Date : September 07, 2022

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 22H30-PTH02
Customer identification : Peppermint ORGANIC - India - P40112R
Type : Essential oil
Source : *Mentha x piperita*
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 : Pamela Lavoie, M.Sc., Chimiste
Analysis date : September 01, 2022

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4605 ± 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	0.02	Aliphatic aldehyde
2-Methylbutyral	0.02	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Isoamyl alcohol	0.03	Aliphatic alcohol
2-Methylbutanol	0.02	Aliphatic alcohol
Ethyl 2-methylbutyrate	0.01	Aliphatic ester
(3*Z*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.03	Furan
α-Thujene	0.05	Monoterpene
α-Pinene	0.80	Monoterpene
3-Methylcyclohexanone	0.03	Aliphatic ketone
Camphene	0.02	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
Benzaldehyde	0.01	Simple phenolic
Sabinene	0.51	Monoterpene
β-Pinene	1.20	Monoterpene
Octen-3-ol	0.08	Aliphatic alcohol
Octan-3-one	0.03	Aliphatic ketone
Myrcene	0.27	Monoterpene
Octan-3-ol	0.17	Aliphatic alcohol
Pseudolimonene	0.02	Monoterpene
α-Phellandrene	0.03	Monoterpene
α-Terpinene	0.29	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	0.21	Monoterpene
Limonene	2.01	Monoterpene
1,8-Cineole	5.47	Monoterpenic ether
2-Ethylhexanol	0.01	Aliphatic alcohol
(*Z*)-β-Ocimene	0.25	Monoterpene
(*E*)-β-Ocimene	0.07	Monoterpene
γ-Terpinene	0.50	Monoterpene
cis-Sabinene hydrate	0.37	Monoterpenic alcohol
para-Mentha-3,8-diene	0.01	Monoterpene
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Octanol	0.02	Aliphatic alcohol
para-Cymenene	0.01	Monoterpene
Terpinolene	0.16	Monoterpene
trans-Sabinene hydrate	0.05	Monoterpenic alcohol
Nonan-3-ol	0.01	Aliphatic alcohol
