Date : March 30, 2021

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 21C16-PTH12
Customer identification : Marjoram Organic - Egypt - MJ0106912R
Type : Essential oil
Source : *Origanum majorana*
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 : Seydou Ka, M. Sc.
Analysis date : March 25, 2021

Checked and approved by :

Sylvain Mercier, M. Sc., chimiste 2014-005

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia. This report is digitally signed, it is only considered valid if the digital signature is intact. The results only describe the samples that were submitted to the assays.

Méthode certifiée ISO 17025:2017 Certified method

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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.

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Analysis summary – Consolidated contents

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

Identification	%	Class
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Methyl 2-methylbutyrate	0.02	Aliphatic ester
Octane	0.01	Alkane
(2*E*)-Hexenal	0.02	Aliphatic aldehyde
(3*Z*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	tr	Aliphatic alcohol
Hashishene	0.02	Monoterpene
Tricyclene	tr	Monoterpene
α-Thujene	0.88	Monoterpene
α-Pinene	0.91	Monoterpene
Camphene	0.05	Monoterpene
α-Fenchene	0.01	Monoterpene
Sabinene	8.55	Monoterpene
β-Pinene	0.56	Monoterpene
3-Methyl-3-cyclohexenone	tr	Aliphatic ketone
3-Methylpentyl acetate	0.01	Aliphatic ester
Octan-3-one	0.02	Aliphatic ketone
Myrcene	2.16	Monoterpene
Pseudolimonene	0.07	Monoterpene
α-Phellandrene	0.55	Monoterpene
Δ3-Carene	0.01	Monoterpene
(3*Z*)-Hexenyl acetate	0.01	Aliphatic ester
α-Terpinene	9.29	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	1.78	Monoterpene
β-Phellandrene	2.42*	Monoterpene
1,8-Cineole	[2.42]*	Monoterpenic ether
Limonene	1.86	Monoterpene
(*Z*)-β-Ocimene	0.02	Monoterpene
(*E*)-β-Ocimene	0.04	Monoterpene
γ-Terpinene	14.82	Monoterpene
cis-Sabinene hydrate	2.95	Monoterpenic alcohol
para-Cymenene	0.03	Monoterpene
Terpinolene	3.35	Monoterpene
Unknown	0.02	Oxygenated monoterpene
trans-Sabinene hydrate	8.54	Monoterpenic alcohol
Linalool	0.67	Monoterpenic alcohol
Unknown	0.02	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	1.57	Monoterpenic alcohol
α-Campholenal	0.03	Monoterpenic aldehyde
trans-Pinocarveol	0.06	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.95	Monoterpenic alcohol
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	0.03	Monoterpenic alcohol
Terpinen-4-ol	23.90	Monoterpenic alcohol
Cryptone	0.01	Normonoterpenic ketone
para-Cymen-8-ol	0.05	Monoterpenic alcohol
α-Terpineol	3.61	Monoterpenic alcohol
Myrtenol	0.01	Monoterpenic alcohol
cis-Piperitol	0.34	Monoterpenic alcohol
cis-Dihydrocarvone	0.19	Monoterpenic ketone
Methylchavicol	0.01	Phenylpropanoid
trans-Dihydrocarvone	0.14	Monoterpenic ketone
Unknown	0.02	Unknown
trans-Piperitol	0.49	Monoterpenic alcohol
trans-Carveol	0.05	Monoterpenic alcohol
Nerol	0.03	Monoterpenic alcohol
Citronellol	0.06	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Carvone	0.05	Monoterpenic ketone
Neral	0.02	Monoterpenic aldehyde
Carvenone	0.04	Monoterpenic ketone
trans-Sabinene hydrate acetate	0.73	Monoterpenic ester
Geraniol	0.07	Monoterpenic alcohol
Linalyl acetate	1.09	Monoterpenic ester
trans-Ascaridole glycol	0.01	Monoterpenic alcohol
Citronellyl formate	0.01	Monoterpenic ester
Unknown	tr	Oxygenated monoterpene
Bornyl acetate	0.05	Monoterpenic ester
cis-Ascaridole glycol	0.01	Monoterpenic alcohol
Terpinen-4-yl acetate	0.32	Monoterpenic ester
Thymol	0.06	Monoterpenic alcohol
Unknown	0.01	Monoterpenic alcohol
Unknown	0.05	Monoterpenic alcohol
Bicycloelemene	0.04	Sesquiterpene
α-Cubebene	0.03	Sesquiterpene
Eugenol	0.05	Phenylpropanoid
Neryl acetate	0.02	Monoterpenic ester
Geranyl acetate	0.04	Monoterpenic ester
β-Elemene	0.02	Sesquiterpene
β-Caryophyllene	2.66	Sesquiterpene
β-Copaene	0.01	Sesquiterpene
Aromadendrene	0.03	Sesquiterpene
trans-α-Bergamotene	0.03	Sesquiterpene
α-Humulene	0.12	Sesquiterpene
allo-Aromadendrene	0.03	Sesquiterpene
(*E*)-β-Farnesene	0.01	Sesquiterpene
trans-Cadina-1(6),4-diene	0.03	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
Germacrene D	0.02	Sesquiterpene
Viridiflorene	0.10	Sesquiterpene
Bicyclogermacrene	1.69	Sesquiterpene

