

GC/MS BATCH NUMBER: MJ0102

ESSENTIAL OIL: MARJORAM SWEET ORGANIC
BOTANICAL NAME: ORIGANUM MAJORANA
ORIGIN: EGYPT

KEY CONSTITUENTS PRESENT IN THIS BATCH OF MARJORAM SWEET ORGANIC OIL	%
TERPINEN-4-ol	22.1
trans-SABINENE HYDRATE	18.2
γ-TERPINENE	12.5
SABINENE	7.7
α-TERPINENE	7.5
cis-SABINENE HYDRATE	3.9
α-TERPINEOL	3.0
TERPINOLENE	2.8
LINALYL ACETATE + GERANIOL	2.3
β-CARYOPHYLLENE	2.1
LIMONENE	2.1
MYRCENE	2.1
1,8-CINEOLE + β-PHELLANDRENE	1.8
α-CAMPHOLENAL + cis-PARA-MENTH-2-EN-1-OL	1.5
LINALOOL	1.1

Comments from Robert Tisserand: Fresh, green, dry-herbaceous odor quality. Constituents are in expected amounts.

Date : March 16, 2018

CERTIFICATE OF ANALYSIS - GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 18C05-PTH1-1-CC

Customer identification : Marjoram Organic - Egypt - MJ010281R

Type : Essential oil

Source : *Origanum majorana* ct. Sabinene hydrate/terpinen-4-ol

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 : Sarah-Eve Tremblay, M. Sc. A., Chimiste

Analysis date : March 12, 2018

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: 1.4718 ± 0.0003 (20 °C)

CONCLUSION

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Isobutyral	tr		Aliphatic aldehyde
2-Methyl-3-buten-2-ol	tr		Aliphatic alcohol
Isovaleral	tr	tr*	Aliphatic aldehyde
2-Methylbutyral	tr	[tr]*	Aliphatic aldehyde
Penten-3-ol	tr		Aliphatic alcohol
2-Ethylfuran	tr	tr	Furan
Isoamyl alcohol	tr	0.01*	Aliphatic alcohol
2-Methylbutanol	tr	[0.01]*	Aliphatic alcohol
Methyl isovalerate	0.03	1.33*	Aliphatic ester
Hexanal	tr	tr	Aliphatic aldehyde
(2E)-Hexenal	0.02	[0.01]*	Aliphatic aldehyde
(3Z)-Hexenol	0.02	0.04*	Aliphatic alcohol
(2E)-Hexenol	0.01	0.01	Aliphatic alcohol
Hexanol	0.01	0.01	Aliphatic alcohol
Hashishene	0.01	[1.33]*	Monoterpene
α -Thujene	0.55	[1.33]*	Monoterpene
α -Pinene	0.76	[1.33]*	Monoterpene
Camphene	0.03*	0.03	Monoterpene
α -Fenchene	[0.03]*	tr	Monoterpene
Sabinene	8.13*	7.70	Monoterpene
β -Pinene	[8.13]*	0.42	Monoterpene
3-Methyl-3-cyclohexenone?	0.01	0.01	Aliphatic ketone
3-Methylpentyl acetate	0.01	12.46*	Aliphatic ester
Octan-3-one	0.07	0.06	Aliphatic ketone
Myrcene	2.09	2.09	Monoterpene
α -Phellandrene	0.34*	0.27	Monoterpene
Pseudolimonene	[0.34]*	0.06	Monoterpene
Δ^3 -Carene	0.01	tr	Monoterpene
(3Z)-Hexenyl acetate	0.01	0.02	Aliphatic ester
α -Terpinene	7.53	7.56	Monoterpene
Carvomenthene	0.02	tr	Aliphatic alcohol
para-Cymene	1.41	1.43	Monoterpene
1,8-Cineole	3.91*	1.82*	Monoterpenic ether
β -Phellandrene	[3.91]*	[1.82]*	Monoterpene
Limonene	[3.91]*	2.09	Monoterpene
(Z)- β -Ocimene	0.04	[12.46]*	Monoterpene
(E)- β -Ocimene	0.05	0.06	Monoterpene
γ -Terpinene	12.45	[12.46]*	Monoterpene
cis-Sabinene hydrate	3.91	3.92	Monoterpenic alcohol
para-Cymenene	2.84*	0.01	Monoterpene
Terpinolene	[2.84]*	2.82	Monoterpene
trans-Sabinene hydrate	18.16	18.27*	Monoterpenic alcohol
Linalool	1.27*	1.13	Monoterpenic alcohol
Unknown	[1.27]*	[0.04]*	Oxygenated monoterpene
Unknown	0.08	2.12*	Monoterpenic alcohol
α -Campholenal	1.50*	0.03	Monoterpenic aldehyde
cis-para-Menth-2-en-1-ol	[1.50]*	3.54*	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-	0.02	0.09	Aliphatic alcohol