Linalool	0.23	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.06	Aliphatic ester
Isoamyl isovalerate	0.01	Aliphatic ester
Amyl isovalerate	0.04	Aliphatic ester
endo-Fenchol	0.01	Monoterpenic alcohol

Octen-3-yl acetate	0.02	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.07	Monoterpenic alcohol
Octan-3-yl acetate	0.02	Aliphatic ester
allo-Ocimene	0.01	Monoterpene
trans-Sabinol	0.03	Monoterpenic alcohol
neo-Isopulegol	0.06	Monoterpenic alcohol
Isopulegol	0.14	Monoterpenic alcohol
Menthone	23.43	Monoterpenic ketone
Isomenthone	4.04	Monoterpenic ketone
Menthofuran	2.83	Monoterpenic ether
neo-Menthol	3.85	Monoterpenic alcohol
δ-Terpineol	0.17	Monoterpenic alcohol
Lavandulol	0.05	Monoterpenic alcohol
Terpinen-4-ol	1.09	Monoterpenic alcohol
Menthol	34.52	Monoterpenic alcohol
Isomenthol	0.53	Monoterpenic alcohol
para-Cymen-8-ol	0.03	Monoterpenic alcohol
α-Terpineol	0.25	Monoterpenic alcohol
neoiso-Menthol	0.16	Monoterpenic alcohol
Methylchavicol	0.03	Phenylpropanoid
Myrtenol	0.02	Monoterpenic alcohol
trans-Isopiperitenol	0.01	Monoterpenic alcohol
Unknown	0.02	Unknown
trans-Piperitol	0.03	Monoterpenic alcohol
trans-Carveol	0.01	Monoterpenic alcohol
cis-Carveol	0.01	Monoterpenic alcohol
(3*Z*)-Hexenyl 2-methylbutyrate	0.02	Aliphatic ester
Citronellol	0.03	Monoterpenic alcohol
Pulegone	1.12	Monoterpenic ketone
Carvone	0.16	Monoterpenic ketone
Unknown	0.02	Unknown
Piperitone	0.49	Monoterpenic ketone
Isopiperitenone	0.01	Monoterpenic ketone
neo-Menthyl acetate	0.45	Monoterpenic ester
Decanol	0.01	Aliphatic alcohol
2-Ethylmenthone?	0.05	Aliphatic ketone
Dihydroedulan I	0.07	Terpenic ether
Menthyl acetate	5.90	Monoterpenic ester
Dihydroedulan II	0.08	Terpenic ether
Thymol	0.04	Monoterpenic alcohol
Isomenthyl acetate	0.28	Monoterpenic alcohol
