

Date : November 17, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 20K10-PTH03

Customer identification : Marjoram organic - Egypt - MJ0105203R

Type : Essential oil

Source : *Origanum majorana*

Customer : Plant Therapy

ANALYSIS

Method: PC-MAT-014  - 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 : November 11, 2020

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: 1.4747 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

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

ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

New readers of similar reports are encouraged to read table footnotes at least once.

Identification	%	Class
Ethanol	tr	Aliphatic alcohol
Isobutyral	tr	Aliphatic aldehyde
2-Methyl-3-buten-2-ol	0.01	Aliphatic alcohol
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Ethylfuran	0.01	Furan
Isoamyl alcohol	tr	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
Methyl 2-methylbutyrate	0.02	Aliphatic ester
Hexanal	0.01	Aliphatic aldehyde
Octane	tr	Alkane
(2E)-Hexenal	0.01	Aliphatic aldehyde
(3Z)-Hexenol	tr	Aliphatic alcohol
Hashishene	0.02	Monoterpene
Isobutyl isobutyrate	tr	Aliphatic ester
α -Thujene	0.86	Monoterpene
α -Pinene	0.90	Monoterpene
Camphene	0.04	Monoterpene
α -Fenchene	0.01	Monoterpene
β -Pinene	0.49	Monoterpene
Sabinene	8.53	Monoterpene
3-Methyl-3-cyclohexenone	tr	Aliphatic ketone
Octen-3-ol	0.01	Aliphatic alcohol
Octan-3-one	0.02	Aliphatic ketone
Myrcene	2.15	Monoterpene
α -Phellandrene	0.56	Monoterpene
Pseudolimonene	0.06	Monoterpene
(3Z)-Hexenyl acetate	0.01	Aliphatic ester
α -Terpinene	9.12	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
ortho-Cymene	tr	Monoterpene
para-Cymene	1.88	Monoterpene
Limonene	1.85	Monoterpene
β -Phellandrene	2.20	Monoterpene
1,8-Cineole	0.23	Monoterpenic ether
(Z)- β -Ocimene	0.03	Monoterpene
(E)- β -Ocimene	0.04	Monoterpene
γ -Terpinene	14.57	Monoterpene
cis-Sabinene hydrate	2.98	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Terpinolene	3.32	Monoterpene
para-Cymenene	0.03	Monoterpene
trans-Sabinene hydrate	8.65	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Linalool	0.68	Monoterpenic alcohol

Unknown	0.03	Monoterpenic alcohol
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
<i>cis</i> -para-Menth-2-en-1-ol	1.56	Monoterpenic alcohol
α -Campholenal	0.03	Monoterpenic aldehyde
<i>trans</i> -Pinocarveol	0.06	Monoterpenic alcohol
<i>trans</i> -para-Menth-2-en-1-ol	0.95	Monoterpenic alcohol
Epoxyterpinolene	0.01	Monoterpenic ether
1,4-Dimethyl-4-acetylcyclohexene	0.01	Monoterpenic ketone
Unknown	0.01	Unknown
Pinocarvone	0.01	Monoterpenic ketone
Isomenthone	0.01	Monoterpenic ketone
Borneol	0.07	Monoterpenic alcohol
δ -Terpineol	0.03	Monoterpenic alcohol
Terpinen-4-ol	23.97	Monoterpenic alcohol
Cryptone	0.04	Normonoterpenic ketone
para-Cymen-8-ol	0.05	Monoterpenic alcohol
Myrtenal	0.04	Monoterpenic aldehyde
α -Terpineol	3.56	Monoterpenic alcohol
<i>cis</i> -Dihydrocarvone	0.11	Monoterpenic ketone
<i>cis</i> -Piperitol	0.29	Monoterpenic alcohol
Myrtenol	0.01	Monoterpenic alcohol
Methylchavicol	tr	Phenylpropanoid
Unknown	0.03	Unknown
<i>trans</i> -Dihydrocarvone	0.12	Monoterpenic ketone
<i>trans</i> -Piperitol	0.49	Monoterpenic alcohol
<i>trans</i> -Carveol	0.02	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
Citronellol	0.05	Monoterpenic alcohol
Unknown	0.03	Oxygenated monoterpene
Carvone	0.01	Monoterpenic ketone
Neral	0.03	Monoterpenic aldehyde
Carvenone	0.03	Monoterpenic ketone
<i>trans</i> -Sabinene hydrate acetate	0.72	Monoterpenic ester
Geraniol	0.07	Monoterpenic alcohol
Linalyl acetate	1.06	Monoterpenic ester
<i>trans</i> -Ascaridole glycol	0.05	Monoterpenic alcohol
Geranial	0.01	Monoterpenic aldehyde
Citronellyl formate	0.02	Monoterpenic ester
<i>cis</i> -Ascaridole glycol	0.05	Monoterpenic alcohol
Bornyl acetate	0.05	Monoterpenic ester
Thymol	0.03	Monoterpenic alcohol
Terpinen-4-yl acetate	0.29	Monoterpenic ester
Unknown	0.06	Monoterpenic alcohol
Unknown	0.01	Unknown
Unknown	0.04	Monoterpenic alcohol
Bicycloelemene	0.03	Sesquiterpene
α -Cubebene	0.01	Sesquiterpene
Eugenol	0.03	Phenylpropanoid
Neryl acetate	0.02	Monoterpenic ester
Geranyl acetate	0.04	Monoterpenic ester
β -Elemene	0.02	Sesquiterpene
β -Caryophyllene	2.65	Sesquiterpene

