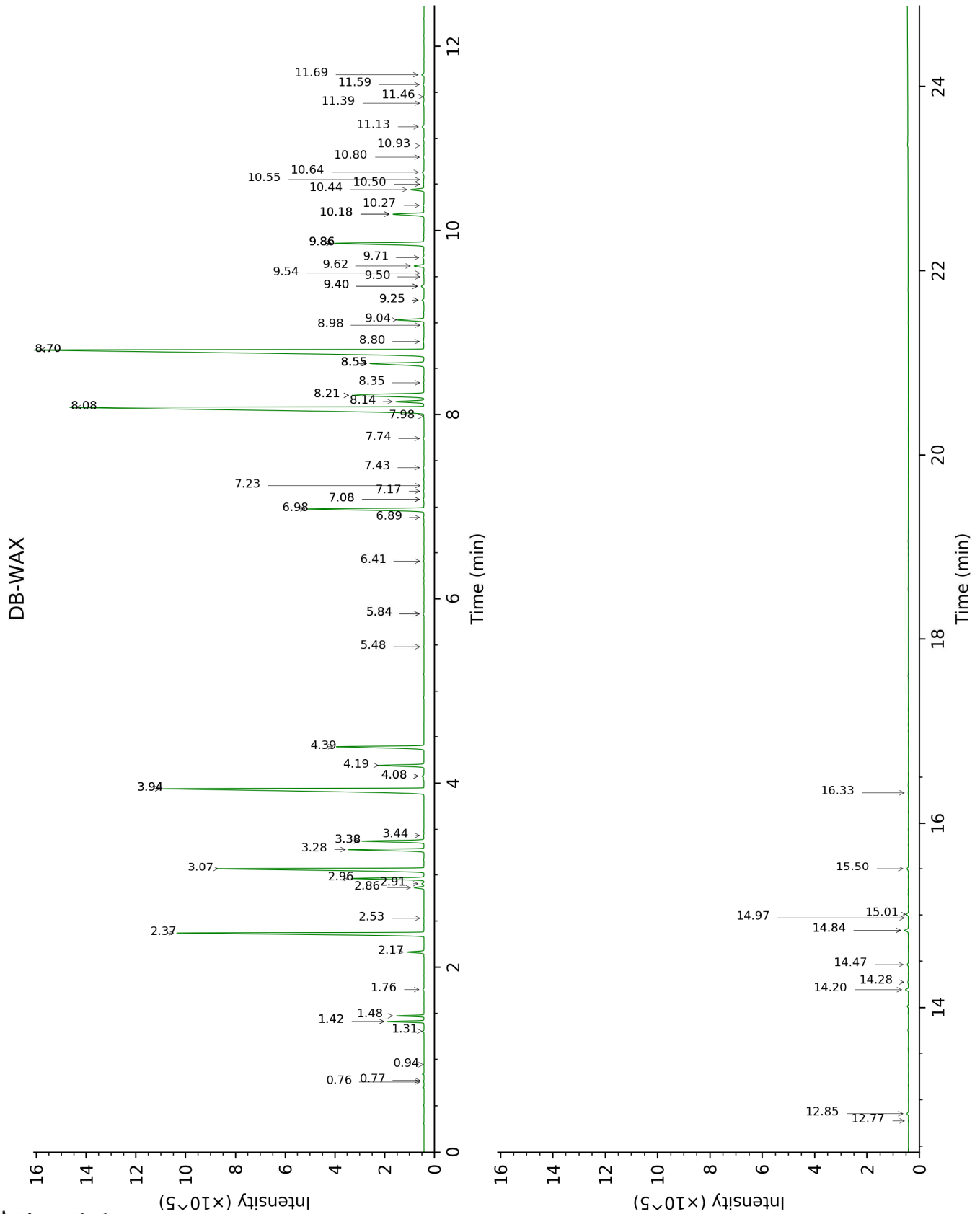
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.65	640	tr	0.77	888	tr
2-Methylbutyral	0.68	649	tr	0.76	883	0.01
2-Ethylfuran	0.83	692	tr	0.94	925	tr
Methyl 2-methylbutyrate	1.34	771	0.03	1.31	978	0.03
(2E)-Hexenal	2.11	847	0.01	3.44	1173	0.02
(3Z)-Hexenol	2.20	854	0.01	5.84*	1346	0.03
Hexanol	2.40	871	0.01	5.48	1320	0.01
Hashishene	2.96	914	0.02	1.42*	994	1.35
α -Thujene	3.12	924	0.57	1.48	1003	0.55
α -Pinene	3.19	929	0.80	1.42*	994	[1.35]
Camphene	3.39	942	0.03	1.76	1029	0.03
β -Pinene	3.82*	970	8.70	2.17	1068	0.45
Sabinene	3.82*	970	[8.70]	2.37	1087	8.07
3-Methylpentyl acetate	3.97	980	0.02			
Octan-3-one	4.05	986	0.06	4.08*	1223	0.06
Myrcene	4.14	992	2.15	2.96	1136	2.10
α -Phellandrene	4.28*	1000	0.34	2.86	1128	0.27
Pseudolimonene	4.28*	1000	[0.34]	2.91	1131	0.06
Δ^3 -Carene	4.35	1006	0.01			
α -Terpinene	4.50	1015	7.53	3.07	1144	7.37
Carvomenthene	4.55	1018	0.01	2.53	1102	0.01
para-Cymene	4.60	1021	1.30	4.19	1232	1.29
Limonene	4.67†	1025	4.08	3.28	1161	2.16
1,8-Cineole	4.68*†	1026	[4.08]	3.38*	1168	1.84
β -Phellandrene	4.68*†	1026	[4.08]	3.38*	1168	[1.84]
(Z)- β -Ocimene	4.88	1039	0.04	3.94*	1213	12.12
(E)- β -Ocimene	5.04	1049	0.06	4.08*	1223	[0.06]
γ -Terpinene	5.19	1058	12.33	3.94*	1213	[12.12]
cis-Sabinene hydrate	5.31	1065	3.78	6.98	1430	3.83
para-Cymenene	5.63*	1086	2.84	6.41	1387	0.02
Terpinolene	5.63*	1086	[2.84]	4.40	1248	2.76
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.85*	1100	19.18	5.84*	1346	[0.03]
trans-Sabinene hydrate	5.85*	1100	[19.18]	8.08	1513	19.31
Linalool	5.88	1102	0.87	8.14	1518	0.87
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.92	1104	0.03	8.56*	1550	1.99
cis-para-Menth-2-en-1-ol	6.15	1119	1.55	8.21*	1523	3.28

