Date : April 08, 2022

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 22D07-PTH03
Customer identification : Marjoram ORGANIC - Egypt - MJ0107R
Type : Essential oil
Source : *Origanum majorana* ct. Sabinene hydrate
Customer : Plant Therapy

Analysis

Method: PC-MAT-014 ISO - 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 2014-005
Analysis date : April 07, 2022

Checked and approved by :

Alexis St-Gelais, Ph. D., Chimiste 2013-174

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Méthode certifiée ISO 17025:2017 Certified method

Laboratoire PhytoChemia

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.4748 ± 0.0003 (20 °C; method PC-MAT-016)

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	%	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	tr	Furan
Isoamyl alcohol	tr	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
Methyl 2-methylbutyrate	0.02	Aliphatic ester
Hexanal	tr	Aliphatic aldehyde
Octane	0.01	Alkane
(2*E*)-Hexenal	0.01	Aliphatic aldehyde
(3*Z*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
Hashishene	0.02	Monoterpene
Isobutyl isobutyrate	tr	Aliphatic ester
α-Thujene	0.72	Monoterpene
α-Pinene	0.76	Monoterpene
α-Fenchene	0.01	Monoterpene
Camphene	0.04	Monoterpene
β-Pinene	0.46	Monoterpene
Sabinene	7.38	Monoterpene
3-Methyl-3-cyclohexenone	0.01	Aliphatic ketone
Octen-3-ol	tr	Aliphatic alcohol
Octan-3-one	0.02	Aliphatic ketone
Myrcene	1.89	Monoterpene
α-Phellandrene	0.48	Monoterpene
Pseudolimonene	0.06	Monoterpene
Δ3-Carene	0.01	Monoterpene
(3*Z*)-Hexenyl acetate	0.01	Aliphatic ester
α-Terpinene	8.38	Monoterpene
meta-Cymene	0.01	Monoterpene
para-Cymene	1.82	Monoterpene
β-Phellandrene	2.17*	Monoterpene
1,8-Cineole	2.17*	Monoterpenic ether
Limonene	1.73	Monoterpene
(*Z*)-β-Ocimene	0.02	Monoterpene
(*E*)-β-Ocimene	0.03	Monoterpene
Isobutyl angelate	tr	Aliphatic ester
γ-Terpinene	14.06	Monoterpene
cis-Sabinene hydrate	3.23	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Terpinolene	3.28	Monoterpene
para-Cymenene	0.03	Monoterpene
trans-Sabinene hydrate	9.09	Monoterpenic alcohol

