Date : November 29, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19K15-PTH01-1-CC
Customer identification : Marjoram Organic - Egypt - MJ010494R
Type : Essential oil
Source : *Origanum majorana*
Customer : Plant Therapy

Analysis

Method: PC-MAT-007 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID (in French); identifications validated by GC-MS.
Analyst : Sylvain Mercier, M. Sc., Chimiste
Analysis date : November 25, 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: 1.4734 ± 0.0003 (20 °C)

CONCLUSION

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

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Analysis summary – Consolidated contents

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

Identification	%	Classe
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Isoamyl alcohol	tr	Aliphatic alcohol
Methyl 2-methylbutyrate	0.04	Aliphatic ester
Hexanal	tr	Aliphatic aldehyde
Octane	tr	Alkane
(2*E*)-Hexenal	0.02	Aliphatic aldehyde
(3*Z*)-Hexenol	0.02	Aliphatic alcohol
(2*E*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
Hashishene	0.02	Monoterpene
Tricyclene	tr	Monoterpene
α-Thujene	1.29	Monoterpene
α-Pinene	0.93	Monoterpene
Camphene	0.03	Monoterpene
α-Fenchene	tr	Monoterpene
Sabinene	9.23	Monoterpene
β-Pinene	0.51	Monoterpene
3-Methyl-3-cyclohexenone	0.02	Aliphatic ketone
3-Methylpentyl acetate	0.01	Aliphatic ester
Octan-3-one	0.05	Aliphatic ketone
Myrcene	2.20	Monoterpene
Pseudolimonene	0.08	Monoterpene
α-Phellandrene	0.53	Monoterpene
(3*Z*)-Hexenyl acetate	0.01	Aliphatic ester
α-Terpinene	8.85	Monoterpene
Carvomenthene	0.03	Aliphatic alcohol
para-Cymene	2.13	Monoterpene
Limonene	2.30	Monoterpene
1,8-Cineole	2.12*	Monoterpenic ether
β-Phellandrene	[2.12]*	Monoterpene
(*Z*)-β-Ocimene	0.03	Monoterpene
(*E*)-β-Ocimene	0.09	Monoterpene
γ-Terpinene	14.22	Monoterpene
cis-Sabinene hydrate	3.41	Monoterpenic alcohol
Terpinolene	3.24	Monoterpene
para-Cymenene	0.03	Monoterpene
trans-Sabinene hydrate	13.32	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Linalool	0.86	Monoterpenic alcohol
Unknown	0.03	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	1.23	Monoterpenic alcohol
trans-Pinocarveol	0.07	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.74	Monoterpenic alcohol
Epoxyterpinolene	0.01	Monoterpenic ether
Unknown	0.01	Unknown

