

Date : February 18, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19B15-PTH04-1-SCC

Customer identification : Marjoram - Egypt - M2010786R

Type : Essential oil

Source : *Origanum majorana*

Customer : Plant Therapy

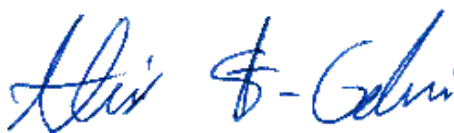
ANALYSIS

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 : February 18, 2019

Checked and approved by :



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

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid

Refractive index: 1.4743 ± 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	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	tr	Aliphatic aldehyde
2-Ethylfuran	0.01	tr	Furan
Methyl 2-methylbutyrate	0.03	0.02	Aliphatic ester
Hexanal	tr		Aliphatic aldehyde
Octane	tr	0.02	Alkane
(2E)-Hexenal	0.02	1.94*	Aliphatic aldehyde
(3Z)-Hexenol	0.02	0.01	Aliphatic alcohol
Hexanol	tr		Aliphatic alcohol
Hashishene	0.01	0.76*	Monoterpene
α -Thujene	0.66	0.66	Monoterpene
α -Pinene	0.76	[0.76]*	Monoterpene
Camphene	0.03	0.03	Monoterpene
Sabinene	6.74*	6.25	Monoterpene
β -Pinene	[6.74]*	0.43	Monoterpene
Octan-3-one	0.05	0.05	Aliphatic ketone
Myrcene	1.97	1.94	Monoterpene
α -Phellandrene	0.44	0.42	Monoterpene
α -Terpinene	8.40	8.34	Monoterpene
Carvomenthene	0.01	0.01	Aliphatic alcohol
para-Cymene	3.01	3.02	Monoterpene
β -Phellandrene	3.96*	[1.94]*	Monoterpene
1,8-Cineole	[3.96]*	[1.94]*	Monoterpenic ether
Limonene	[3.96]*	2.01	Monoterpene
(Z)- β -Ocimene	0.03	14.33*	Monoterpene
(E)- β -Ocimene	0.05	0.07	Monoterpene
γ -Terpinene	14.40	[14.33]*	Monoterpene
cis-Sabinene hydrate	3.45	3.54*	Monoterpenic alcohol
Terpinolene	3.28*	3.23	Monoterpene
para-Cymenene	[3.28]*	0.02	Monoterpene
trans-Sabinene hydrate	7.80	7.94	Monoterpenic alcohol
Linalool	1.06*	1.07	Monoterpenic alcohol
Unknown	[1.06]*	0.02	Oxygenated monoterpene
Unknown	0.01	0.04	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	1.33	1.36	Monoterpenic alcohol
α -Campholenal	0.02	0.03*	Monoterpenic aldehyde
trans-Pinocarveol	0.11	0.12*	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	1.00	1.01	Monoterpenic alcohol
Epoxyterpinolene	0.02	0.02	Monoterpenic ether
Unknown	0.11*	[3.54]*	Unknown
1,4-Dimethyl-4-acetylcyclohexene	[0.11]*	0.06	Monoterpenic ketone
Pinocavone	0.01	0.02	Monoterpenic ketone
Isomenthone	0.01	0.04	Monoterpenic ketone
Borneol	0.05*	3.31*	Monoterpenic alcohol
δ -Terpineol	[0.05]*	0.04	Monoterpenic alcohol
Terpinen-4-ol	27.04*	27.78	Monoterpenic alcohol
Cryptone	[27.04]*	[0.12]*	Normoterpenic ketone
para-Cymen-8-ol	0.05	0.06	Monoterpenic alcohol

