

Date : January 29, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19A28-PTH03-1-CC

Customer identification : Marjoram - Egypt - M2010885R

Type : Essential oil

Source : *Origanum majorana*

Customer : Plant Therapy

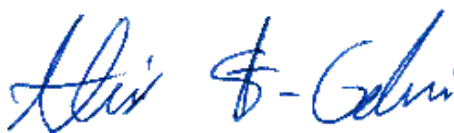
ANALYSIS

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 : Sylvain Mercier, M. Sc., Chimiste

Analysis date : January 28, 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: 1.4733 ± 0.0003 (20 °C)

CONCLUSION

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Acetone	0.01	0.01	Aliphatic ketone
2-Methyl-3-buten-2-ol	tr	tr	Aliphatic alcohol
Isovaleral	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	0.01	Aliphatic aldehyde
2-Ethylfuran	0.01	0.01	Furan
Methyl 2-methylbutyrate	0.02	0.03	Aliphatic ester
Hexanal	0.01	tr	Aliphatic aldehyde
Octane	tr	tr	Alkane
(2E)-Hexenal	0.02	0.02	Aliphatic aldehyde
(3Z)-Hexenol	0.01	0.01	Aliphatic alcohol
(2E)-Hexenol	tr	0.01	Aliphatic alcohol
Hexanol	tr	0.01	Aliphatic alcohol
Hashishene	0.01*	0.85*	Monoterpene
Isobutyl isobutyrate	[0.01]*	tr	Aliphatic ester
Tricyclene	tr	tr	Monoterpene
α -Thujene	0.75	0.74	Monoterpene
α -Pinene	0.84	[0.85]*	Monoterpene
α -Fenchene	0.01	0.01	Monoterpene
Camphene	0.04	0.03	Monoterpene
β -Pinene	7.46*	0.47	Monoterpene
Sabinene	[7.46]*	6.92	Monoterpene
3-Methyl-3-cyclohexenone	0.02	0.02	Aliphatic ketone
3-Methylpentyl acetate	0.01	14.38*	Aliphatic ester
Octan-3-one	0.03	0.02	Aliphatic ketone
Myrcene	2.12	2.10	Monoterpene
α -Phellandrene	0.52*	0.45	Monoterpene
Pseudolimonene	[0.52]*	0.07	Monoterpene
α -Terpinene	9.07	8.98	Monoterpene
Carvomenthene	0.01	0.01	Aliphatic alcohol
para-Cymene	1.61	1.63	Monoterpene
Limonene	4.12	1.95	Monoterpene
β -Phellandrene	[4.12]*	2.13*	Monoterpene
1,8-Cineole	[4.12]*	[2.13]*	Monoterpenic ether
(Z)- β -Ocimene	0.04	[14.38]*	Monoterpene
(E)- β -Ocimene	0.05	0.07	Monoterpene
γ -Terpinene	14.46	[14.38]*	Monoterpene
cis-Sabinene hydrate	4.76	4.87*	Monoterpenic alcohol
Terpinolene	3.30*	3.26	Monoterpene
para-Cymenene	[3.30]*	0.02	Monoterpene
trans-Sabinene hydrate	10.22	10.42	Monoterpenic alcohol
Unknown	0.93	0.03	Oxygenated monoterpene
Linalool	[0.93]	0.92	Monoterpenic alcohol
Unknown	0.03	2.64*	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	1.27	2.76	Monoterpenic alcohol
α -Campholenal	0.06	0.05*	Monoterpenic aldehyde
trans-Pinocarveol	0.07	0.07	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.87	0.88	Monoterpenic alcohol
Unknown	0.04*	[4.87]*	Unknown