β-Copaene	0.01	Sesquiterpene
Aromadendrene	0.03	Sesquiterpene
<i>trans</i> -α-Bergamotene	0.04	Sesquiterpene
α-Humulene	0.13	Sesquiterpene
allo-Aromadendrene	0.03	Sesquiterpene
(<i>E</i>)-β-Farnesene	0.01	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
Germacrene D	0.03	Sesquiterpene
Bicyclogermacrene	1.72	Sesquiterpene
Viridiflorene	0.05	Sesquiterpene
α-Muurolene	0.02	Sesquiterpene
γ-Cadinene	0.03	Sesquiterpene
(3 <i>E</i> ,6 <i>E</i>)-α-Farnesene	0.02	Sesquiterpene
δ-Cadinene	0.03	Sesquiterpene
Isocaryophyllene epoxide B	0.03	Sesquiterpenic ether
Spathulenol	0.06	Sesquiterpenic alcohol
Caryophyllene oxide	0.06	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Viridiflorol	0.01	Sesquiterpenic alcohol
10-epi-γ-Eudesmol	0.04	Sesquiterpenic alcohol
Isospathulenol	0.04	Sesquiterpenic alcohol
τ-Cadinol	0.03	Sesquiterpenic alcohol
α-Muurolol	0.01	Sesquiterpenic alcohol
(3 <i>Z</i>)-Caryophylla-3,8(13)-dien-5β-ol	0.02	Sesquiterpenic alcohol
Unknown	0.01	Diterpene
Consolidated total	98.84%	