enone			
<i>trans</i> -Pinocarveol	0.07	0.08*	Monoterpenic alcohol
<i>trans</i> -para-Menth-2-en-1-ol	0.82	0.84	Monoterpenic alcohol
Epoxyterpinolene	0.01	0.01	Monoterpenic ether
Unknown	0.04*	0.02	Unknown
1,4-Dimethyl-4-acetylcyclohexene	[0.04]*	tr	Monoterpenic ketone
Pinocavone	0.02	[18.27]*	Monoterpenic ketone
Isomenthone	0.01	0.02*	Monoterpenic ketone
Borneol	0.06	3.07*	Monoterpenic alcohol
δ-Terpineol	0.01	0.02	Monoterpenic alcohol
Terpinen-4-ol	22.07	21.93*	Monoterpenic alcohol
Cryptone	0.06	[0.08]*	Normonoterpenic ketone
para-Cymen-8-ol	0.04	0.07*	Monoterpenic alcohol
α-Terpineol	2.97	[3.07]*	Monoterpenic alcohol
<i>cis</i> -Dihydrocarvone	0.40*	[21.93]*	Monoterpenic ketone
<i>cis</i> -Piperitol	[0.40]*	0.31*	Monoterpenic alcohol
Methylchavicol	0.03	tr	Phenylpropanoid
Unknown	0.02	0.03	Unknown
<i>trans</i> -Piperitol	0.43	0.44	Monoterpenic alcohol
<i>trans</i> -Carveol	0.02	0.02	Monoterpenic alcohol
Nerol	0.04	0.06	Monoterpenic alcohol
Unknown	0.03	0.03	Oxygenated monoterpene
Citronellol	0.01	0.03	Monoterpenic alcohol
Neral	0.01	[0.31]*	Monoterpenic aldehyde
Carvenone	0.03	0.01	Monoterpenic ketone
<i>trans</i> -Sabinene hydrate acetate	0.09	0.07	Monoterpenic ester
Linalyl acetate	2.32	[3.54]*	Monoterpenic ester
Geraniol	[2.32]	[0.07]*	Monoterpenic alcohol
<i>trans</i> -Ascaridole glycol	0.04	0.01	Monoterpenic alcohol
Geranial	0.13	1.07*	Monoterpenic aldehyde
Citronellyl formate	0.02	0.01	Monoterpenic ester
Unknown	0.01	0.01	Oxygenated monoterpene
Bornyl acetate	0.03	0.01	Monoterpenic ester
<i>cis</i> -Ascaridole glycol?	0.05	0.06	Monoterpenic alcohol
Terpinen-4-yl acetate	0.04*	0.02	Monoterpenic ester
Thymol analogue I	[0.04]*	0.01	Monoterpenic alcohol
Thymol	0.04	0.01	Monoterpenic alcohol
Unknown	0.01		Monoterpenic alcohol
Unknown	0.08	0.09*	Monoterpenic alcohol
Bicycloelemene	0.02	[0.02]*	Sesquiterpene
Eugenol	0.03	0.01	Phenylpropanoid
Neryl acetate	0.04	0.04	Monoterpenic ester
Geranyl acetate	0.07	0.07	Monoterpenic ester
β-Caryophyllene	2.10	[2.12]*	Sesquiterpene
Aromadendrene	0.03*	[21.93]*	Sesquiterpene
<i>trans</i> -α-Bergamotene	[0.03]*	[2.12]*	Sesquiterpene
α-Humulene	0.10	0.10	Sesquiterpene
allo-Aromadendrene	0.02	0.01	Sesquiterpene
Germacrene D	0.01	[3.07]*	Sesquiterpene
(1S,2S,4S)-para-Menthane-1,2,4-triol	0.03		Monoterpenic alcohol
Viridiflorene	1.11*	0.02	Sesquiterpene
Bicyclogermacrene	[1.11]*	[1.07]*	Sesquiterpene