1,4-Dimethyl-4-acetylcyclohexene	0.04	Monoterpenic ketone
Pinocarvone	0.01	Monoterpenic ketone
Isomenthone	0.01	Monoterpenic ketone
Borneol	0.06	Monoterpenic alcohol
δ-Terpineol	0.01	Monoterpenic alcohol
Terpinen-4-ol	22.01	Monoterpenic alcohol
Cryptone	0.01	Normonoterpenic ketone
para-Cymen-8-ol	0.03	Monoterpenic alcohol
α-Terpineol	2.79	Monoterpenic alcohol
cis-Piperitol	0.31	Monoterpenic alcohol
Unknown	0.03	Unknown
trans-Piperitol	0.41	Monoterpenic alcohol
trans-Carveol	0.02	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
Citronellol	0.03	Monoterpenic alcohol
Unknown	0.03	Oxygenated monoterpene
Neral	tr	Monoterpenic aldehyde
Carvone	0.01	Monoterpenic ketone
trans-Sabinene hydrate acetate	0.07	Monoterpenic ester
Linalyl acetate	1.45	Monoterpenic ester
Geraniol	0.06	Monoterpenic alcohol
trans-Ascaridole glycol	0.13	Monoterpenic alcohol
Citronellyl formate	0.02	Monoterpenic ester
Unknown	0.01	Unknown
cis-Ascaridole glycol	0.03	Monoterpenic alcohol
Bornyl acetate	0.03	Monoterpenic ester
Thymol analogue I	0.02	Monoterpenic alcohol
Thymol	0.01	Monoterpenic alcohol
Terpinen-4-yl acetate	0.09	Monoterpenic ester
Thymol analogue II	0.03	Monoterpenic alcohol
Unknown	0.01	Monoterpenic alcohol
Unknown	0.14	Monoterpenic alcohol
Bicycloelemene	0.04	Sesquiterpene
Eugenol	0.06	Phenylpropanoid
Neryl acetate	0.05	Monoterpenic ester
α-Copaene	0.01	Sesquiterpene
Geranyl acetate	0.07	Monoterpenic ester
β-Elemene	0.02	Sesquiterpene
β-Caryophyllene	1.71	Sesquiterpene
Aromadendrene	0.04	Sesquiterpene
α-Humulene	0.10	Sesquiterpene
allo-Aromadendrene	0.03	Sesquiterpene
γ-Muurolene	0.05	Sesquiterpene
Germacrene D	0.02	Sesquiterpene
Bicyclogermacrene	0.69	Sesquiterpene
Viridiflorene	0.04	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
(3*E*,6*E*)-α-Farnesene	0.01	Sesquiterpene
δ-Cadinene	0.02	Sesquiterpene
Spathulenol	0.06	Sesquiterpenic alcohol
Caryophyllene oxide	0.08	Sesquiterpenic ether
Viridiflorol	0.01	Sesquiterpenic alcohol

10-epi-γ-Eudesmol	0.01	Sesquiterpenic alcohol
Isospathulenol	0.07	Sesquiterpenic alcohol
Unknown	0.01	Diterpene
Consolidated total	**98.90%**	