Unknown	0.01	Oxygenated monoterpene
Linalool	0.76	Monoterpenic alcohol
Unknown	0.03	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	1.62	Monoterpenic alcohol
α-Campholenal	0.02	Monoterpenic aldehyde
4-Hydroxy-4-methylcyclohex-2-enone	0.02	Aliphatic alcohol
trans-Pinocarveol	0.06	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	1.00	Monoterpenic alcohol
Epoxyterpinolene	0.01	Monoterpenic ether
Camphene hydrate	tr	Monoterpenic alcohol
Unknown	tr	Unknown
1,4-Dimethyl-4-acetylcyclohexene	0.03	Monoterpenic ketone
Pinocarvone	tr	Monoterpenic ketone
Isomenthone	0.01	Monoterpenic ketone
Borneol	0.01	Monoterpenic alcohol
δ-Terpineol	0.06	Monoterpenic alcohol
Terpinen-4-ol	25.52	Monoterpenic alcohol
para-Cymen-8-ol	0.05	Monoterpenic alcohol
Cryptone	0.01	Normonoterpenic ketone
Myrtenal	0.01	Monoterpenic aldehyde
α-Terpineol	3.91	Monoterpenic alcohol
Myrtenol	0.01	Monoterpenic alcohol
Methylchavicol	0.01	Phenylpropanoid
cis-Piperitol	0.31	Monoterpenic alcohol
trans-Dihydrocarvone	0.14	Monoterpenic ketone
Unknown	0.02	Unknown
trans-Piperitol	0.52	Monoterpenic alcohol
trans-Carveol	0.01	Monoterpenic alcohol
Nerol	0.03	Monoterpenic alcohol
Citronellol	0.06	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Neral	0.04	Monoterpenic aldehyde
Carvenone	0.02	Monoterpenic ketone
trans-Sabinene hydrate acetate	0.71	Monoterpenic ester
Linalyl acetate	1.16	Monoterpenic ester
Geraniol	0.08	Monoterpenic alcohol
trans-Ascaridole glycol	0.09	Monoterpenic alcohol
Citronellyl formate	0.02	Monoterpenic ester
Bornyl acetate	0.06	Monoterpenic ester
cis-Ascaridole glycol	tr	Monoterpenic alcohol
Terpinen-4-yl acetate	0.29	Monoterpenic ester
Thymol analogue I (isothymol?)	0.01	Monoterpenic alcohol
Unknown	0.02	Monoterpenic alcohol
Thymol	0.16	Monoterpenic alcohol
Unknown	0.06	Monoterpenic alcohol
Bicycloelemene	0.05	Sesquiterpene
α-Cubebene	0.01	Sesquiterpene
Eugenol	0.04	Phenylpropanoid
Neryl acetate	0.03	Monoterpenic ester
α-Copaene	0.01	Sesquiterpene
Geranyl acetate	0.03	Monoterpenic ester
β-Elemene	0.03	Sesquiterpene

β-Caryophyllene	2.83	Sesquiterpene
β-Copaene	0.01	Sesquiterpene
Aromadendrene	0.03	Sesquiterpene
trans-α-Bergamotene	tr	Sesquiterpene
α-Humulene	0.13	Sesquiterpene
allo-Aromadendrene	0.03	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
Germacrene D	0.02	Sesquiterpene
(1S,2S,4S)-para-Menthane-1,2,4-triol	0.02	Monoterpenic alcohol
Bicyclogermacrene	1.75	Sesquiterpene
Viridiflorene	0.05	Sesquiterpene
α-Selinene	0.01	Sesquiterpene
α-Muurolene	0.03	Sesquiterpene
γ-Cadinene	0.06	Sesquiterpene
δ-Cadinene	0.03	Sesquiterpene
Isocaryophyllene epoxide B	0.01	Sesquiterpenic ether
Spathulenol	0.08	Sesquiterpenic alcohol
Caryophyllene oxide	0.07	Sesquiterpenic ether
Globulol	0.03	Sesquiterpenic alcohol
Viridiflorol	0.01	Sesquiterpenic alcohol
Humulene epoxide II	0.01	Sesquiterpenic ether
10-epi-γ-Eudesmol	0.01	Sesquiterpenic alcohol
Caryophylladienol II	0.01	Sesquiterpenic alcohol
Isospathulenol	0.06	Sesquiterpenic alcohol
τ-Cadinol	0.04	Sesquiterpenic alcohol
α-Muurolol	0.02	Sesquiterpenic alcohol
α-Cadinol	0.01	Sesquiterpenic alcohol
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.01	Sesquiterpenic alcohol
Unknown	0.02	Diterpene
Consolidated total	**98.46%**	