α-Muurolene	0.02	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
(3*E*,6*E*)-α-Farnesene	0.04	Sesquiterpene
δ-Cadinene	0.03	Sesquiterpene
Isocaryophyllene epoxide B	tr	Sesquiterpenic ether
Spathulenol	0.07	Sesquiterpenic alcohol
Caryophyllene oxide	0.05	Sesquiterpenic ether
Caryophyllene oxide isomer	tr	Sesquiterpenic ether
Viridiflorol	0.01	Sesquiterpenic alcohol
Humulene epoxide II	0.01	Sesquiterpenic ether
10-epi-γ-Eudesmol	tr	Sesquiterpenic alcohol
Isospathulenol	0.04	Sesquiterpenic alcohol
τ-Cadinol	0.02	Sesquiterpenic alcohol
Unknown	0.01	Diterpene
Consolidated total	**99.16%**	

*: 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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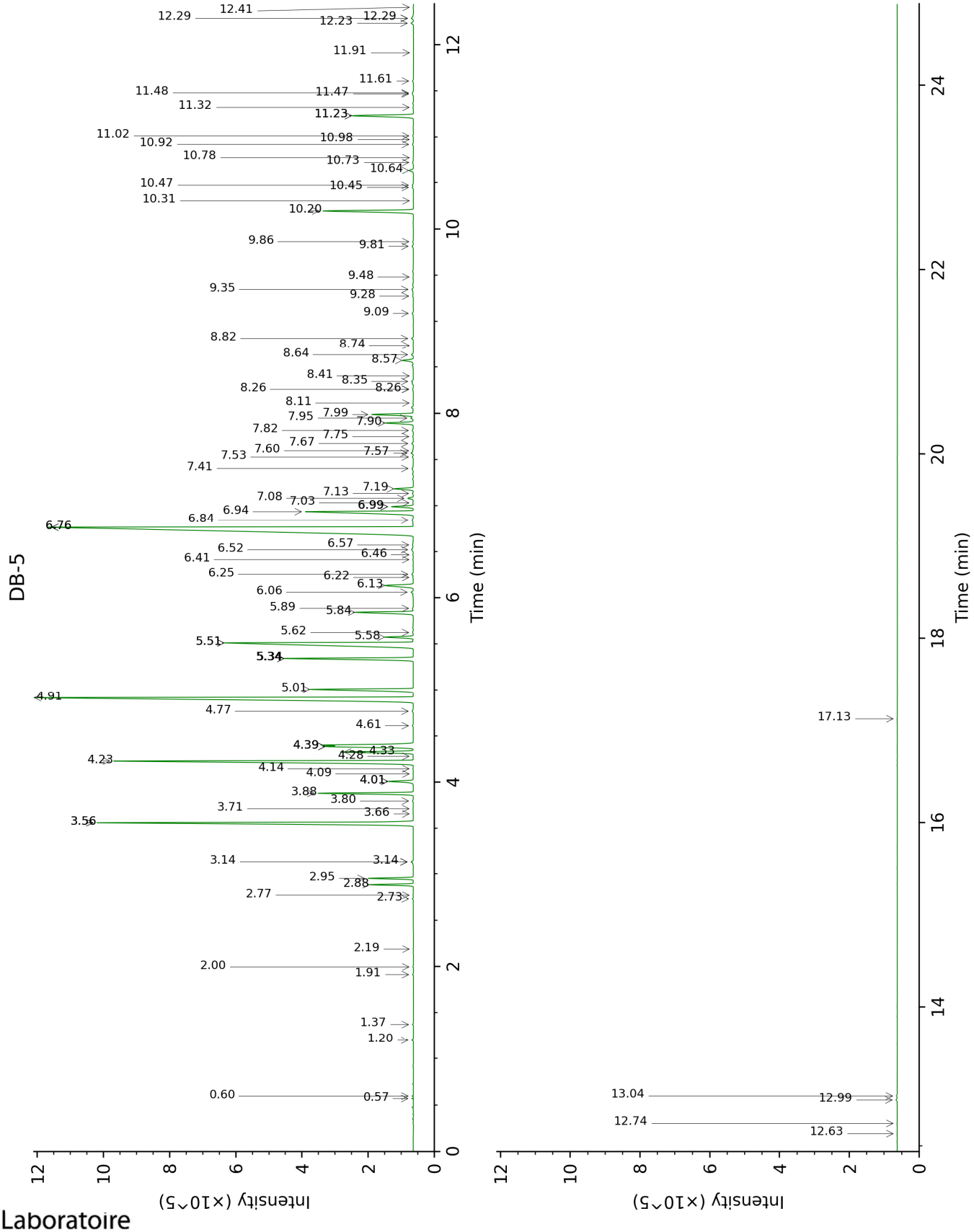
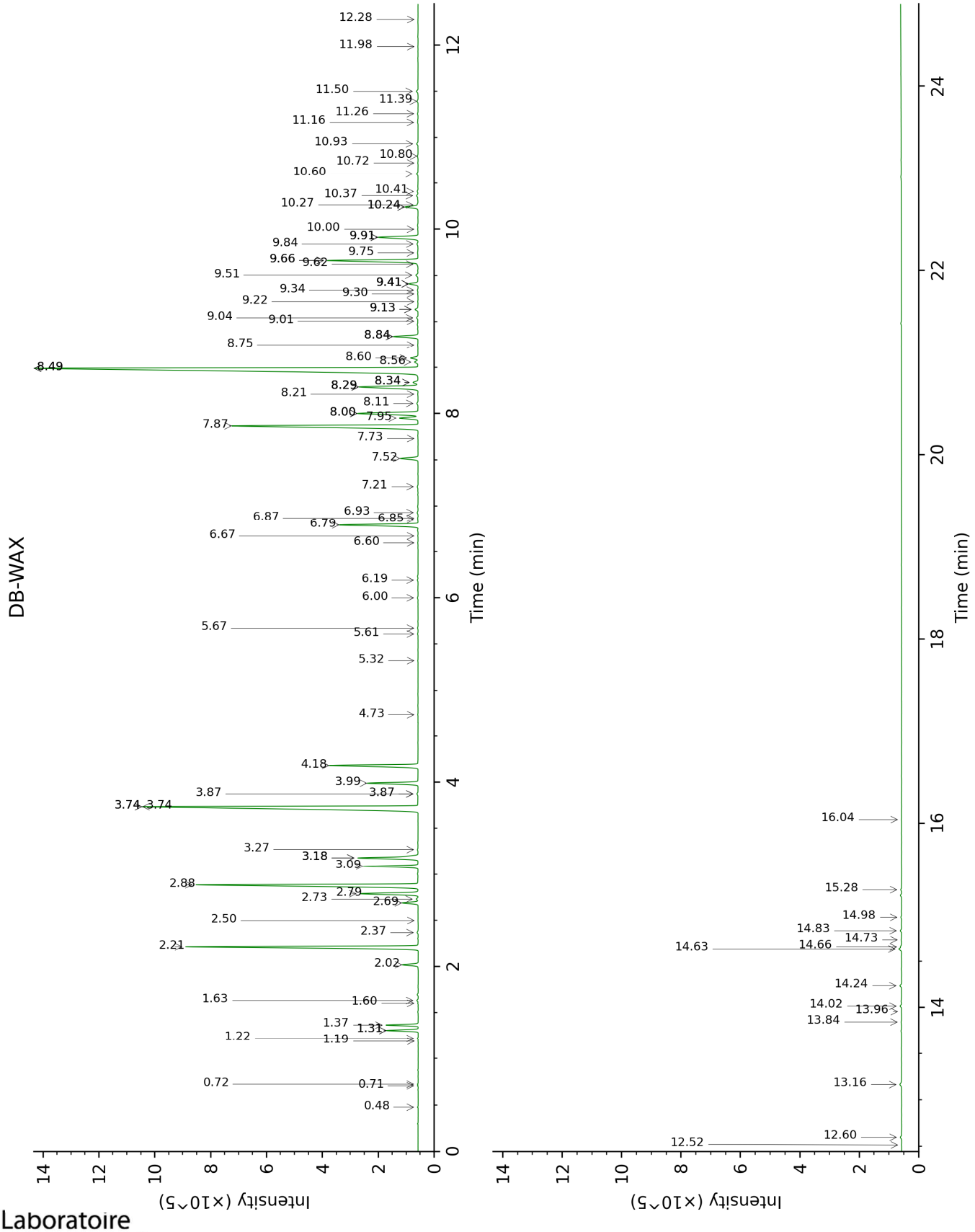