*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total
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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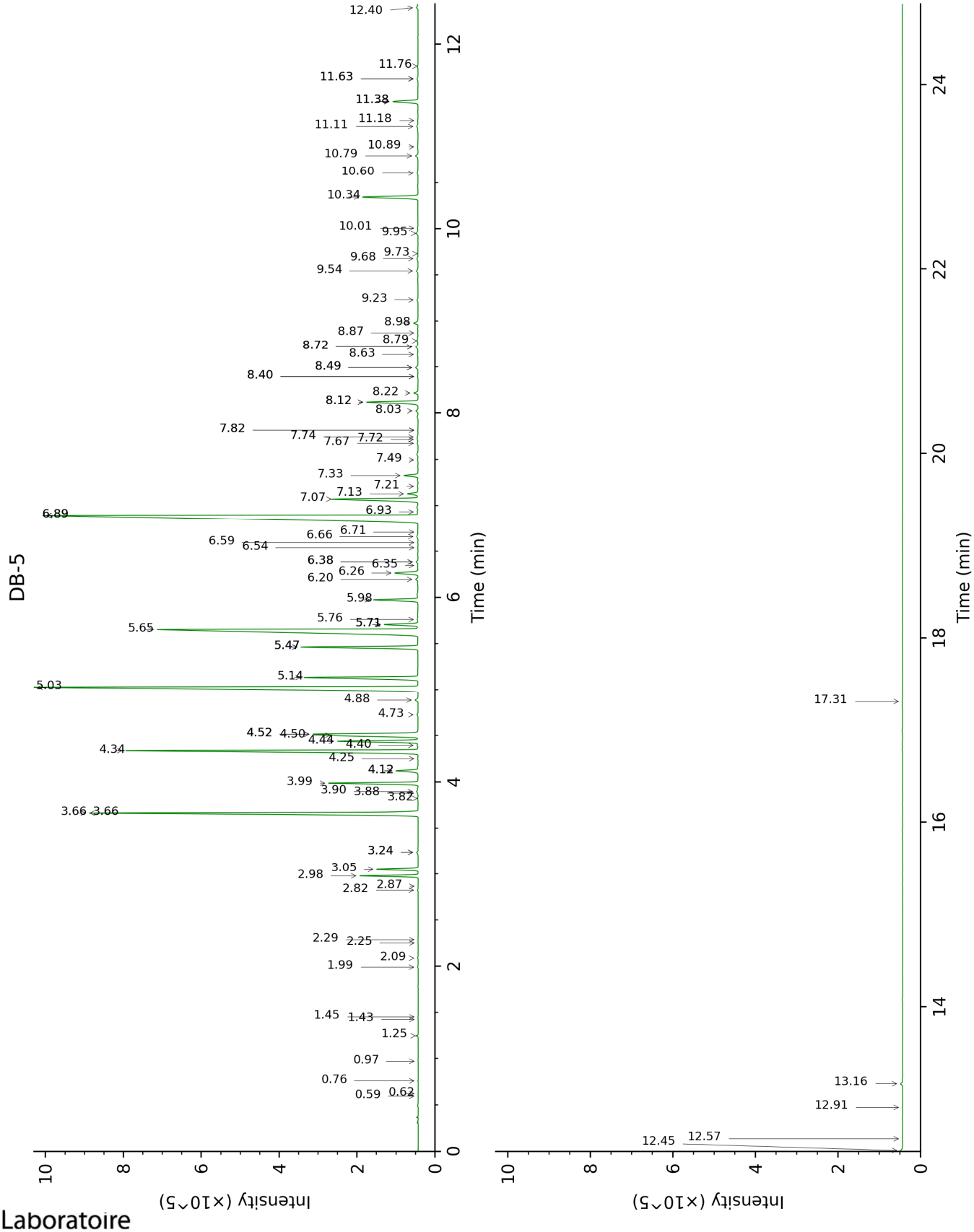
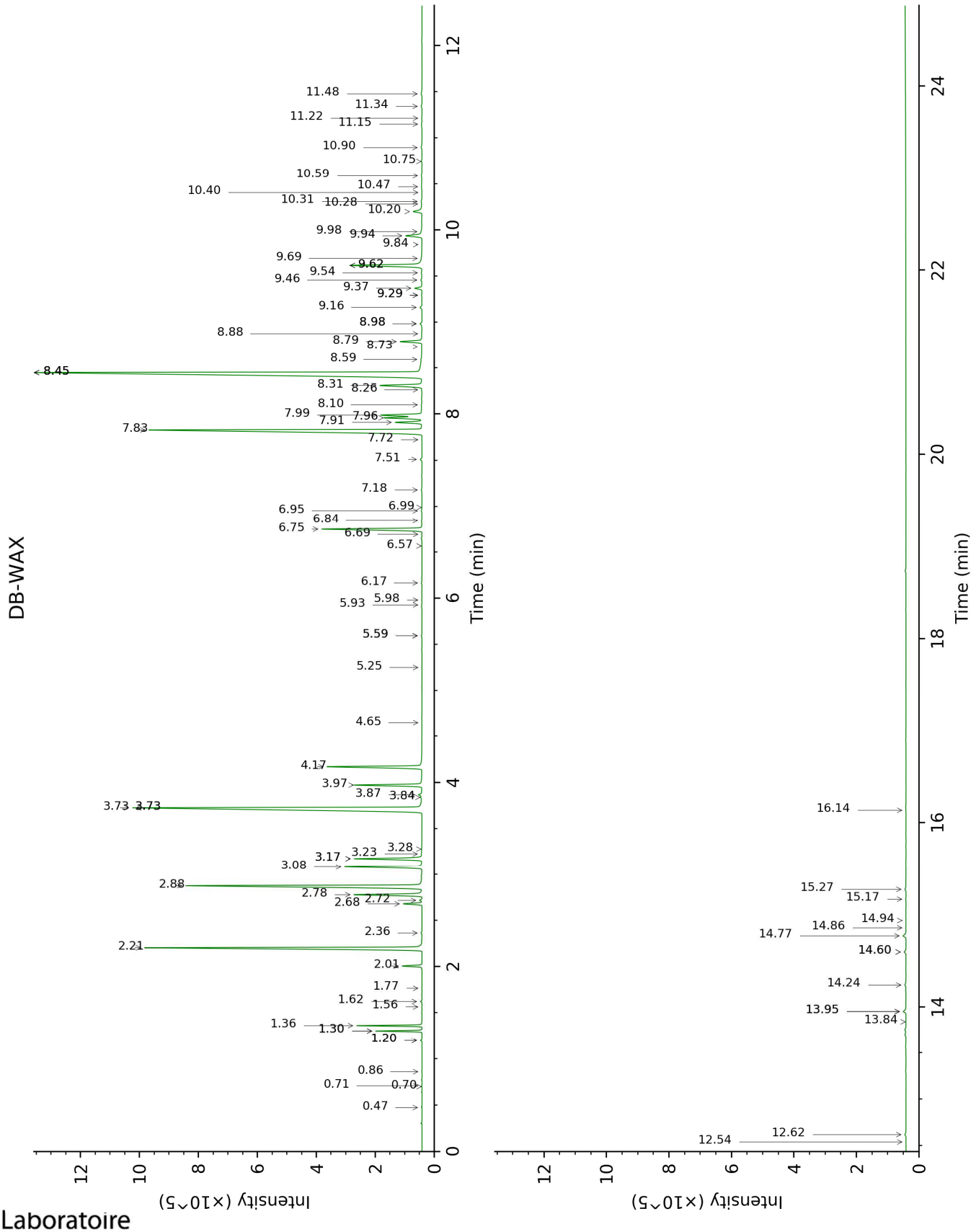