α -Terpineol	3.14	[3.31]*	Monoterpenic alcohol
<i>cis</i> -Piperitol	0.56*	0.35*	Monoterpenic alcohol
Methylchavicol	[0.56]*	0.11*	Phenylpropanoid
Unknown	0.02	0.02	Unknown
<i>trans</i> -Piperitol	0.67	0.67*	Monoterpenic alcohol
<i>trans</i> -Carveol	0.03	0.02	Monoterpenic alcohol
Nerol	0.03	0.03	Monoterpenic alcohol
Citronellol	0.03	0.04	Monoterpenic alcohol
Unknown	0.05	0.07	Oxygenated monoterpene
Neral	0.08	[0.35]*	Monoterpenic aldehyde
<i>trans</i> -Sabinene hydrate acetate	0.44	0.42	Monoterpenic ester
Linalyl acetate	2.21*	2.15	Monoterpenic ester
Geraniol	[2.21]*	0.11	Monoterpenic alcohol
Geranial	0.13*	1.05*	Monoterpenic aldehyde
<i>trans</i> -Ascaridole glycol	[0.13]*	0.01	Monoterpenic alcohol
Citronellyl formate	0.01		Monoterpenic ester
Bornyl acetate	0.06	0.03	Monoterpenic ester
<i>cis</i> -Ascaridole glycol?	0.09	0.11*	Monoterpenic alcohol
Terpinen-4-yl acetate	0.14	0.14	Monoterpenic ester
Thymol	0.02	0.02	Monoterpenic alcohol
Unknown	0.04		Monoterpenic alcohol
Unknown	0.17	0.18*	Monoterpenic alcohol
Bicycloelemene	0.03	[0.03]*	Sesquiterpene
Eugenol	0.15	[0.11]*	Phenylpropanoid
Neryl acetate	0.03	0.04	Monoterpenic ester
Geranyl acetate	0.05	0.11	Monoterpenic ester
β -Caryophyllene	2.33	1.80	Sesquiterpene
β -Copaene	0.01	0.07	Sesquiterpene
Aromadendrene	0.04	0.04	Sesquiterpene
α -Humulene	0.11	[0.11]*	Sesquiterpene
Germacrene D	0.01	0.02	Sesquiterpene
Bicyclogermacrene	1.08*	[1.05]*	Sesquiterpene
Viridiflorene	[1.08]*	0.05	Sesquiterpene
γ -Cadinene	0.05	[0.67]*	Sesquiterpene
δ -Cadinene	0.03	0.02	Sesquiterpene
Spathulenol	0.07	0.07	Sesquiterpenic alcohol
Caryophyllene oxide	0.08	0.07	Sesquiterpenic ether
Globulol	0.03	0.02	Sesquiterpenic alcohol
Viridiflorol	0.02	0.02	Sesquiterpenic alcohol
Humulene epoxide II	0.02	0.01	Sesquiterpenic ether
10-epi- γ -Eudesmol	0.01	0.02	Sesquiterpenic alcohol
Isospathulenol	0.06	0.06	Sesquiterpenic alcohol
τ -Cadinol	0.01	[0.18]*	Sesquiterpenic alcohol
Unknown	0.03	0.01	Diterpene
Total identified	97.81%	97.86%	