Unknown	0.02	Unknown
Bicycloelemene	0.02	Sesquiterpene
trans-Carvyl acetate	0.01	Monoterpenic ester
Piperitenone	0.01	Monoterpenic ketone
Menthofurolactone isomer II	0.02	Monoterpenic lactone
Evodone	0.03	Monoterpenic ketone
Eugenol	0.02	Phenylpropanoid
α-Copaene	0.03	Sesquiterpene
β-Bourbonene	0.20	Sesquiterpene
1,5-diepi-β-Bourbonene	0.01	Sesquiterpene
β-Cubebene	0.03	Sesquiterpene

β-Elemene	0.09	Sesquiterpene
Unknown	0.06	Unknown
Isocaryophyllene	0.04	Sesquiterpene
β-Ylangene	0.08	Sesquiterpene
β-Caryophyllene	2.27	Sesquiterpene
β-Copaene	0.05	Sesquiterpene
trans-α-Bergamotene	0.02	Sesquiterpene
Isogermacrene D	0.02	Sesquiterpene
α-Humulene	0.10	Sesquiterpene
Muurola-4,11-diene	0.01	Sesquiterpene
9-epi-β-Caryophyllene	0.05	Sesquiterpene
(*E*)-β-Farnesene	0.34	Sesquiterpene
γ-Muurolene	0.03	Sesquiterpene
Germacrene D	1.51	Sesquiterpene
Menthalactone	0.03	Monoterpenic lactone
Bicyclogermacrene	0.15	Sesquiterpene
Viridiflorene	0.01	Sesquiterpene
α-Muurolene	0.02	Sesquiterpene
ε-Amorphene	0.03	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
δ-Cadinene	0.05	Sesquiterpene
trans-Calamenene	0.02	Sesquiterpene
Isocaryophyllene epoxide B	0.01	Sesquiterpenic ether
Spathulenol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Caryophyllene oxide	0.05	Sesquiterpenic ether
Viridiflorol	0.14	Sesquiterpenic alcohol
Isospathulenol	0.01	Sesquiterpenic alcohol
τ-Muurolol	0.02	Sesquiterpenic alcohol
α-Cadinol	0.01	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
Mint sulfide?	0.01	Sesquiterpenic sulfide
Consolidated total	**99.07%**	

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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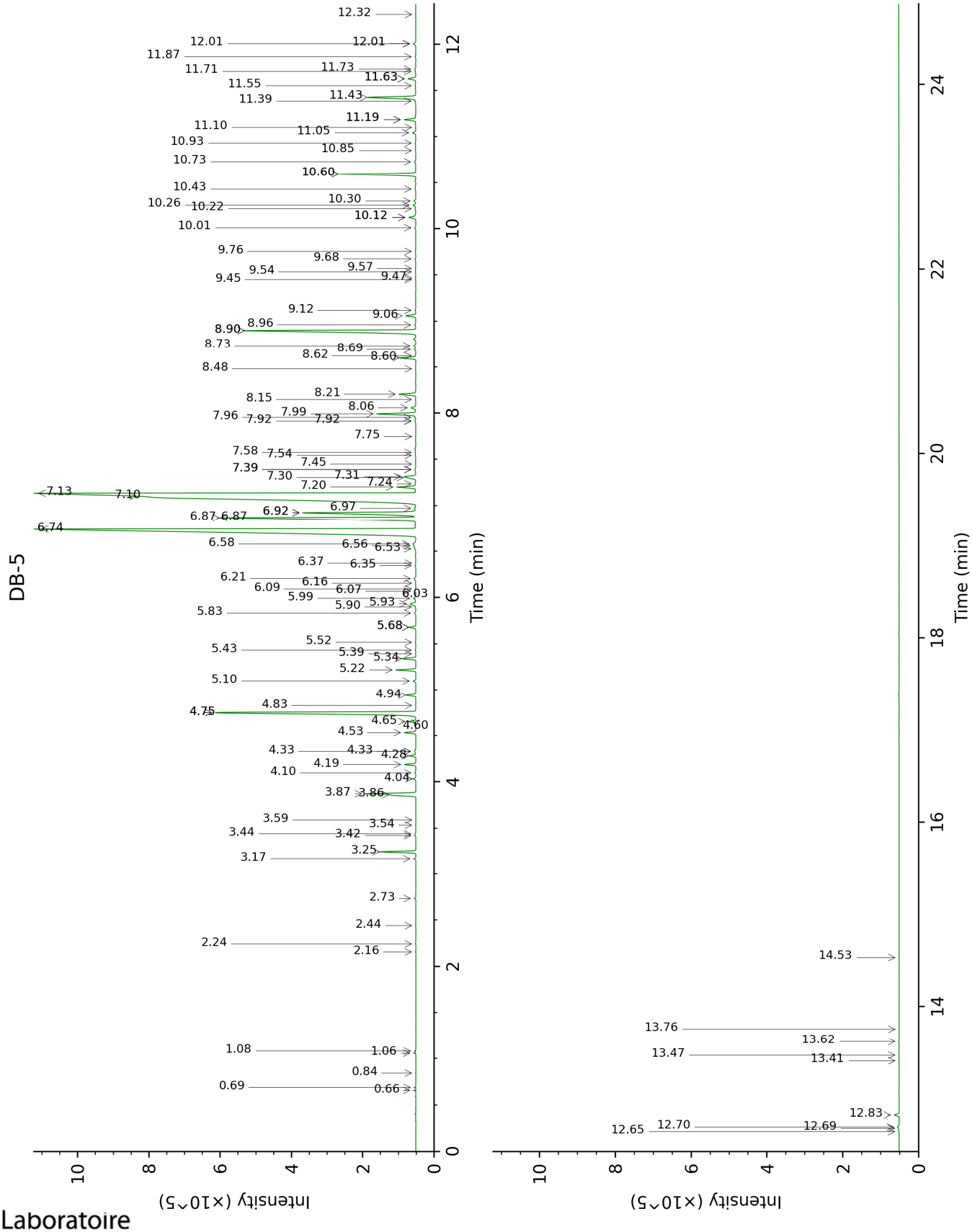
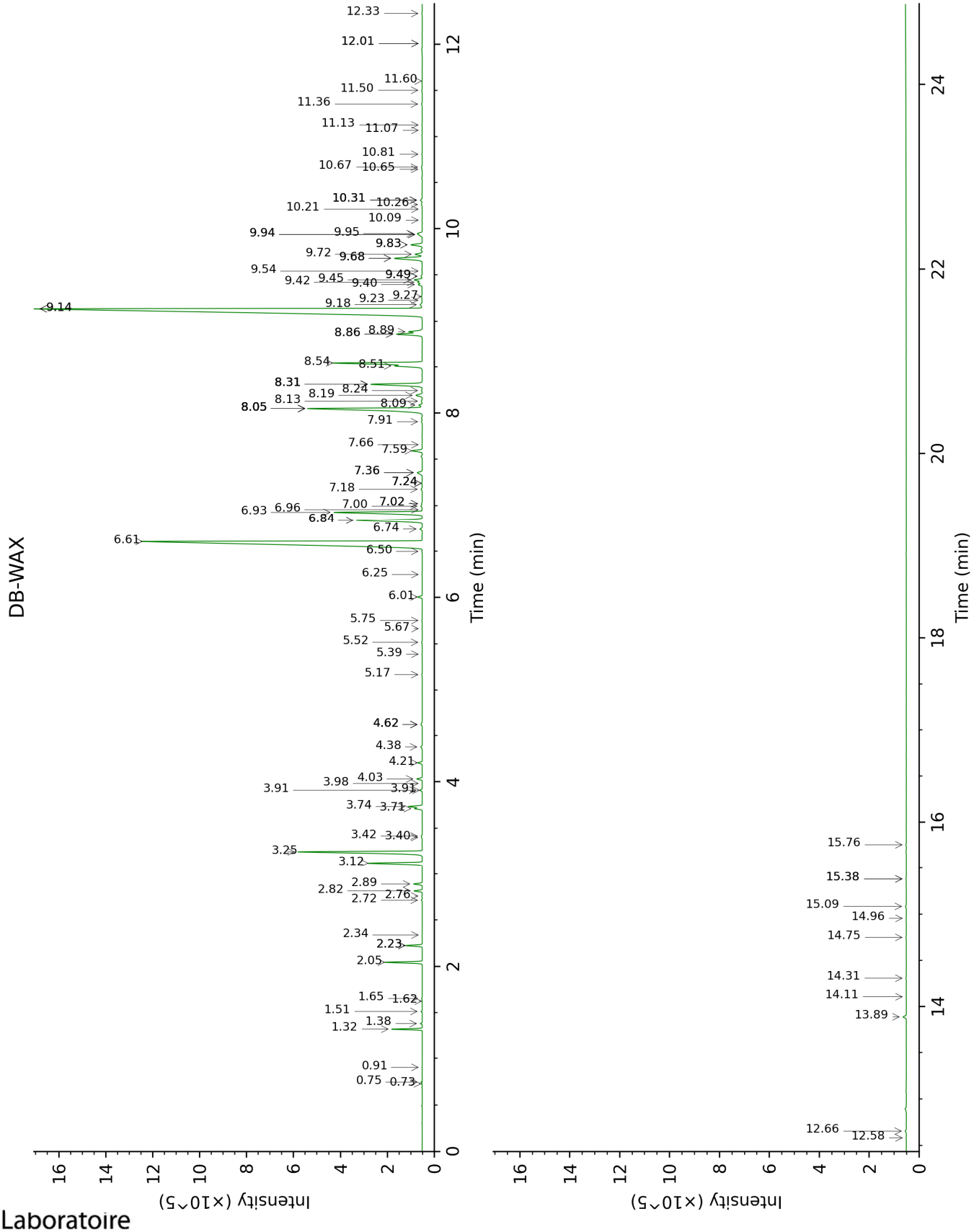

DB-5
Time (min)