DB-5
Time (min)
Intensity (×10^5)
12.40
11.76
11.63
11.38
11.18
11.11
10.89
10.79
10.60
10.34
10.01
9.95
9.73
9.68
9.54
9.23
8.98
8.87
8.79
8.72
8.63
8.49
8.40
8.22
8.12
8.03
7.82
7.74
7.72
7.67
7.49
7.33
7.21
7.13
7.07
6.93
6.89
6.71
6.66
6.59
6.54
6.38
6.35
6.26
6.20
5.98
5.76
5.71
5.65
5.47
5.14
5.03
4.88
4.73
4.52
4.50
4.44
4.40
4.34
4.25
4.12
3.99
3.90
3.88
3.82
3.66
3.24
3.05
2.98
2.87
2.82
2.29
2.25
2.09
1.99
1.45
1.43
1.25
0.97
0.76
0.62
0.59
17.31
13.16
12.91
12.57
12.45


DB-WAX
Intensity (×10^5)
Time (min)
11.48
11.34
11.22
11.15
10.90
10.75
10.59
10.47
10.40
10.31
10.28
10.20
9.98
9.94
9.84
9.69
9.62
9.54
9.46
9.37
9.29
9.16
8.98
8.88
8.79
8.73
8.59
8.45
8.31
8.26
8.10
7.99
7.96
7.91
7.83
7.72
7.51
7.18
6.99
6.95
6.84
6.75
6.69
6.57
6.17
5.98
5.93
5.59
5.25
4.65
4.17
3.97
3.87
3.84
3.73
3.73
3.28
3.23
3.17
3.08
2.88
2.78
2.72
2.68
2.36
2.21
2.01
1.77
1.62
1.56
1.36
1.30
1.20
0.86
0.71
0.70
0.47
16.14
15.27
15.17
14.94
14.86
14.77
14.60
14.24
13.95
13.84
12.62
12.54