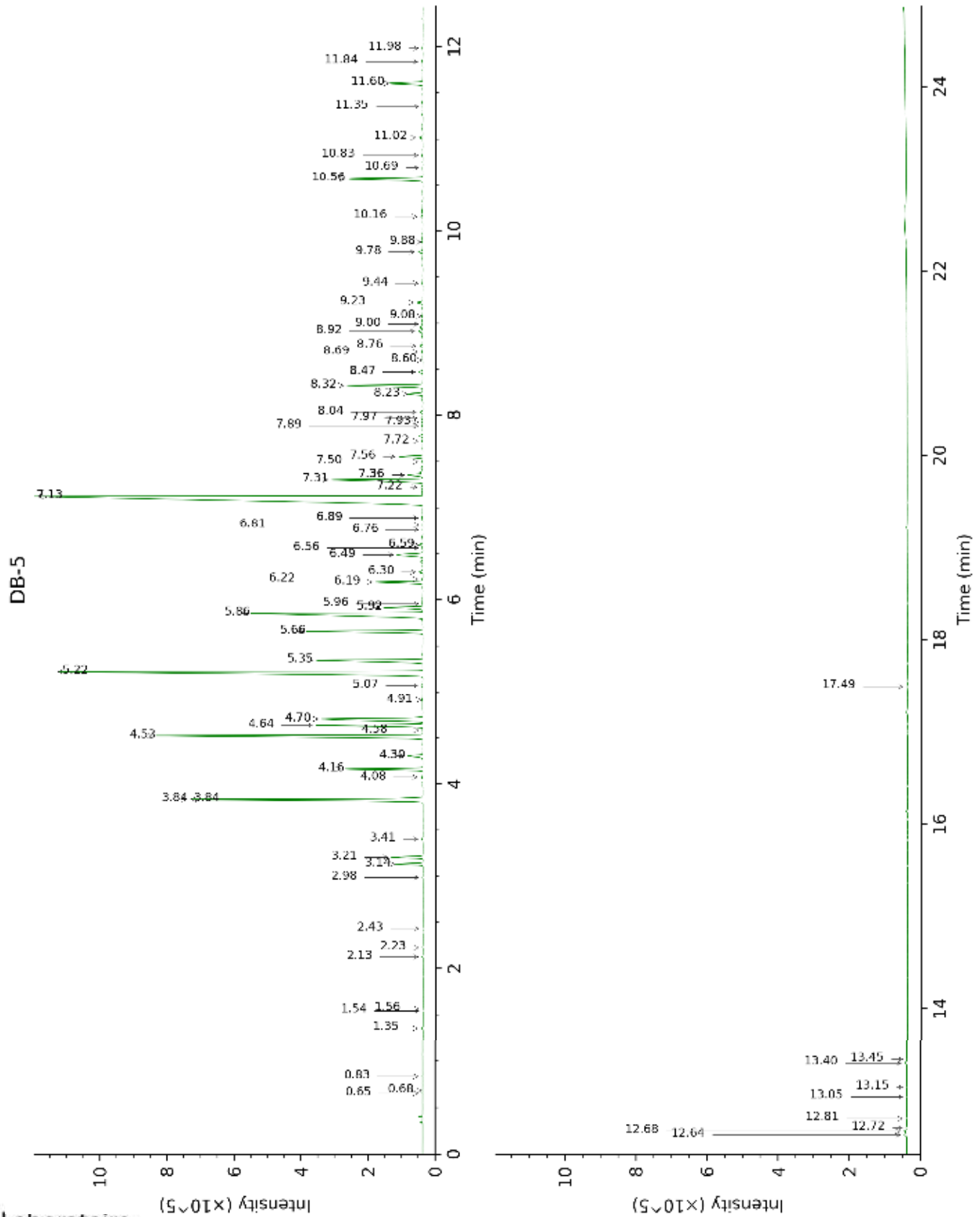
*: Two or more compounds are coeluting on this column