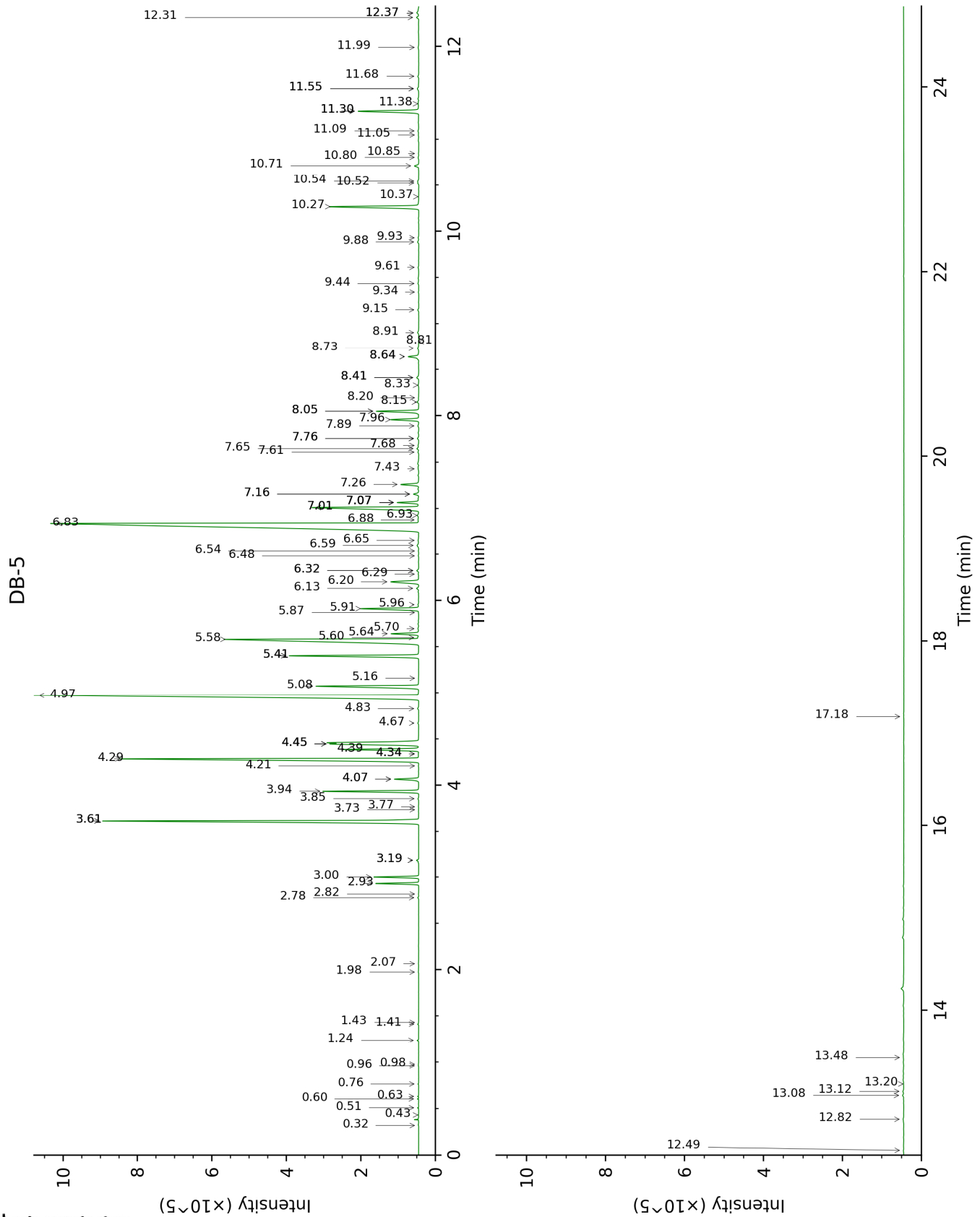
tr: The compound has been detected below 0.005% of total signal.