1,4-Dimethyl-4-acetylcyclohexene	[0.04]*	0.03	Monoterpenic ketone
Pinocarpone	0.01	0.01	Monoterpenic ketone
Isomenthone	0.01	[0.05]*	Monoterpenic ketone
Borneol	0.05	3.42*	Monoterpenic alcohol
δ-Terpineol	0.01	0.02*	Monoterpenic alcohol
Terpinen-4-ol	23.27	23.50*	Monoterpenic alcohol
Cryptone	0.04	0.03	Normonoterpenic ketone
para-Cymen-8-ol	0.06	0.04	Monoterpenic alcohol
α-Terpineol	3.33	[3.42]*	Monoterpenic alcohol
cis-Piperitol	0.55*	0.31	Monoterpenic alcohol
Methylchavicol	[0.55]*	0.19*	Phenylpropanoid
cis-Dihydrocarvone	[0.55]*	[2.64]*	Monoterpenic ketone
trans-Dihydrocarvone	0.10	0.13	Monoterpenic ketone
Unknown	0.03	0.02	Unknown
trans-Piperitol	0.55	0.54	Monoterpenic alcohol
trans-Carveol	0.02	0.02	Monoterpenic alcohol
Nerol	0.07	0.06	Monoterpenic alcohol
Citronellol	0.07	0.10	Monoterpenic alcohol
Unknown	0.03	0.04	Oxygenated monoterpene
Neral	0.07*	[0.02]*	Monoterpenic aldehyde
Carvone	[0.07]*	0.08	Monoterpenic ketone
Carvenone	0.04	[3.42]*	Monoterpenic ketone
trans-Sabinene hydrate acetate	0.50	0.50	Monoterpenic ester
Geraniol	1.54	0.10	Monoterpenic alcohol
Linalyl acetate	[1.54]	[2.76]	Monoterpenic ester
trans-Ascaridole glycol	0.10	0.13*	Monoterpenic alcohol
Geranial	0.01	1.26*	Monoterpenic aldehyde
Citronellyl formate	0.02	0.01	Monoterpenic ester
cis-Ascaridole glycol?	0.09*	0.12*	Monoterpenic alcohol
Bornyl acetate	[0.09]*	0.04	Monoterpenic ester
(E)-Anethole	[0.09]*	0.01	Phenylpropanoid
Thymol analogue I	0.02	0.01	Monoterpenic alcohol
Thymol	0.22*	0.02	Monoterpenic alcohol
Terpinen-4-yl acetate	[0.22]*	0.18	Monoterpenic ester
Unknown	0.06		Monoterpenic alcohol
Unknown	0.11	0.12	Monoterpenic alcohol
Bicycloelemene	0.04	0.03	Sesquiterpene
α-Cubebene	0.02	0.01	Sesquiterpene
Eugenol	0.05	[0.12]*	Phenylpropanoid
Neryl acetate	0.04	0.04	Monoterpenic ester
α-Copaene	0.01	0.01	Sesquiterpene
Geranyl acetate	0.07	0.05	Monoterpenic ester
β-Elemene	0.03	[2.64]*	Sesquiterpene
β-Caryophyllene	2.45	[2.64]*	Sesquiterpene
Aromadendrene	0.09*	[23.50]*	Sesquiterpene
trans-α-Bergamotene	[0.09]*	[2.64]*	Sesquiterpene
α-Humulene	0.12	[0.19]*	Sesquiterpene
allo-Aromadendrene	0.04	0.03	Sesquiterpene
γ-Murolene	0.04	0.06	Sesquiterpene
Germacrene D	0.04	[3.42]*	Sesquiterpene
Bicyclogermacrene	1.40*	[1.26]*	Sesquiterpene
Viridiflorene	[1.40]*	0.12	Sesquiterpene

γ -Cadinene	0.10*	0.04	Sesquiterpene
(3E,6E)- α -Farnesene	[0.10]*	0.03	Sesquiterpene
δ -Cadinene	0.07	0.04	Sesquiterpene
Spathulenol	0.06	0.06	Sesquiterpenic alcohol
Caryophyllene oxide	0.07	0.07	Sesquiterpenic ether
Viridiflorol	0.02	0.02	Sesquiterpenic alcohol
10-epi- γ -Eudesmol	0.03	[0.13]*	Sesquiterpenic alcohol
Isospathulenol	0.08	0.09	Sesquiterpenic alcohol
τ -Cadinol	0.04	0.05	Sesquiterpenic alcohol
Unknown	0.03	0.02	Diterpene
Total identified	98.40%	98.45%	