*: 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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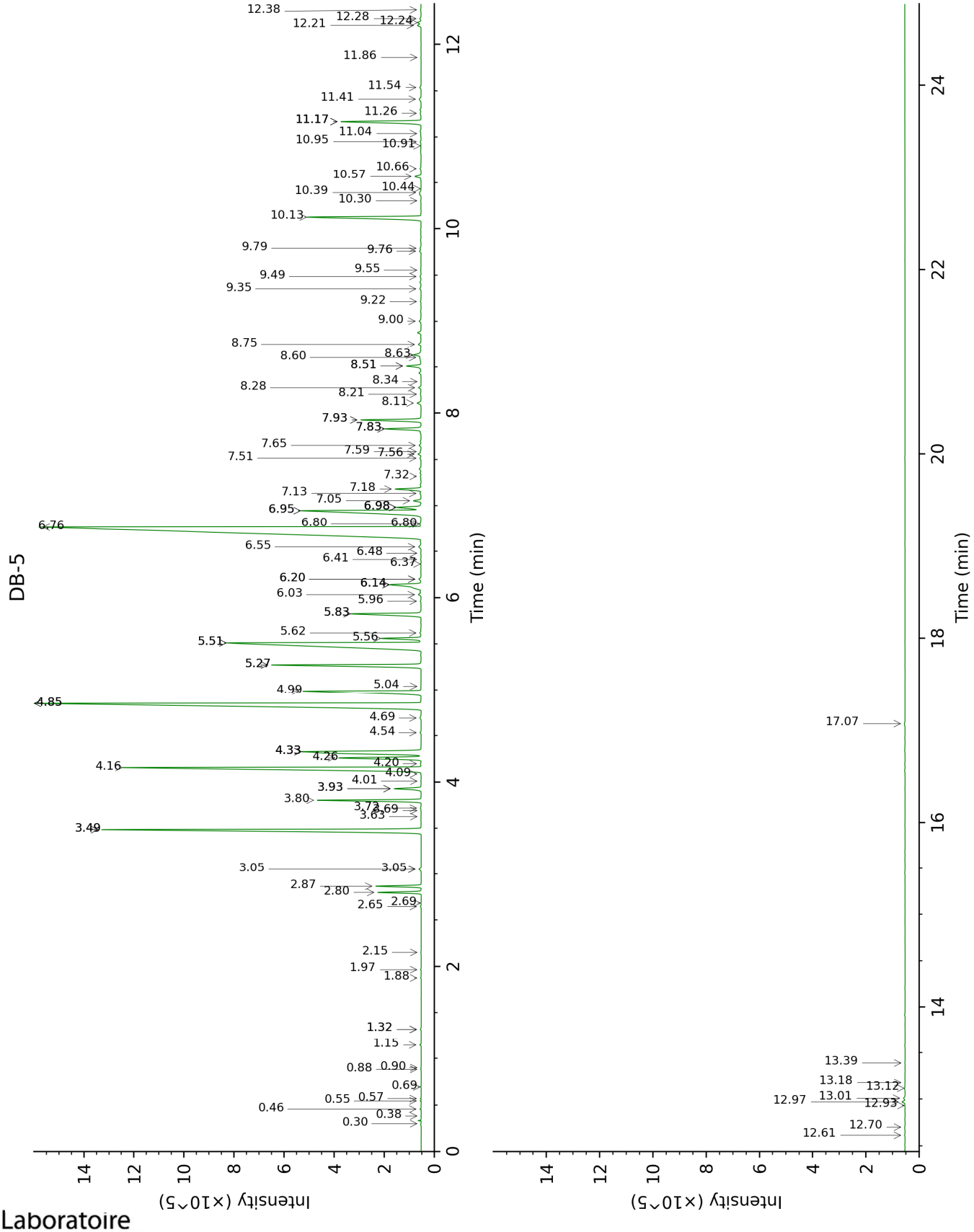
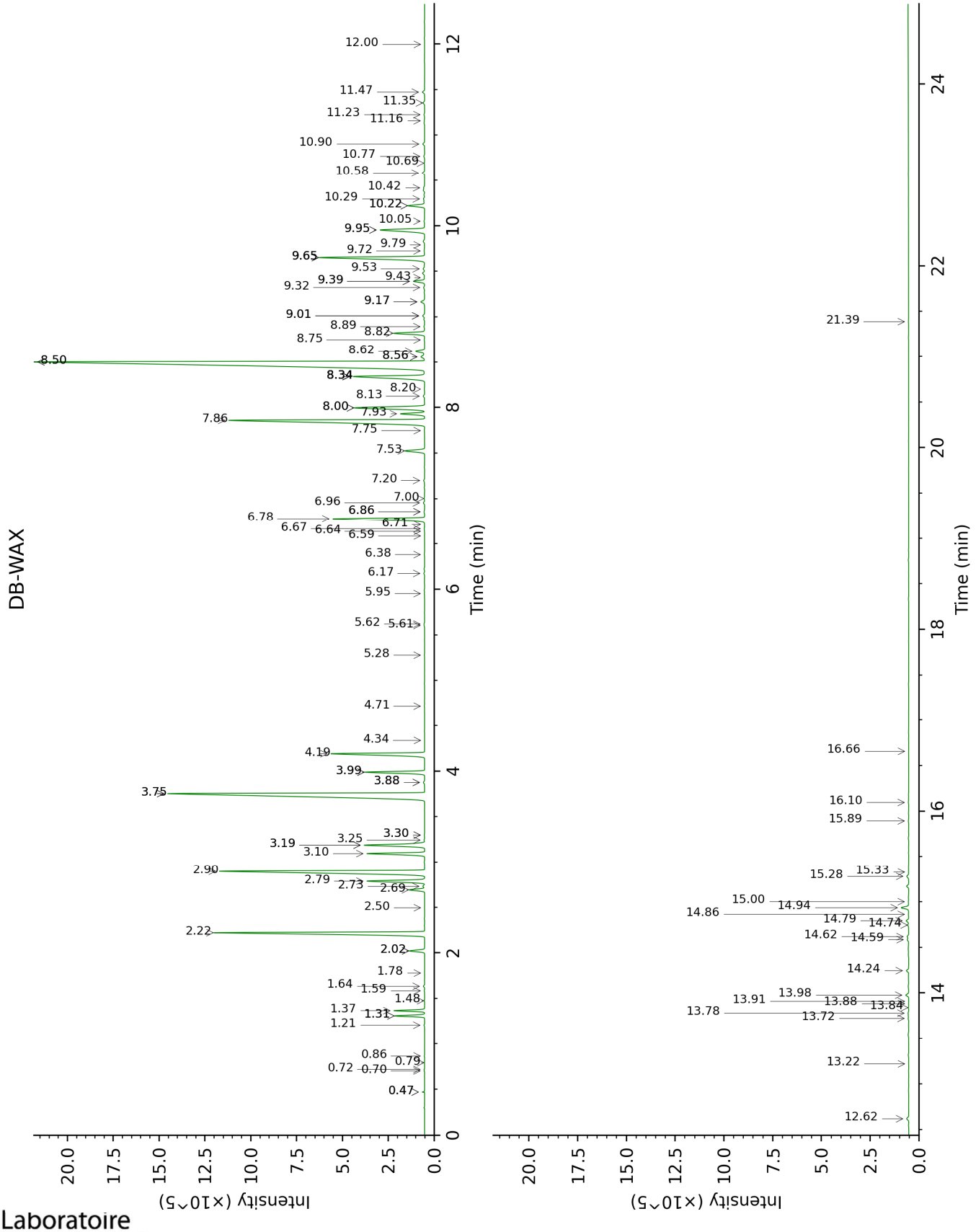