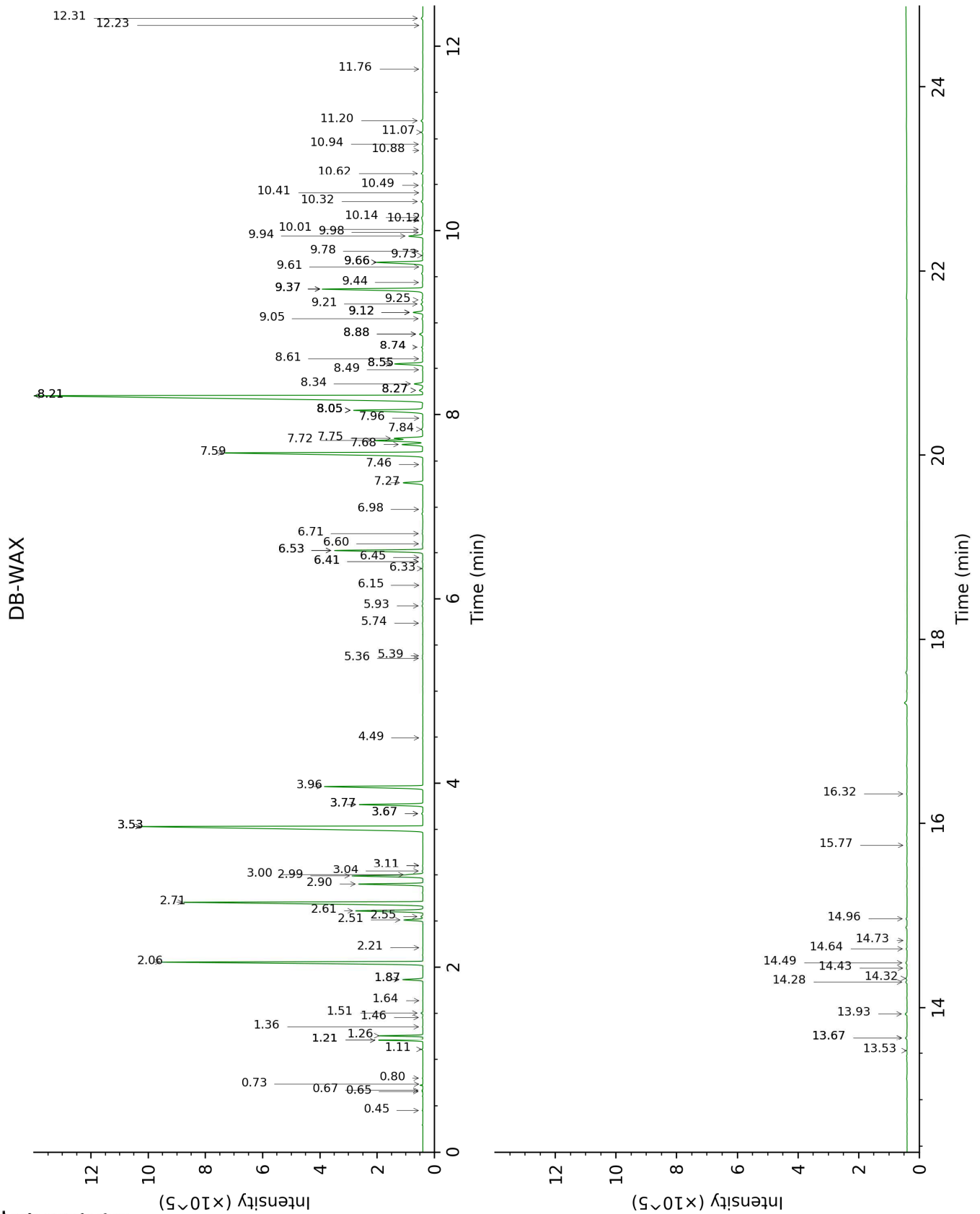
Note: no correction factor was applied

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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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.32	507	tr	0.73	910	tr
Isobutyral	0.43	540	tr			
2-Methyl-3-buten-2-ol	0.51	606	0.01	1.36	1013	0.01
Isovaleral	0.60	644	0.01	0.67	888	0.01
2-Methylbutyral	0.63	654	0.01	0.65	883	0.01
2-Ethylfuran	0.76	705	0.01	0.80	921	0.01
Isoamyl alcohol	0.96	734	tr	3.11*	1176	0.02
2-Methylbutanol	0.98	737	tr	3.11*	1176	[0.02]
Methyl 2-methylbutyrate	1.24	775	0.02	1.11	976	0.02
Hexanal	1.41	801	0.01	1.64	1043	tr
Octane	1.43	804	tr	0.45	788	0.01
(2E)-Hexenal	1.98	850	0.01	3.04	1171	0.02
(3Z)-Hexenol	2.07	858	tr	5.39	1346	0.02
Hashishene	2.78	915	0.02	1.21*	994	0.92
Isobutyl isobutyrate	2.82	918	tr	1.87*	1067	0.54
α-Thujene	2.93	926	0.86	1.26	1004	0.88
α-Pinene	3.00	930	0.90	1.21*	994	[0.92]
Camphene	3.19*†	943	0.06	1.51	1029	0.04
α-Fenchene	3.19*†	943	[0.06]	1.46	1024	0.01
β-Pinene	3.61*	971	9.02	1.87*	1067	[0.54]
Sabinene	3.61*	971	[9.02]	2.06	1087	8.53
3-Methyl-3-cyclohexenone	3.74	979	tr	5.74	1372	0.02
Octen-3-ol	3.77	982	0.01	6.40*	1421	0.02
Octan-3-one	3.86	987	0.02	3.67*	1221	0.04
Myrcene	3.94	993	2.15	2.61	1136	2.16
α-Phellandrene	4.07*	1002	0.60	2.51	1128	0.56
Pseudolimonene	4.07*	1002	[0.60]	2.55	1130	0.06
(3Z)-Hexenyl acetate	4.21	1011	0.01	4.49	1284	0.01
α-Terpinene	4.28	1016	9.12	2.71	1143	9.17
Carvomenthene	4.34*	1019	0.01	2.21	1103	0.01
ortho-Cymene	4.34*	1019	[0.01]	3.77*	1229	1.89
para-Cymene	4.39	1022	1.88	3.77*	1229	[1.89]
Limonene	4.45*†	1026	4.26	2.90	1159	1.85
β-Phellandrene	4.45*†	1026	[4.26]	2.99	1167	2.20
1,8-Cineole	4.45*†	1026	[4.26]	3.00	1168	0.23
(Z)-β-Ocimene	4.67	1040	0.03	3.53*	1211	14.66
(E)-β-Ocimene	4.83	1050	0.04	3.67*	1221	[0.04]
γ-Terpinene	4.97	1059	14.57	3.53*	1211	[14.66]
cis-Sabinene hydrate	5.08	1066	2.98	6.53*	1430	2.98
cis-Linalool oxide (fur.)	5.16	1071	0.01	6.15	1402	0.01
Terpinolene	5.40*	1087	3.33	3.96	1244	3.32