Intensity (×10^5)
12.32
12.01
11.87
11.71
11.55
11.39
11.10
10.93
10.73
10.43
10.26
10.01
9.76
9.54
9.45
9.12
8.90
8.73
8.48
8.15
7.96
7.75
7.58
7.39
7.13
6.87
6.74
6.58
6.37
6.21
6.09
5.99
5.83
5.68
5.52
5.43
5.22
5.10
4.94
4.83
4.75
4.65
4.60
4.53
4.33
4.28
4.19
4.10
4.04
3.87
3.59
3.54
3.44
3.42
3.25
3.17
2.73
2.44
2.24
2.16
1.08
1.06
0.84
0.69
0.66
11.73
11.63
11.43
11.19
11.05
10.85
10.60
10.30
10.22
10.12
9.68
9.57
9.47
9.06
8.96
8.69
8.62
8.60
8.21
8.06
7.99
7.92
7.92
7.54
7.45
7.31
7.30
7.24
7.20
7.10
6.97
6.92
6.87
6.56
6.53
6.35
6.16
6.07
6.03
5.93
5.90
5.39
5.34
14.53
13.76
13.62
13.47
13.41
12.83
12.70
12.69
12.65


DB-WAX
Time (min)
Intensity (×10^5)
12.33
12.01
11.60
11.50
11.36
11.13
11.07
10.81
10.67
10.65
10.31
10.26
10.21
10.09
9.94
9.95
9.83
9.72
9.68
9.54
9.49
9.42
9.45
9.40
9.27
9.23
9.18
9.14
8.89
8.86
8.54
8.51
8.31
8.24
8.19
8.13
8.09
8.05
7.91
7.66
7.59
7.36
7.24
7.18
7.02
7.00
6.96
6.93
6.84
6.74
6.61
6.50
6.25
6.01
5.75
5.67
5.52
5.39
5.17
4.62
4.38
4.21
4.03
3.98
3.91
3.91
3.74
3.71
3.42
3.40
3.25
3.12
2.89
2.82
2.76
2.72
2.34
2.23
2.05
1.65
1.62
1.51
1.38
1.32
0.91
0.75
0.73
15.76
15.38
15.09
14.96
14.75
14.31
14.11
13.89
12.66
12.58

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.66	642	0.02	0.75	889	0.02
2-Methylbutyral	0.69	652	0.02	0.73	881	0.02
2-Ethylfuran	0.84	700	tr	0.90	919	tr
Isoamyl alcohol	1.06	730	0.03	3.42	1180	0.03
2-Methylbutanol	1.08	733	0.02	3.40	1179	0.02
Ethyl 2-methylbutyrate	2.16	848	0.01	1.62	1023	0.01
(3*Z*)-Hexenol	2.24	856	0.01	5.66	1345	0.01
Hexanol	2.44	872	0.01	5.39	1325	0.01
trans-2,5-Diethyltetrahydrofuran	2.74	896	0.03	1.51	1012	0.03
α-Thujene	3.17	926	0.05	1.38	998	0.05
α-Pinene	3.25	931	0.80	1.32	991	0.80
3-Methylcyclohexanone	3.42	942	0.03	4.62*	1269	0.07