DB-5
Time (min)
Intensity (×10^5)
12.41
12.29
12.23
12.29
11.91
11.61
11.48
11.47
11.32
11.23
11.02
10.92
10.98
10.78
10.73
10.64
10.47
10.45
10.31
10.20
9.86
9.81
9.48
9.35
9.28
9.09
8.82
8.74
8.64
8.57
8.41
8.35
8.26
8.26
8.11
7.95
7.99
7.90
7.82
7.75
7.67
7.60
7.57
7.53
7.41
7.08
7.13
7.19
7.03
6.99
6.94
6.84
6.76
6.52
6.57
6.46
6.41
6.25
6.22
6.13
6.06
5.89
5.84
5.62
5.58
5.51
5.34
5.01
4.91
4.77
4.61
4.39
4.28
4.33
4.23
4.14
4.09
4.01
3.88
3.80
3.71
3.66
3.56
3.14
3.14
2.95
2.88
2.77
2.73
2.19
2.00
1.91
1.37
1.20
0.60
0.57
17.13
13.04
12.99
12.74
12.63


DB-WAX
Time (min)
Intensity (×10^5)
12.28
11.98
11.50
11.39
11.26
11.16
10.93
10.80
10.72
10.60
10.41
10.37
10.27
10.24
10.00
9.91
9.84
9.75
9.66
9.62
9.51
9.41
9.34
9.30
9.22
9.13
9.04
9.01
8.84
8.75
8.60
8.56
8.49
8.34
8.29
8.21
8.11
8.00
7.95
7.87
7.73
7.52
7.21
6.93
6.87
6.85
6.79
6.67
6.60
6.19
6.00
5.67
5.61
5.32
4.73
4.18
3.99
3.87
3.87
3.74
3.74
3.27
3.18
3.09
2.88
2.79
2.73
2.69
2.50
2.37
2.21
2.02
1.63
1.60
1.37
1.31
1.22
1.19
0.72
0.71
0.48
16.04
15.28
14.98
14.83
14.73
14.66
14.63
14.24
14.02
13.96
13.84
13.16
12.60
12.52