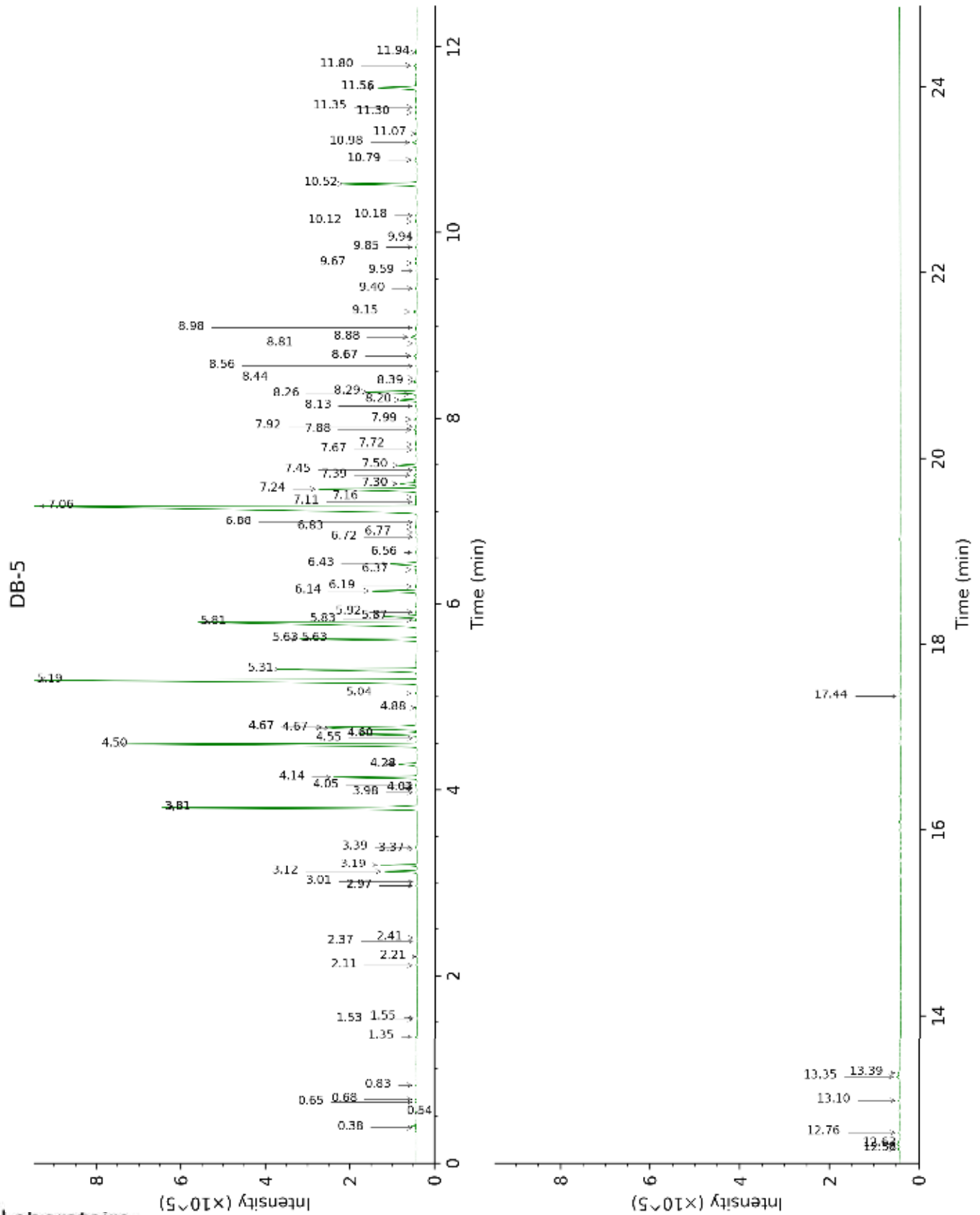
*: Two or more compounds are coeluting on this column

