Date : September 09, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19I06-PTH22-1-SCC
Customer identification : Peppermint Indian - India - P5010895R
Type : Essential oil
Source : *Mentha x piperita*
Customer : Plant Therapy

Analysis

Method: PC-PA-014 - 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 : September 09, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.4608 ± 0.0003 (20 °C)

EUROPEAN PHARMACOPOEIA 9.0 - 07/2012:0405 - PEPPERMINT OIL

Compound	Min. %	Max. %	Observed %	Complies?
Carvone		1.0	0.2	Yes
Pulegone		3.0	1.0	Yes
Menthol	30.0	55.0	40.3	Yes
Menthyl acetate	2.8	10.0	6.2	Yes
Isomenthone	1.5	10.0	3.5	Yes
Menthofuran	1.0	8.0	2.3	Yes
Menthone	14.0	32.0	20.7	Yes
1,8-Cineole	3.5	8.0	4.5	Yes
Limonene	1.0	3.5	1.9	Yes
Total isopulegol		0.20	0.14	Yes
Refractive index	1.457	1.467	1.461	Yes

NF T 75-210:2007 & ISO 856:2006 - OIL OF PEPPERMINT - "OTHER ORIGINS"

Compound	Min. %	Max. %	Observed %	Complies?
β-Caryophyllene	1.0	3.5	2.2	Yes
Menthyl acetate	2.0	8.0	6.2	Yes
Pulegone	0.5	3.0	1.0	Yes
Menthol	32.0	49.0	40.3	Yes
neo-Menthol	2.0	6.0	3.7	Yes
Menthofuran	1.0	8.0	2.3	Yes
Isomenthone	2.0	8.0	3.5	Yes
Menthone	13.0	28.0	20.7	Yes
cis-Sabinene hydrate	0.5	2.0	0.3	No
Limonene	1.0	3.0	1.9	Yes
1,8-Cineole	3.0	8.0	4.5	Yes
Octan-3-ol	0.1	0.5	0.2	Yes
Refractive index	1.459	1.465	1.461	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the European Pharmacopoeia standard for peppermint oil, and marginally does not comply with the ISO/AFNOR standard for non-USA peppermint oil.

Analysis summary – Consolidated contents

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

Identification	%	Classe
Ethanol	tr	Aliphatic alcohol
Isobutyral	tr	Aliphatic aldehyde
2-Methyl-3-buten-2-ol	tr	Aliphatic alcohol
Isobutanol	tr	Aliphatic alcohol
Isovaleral	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.02	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Ethyl 2-methylbutyrate	0.01	Aliphatic ester
(3*Z*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	tr	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.03	Furan
Nonane	tr	Alkane
α-Thujene	0.05	Monoterpene
α-Pinene	0.72	Monoterpene
Camphene	0.02	Monoterpene
3-Methylcyclohexanone	0.02	Aliphatic ketone
Thuja-2,4(10)-diene	0.01	Monoterpene
β-Pinene	1.03	Monoterpene
Sabinene	0.44	Monoterpene
Octen-3-ol	0.08	Aliphatic alcohol
Octan-3-one	0.03	Aliphatic ketone
Myrcene	0.17	Monoterpene
Octan-3-ol	0.15	Aliphatic alcohol
α-Phellandrene	0.04	Monoterpene
Pseudolimonene	0.02	Monoterpene
α-Terpinene	0.24	Monoterpene
para-Cymene	0.24	Monoterpene
Limonene	1.92	Monoterpene
1,8-Cineole	4.49	Monoterpenic ether
(*Z*)-β-Ocimene	0.15	Monoterpene
(*E*)-β-Ocimene	0.04	Monoterpene
γ-Terpinene	0.42	Monoterpene
cis-Sabinene hydrate	0.34	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
para-Cymenene	0.02	Monoterpene
Terpinolene	0.14	Monoterpene
trans-Sabinene hydrate	0.04	Monoterpenic alcohol
Linalool	0.18	Monoterpenic alcohol
Nonanal	0.01	Aliphatic aldehyde
2-Methylbutyl 2-methylbutyrate	0.06	Aliphatic ester
Amyl isovalerate	0.05	Aliphatic ester
Octen-3-yl acetate	0.02	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.05	Monoterpenic alcohol
Octan-3-yl acetate	0.03	Aliphatic ester
trans-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol