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.57	641	0.01	0.72	886	0.01
2-Methylbutyral	0.60	651	0.01	0.71	880	0.01
Methyl 2-methylbutyrate	1.20	774	0.02	1.22	977	0.02
Octane	1.37	800	0.01	0.48	786	0.01
(2*E*)-Hexenal	1.91	849	0.02	3.27	1173	0.02
(3*Z*)-Hexenol	2.00	856	0.01	5.67	1349	0.02
Hexanol	2.19	873	tr	5.32	1324	0.01
Hashishene	2.73	916	0.02	1.31*	992	0.92
Tricyclene	2.77	919	tr	1.19	972	tr
α-Thujene	2.88	927	0.88	1.37	1001	0.88
α-Pinene	2.95	931	0.91	1.31*	992	[0.92]
Camphene	3.14*†	944	0.06	1.63	1028	0.05
α-Fenchene	3.14*†	944	[0.06]	1.60	1025	0.01
Sabinene	3.56*	972	9.11	2.21	1087	8.55
β-Pinene	3.56*	972	[9.11]	2.02	1067	0.56
3-Methyl-3-cyclohexenone	3.66	979	tr	6.00	1373	0.03
3-Methylpentyl acetate	3.71	982	0.01	3.74*	1209	14.77
Octan-3-one	3.80	988	0.02	3.87*	1219	0.05
Myrcene	3.88	994	2.16	2.79	1135	2.13
Pseudolimonene	4.01*	1002	0.61	2.73	1130	0.07
α-Phellandrene	4.01*	1002	[0.61]	2.69	1127	0.55
Δ3-Carene	4.09	1008	0.01	2.50	1112	0.01
(3*Z*)-Hexenyl acetate	4.14	1011	0.01	4.73	1281	0.01
α-Terpinene	4.23	1016	9.29	2.88	1143	9.25
Carvomenthene	4.28	1020	0.01	2.37	1102	0.04
para-Cymene	4.33	1023	1.78	3.99	1227	1.80
β-Phellandrene	4.39*†	1026	4.28	3.18*	1166	2.41
1,8-Cineole	4.39*†	1026	[4.28]	3.18*	1166	[2.41]
Limonene	4.39*†	1026	[4.28]	3.09	1159	1.86
(*Z*)-β-Ocimene	4.61	1041	0.02	3.74*	1209	[14.77]
(*E*)-β-Ocimene	4.77	1051	0.04	3.87*	1219	[0.05]
γ-Terpinene	4.91	1060	14.82	3.74*	1209	[14.77]
cis-Sabinene hydrate	5.01	1066	2.95	6.79	1431	2.92
para-Cymenene	5.34*	1087	3.39	6.19	1387	0.03
Terpinolene	5.34*	1087	[3.39]	4.18	1241	3.35
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.51*	1098	8.63	5.61	1345	0.02
trans-Sabinene hydrate	5.51*	1098	[8.63]	7.87	1512	8.54
Linalool	5.58	1102	0.67	7.95	1519	0.68
Unknown [m/z 119, 109 (94), 43	5.62	1105	0.02	8.34*	1549	0.21

(61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]						
cis-para-Menth-2-en-1-ol	5.84	1119	1.57	8.00*	1523	2.60
α-Campholenal	5.89	1122	0.03	6.87	1437	0.02
trans-Pinocarveol	6.06	1133	0.06	9.04	1604	0.06
trans-para-Menth-2-en-1-ol	6.13	1138	0.95	8.84*	1588	0.94
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.22	1143	0.01	6.67	1422	0.01
1,4-Dimethyl-4-acetylcyclohexene	6.25	1146	0.04	7.21	1463	0.03
Pinocarvone	6.41	1156	0.01	7.73	1502	0.01
Isomenthone	6.46	1159	0.01	6.85	1436	0.01
Borneol	6.52	1163	0.06	9.66*	1655	3.65
δ-Terpineol	6.57	1166	0.03	9.34	1629	0.02
Terpinen-4-ol	6.76*	1178	24.00	8.49*	1561	23.93
Cryptone	6.76*	1178	[24.00]	9.01	1602	0.01
para-Cymen-8-ol	6.84	1183	0.05	11.39	1801	0.04
α-Terpineol	6.94	1189	3.61	9.66*	1655	[3.65]
Myrtenol	6.99*	1193	0.52	10.72	1744	0.01
cis-Piperitol	6.99*	1193	[0.52]	9.41*	1634	0.35
cis-Dihydrocarvone	6.99*	1193	[0.52]	8.34*	1549	[0.21]
Methylchavicol	7.03	1196	0.01	9.22	1619	0.01
trans-Dihydrocarvone	7.08	1199	0.14	8.56	1566	0.15
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.14	1202	0.02	10.80	1750	0.03
trans-Piperitol	7.19	1205	0.49	10.24*	1702	0.52
trans-Carveol	7.40	1220	0.05	11.26	1789	0.02
Nerol	7.53	1228	0.03	10.93	1761	0.06
Citronellol	7.57	1231	0.06	10.60	1733	0.07
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.60	1233	0.02	11.16	1781	0.02
Carvone	7.68	1238	0.05	9.84	1670	0.05
Neral	7.75	1243	0.02	9.30	1626	0.01
Carvenone	7.82	1248	0.04	9.75	1662	0.03
trans-Sabinene hydrate acetate	7.90	1253	0.73	7.52	1486	0.69
Geraniol	7.95	1257	0.07	11.50	1810	0.07
Linalyl acetate	7.99	1259	1.09	8.00*	1523	[2.60]
trans-Ascaridole glycol	8.11	1268	0.01	14.02	2042	0.06