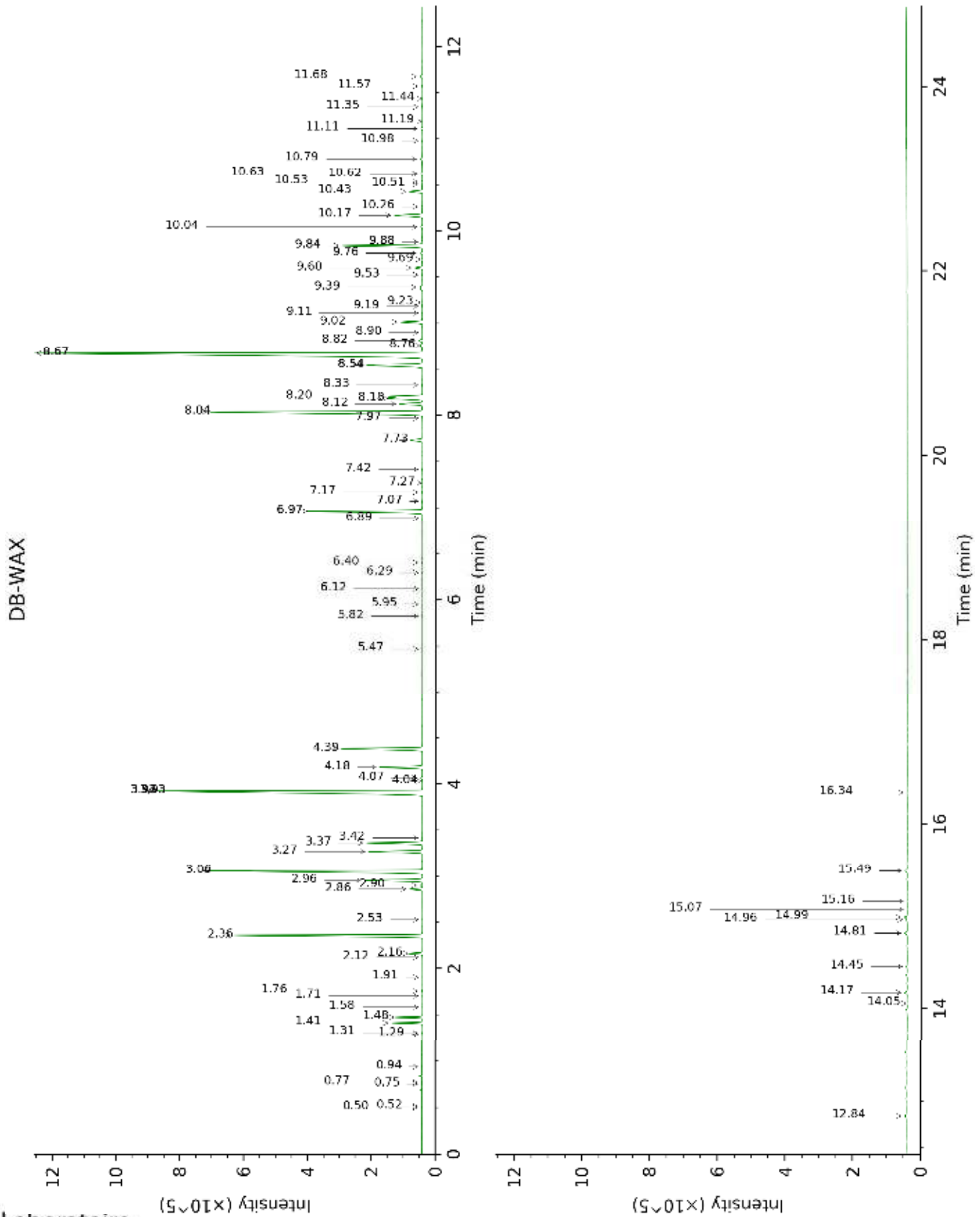
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Acetone	0.38	514	0.01	0.50	783	0.01
2-Methyl-3-buten-2-ol	0.54	605	tr	1.58	1013	tr
Isovaleral	0.65	640	0.01	0.77	888	0.01
2-Methylbutyral	0.68	648	0.01	0.75	882	0.01
2-Ethylfuran	0.83	692	0.01	0.94	924	0.01
Methyl 2-methylbutyrate	1.35	771	0.02	1.31	978	0.03
Hexanal	1.53	796	0.01	1.91	1043	tr
Octane	1.55	799	tr	0.52	792	tr
(2E)-Hexenal	2.11	847	0.02	3.42	1172	0.02
(3Z)-Hexenol	2.21	855	0.01	5.95	1354	0.01
(2E)-Hexenol	2.37	868	tr	6.12	1366	0.01
Hexanol	2.41	872	tr	5.47	1319	0.01
Hashishene	2.97*	914	0.01	1.41*	993	0.85
Isobutyl isobutyrate	2.97*	914	[0.01]	2.12	1064	tr
Tricyclene	3.01	917	tr	1.29	975	tr
α -Thujene	3.12	924	0.75	1.48	1003	0.74
α -Pinene	3.19	929	0.84	1.41*	993	[0.85]
α -Fenchene	3.37	941	0.01	1.71	1024	0.01
Camphene	3.39	942	0.04	1.76	1029	0.03
β -Pinene	3.81*	970	7.46	2.16	1067	0.47
Sabinene	3.81*	970	[7.46]	2.36	1086	6.92
3-Methyl-3-cyclohexenone	3.98	981	0.02	6.29	1379	0.02
3-Methylpentyl acetate	4.02	984	0.01	3.93*	1212	14.38
Octan-3-one	4.05	986	0.03	4.04	1220	0.02
Myrcene	4.14	992	2.12	2.96	1135	2.10
α -Phellandrene	4.28*	1001	0.52	2.86	1128	0.45
Pseudolimonene	4.28*	1001	[0.52]	2.90	1131	0.07
α -Terpinene	4.50	1014	9.07	3.06	1143	8.98
Carvomenthene	4.56	1018	0.01	2.53	1102	0.01
para-Cymene	4.60	1021	1.61	4.18	1232	1.63
Limonene	4.67†	1025	4.12	3.27	1160	1.95
β -Phellandrene	4.67*†	1026	[4.12]	3.37*	1168	2.13
1,8-Cineole	4.67*†	1026	[4.12]	3.37*	1168	[2.13]
(Z)- β -Ocimene	4.88	1039	0.04	3.93*	1212	[14.38]
(E)- β -Ocimene	5.04	1049	0.05	4.07	1223	0.07
γ -Terpinene	5.19	1058	14.46	3.93*	1212	[14.38]
cis-Sabinene hydrate	5.31	1065	4.76	6.97*	1429	4.87
Terpinolene	5.63*	1086	3.30	4.39	1247	3.26
para-Cymenene	5.63*	1086	[3.30]	6.40	1387	0.02
trans-Sabinene hydrate	5.81	1097	10.22	8.04	1509	10.42
Unknown [m/z 95,	5.84†	1099	0.93	5.82	1345	0.03

