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.

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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
(2*E*)-Hexenal	0.02	0.02	Aliphatic aldehyde
(3*Z*)-Hexenol	0.01	0.01	Aliphatic alcohol
(2*E*)-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
Pinocarvone	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-Muurolene	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
(3*E*,6*E*)-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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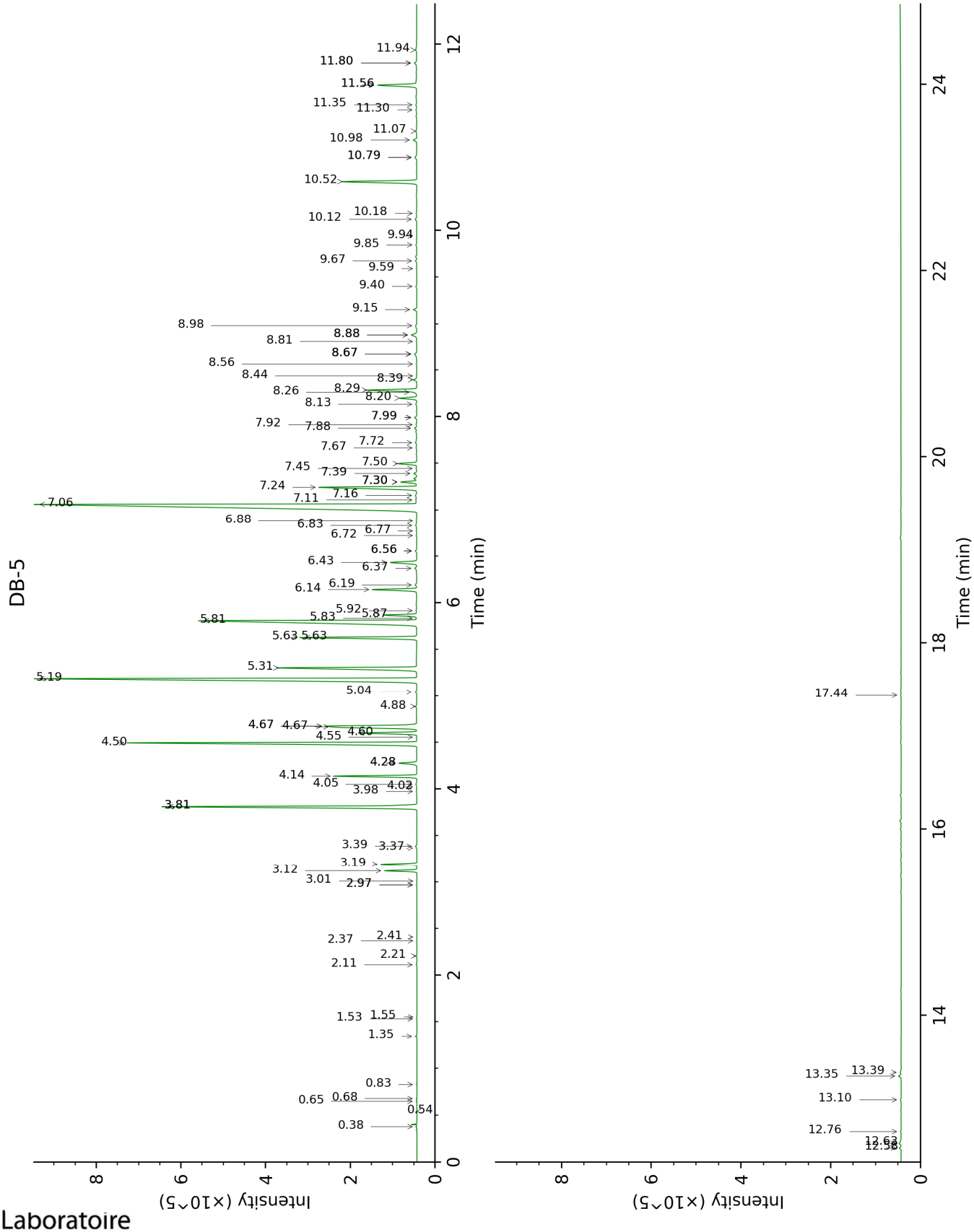
DB-5
Time (min)
Intensity (×10^5)
11.94
11.80
11.56
11.35
11.30
11.07
10.98
10.79
10.52
10.18
10.12
9.94
9.85
9.67
9.59
9.40
9.15
8.98
8.88
8.81
8.67
8.56
8.44
8.39
8.29
8.26
8.20
8.13
7.99
7.92
7.88
7.72
7.67
7.50
7.45
7.39
7.30
7.24
7.16
7.11
7.06
6.88
6.83
6.77
6.72
6.56
6.43
6.37
6.19
6.14
5.92
5.87
5.83
5.81
5.63
5.31
5.19
5.04
4.88
4.67
4.60
4.55
4.50
4.28
4.14
4.05
4.02
3.98
3.81
3.39
3.37
3.19
3.12
3.01
2.97
2.41
2.37
2.21
2.11
1.55
1.53
1.35
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0.68
0.65
0.54
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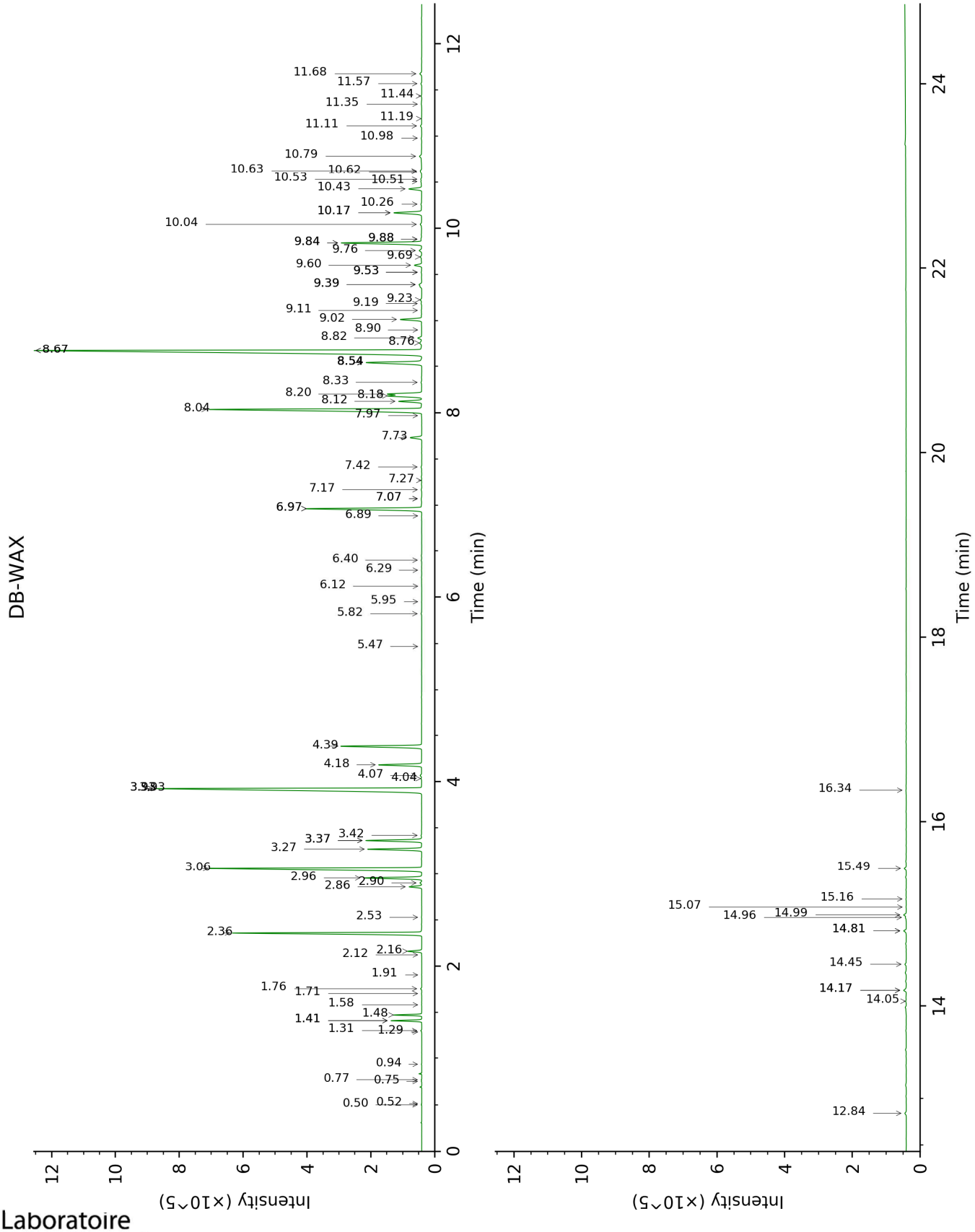
17.44
13.39
13.35
13.10
12.76
12.63
12.38