Citronellyl formate	8.26*	1278	0.03	8.75	1581	0.01
Unknown [m/z 95, 67 (45), 41 (42), 110 (42), 43 (41), 59 (36)]	8.26*	1278	[0.03]	12.28	1879	tr
Bornyl acetate	8.35	1283	0.05	8.11	1531	0.05
cis-Ascaridole glycol	8.41	1287	0.01	14.63	2102	0.12
Terpinen-4-yl acetate	8.57	1299	0.32	8.60	1570	0.29
Thymol	8.64	1303	0.06	14.98	2136	0.03
Unknown analog	8.74	1310	0.01			
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.82	1316	0.05	14.83	2122	0.05
Bicycloelemene	9.09	1335	0.04	6.93	1442	0.04
α-Cubebene	9.28	1348	0.03	6.60	1417	0.01
Eugenol	9.35	1353	0.05	14.66	2104	0.03
Neryl acetate	9.48	1363	0.02	10.00	1683	0.01
Geranyl acetate	9.81	1386	0.04	10.41	1717	0.03
β-Elemene	9.86	1390	0.02	8.29*	1545	2.67
β-Caryophyllene	10.20	1414	2.66	8.29*	1545	[2.67]
β-Copaene	10.31	1422	0.01	8.21	1539	0.01
Aromadendrene	10.45	1433	0.03	8.49*	1561	[23.93]
trans-α-Bergamotene	10.47	1434	0.03	8.29*	1545	[2.67]
α-Humulene	10.64	1447	0.12	9.14*	1612	0.13
allo-Aromadendrene	10.73	1454	0.03	8.84*	1588	[0.94]
(*E*)-β-Farnesene	10.78	1457	0.01	9.41*	1634	[0.35]
trans-Cadina-1(6),4-diene	10.92	1468	0.03	9.14*	1612	[0.13]
γ-Muurolene	10.98	1472	0.01	9.41*	1634	[0.35]
Germacrene D	11.02	1475	0.02	9.62	1652	0.03
Viridiflorene	11.23*	1491	1.78	9.50	1642	0.10
Bicyclogermacrene	11.23*	1491	[1.78]	9.92*	1676	1.75
α-Muurolene	11.32	1498	0.02	9.92*	1676	[1.75]
γ-Cadinene	11.47	1509	0.02	10.24*	1702	[0.52]
(3*E*,6*E*)-α-Farnesene	11.48	1510	0.04	10.36	1713	0.06
δ-Cadinene	11.61	1520	0.03	10.26	1704	0.02
Isocaryophyllene epoxide B	11.91	1544	tr	11.98	1853	tr
Spathulenol	12.23	1569	0.07	14.24	2063	0.08
Caryophyllene oxide	12.28*	1573	0.09	12.60	1908	0.05
Caryophyllene oxide isomer	12.28*	1573	[0.09]	12.52	1901	tr
Viridiflorol	12.41	1583	0.01	13.84	2025	0.03
Humulene epoxide II	12.63	1601	0.01	13.16	1961	0.11

10-epi-γ-Eudesmol	12.74	1610	tr	13.96	2036	0.01
Isospathulenol	13.00	1631	0.04	15.28	2166	0.04
τ-Cadinol	13.04	1634	0.02	14.73	2112	0.02
Unknown [m/z 257, 258 (20), 91 (19), 272 (18)]	17.13	1999	0.01	16.04	2245	0.01
Total identified		**99.23%**			**98.95%**	
Total reported		**99.38%**			**99.09%**	

*: 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