150 (45), 110 (35), 107 (23), 109 (21)]						
Linalool	5.87†	1101	[0.93]	8.12	1516	0.92
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	8.54*	1549	2.64
<i>cis</i> -para-Menth-2- en-1-ol	6.14	1119	1.27	8.18†	1521	2.76
α-Campholenal	6.19	1122	0.06	7.07*	1437	0.05
<i>trans</i> -Pinocarveol	6.37	1133	0.07	9.23	1602	0.07
<i>trans</i> -para-Menth- 2-en-1-ol	6.43	1137	0.87	9.02	1586	0.88
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.56*	1145	0.04	6.97*	1429	[4.87]
1,4-Dimethyl-4- acetylcyclohexene	6.56*	1145	[0.04]	7.42	1462	0.03
Pinocarvone	6.72	1156	0.01	7.97	1504	0.01
Isomenthone	6.77	1159	0.01	7.07*	1437	[0.05]
Borneol	6.83	1163	0.05	9.84*†	1653	3.42
δ-Terpineol	6.88	1166	0.01	9.53*	1627	0.02
Terpinen-4-ol	7.06	1178	23.27	8.67*	1559	23.50
Cryptone	7.11	1181	0.04	9.19	1599	0.03
para-Cymen-8-ol	7.16	1184	0.06	11.57	1798	0.04
α-Terpineol	7.24	1190	3.33	9.84*†	1653	[3.42]
<i>cis</i> -Piperitol	7.30*†	1194	0.55	9.60	1633	0.31
Methylchavicol	7.30*†	1194	[0.55]	9.39*†	1616	0.19
<i>cis</i> - Dihydrocarvone	7.30*†	1194	[0.55]	8.54*	1549	[2.64]
<i>trans</i> - Dihydrocarvone	7.39	1200	0.10	8.76	1566	0.13
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.45	1203	0.03	10.98	1748	0.02
<i>trans</i> -Piperitol	7.50	1207	0.55	10.43	1700	0.54
<i>trans</i> -Carveol	7.67	1218	0.02	11.44	1787	0.02
Nerol	7.72	1222	0.07	11.11	1759	0.06
Citronellol	7.88	1232	0.07	10.79	1731	0.10
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.92	1235	0.03	11.35	1779	0.04
Neral	7.99*	1240	0.07	9.53*	1627	[0.02]
Carvone	7.99*	1240	[0.07]	10.04	1669	0.08
Carvenone	8.13	1250	0.04	9.88*†	1656	[3.42]
<i>trans</i> -Sabinene hydrate acetate	8.20	1254	0.50	7.73	1486	0.50