trans-Sabinol	0.05	Monoterpenic alcohol
Isopulegol	0.14	Monoterpenic alcohol
Menthone	20.71	Monoterpenic ketone
Isomenthone	3.52	Monoterpenic ketone
Menthofuran	2.27	Monoterpenic ether
neo-Menthol	3.73	Monoterpenic alcohol
δ-Terpineol	0.05	Monoterpenic alcohol
Terpinen-4-ol	0.66	Monoterpenic alcohol
Menthol	40.32	Monoterpenic alcohol
Isomenthol	0.52	Monoterpenic alcohol
α-Terpineol	0.26	Monoterpenic alcohol
neoiso-Menthol	0.16	Monoterpenic alcohol
Myrtenal	0.01	Monoterpenic aldehyde
Methylchavicol	0.03	Phenylpropanoid
Myrtenol	0.02	Monoterpenic alcohol
trans-Isopiperitenol	0.01	Monoterpenic alcohol
Unknown	0.01	Unknown
trans-Piperitol	0.02	Monoterpenic alcohol
Decanal	0.02	Aliphatic aldehyde
trans-Carveol	0.01	Monoterpenic alcohol
Citronellol	0.02	Monoterpenic alcohol
Pulegone	0.99	Monoterpenic ketone
Carvone	0.18	Monoterpenic ketone
Piperitone	0.45	Monoterpenic ketone
Isopiperitenone	0.03	Monoterpenic ketone
neo-Menthyl acetate	0.51	Monoterpenic ester
Decanol	0.04	Aliphatic alcohol
2-Ethylmenthone?	0.03	Aliphatic ketone
Dihydroedulan I	0.06	Terpenic ether
Menthyl acetate	6.21	Monoterpenic ester
Dihydroedulan II	0.08	Terpenic ether
Thymol	0.05	Monoterpenic alcohol
Isomenthyl acetate	0.32	Monoterpenic alcohol
Bicycloelemene	0.01	Sesquiterpene
Piperitenone	0.01	Monoterpenic ketone
α-Copaene	0.02	Sesquiterpene
β-Bourbonene	0.14	Sesquiterpene
1,5-diepi-β-Bourbonene	0.04	Sesquiterpene
β-Cubebene	0.01	Sesquiterpene
β-Elemene	0.07	Sesquiterpene
Unknown	0.04	Unknown
Unknown	0.04	Sesquiterpene
β-Ylangene	0.06	Sesquiterpene
β-Caryophyllene	2.18	Sesquiterpene
β-Copaene	0.06	Sesquiterpene
Aromadendrene	0.03	Sesquiterpene
Isogermacrene D	0.02	Sesquiterpene
α-Humulene	0.14	Sesquiterpene
(*E*)-β-Farnesene	0.25	Sesquiterpene
γ-Muurolene	0.12	Sesquiterpene
Germacrene D	1.06	Sesquiterpene
Menthalactone	0.06	Monoterpenic lactone

Bicyclogermacrene	0.06	Sesquiterpene
Viridiflorene	0.04	Sesquiterpene
5-Methyl-2,4-diisopropylphenol	0.01	Terpene derivative
α-Muurolene	0.09	Sesquiterpene
ε-Amorphene	0.02	Sesquiterpene
γ-Cadinene	0.03	Sesquiterpene
δ-Cadinene	0.08	Sesquiterpene
Isocaryophyllene epoxide B	0.02	Sesquiterpenic ether
(*E*)-Nerolidol	0.01	Sesquiterpenic alcohol
Spathulenol	0.03	Sesquiterpenic alcohol
Caryophyllene oxide	0.07	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Viridiflorol	0.15	Sesquiterpenic alcohol
Isospathulenol	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.02	Sesquiterpenic alcohol
α-Muurolol	0.02	Sesquiterpenic alcohol
Unknown	0.01	Sesquiterpenic alcohol
α-Cadinol	0.02	Sesquiterpenic alcohol
Mint sulfide?	0.01	Sesquiterpenic sulfide
Consolidated total	**97.88%**	