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.60	641	tr	0.71	885	0.01
2-Methylbutyral	0.62	652	tr	0.70	882	tr
2-Ethylfuran	0.76	705	tr	0.86	921	tr
Isoamyl alcohol	0.97	737	tr	3.28	1176	0.02
Methyl 2-methylbutyrate	1.25	776	0.04	1.20*	976	0.03
Hexanal	1.43	800	tr	1.77	1043	0.01
Octane	1.45	804	tr	0.47	786	0.01
(2*E*)-Hexenal	1.99	848	0.02	3.23	1172	0.04
(3*Z*)-Hexenol	2.09	856	0.02	5.60*	1345	0.03
(2*E*)-Hexenol	2.25	870	0.01	5.93	1369	0.01
Hexanol	2.29	873	0.01	5.25	1320	0.01
Hashishene	2.82	914	0.02	1.30*	994	0.93
Tricyclene	2.87	917	tr	1.20*	976	[0.03]
α-Thujene	2.98	924	1.29	1.36	1004	1.30
α-Pinene	3.05	929	0.93	1.30*	994	[0.93]
Camphene	3.24*	941	0.05	1.62	1029	0.03
α-Fenchene	3.24*	941	[0.05]	1.56	1024	tr
Sabinene	3.66*	970	9.63	2.20	1086	9.23
β-Pinene	3.66*	970	[9.63]	2.01	1067	0.51
3-Methyl-3-cyclohexenone	3.82	980	0.02	5.98	1372	0.02
3-Methylpentyl acetate	3.88	984	0.01	3.73*	1212	14.29
Octan-3-one	3.90	985	0.05	3.84	1221	0.05
Myrcene	3.99	991	2.20	2.78	1136	2.17
Pseudolimonene	4.12*	1000	0.61	2.72	1131	0.08
α-Phellandrene	4.12*	1000	[0.61]	2.68	1128	0.53
(3*Z*)-Hexenyl acetate	4.25	1008	0.01	4.65	1282	0.01
α-Terpinene	4.34	1014	8.85	2.88	1144	8.93
Carvomenthene	4.40	1018	0.03	2.36	1102	0.03
para-Cymene	4.44	1020	2.13	3.97	1231	2.12
Limonene	4.50†	1024	4.42	3.08	1160	2.30
1,8-Cineole	4.52*†	1025	[4.42]	3.17*	1168	2.15
β-Phellandrene	4.52*†	1025	[4.42]	3.17*	1168	[2.15]
(*Z*)-β-Ocimene	4.73	1038	0.03	3.73*	1212	[14.29]
(*E*)-β-Ocimene	4.88	1049	0.09	3.87	1223	0.14
γ-Terpinene	5.03	1058	14.22	3.73*	1212	[14.29]
cis-Sabinene hydrate	5.14	1065	3.41	6.75	1428	3.31
Terpinolene	5.47*	1086	3.24	4.17	1246	3.24
para-Cymenene	5.47*	1086	[3.24]	6.17	1386	0.03
trans-Sabinene hydrate	5.65	1098	13.32	7.83	1509	12.99
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.71*	1102	0.88	5.60*	1345	[0.03]