Geraniol	8.26†	1259	1.54	11.68	1808	0.10
Linalyl acetate	8.28†	1260	[1.54]	8.20†	1522	[2.76]
<i>trans</i> -Ascaridole glycol	8.40	1268	0.10	14.17*	2037	0.13
Geranial	8.44	1271	0.01	10.17*	1679	1.26
Citronellyl formate	8.56	1280	0.02	8.90	1577	0.01
<i>cis</i> -Ascaridole glycol?	8.67*	1287	0.09	14.81*	2099	0.12
Bornyl acetate	8.67*	1287	[0.09]	8.33	1532	0.04
(<i>E</i>)-Anethole	8.67*	1287	[0.09]	11.19	1766	0.01
Thymol analogue I	8.81	1297	0.02	15.07	2125	0.01
Thymol	8.88*	1301	0.22	15.16	2133	0.02
Terpinen-4-yl acetate	8.88*	1301	[0.22]	8.82	1570	0.18
Unknown analog	8.98	1305	0.06			
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.15	1317	0.11	14.99	2116	0.12
Bicycloelemene	9.40	1334	0.04	7.17	1444	0.03
α-Cubebene	9.59	1348	0.02	6.89	1423	0.01
Eugenol	9.67	1354	0.05	14.81*	2099	[0.12]
Neryl acetate	9.85	1366	0.04	10.26	1687	0.04
α-Copaene	9.94	1373	0.01	7.27	1451	0.01
Geranyl acetate	10.12	1385	0.07	10.63	1718	0.05
β-Elemene	10.18	1390	0.03	8.54*	1549	[2.64]
β-Caryophyllene	10.52	1415	2.45	8.54*	1549	[2.64]
Aromadendrene	10.79*	1435	0.09	8.67*	1559	[23.50]
<i>trans</i> -α-Bergamotene	10.79*	1435	[0.09]	8.54*	1549	[2.64]
α-Humulene	10.98	1448	0.12	9.39*†	1616	[0.19]
allo-Aromadendrene	11.07	1456	0.04	9.11	1593	0.03
γ-Murolene	11.30	1473	0.04	9.69	1640	0.06
Germacrene D	11.35	1477	0.04	9.88*†	1656	[3.42]
Bicyclogermacrene	11.56*	1492	1.40	10.17*	1679	[1.26]
Viridiflorene	11.56*	1492	[1.40]	9.76	1646	0.12
γ-Cadinene	11.80*	1510	0.10	10.51	1707	0.04
(3 <i>E</i> ,6 <i>E</i>)-α-Farnesene	11.80*	1510	[0.10]	10.62	1717	0.03
δ-Cadinene	11.94	1521	0.07	10.53	1709	0.04
Spathulenol	12.58	1572	0.06	14.45	2064	0.06
Caryophyllene oxide	12.63	1576	0.07	12.84	1912	0.07
Viridiflorol	12.76	1586	0.02	14.05	2025	0.02
10-epi-γ-Eudesmol	13.10	1613	0.03	14.17*	2037	[0.13]
Isospathulenol	13.35	1634	0.08	15.49	2167	0.09
τ-Cadinol	13.39	1637	0.04	14.96	2113	0.05
Unknown [m/z 257, 258 (20), 91 (19), 272 (18)]	17.44	1998	0.03	16.34	2254	0.02
Total identified		98.40%			98.45%	

Total reported	98.69%	98.69%
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*: 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