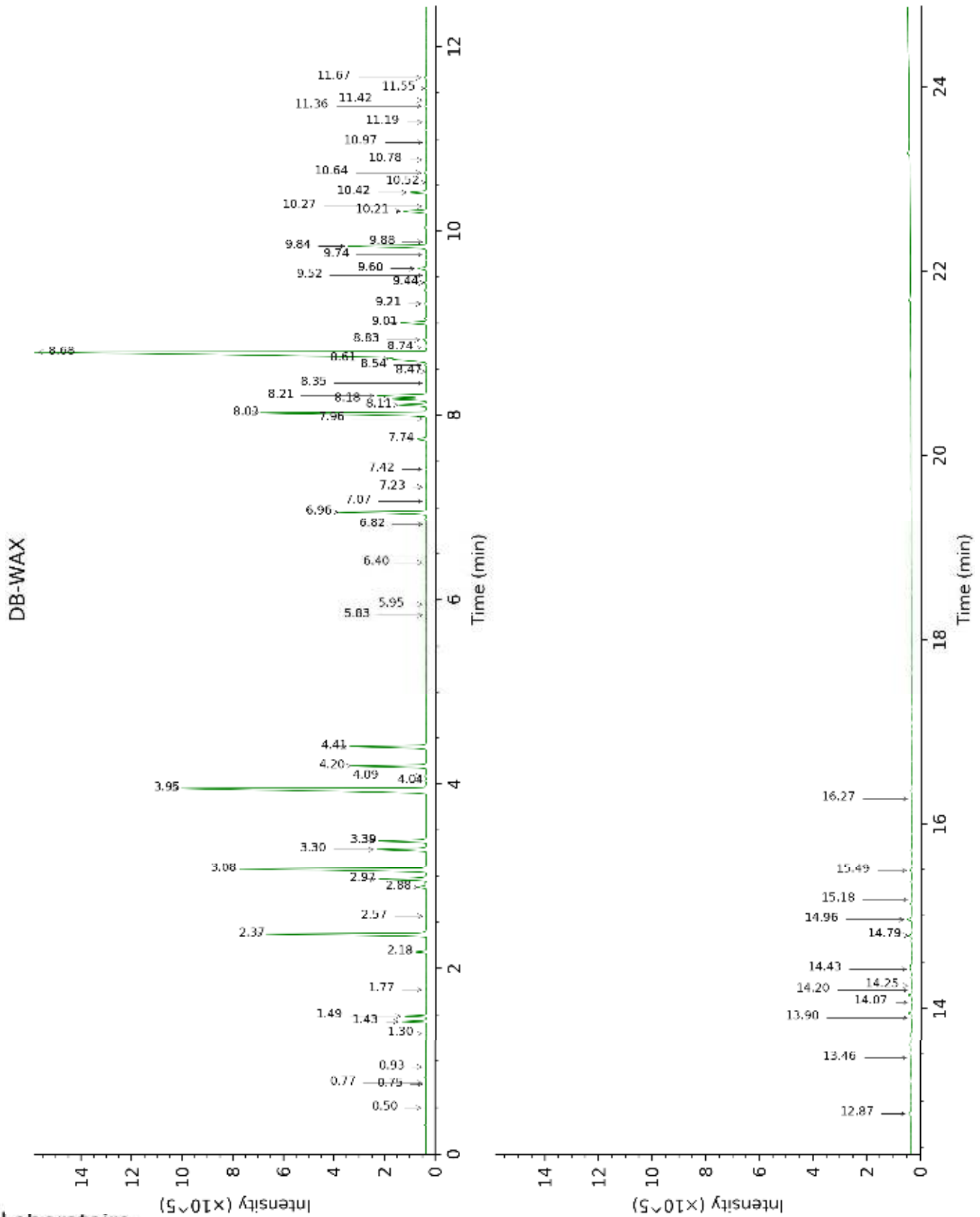
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	641	0.01	0.77	886	0.01
2-Methylbutyral	0.68	650	tr	0.75	881	tr
2-Ethylfuran	0.83	694	0.01	0.93	923	tr
Methyl 2-methylbutyrate	1.35	772	0.03	1.30	976	0.02
Hexanal	1.54	797	tr			
Octane	1.56	800	tr	0.50	784	0.02
(2E)-Hexenal	2.13	848	0.02	3.39*	1168	1.94
(3Z)-Hexenol	2.23	856	0.02	5.95	1349	0.01
Hexanol	2.43	872	tr			
Hashishene	2.98	914	0.01	1.43*	995	0.76
α-Thujene	3.14	924	0.66	1.49	1003	0.66
α-Pinene	3.21	929	0.76	1.43*	995	[0.76]
Camphene	3.41	942	0.03	1.77	1029	0.03
Sabinene	3.84*	970	6.74	2.37	1086	6.25
β-Pinene	3.84*	970	[6.74]	2.18	1068	0.43
Octan-3-one	4.08	986	0.05	4.04	1220	0.05
Myrcene	4.16	991	1.97	2.97	1135	1.94
α-Phellandrene	4.30	1000	0.44	2.88	1128	0.42
α-Terpinene	4.52	1014	8.40	3.08	1144	8.34
Carvomenthene	4.58	1018	0.01	2.57	1104	0.01
para-Cymene	4.64	1021	3.01	4.20	1232	3.02
β-Phellandrene	4.70*	1025	3.96	3.39*	1168	[1.94]
1,8-Cineole	4.70*	1025	[3.96]	3.39*	1168	[1.94]
Limonene	4.70*	1025	[3.96]	3.30	1161	2.01
(Z)-β-Ocimene	4.91	1038	0.03	3.95*	1213	14.33
(E)-β-Ocimene	5.07	1048	0.05	4.09	1224	0.07
γ-Terpinene	5.22	1058	14.40	3.95*	1213	[14.33]
cis-Sabinene hydrate	5.35	1066	3.45	6.96*	1424	3.54
Terpinolene	5.66*	1085	3.28	4.41	1248	3.23
para-Cymenene	5.66*	1085	[3.28]	6.40	1382	0.02
trans-Sabinene hydrate	5.86	1097	7.80	8.03	1506	7.94
Linalool	5.92*	1101	1.06	8.11	1513	1.07
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.92*	1101	[1.06]	5.84	1341	0.02
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.96	1104	0.01	8.47	1541	0.04
cis-para-Menth-2-en-1-ol	6.19	1119	1.33	8.18	1518	1.36
α-Campholenal	6.22	1121	0.02	7.23*	1445	0.03
trans-Pinocarveol	6.30	1126	0.11	9.22*	1600	0.12