α -Campholenal	6.20	1122	0.05	7.08*	1438	0.03
<i>trans</i> -Pinocarveol	6.37	1133	0.07	9.25*	1604	0.08
<i>trans</i> -para-Menth-2-en-1-ol	6.44	1138	0.85	9.04	1587	0.85
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.52	1143	0.01	6.89	1423	0.02
1,4-Dimethyl-4-acetylcyclohexene	6.56	1145	0.05	7.43	1463	0.03
Pinocarvone	6.72	1156	0.02	7.98	1505	0.02
Isomenthone	6.77	1159	0.01	7.17	1444	0.02
Borneol	6.84	1164	0.06	9.86*	1654	3.07
δ -Terpineol	6.89	1167	0.02	9.54	1628	0.02
Terpinen-4-ol	7.08*	1179	21.89	8.70*	1561	21.77
Cryptone	7.08*	1179	[21.89]	9.25*	1604	[0.08]
para-Cymen-8-ol	7.16	1184	0.05	11.59	1800	0.03
α -Terpineol	7.25	1190	3.02	9.86*	1654	[3.07]
<i>cis</i> -Piperitol	7.30*	1194	0.34	9.62	1634	0.31
Methylchavicol	7.30*	1194	[0.34]	9.40*	1616	0.10
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.39	1200	0.01	10.93	1743	0.01
<i>trans</i> -Piperitol	7.50	1206	0.42	10.44	1702	0.42
<i>trans</i> -Carveol	7.66	1218	0.02	11.46	1788	0.02
Nerol	7.83	1230	0.04	11.13	1760	0.06
Citronellol	7.87	1232	0.02	10.80	1732	0.03
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.91	1235	0.02	11.39	1782	0.02
Neral	7.99	1240	0.01	9.50	1625	0.01
<i>trans</i> -Sabinene hydrate acetate	8.13	1250	0.04	7.74	1487	0.03
Geraniol	8.29*	1261	1.81	11.69	1809	0.07
Linalyl acetate	8.29*	1261	[1.81]	8.21*	1523	[3.28]
<i>trans</i> -Ascaridole glycol	8.39*	1268	0.09	14.28	2047	0.03
Geranial	8.39*	1268	[0.09]	10.18*	1680	1.07
Bornyl acetate	8.56*	1279	0.02	8.35	1534	0.01
Citronellyl formate	8.56*	1279	[0.02]	8.98	1583	0.01
<i>cis</i> -Ascaridole glycol?	8.66	1286	0.06	14.84*	2101	0.16
Terpinen-4-yl acetate	8.88	1302	0.05	8.80	1569	0.03
Unknown analog	8.96	1307	0.03			
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.14	1316	0.07	15.01	2118	0.08
Bicycloelemene	9.40	1334	0.03	7.08*	1438	[0.03]

Eugenol	9.72	1357	0.06	14.84*	2101	[0.16]
Neryl acetate	9.84	1366	0.05	10.27	1688	0.04
α -Copaene	9.94	1373	0.01	7.23	1449	0.01
β -Elemene	10.11*	1385	0.07	8.56*	1550	[1.99]
Geranyl acetate	10.11*	1385	[0.07]	10.64	1718	0.06
β -Caryophyllene	10.52	1414	1.96	8.56*	1550	[1.99]
<i>trans</i> - α - Bergamotene	10.78*	1434	0.02	8.56*	1550	[1.99]
Aromadendrene	10.78*	1434	[0.02]	8.70*	1561	[21.77]
α -Humulene	10.97	1448	0.09	9.40*	1616	[0.10]
Germacrene D	11.28	1471	0.04	9.86*	1654	[3.07]
(1S,2S,4S)-para- Menthane-1,2,4- triol	11.35	1476	0.01			
Viridiflorene	11.56*	1492	1.07	9.71	1642	0.05
Bicyclogermacrene	11.56*	1492	[1.07]	10.18*	1680	[1.07]
γ -Cadinene	11.79	1510	0.04	10.50	1707	0.03
δ -Cadinene	11.93	1521	0.01	10.55	1711	0.02
Spathulenol	12.58	1572	0.05	14.47	2065	0.05
Caryophyllene oxide	12.63*	1576	0.07	12.85	1913	0.06
Caryophyllene oxide isomer	12.63*	1576	[0.07]	12.77	1905	0.01
10-epi- γ -Eudesmol	13.09	1612	0.01	14.20	2039	0.09
Isospathulenol	13.34	1633	0.05	15.50	2168	0.06
τ -Cadinol	13.38	1637	0.01	14.97	2115	0.01
Unknown [m/z 257, 258 (20), 91 (19), 272 (18)]	17.43	1998	0.02	16.33	2253	0.02
Total identified		98.99%			98.65%	
Total reported		99.19%			98.80%	

*: 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