Camphene	3.44	943	0.02	1.65	1026	0.02
Thuja-2,4(10)-diene	3.54	950	0.01	2.23*	1084	0.53
Benzaldehyde	3.59	953	0.01	7.24*	1461	0.04
Sabinene	3.86†	971	1.71	2.23*	1084	[0.53]
β-Pinene	3.87†	972	[1.71]	2.05	1066	1.20
Octen-3-ol	4.04	983	0.08	6.74	1424	0.09
Octan-3-one	4.10	987	0.03	3.91*	1218	0.09
Myrcene	4.19	993	0.27	2.82	1133	0.27
Octan-3-ol	4.28	999	0.17	6.01	1370	0.17
Pseudolimonene	4.33*	1002	0.06	2.76	1128	0.02
α-Phellandrene	4.33*	1002	[0.06]	2.72	1125	0.03
α-Terpinene	4.53	1015	0.29	2.89	1139	0.29
Carvomenthene	4.60	1019	0.01	2.34	1095	0.01
para-Cymene	4.65	1022	0.21	4.03	1226	0.20
Limonene	4.75*	1028	7.47	3.12	1157	2.01
1,8-Cineole	4.75*	1028	[7.47]	3.25	1167	5.47
2-Ethylhexanol	4.83	1033	0.01	7.18	1456	0.05
(*Z*)-β-Ocimene	4.94	1040	0.25	3.71†	1203	0.76
(*E*)-β-Ocimene	5.10	1050	0.07	3.91*	1218	[0.09]
γ-Terpinene	5.22	1058	0.50	3.74†	1205	[0.76]
cis-Sabinene hydrate	5.34	1065	0.37	6.84*	1431	3.22
para-Mentha-3,8-diene	5.39	1069	0.01	3.98	1223	0.01
cis-Linalool oxide (fur.)	5.43	1071	0.02	6.50	1406	0.02
Octanol	5.52	1076	0.02	8.05*	1522	6.34
para-Cymenene	5.68*	1086	0.17	6.25	1387	0.01
Terpinolene	5.68*	1086	[0.17]	4.21	1239	0.16
trans-Sabinene hydrate	5.83	1096	0.05	7.91	1511	0.04
Nonan-3-ol	5.90	1100	0.01	7.24*	1461	[0.04]
Linalool	5.93	1102	0.23	8.05*	1522	[6.34]
2-Methylbutyl 2-methylbutyrate	5.99	1106	0.06	4.38	1252	0.07
Isoamyl isovalerate	6.03	1108	0.01	4.62*	1269	[0.07]
Amyl isovalerate	6.07	1111	0.04	4.62*	1269	[0.07]

endo-Fenchol	6.09	1113	0.01	8.31*	1542	2.39
Octen-3-yl acetate	6.16	1116	0.02	5.75	1351	0.01
cis-para-Menth-2-en-1-ol	6.21	1120	0.07	8.05*	1522	[6.34]
Octan-3-yl acetate	6.35	1129	0.02	5.17	1309	0.02
allo-Ocimene	6.37	1130	0.01	5.52	1334	0.03
trans-Sabinol	6.53	1140	0.03	9.72†	1654	[1.79]
neo-Isopulegol	6.56	1142	0.06	8.13	1528	0.05