Linalool	5.71*	1102	[0.88]	7.91	1515	0.86
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.76	1105	0.03	8.45*	1558	22.09
cis-para-Menth-2-en-1-ol	5.98	1119	1.23	7.96	1519	1.24
trans-Pinocarveol	6.20	1134	0.07	8.98*	1600	0.08
trans-para-Menth-2-en-1-ol	6.26	1138	0.74	8.79	1585	0.76
Epoxyterpinolene	6.35	1144	0.01	6.57	1415	0.01
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.38*	1146	0.06	6.69	1424	0.01
1,4-Dimethyl-4-acetylcyclohexene	6.38*	1146	[0.06]	7.18	1460	0.04
Pinocarvone	6.54	1156	0.01	7.72	1501	0.01
Isomenthone	6.60	1160	0.01	6.84	1435	0.04
Borneol	6.66	1164	0.06	9.62*	1651	2.81
δ-Terpineol	6.71	1168	0.01	9.29*	1625	0.02
Terpinen-4-ol	6.89*	1180	22.15	8.45*	1558	[22.09]
Cryptone	6.89*	1180	[22.15]	8.98*	1600	[0.08]
para-Cymen-8-ol	6.93	1182	0.03	11.34	1797	0.04
α-Terpineol	7.07	1192	2.79	9.62*	1651	[2.81]
cis-Piperitol	7.13	1196	0.31	9.37	1631	0.27
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.21	1201	0.03	10.75	1746	0.03
trans-Piperitol	7.33	1209	0.41	10.20	1699	0.41
trans-Carveol	7.49	1221	0.02	11.22	1786	0.02
Nerol	7.72	1232	0.02	10.90	1759	0.06
Citronellol	7.67	1233	0.03	10.59	1732	0.05
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.74	1234	0.03	11.15	1780	0.04
Neral	7.82*	1239	0.01	9.29*	1625	[0.02]
Carvone	7.82*	1239	[0.01]	9.84	1670	0.01
trans-Sabinene hydrate acetate	8.02	1253	0.07	7.51	1485	0.06
Linalyl acetate	8.12*	1259	1.51	7.99	1522	1.45
Geraniol	8.12*	1259	[1.51]	11.48	1809	0.06
trans-Ascaridole glycol	8.22	1266	0.13	13.95*	2036	0.14
Citronellyl formate	8.40*	1278	0.02	8.73	1580	0.02
Unknown [m/z 43, 79 (78), 128 (46), 58 (42), 127 (42)...]	8.40*	1278	[0.02]	12.54	1904	0.01

cis-Ascaridole glycol	8.49*	1284	0.09	14.60*	2099	0.09
Bornyl acetate	8.49*	1284	[0.09]	8.10	1530	0.03
Thymol analogue I	8.63	1294	0.02	14.86	2125	0.02
Thymol	8.72*	1299	0.10	14.94	2133	0.01
Terpinen-4-yl acetate	8.72*	1299	[0.10]	8.59	1569	0.09
Thymol analogue II	8.79	1304	0.03	15.17	2156	0.02
Unknown analog	8.87	1310	0.01			
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.98	1317	0.14	14.77	2116	0.15
Bicycloelemene	9.23	1335	0.04	6.95	1444	0.03
Eugenol	9.54	1357	0.06	14.60*	2099	[0.09]
Neryl acetate	9.68	1366	0.05	9.98	1681	0.07
α-Copaene	9.73	1370	0.01	6.99	1446	0.01
Geranyl acetate	9.95	1385	0.07	10.47	1722	0.08
β-Elemene	10.01	1389	0.02	8.26	1543	0.02
β-Caryophyllene	10.34	1413	1.71	8.31	1547	1.66
Aromadendrene	10.60	1432	0.04	8.45*	1558	[22.09]
α-Humulene	10.80	1447	0.10	9.16	1614	0.08
allo-Aromadendrene	10.89	1454	0.03	8.88	1591	0.02
γ-Muurolene	11.11	1470	0.05	9.46	1638	0.05
Germacrene D	11.18	1475	0.02	9.69	1657	0.06
Bicyclogermacrene	11.38*	1490	0.80	9.94	1677	0.69
Viridiflorene	11.38*	1490	[0.80]	9.54	1644	0.04
γ-Cadinene	11.63*	1509	0.04	10.28	1706	0.02
(3*E*,6*E*)-α-Farnesene	11.63*	1509	[0.04]	10.40	1716	0.01
δ-Cadinene	11.76	1519	0.02	10.31	1708	0.05
Spathulenol	12.40	1569	0.06	14.24	2064	0.07
Caryophyllene oxide	12.45	1573	0.08	12.62	1911	0.06
Viridiflorol	12.57	1583	0.01	13.84	2025	0.01
10-epi-γ-Eudesmol	12.91	1609	0.01	13.95*	2036	[0.14]
Isospathulenol	13.16	1630	0.07	15.27	2167	0.05
Unknown [m/z 257, 258 (20), 91 (19), 272 (18)]	17.31	2000	0.01	16.14	2256	0.01
Total identified		**98.79%**			**98.46%**	
Total reported		**99.05%**			**98.70%**	

*: 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