(3E,6E)- α -Farnesene	0.05*	0.04	Sesquiterpene
γ -Cadinene	[0.05]*	0.06	Sesquiterpene
δ -Cadinene	0.02	[0.06]	Sesquiterpene
Isocaryophyllene epoxide B	0.01	0.01	Sesquiterpenic ether
Spathulenol	0.05	0.05	Sesquiterpenic alcohol
Caryophyllene oxide	0.09*	0.08	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.09]*	0.02	Sesquiterpenic ether
Viridiflorol	tr	0.01	Sesquiterpenic alcohol
10-epi- γ -Eudesmol	0.01	0.01	Sesquiterpenic alcohol
Isospathulenol	0.05	0.06	Sesquiterpenic alcohol
τ -Cadinol	0.02	[0.09]*	Sesquiterpenic alcohol
α -Cadinol	0.01	0.01	Sesquiterpenic alcohol
Unknown	0.02	0.02	Diterpene
Total identified	99.00%	98.33%	

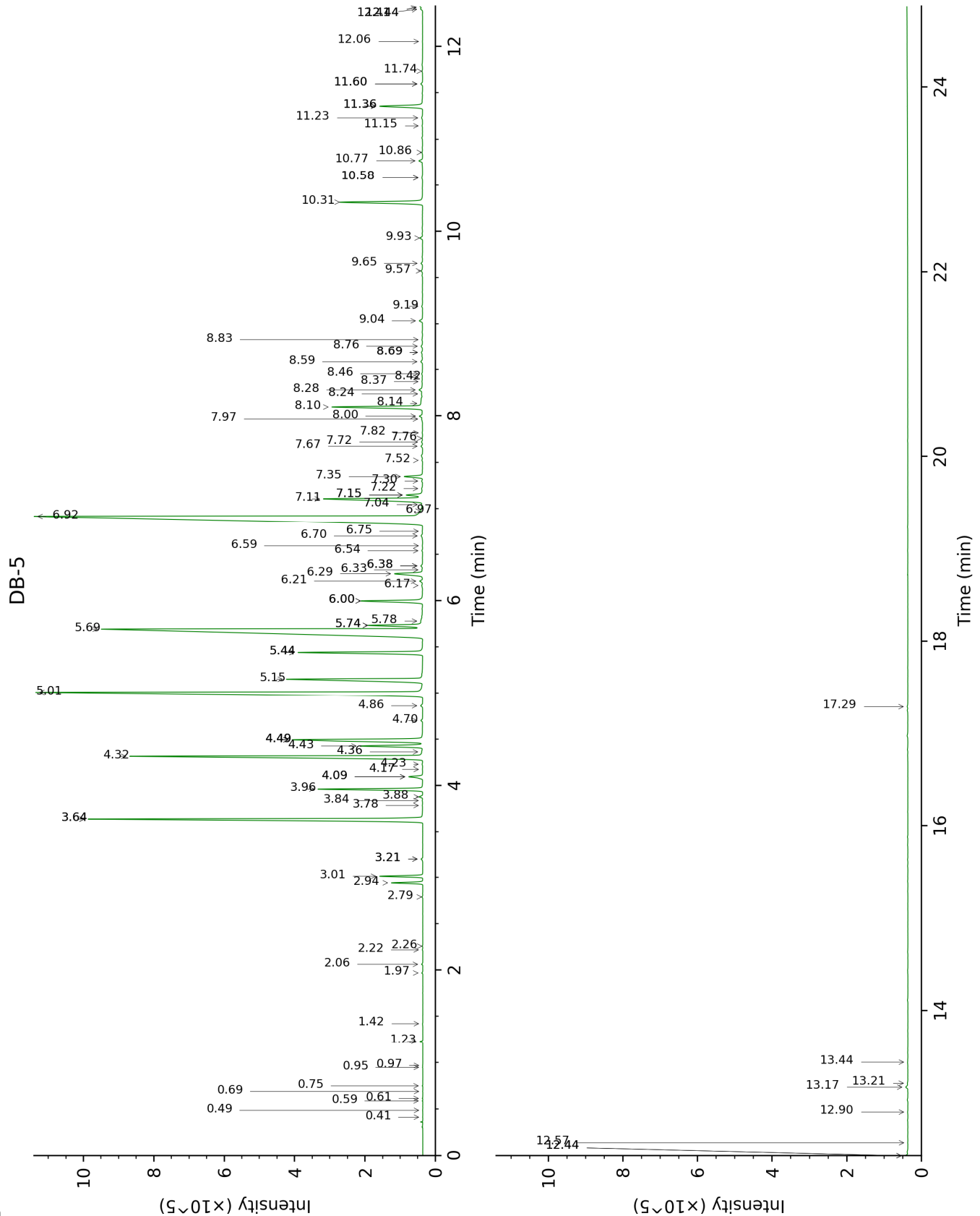
*: Two or more compounds are coeluting on this column