DB-5
Time (min)
Intensity (×10^5)
12.38
12.28
12.24
12.21
11.86
11.54
11.41
11.26
11.17
11.04
10.95
10.91
10.66
10.57
10.44
10.39
10.30
10.13
9.79
9.76
9.55
9.49
9.35
9.22
9.00
8.75
8.63
8.60
8.51
8.34
8.28
8.21
8.11
7.93
7.83
7.65
7.59
7.56
7.51
7.32
7.18
7.13
7.05
6.98
6.95
6.80
6.80
6.76
6.55
6.48
6.41
6.37
6.20
6.14
6.03
5.96
5.83
5.62
5.56
5.51
5.27
5.04
4.99
4.85
4.69
4.54
4.33
4.26
4.20
4.16
4.09
4.01
3.93
3.80
3.72
3.69
3.63
3.49
3.05
3.05
2.87
2.80
2.65
2.69
2.15
1.97
1.88
1.32
1.15
0.88
0.90
0.69
0.55
0.57
0.46
0.38
0.30
17.07
13.39
13.18
13.12
12.97
13.01
12.93
12.70
12.61


DB-WAX
Time (min)
Intensity (×10^5)
12.00
11.47
11.35
11.23
11.16
10.90
10.77
10.69
10.58
10.42
10.29
10.22
10.05
9.95
9.79
9.72
9.65
9.53
9.43
9.39
9.32
9.17
9.01
8.89
8.82
8.75
8.62
8.56
8.50
8.34
8.20
8.13
8.00
7.93
7.86
7.75
7.53
7.20
7.00
6.96
6.86
6.78
6.71
6.67
6.64
6.59
6.38
6.17
5.95
5.62
5.61
5.28
4.71
4.34
4.19
3.99
3.88
3.75
3.30
3.25
3.19
3.10
2.90
2.79
2.73
2.69
2.50
2.22
2.02
1.78
1.64
1.59
1.48
1.37
1.31
1.21
0.86
0.79
0.72
0.70
0.47
21.39
16.66
16.10
15.89
15.33
15.28
15.00
14.94
14.86
14.79
14.74
14.62
14.59
14.24
13.98
13.91
13.88
13.84
13.78
13.72
13.22
12.62

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.30	500	tr	0.79	908	tr
Isobutyral	0.38	539	tr	0.47*	785	0.02
2-Methyl-3-buten-2-ol	0.46	607	0.01	1.48	1013	0.01
Isovaleral	0.54	642	0.01	0.72	888	0.01
2-Methylbutyral	0.57	652	0.01	0.70	882	0.01
2-Ethylfuran	0.70	702	tr	0.86	920	0.01
Isoamyl alcohol	0.88	732	tr	3.30*	1176	0.02
2-Methylbutanol	0.90	735	tr	3.30*	1176	[0.02]
Methyl 2-methylbutyrate	1.15	774	0.02	1.21	977	0.02
Hexanal	1.32*	801	0.01	1.78	1043	tr
Octane	1.32*	801	[0.01]	0.47*	785	[0.02]
(2*E*)-Hexenal	1.88	850	0.01	3.24	1172	0.02
(3*Z*)-Hexenol	1.97	858	0.01	5.62	1347	0.02
Hexanol	2.15	874	0.01	5.28	1322	0.01
Hashishene	2.65	914	0.02	1.31*	994	0.77
Isobutyl isobutyrate	2.69	917	tr	2.02*	1068	0.47
α-Thujene	2.80	925	0.72	1.37	1002	0.72
α-Pinene	2.87	929	0.76	1.31*	994	[0.77]
α-Fenchene	3.05*	942	0.05	1.59	1024	0.01
Camphene	3.05*	942	[0.05]	1.64	1029	0.04
β-Pinene	3.49*	971	7.86	2.02*	1068	[0.47]
Sabinene	3.49*	971	[7.86]	2.22	1088	7.38
3-Methyl-3-cyclohexenone	3.63	981	0.01	5.95	1371	0.01
Octen-3-ol	3.69	985	tr	6.64	1420	0.01
Octan-3-one	3.72	987	0.02	3.88*	1221	0.05
Myrcene	3.80	993	1.89	2.79	1135	1.89
α-Phellandrene	3.93*	1001	0.54	2.69	1128	0.48
Pseudolimonene	3.93*	1001	[0.54]	2.73	1131	0.06
Δ3-Carene	4.01	1006	0.01	2.50	1112	0.01
(3*Z*)-Hexenyl acetate	4.09	1011	0.01	4.71	1284	0.01
α-Terpinene	4.16	1016	8.38	2.90	1144	8.37
meta-Cymene	4.20	1018	0.01	3.99*	1229	1.82
para-Cymene	4.26	1022	1.82	3.99*	1229	[1.82]
β-Phellandrene	4.33*	1026	3.89	3.19*	1167	2.15
1,8-Cineole	4.33*	1026	[3.89]	3.19*	1167	[2.15]
Limonene	4.33*	1026	[3.89]	3.10	1160	1.73
(*Z*)-β-Ocimene	4.54	1039	0.02	3.75*	1212	14.08
(*E*)-β-Ocimene	4.69	1049	0.03	3.88*	1221	[0.05]
Isobutyl angelate	4.85*	1059	14.09	4.34	1256	tr
γ-Terpinene	4.85*	1059	[14.09]	3.75*	1212	[14.08]
cis-Sabinene hydrate	4.99	1068	3.23	6.78	1430	3.21