para-Cymenene	5.40*	1087	[3.33]	5.93	1386	0.03
<i>trans</i> -Sabinene hydrate	5.58	1098	8.65	7.59	1510	8.59
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.60	1099	0.02	5.36	1344	0.02
Linalool	5.64	1102	0.68	7.68	1517	0.68
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.70	1105	0.03	8.05*	1546	2.86
<i>trans</i> -para-Mentha-2,8-dien-1-ol	5.87	1116	0.01	8.55*	1585	0.94
<i>cis</i> -para-Menth-2-en-1-ol	5.91	1119	1.56	7.72†	1520	2.61
α-Campholenal	5.96	1122	0.03	6.60	1435	0.03
<i>trans</i> -Pinocarveol	6.13	1133	0.06	8.74*†	1599	0.09
<i>trans</i> -para-Menth-2-en-1-ol	6.20	1138	0.95	8.55*	1585	[0.94]
Epoxyterpinolene	6.28	1143	0.01	6.33	1415	0.02
1,4-Dimethyl-4-acetylcyclohexene	6.32*	1146	0.06	6.98	1464	0.01
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.32*	1146	[0.06]	6.45	1424	0.01
Pinocarvone	6.48	1156	0.01	7.46	1500	0.02
Isomenthone	6.54	1160	0.01	6.53*	1430	[2.98]
Borneol	6.60	1163	0.07	9.37*	1651	3.67
δ-Terpineol	6.65	1167	0.03	9.05	1625	0.04
Terpinen-4-ol	6.83	1179	23.97	8.21*	1558	23.87
Cryptone	6.88	1182	0.04	8.74*†	1599	[0.09]
para-Cymen-8-ol	6.93	1185	0.05	11.07	1795	0.04
Myrtenal	7.01*	1190	3.60	8.27*	1562	0.16
α-Terpineol	7.01*	1190	[3.60]	9.37*	1651	[3.67]
<i>cis</i> -Dihydrocarvone	7.07*	1194	0.53	8.05*	1546	[2.86]
<i>cis</i> -Piperitol	7.07*	1194	[0.53]	9.12*	1630	0.34
Myrtenol	7.07*	1194	[0.53]	10.41	1738	0.01
Methylchavicol	7.07*	1194	[0.53]	8.88*	1611	0.13
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.16*	1200	0.14	10.49	1745	0.03
<i>trans</i> -Dihydrocarvone	7.16*	1200	[0.14]	8.27*	1562	[0.16]
<i>trans</i> -Piperitol	7.26	1207	0.49	9.94	1698	0.49
<i>trans</i> -Carveol	7.43	1218	0.02	10.94	1784	0.03
Nerol	7.61	1231	0.02	10.62	1756	0.06