[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	%
Isobutyral	0.41	537	tr			
2-Methyl-3-buten-2-ol	0.49	602	tr			
Isovaleral	0.59	638	tr	0.81*	883	tr
2-Methylbutyral	0.61	647	tr	0.81*	883	[tr]
Penten-3-ol	0.69	673	tr			
2-Ethylfuran	0.75	694	tr	0.99	917	tr
Isoamyl alcohol	0.95	727	tr	3.60*	1176	0.01
2-Methylbutanol	0.97	730	tr	3.60*	1176	[0.01]
Methyl isovalerate	1.23	768	0.03	1.48*	995	1.33
Hexanal	1.42	796	tr	2.01	1046	tr
(2E)-Hexenal	1.97	844	0.02	3.60*	1176	[0.01]
(3Z)-Hexenol	2.06	852	0.02	5.98*	1346	0.04
(2E)-Hexenol	2.22	865	0.01	6.31	1370	0.01
Hexanol	2.26	868	0.01	5.62	1320	0.01
Hashishene	2.79	910	0.01	1.48*	995	[1.33]
α-Thujene	2.94	920	0.55	1.48*	995	[1.33]
α-Pinene	3.01	925	0.76	1.48*	995	[1.33]
Camphene	3.21*	938	0.03	1.83	1030	0.03
α-Fenchene	3.21*	938	[0.03]	1.77	1024	tr
Sabinene	3.64*	967	8.13	2.46	1088	7.70
β-Pinene	3.64*	967	[8.13]	2.25	1069	0.42
3-Methyl-3-cyclohexenone?	3.78	976	0.01	6.37	1374	0.01
3-Methylpentyl acetate	3.84	980	0.01	4.05*	1209	12.46
Octan-3-one	3.88	983	0.07	4.17	1218	0.06
Myrcene	3.96	988	2.09	3.06	1135	2.09
α-Phellandrene	4.09*	997	0.34	2.96	1128	0.27
Pseudolimonene	4.09*	997	[0.34]	3.00	1131	0.06
Δ3-Carene	4.17	1002	0.01	2.78	1113	tr
(3Z)-Hexenyl acetate	4.23	1006	0.01	5.05	1280	0.02
α-Terpinene	4.32	1011	7.53	3.17	1143	7.56
Carvomenthene	4.36	1014	0.02	2.62	1102	tr
para-Cymene	4.43	1018	1.41	4.31	1228	1.43
1,8-Cineole	4.49*	1022	3.91	3.48*	1167	1.82
β-Phellandrene	4.49*	1022	[3.91]	3.48*	1167	[1.82]
Limonene	4.49*	1022	[3.91]	3.39	1160	2.09
(Z)-β-Ocimene	4.70	1035	0.04	4.05*	1209	[12.46]
(E)-β-Ocimene	4.86	1045	0.05	4.19	1219	0.06
γ-Terpinene	5.01	1055	12.45	4.05*	1209	[12.46]
cis-Sabinene hydrate	5.15	1064	3.91	7.12	1428	3.92
para-Cymenene	5.44*	1082	2.84	6.60	1390	0.01
Terpinolene	5.44*	1082	[2.84]	4.51	1242	2.82
trans-Sabinene hydrate	5.69	1098	18.16	8.22*	1510	18.27

Linalool	5.74*	1100	1.27	8.28	1515	1.13
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.74*	1100	[1.27]	5.98*	1346	[0.04]
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.78	1103	0.08	8.70*	1547	2.12
α -Campholenal	6.00*	1117	1.50	7.24	1437	0.03
<i>cis</i> -para-Menth-2-en-1-ol	6.00*	1117	[1.50]	8.35*	1521	3.54
4-Hydroxy-4-methylcyclohex-2-enone	6.16	1128	0.02	14.36	2033	0.09
<i>trans</i> -Pinocarveol	6.21	1131	0.07	9.40*	1602	0.08
<i>trans</i> -para-Menth-2-en-1-ol	6.29	1136	0.82	9.18	1584	0.84
Epoxyterpinolene	6.33	1138	0.01	6.99	1419	0.01
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.38*	1141	0.04	7.04	1422	0.02
1,4-Dimethyl-4-acetylcyclohexene	6.38*	1141	[0.04]	7.66	1468	tr
Pinocarvone	6.54	1152	0.02	8.22*	1510	[18.27]
Isomenthone	6.59	1155	0.01	7.30*	1442	0.02
Borneol	6.70	1162	0.06	10.01*	1651	3.07
δ -Terpineol	6.75	1165	0.01	9.69	1625	0.02
Terpinen-4-ol	6.92	1176	22.07	8.85*	1559	21.93
Cryptone	6.98	1179	0.06	9.40*	1602	[0.08]
para-Cymen-8-ol	7.04	1184	0.04	11.85*	1804	0.07
α -Terpineol	7.11	1188	2.97	10.01*	1651	[3.07]
<i>cis</i> -Dihydrocarvone	7.15*	1190	0.40	8.85*	1559	[21.93]
<i>cis</i> -Piperitol	7.15*	1190	[0.40]	9.77*	1632	0.31
Methylchavicol	7.22	1195	0.03	9.65	1622	tr
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.30	1200	0.02	11.15	1745	0.03
<i>trans</i> -Piperitol	7.35	1203	0.43	10.60	1698	0.44
<i>trans</i> -Carveol	7.52	1215	0.02	11.61	1784	0.02
Nerol	7.68	1225	0.04	11.28	1756	0.06
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.72	1228	0.03	11.53	1777	0.03
Citronellol	7.76	1231	0.01	10.95	1728	0.03
Neral	7.82	1235	0.01	9.77*	1632	[0.31]
Carvenone	7.97	1245	0.03	10.16	1663	0.01