cis-Linalool oxide (fur.)	5.04	1071	0.01	6.38	1401	0.01
Terpinolene	5.27*	1086	3.29	4.19	1245	3.28
para-Cymenene	5.27*	1086	[3.29]	6.18	1386	0.03
trans-Sabinene hydrate	5.51*	1101	9.20	7.86	1511	9.09
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.51*	1101	[9.20]	5.60	1346	0.01
Linalool	5.56	1104	0.76	7.93	1516	0.74
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.62	1108	0.03	8.34*	1548	3.03
cis-para-Menth-2-en-1-ol	5.83*	1121	1.65	8.00*	1521	2.78
α-Campholenal	5.83*	1121	[1.65]	6.86*	1436	0.03
4-Hydroxy-4-methylcyclohex-2-enone	5.96	1130	0.02	13.88	2027	0.01
trans-Pinocarveol	6.03	1134	0.06	9.01*	1600	0.07
trans-para-Menth-2-en-1-ol	6.14*†	1141	1.01	8.82	1585	1.00
Epoxyterpinolene	6.14*†	1141	[1.01]	6.59	1416	0.01
Camphene hydrate	6.14*†	1141	[1.01]	8.34*	1548	[3.03]
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.20*	1145	0.05	6.71	1426	tr
1,4-Dimethyl-4-acetylcyclohexene	6.20*	1145	[0.05]	7.20	1462	0.03
Pinocarvone	6.36	1156	tr	7.75	1502	0.02
Isomenthone	6.41	1159	0.01	6.86*	1436	[0.03]
Borneol	6.48	1163	0.01	9.65*	1652	3.94
δ-Terpineol	6.55	1168	0.06	9.32	1625	0.04
Terpinen-4-ol	6.76†	1181	25.75	8.50*	1560	25.55
para-Cymen-8-ol	6.80*†	1183	[25.75]	11.35	1795	0.05
Cryptone	6.80*†	1183	[25.75]	9.01*	1600	[0.07]
Myrtenal	6.95*	1193	3.94	8.56*	1565	0.16
α-Terpineol	6.95*	1193	[3.94]	9.65*	1652	[3.94]
Myrtenol	6.98*	1195	0.56	10.69	1738	0.01
Methylchavicol	6.98*	1195	[0.56]	9.17*	1612	0.14
cis-Piperitol	6.98*	1195	[0.56]	9.39*	1631	0.36
trans-Dihydrocarvone	7.06	1200	0.14	8.56*	1565	[0.16]
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.14	1205	0.02	10.77	1745	0.03