Isopulegol	6.58	1144	0.14	8.09	1525	0.14
Menthone	6.74	1154	23.43	6.61	1414	23.41
Isomenthone	6.87*	1162	6.87	6.93	1437	4.04
Menthofuran	6.87*	1162	[6.87]	6.84*	1431	[3.22]
neo-Menthol	6.92*	1166	4.02	8.54	1560	3.85
δ-Terpineol	6.92*	1166	[4.02]	9.42	1630	0.17
Lavandulol	6.97	1169	0.05	9.49*	1635	0.06
Terpinen-4-ol	7.10†	1177	35.71	8.51	1558	1.09
Menthol	7.14†	1179	[35.71]	9.14*	1607	34.53
Isomenthol	7.20	1184	0.53	8.89	1587	0.56
para-Cymen-8-ol	7.24	1186	0.03	11.50	1803	0.03
α-Terpineol	7.30†	1190	0.47	9.68*†	1651	1.79
neoiso-Menthol	7.31†	1191	[0.47]	9.40	1628	0.16
Methylchavicol	7.39*	1196	0.05	9.23	1614	0.03
Myrtenol	7.39*	1196	[0.05]	10.81	1744	0.02
trans-Isopiperitenol	7.45	1199	0.01	10.31*	1702	0.09
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.54	1205	0.02			
trans-Piperitol	7.58	1208	0.03	10.31*	1702	[0.09]
trans-Carveol	7.75	1219	0.01	11.36	1790	0.04
cis-Carveol	7.92*	1230	0.03	11.60	1812	0.01
(3*Z*)-Hexenyl 2-methylbutyrate	7.92*	1230	[0.03]	7.02*	1444	0.03
Citronellol	7.96	1233	0.03	10.67	1732	0.04
Pulegone	7.99	1236	1.12	8.86*	1585	1.16
Carvone	8.06	1240	0.16	9.94*†	1671	0.32
Unknown [m/z 112, 43 (70), 70 (63), 59 (53), 97 (46), 84 (25)...]	8.15	1246	0.02	10.21	1694	0.01
Piperitone	8.21	1250	0.49	9.83*	1662	0.49
Isopiperitenone	8.48	1268	0.01	11.07	1766	0.01
neo-Menthyl acetate	8.60	1276	0.45	7.59	1487	0.43
Decanol	8.62	1277	0.01	10.65	1730	0.02
2-Ethylmenthone?	8.69	1282	0.05			
Dihydroedulan I	8.73	1285	0.07	7.00	1442	0.06
Menthyl acetate	8.90*	1296	6.08	8.05*	1522	[6.34]
Dihydroedulan II	8.90*	1296	[6.08]	7.36*	1469	0.28
Thymol	8.96	1300	0.04	15.08	2135	0.04
Isomenthyl acetate	9.06	1307	0.28	8.19	1533	0.31
Unknown [m/z 43, 136 (55), 121 (55), 107 (48),	9.12	1311	0.02			

93 (48), 81 (30), 79 (29)...]						