<i>trans</i> -para-Menth-2-en-1-ol	6.49	1138	1.00	9.01	1583	1.01
Epoxyterpinolene	6.56	1142	0.02	6.82	1414	0.02
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.59*	1144	0.11	6.96*	1424	[3.54]
1,4-Dimethyl-4-acetylcyclohexene	6.59*	1144	[0.11]	7.42	1459	0.06
Pinocarvone	6.76	1155	0.01	7.96	1501	0.02
Isomenthone	6.81	1158	0.01	7.07	1433	0.04
Borneol	6.89*	1164	0.05	9.84*	1651	3.31
δ-Terpineol	6.89*	1164	[0.05]	9.52	1625	0.04
Terpinen-4-ol	7.13*	1179	27.04	8.68	1558	27.78
Cryptone	7.13*	1179	[27.04]	9.22*	1600	[0.12]
para-Cymen-8-ol	7.22	1185	0.05	11.55	1796	0.06
α-Terpineol	7.31	1190	3.14	9.84*	1651	[3.31]
<i>cis</i> -Piperitol	7.36*†	1194	0.56	9.60*	1631	0.35
Methylchavicol	7.36*†	1194	[0.56]	9.44*	1618	0.11
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.50	1203	0.02	10.97	1746	0.02
<i>trans</i> -Piperitol	7.56	1207	0.67	10.42*	1698	0.67
<i>trans</i> -Carveol	7.72	1218	0.03	11.42	1785	0.02
Nerol	7.89	1229	0.03	11.18	1764	0.03
Citronellol	7.93	1232	0.03	10.78	1730	0.04
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.97	1235	0.05	11.36	1779	0.07
Neral	8.04	1239	0.08	9.60*	1631	[0.35]
<i>trans</i> -Sabinene hydrate acetate	8.23	1252	0.44	7.74	1484	0.42
Linalyl acetate	8.32*	1259	2.21	8.21	1520	2.15
Geraniol	8.32*	1259	[2.21]	11.67	1806	0.11
Geranial	8.47*	1268	0.13	10.21*	1682	1.05
<i>trans</i> -Ascaridole glycol	8.47*	1268	[0.13]	14.25	2044	0.01
Citronellyl formate	8.60	1277	0.01			
Bornyl acetate	8.69	1283	0.06	8.35	1531	0.03
<i>cis</i> -Ascaridole glycol?	8.76	1288	0.09	14.79*	2096	0.11
Terpinen-4-yl acetate	8.92	1299	0.14	8.83	1569	0.14
Thymol	9.00	1301	0.02	15.18	2135	0.02
Unknown analog	9.08	1307	0.04			
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.23	1317	0.17	14.96*	2114	0.18
Bicycloelemene	9.44	1332	0.03	7.23*	1445	[0.03]

Eugenol	9.78	1356	0.15	14.79*	2096	[0.11]
Neryl acetate	9.88	1363	0.03	10.27	1686	0.04
Geranyl acetate	10.16	1382	0.05	10.64	1717	0.11
β-Caryophyllene	10.56	1412	2.33	8.61	1552	1.80
β-Copaene	10.69	1421	0.01	8.54	1546	0.07
Aromadendrene	10.83	1431	0.04	8.74	1562	0.04
α-Humulene	11.02	1445	0.11	9.44*	1618	[0.11]
Germacrene D	11.35	1470	0.01	9.88	1655	0.02
Bicyclogermacrene	11.60*	1489	1.08	10.21*	1682	[1.05]
Viridiflorene	11.60*	1489	[1.08]	9.74	1643	0.05
γ-Cadinene	11.84	1507	0.05	10.42*	1698	[0.67]
δ-Cadinene	11.98	1518	0.03	10.52	1708	0.02
Spathulenol	12.64	1570	0.07	14.43	2061	0.07
Caryophyllene oxide	12.68	1573	0.08	12.87	1914	0.07
Globulol	12.72	1576	0.03	13.90	2010	0.02
Viridiflorol	12.82	1583	0.02	14.07	2026	0.02
Humulene epoxide II	13.05	1602	0.02	13.46	1969	0.01
10-epi-γ-Eudesmol	13.15	1610	0.01	14.20	2039	0.02
Isospathulenol	13.40	1631	0.06	15.49	2167	0.06
τ-Cadinol	13.45	1635	0.01	14.96*	2114	[0.18]
Unknown [m/z 257, 258 (20), 91 (19), 272 (18)]	17.49	1994	0.03	16.28	2247	0.01
Total identified		97.81%			97.86%	
Total reported		98.14%			98.01%	

*: 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