DB-WAX
Intensity (×10^5)
Time (min)
11.68
11.57
11.44
11.35
11.19
11.11
10.98
10.79
10.63
10.62
10.53
10.51
10.43
10.26
10.17
10.04
9.88
9.84
9.76
9.69
9.60
9.53
9.39
9.23
9.19
9.11
9.02
8.90
8.82
8.76
8.67
8.54
8.33
8.20
8.18
8.12
8.04
7.97
7.73
7.42
7.27
7.17
7.07
6.97
6.89
6.40
6.29
6.12
5.95
5.82
5.47
4.39
4.18
4.07
4.04
3.42
3.37
3.27
3.06
2.96
2.90
2.86
2.53
2.36
2.16
2.12
1.91
1.76
1.71
1.58
1.48
1.41
1.31
1.29
0.94
0.77
0.75
0.52
0.50
16.34
15.49
15.16
15.07
14.99
14.96
14.81
14.45
14.17
14.05
12.84

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
(2*E*)-Hexenal	2.11	847	0.02	3.42	1172	0.02
(3*Z*)-Hexenol	2.21	855	0.01	5.95	1354	0.01
(2*E*)-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
cis-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
trans-Pinocarveol	6.37	1133	0.07	9.23	1602	0.07
trans-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]
cis-Piperitol	7.30*†	1194	0.55	9.60	1633	0.31
Methylchavicol	7.30*†	1194	[0.55]	9.39*†	1616	0.19
cis-Dihydrocarvone	7.30*†	1194	[0.55]	8.54*	1549	[2.64]
trans-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
trans-Piperitol	7.50	1207	0.55	10.43	1700	0.54
trans-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]
trans-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]
trans-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
cis-Ascaridole glycol?	8.67*	1287	0.09	14.81*	2099	0.12
Bornyl acetate	8.67*	1287	[0.09]	8.33	1532	0.04
(*E*)-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]
trans-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-Muurolene	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*E*,6*E*)-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%**

*: 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

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