Bicycloelemene	9.45	1334	0.02	6.96	1440	0.01
trans-Carvyl acetate	9.47	1335	0.01	10.09	1684	0.01
Piperitenone	9.54	1340	0.01	12.01*	1847	0.01
Menthofurolactone isomer II	9.57	1342	0.02			
Evodone	9.68	1350	0.03	12.33	1876	0.03
Eugenol	9.76	1356	0.02	14.75	2102	0.02
α-Copaene	10.01	1373	0.03	7.02*	1444	[0.03]
β-Bourbonene	10.12*	1381	0.21	7.36*	1469	[0.28]
1,5-diepi-β-Bourbonene	10.12*	1381	[0.21]	7.24*	1461	[0.04]
β-Cubebene	10.22	1388	0.03	7.66	1492	0.02
β-Elemene	10.26	1391	0.09	8.31*	1542	[2.39]
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.30	1394	0.06			
Isocaryophyllene	10.43	1403	0.04	8.05*	1522	[6.34]
β-Ylangene	10.60*	1415	2.35	8.05*	1522	[6.34]
β-Caryophyllene	10.60*	1415	[2.35]	8.31*	1542	[2.39]
β-Copaene	10.73	1425	0.05	8.24	1537	0.04
trans-α-Bergamotene	10.85	1434	0.02	8.31*	1542	[2.39]
Isogermacrene D	10.93	1440	0.02	8.86*	1585	[1.16]
α-Humulene	11.05	1449	0.10	9.18	1610	0.12
Muurola-4,11-diene	11.10	1453	0.01	9.14*	1607	[34.53]
9-epi-β-Caryophyllene	11.19*	1459	0.33	9.27	1617	0.05
(*E*)-β-Farnesene	11.19*	1459	[0.33]	9.45	1632	0.34
γ-Muurolene	11.39	1474	0.03	9.49*	1635	[0.06]
Germacrene D	11.43	1477	1.51	9.68*†	1651	[1.79]
Menthalactone	11.55	1486	0.03	15.76	2202	0.02
Bicyclogermacrene	11.63*	1492	0.24	9.95†	1672	[0.32]
Viridiflorene	11.63*	1492	[0.24]	9.54	1640	0.01
α-Muurolene	11.71	1498	0.02	9.94*†	1671	[0.32]
ε-Amorphene	11.73	1500	0.03	9.83*	1662	[0.49]
γ-Cadinene	11.87	1510	0.02	10.26	1698	0.05
δ-Cadinene	12.01*	1521	0.08	10.31*	1702	[0.09]
trans-Calamenene	12.01*	1521	[0.08]	11.13	1771	0.02
Isocaryophyllene epoxide B	12.32	1546	0.01	12.01*	1847	[0.01]
Spathulenol	12.65	1571	0.02	14.31	2059	0.02
Caryophyllene oxide isomer	12.69	1574	0.01	12.58	1900	0.02
Caryophyllene oxide	12.70	1575	0.05	12.66	1906	0.06
Viridiflorol	12.83	1585	0.14	13.89	2020	0.14
Isospathulenol	13.41	1632	0.01	15.38*	2164	0.02
τ-Muurolol	13.47	1637	0.02	14.96	2122	0.01
α-Cadinol	13.62	1649	0.01	15.38*	2164	[0.02]
Unknown [m/z 82, 81 (92), 95 (76), 67 (69), 93	13.76	1661	0.01	14.11	2040	0.01

(68), 107 (68), 79 (63), 91 (61)... 220 (11)]				
Mint sulfide?	14.53	1726	0.01	
Total identified		**99.23%**		**98.98%**
Total reported		**99.36%**		**99.00%**

*: 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