Citronellol	7.65	1233	0.05	10.32	1730	0.06
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.68	1236	0.03	10.88	1778	0.01
Carvone	7.76*	1241	0.04	9.61	1671	0.01
Neral	7.76*	1241	[0.04]	9.12*	1630	[0.34]
Carvenone	7.89	1250	0.03	9.44	1657	0.03
<i>trans</i> -Sabinene hydrate acetate	7.96	1254	0.72	7.27	1485	0.70
Geraniol	8.05*	1261	1.13	11.20	1806	0.07
Linalyl acetate	8.05*	1261	[1.13]	7.75†	1522	[2.61]
<i>trans</i> -Ascaridole glycol	8.15	1267	0.05	13.67*	2036	0.07
Geranial	8.20	1271	0.01	9.73	1681	0.01
Citronellyl formate	8.33	1280	0.02	8.49	1580	0.02
<i>cis</i> -Ascaridole glycol	8.41*	1286	0.07	14.32	2099	0.05
Bornyl acetate	8.41*	1286	[0.07]	7.84	1530	0.05
Thymol	8.64*	1301	0.34	14.64	2132	0.03
Terpinen-4-yl acetate	8.64*	1301	[0.34]	8.34	1568	0.29
Unknown analog	8.73	1304	0.06			
Unknown [m/z 69, 41 (79), 91 (56), 92 (54), 79 (50), 77 (35)...]	8.81	1309	0.01			
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.91	1316	0.04	14.49	2116	0.05
Bicycloelemene	9.15	1334	0.03	6.71	1443	0.02
α -Cubebene	9.34	1347	0.01	6.40*	1421	[0.02]
Eugenol	9.44	1354	0.03	14.28	2095	0.05
Neryl acetate	9.61	1366	0.02	9.78	1684	0.02
Geranyl acetate	9.88	1385	0.04	10.14	1715	0.07
β -Elemene	9.93	1389	0.02	8.05*	1546	[2.86]
β -Caryophyllene	10.27	1413	2.65	8.05*	1546	[2.86]
β -Copaene	10.37	1421	0.01	7.96	1539	0.01
Aromadendrene	10.52	1432	0.03	8.21*	1558	[23.87]
<i>trans</i> - α -Bergamotene	10.54	1434	0.04	8.05*	1546	[2.86]
α -Humulene	10.71	1446	0.13	8.88*	1611	[0.13]
allo-Aromadendrene	10.80	1453	0.03	8.61	1589	0.02
(<i>E</i>)- β -Farnesene	10.85	1456	0.01	9.12*	1630	[0.34]
γ -Muurolene	11.05	1471	0.02	9.21	1638	0.08
Germacrene D	11.09	1474	0.03	9.37*	1651	[3.67]
Bicyclogermacrene	11.30*	1490	1.79	9.66*	1675	1.74
Viridiflorene	11.30*	1490	[1.79]	9.25	1641	0.05
α -Muurolene	11.38	1496	0.02	9.66*	1675	[1.74]
γ -Cadinene	11.55*	1509	0.06	9.98	1701	0.03

(3E,6E)- α -Farnesene	11.55*	1509	[0.06]	10.12	1712	0.02
δ -Cadinene	11.68	1519	0.03	10.01	1704	0.04
Isocaryophyllene epoxide B	11.99	1544	0.03	11.76	1856	0.02
Spathulenol	12.32	1570	0.06	13.93	2061	0.07
Caryophyllene oxide	12.36*	1573	0.09	12.31	1906	0.06
Caryophyllene oxide isomer	12.36*	1573	[0.09]	12.23	1899	0.01
Viridiflorol	12.49	1583	0.01	13.53	2022	0.02
10-epi- γ -Eudesmol	12.82	1610	0.04	13.67*	2036	[0.07]
Isospathulenol	13.08	1631	0.04	14.96	2165	0.04
τ -Cadinol	13.12	1635	0.03	14.43	2110	0.03
α -Muurolol	13.20	1641	0.01	14.73	2141	0.01
(3Z)-Caryophylla-3,8(13)-dien-5 β -ol	13.48	1665	0.02	16.32	2309	0.02
Unknown [m/z 257, 258 (20), 91 (19), 272 (18)]	17.18	1997	0.01	15.77	2249	0.01
Total identified		98.78%			98.74%	
Total reported		98.98%			98.88%	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated 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