<i>trans</i> -Sabinene hydrate acetate	8.00	1247	0.09	7.88	1485	0.07
Linalyl acetate	8.10†	1253	2.32	8.35*	1521	[3.54]
Geraniol	8.14†	1256	[2.32]	11.85*	1804	[0.07]
<i>trans</i> -Ascaridole glycol	8.24	1263	0.04	14.51	2048	0.01
Geranial	8.28	1266	0.13	10.33*	1676	1.07
Citronellyl formate	8.37	1272	0.02	9.11	1579	0.01
Unknown [m/z 95, 67 (45), 41 (42), 110 (42), 43 (41), 59 (36)]	8.42	1275	0.01	12.74	1883	0.01
Bornyl acetate	8.46	1277	0.03	8.49	1531	0.01
<i>cis</i> -Ascaridole glycol?	8.59	1286	0.05	15.01	2096	0.06
Terpinen-4-yl acetate	8.69*	1293	0.04	8.98	1569	0.02
Thymol analogue I	8.69*	1293	[0.04]	15.28	2122	0.01
Thymol	8.76	1298	0.04	15.45	2139	0.01
Unknown analog	8.83	1302	0.01			
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.04	1317	0.08	15.18*	2113	0.09
Bicycloelemene	9.19	1328	0.02	7.30*	1442	[0.02]
Eugenol	9.57	1355	0.03	15.14	2108	0.01
Neryl acetate	9.66	1360	0.04	10.42	1684	0.04
Geranyl acetate	9.93	1380	0.07	10.79	1714	0.07
β-Caryophyllene	10.32	1407	2.10	8.70*	1547	[2.12]
Aromadendrene	10.58*	1427	0.03	8.85*	1559	[21.93]
<i>trans</i> -α-Bergamotene	10.58*	1427	[0.03]	8.70*	1547	[2.12]
α-Humulene	10.77	1441	0.10	9.55	1613	0.10
allo-Aromadendrene	10.86	1448	0.02	9.27	1591	0.01
Germacrene D	11.15	1469	0.01	10.01*	1651	[3.07]
(1S,2S,4S)-para-Menthane-1,2,4-triol	11.23	1475	0.03			
Viridiflorene	11.36*	1485	1.11	9.91	1643	0.02
Bicyclogermacrene	11.36*	1485	[1.11]	10.33*	1676	[1.07]
(3E,6E)-α-Farnesene	11.60*	1503	0.05	10.75	1711	0.04
γ-Cadinene	11.60*	1503	[0.05]	10.68†	1705	0.06
δ-Cadinene	11.74	1513	0.02	10.72†	1708	[0.06]
Isocaryophyllene epoxide B	12.06	1538	0.01	12.40	1853	0.01
Spathulenol	12.41	1566	0.05	14.64	2060	0.05
Caryophyllene oxide	12.44*†	1568	0.09	13.03	1909	0.08
Caryophyllene oxide isomer	12.44*†	1568	[0.09]	12.95	1902	0.02

Viridiflorol	12.58	1579	tr	14.23	2021	0.01
10-epi- γ -Eudesmol	12.90	1605	0.01	14.42	2039	0.01
Isospathulenol	13.17	1627	0.05	15.68	2162	0.06
τ -Cadinol	13.21	1630	0.02	15.18*	2113	[0.09]
α -Cadinol	13.44	1649	0.01	15.79	2174	0.01
Unknown [m/z 257, 258 (20), 91 (19), 272 (18)]	17.29	1992	0.02	16.51	2248	0.02
Total identified	99.00%			98.33%		
Total reported	99.25%			98.43%		

*: 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