trans-Piperitol	7.18	1208	0.52	10.22*	1698	0.54
trans-Carveol	7.32	1217	0.01	11.23	1784	0.02
Nerol	7.52	1230	0.03	10.90	1756	0.06
Citronellol	7.56	1233	0.06	10.58	1729	0.07
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.59	1235	0.02	11.16	1778	0.02
Neral	7.65	1240	0.04	9.39*	1631	[0.36]
Carvenone	7.83*	1252	0.72	9.72	1658	0.02
trans-Sabinene hydrate acetate	7.83*	1252	[0.72]	7.53	1486	0.71
Linalyl acetate	7.93*	1258	1.24	8.00*	1521	[2.78]
Geraniol	7.93*	1258	[1.24]	11.47	1805	0.08
trans-Ascaridole glycol	8.11	1270	0.09	13.98	2036	0.10
Citronellyl formate	8.21	1277	0.02	8.75	1580	0.02
Bornyl acetate	8.28	1281	0.06	8.13	1531	0.05
cis-Ascaridole glycol	8.34	1286	tr	14.62	2098	0.05
Terpinen-4-yl acetate	8.51*	1297	0.31	8.62	1570	0.29
Thymol analogue I (isothymol?)	8.51*	1297	[0.31]	14.86	2123	0.01
Unknown analog	8.60	1303	0.02	13.78	2016	0.02
Thymol	8.63	1305	0.16	14.94	2130	0.26
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.75	1314	0.06	14.79	2116	0.09
Bicycloelemene	9.00	1331	0.05	6.96	1443	0.04
α-Cubebene	9.22	1346	0.01	6.67	1422	0.02
Eugenol	9.35	1356	0.04	14.58	2095	0.06
Neryl acetate	9.49	1365	0.03	10.05	1684	0.02
α-Copaene	9.56	1370	0.01	7.00	1447	0.02
Geranyl acetate	9.76	1385	0.03	10.42	1715	0.04
β-Elemene	9.79	1387	0.03	8.34*	1548	[3.03]
β-Caryophyllene	10.13	1411	2.83	8.34*	1548	[3.03]
β-Copaene	10.30	1424	0.01	8.20	1537	0.01
Aromadendrene	10.39	1431	0.03	8.50*	1560	[25.55]
trans-α-Bergamotene	10.44	1434	tr	8.34*	1548	[3.03]
α-Humulene	10.57	1444	0.13	9.17*	1612	[0.14]
allo-Aromadendrene	10.66	1450	0.03	8.90	1591	0.02
γ-Muurolene	10.91	1469	0.01	9.43	1634	0.01
Germacrene D	10.95	1472	0.02	9.65*	1652	[3.94]
(1S,2S,4S)-para-Menthane-1,2,4-triol	11.04	1478	0.02	21.39	2877	0.01
Bicyclogermacrene	11.17*	1488	1.83	9.95*	1677	1.78
Viridiflorene	11.17*	1488	[1.83]	9.53	1642	0.05

α-Selinene	11.17*	1488	[1.83]	9.79	1663	0.01
α-Muurolene	11.26	1495	0.03	9.95*	1677	[1.78]
γ-Cadinene	11.41	1506	0.06	10.22*	1698	[0.54]
δ-Cadinene	11.54	1516	0.03	10.30	1704	0.04
Isocaryophyllene epoxide B	11.86	1542	0.01	12.00	1852	tr
Spathulenol	12.21	1569	0.08	14.24	2062	0.08
Caryophyllene oxide	12.24	1571	0.07	12.62	1908	0.08
Globulol	12.28	1574	0.03	13.72	2011	0.02
Viridiflorol	12.38	1582	0.01	13.84	2022	0.01
Humulene epoxide II	12.61	1601	0.01	13.22	1964	0.01
10-epi-γ-Eudesmol	12.70	1608	0.01	13.91	2029	tr
Caryophylladienol II	12.93	1627	0.01	15.89	2229	0.02
Isospathulenol	12.97	1630	0.06	15.28	2166	0.07
τ-Cadinol	13.01	1634	0.04	14.74	2111	0.04
α-Muurolol	13.12	1642	0.02	15.00	2137	0.01
α-Cadinol	13.18	1647	0.01	15.33	2170	0.01
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.39	1665	0.01	16.66	2310	0.01
Unknown [m/z 257, 258 (20), 91 (19), 272 (18)]	17.07	1995	0.02	16.10	2250	0.02
Total identified		**98.87%**			**98.54%**	
Total reported		**99.05%**			**98.74%**	

*: 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