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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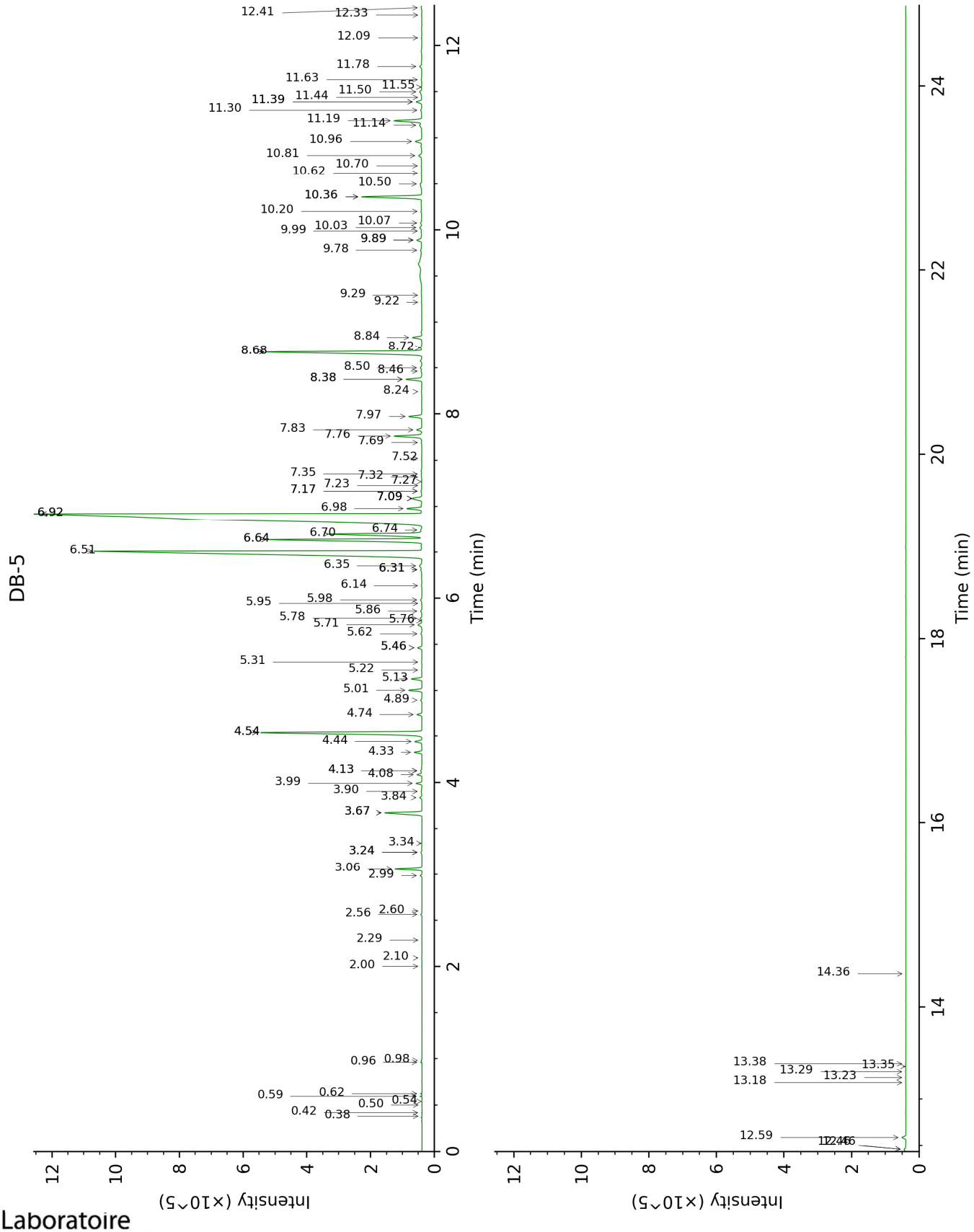
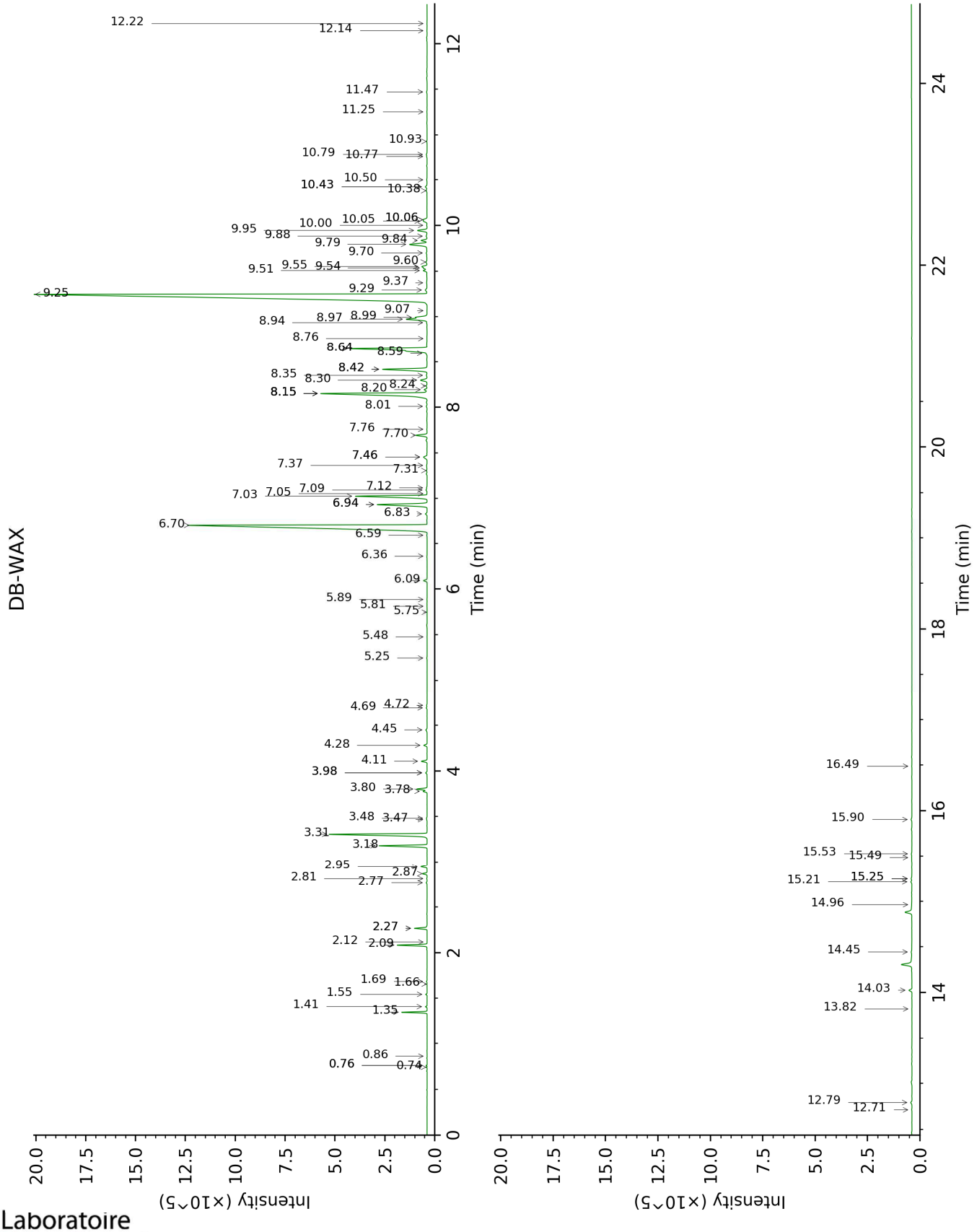

DB-5
Intensity (×10^5)
Time (min)
12.41
12.33
12.09
11.78
11.63
11.55
11.50
11.44
11.39
11.30
11.19
11.14
10.96
10.81
10.70
10.62
10.50
10.36
10.20
10.07
10.03
9.99
9.89
9.78
9.29
9.22
8.84
8.72
8.68
8.50
8.46
8.38
8.24
7.97
7.83
7.76
7.69
7.52
7.35
7.32
7.27
7.23
7.17
7.09
6.98
6.92
6.74
6.70
6.64
6.51
6.35
6.31
6.14
5.98
5.95
5.86
5.78
5.76
5.71
5.62
5.46
5.31
5.22
5.13
5.01
4.89
4.74
4.54
4.44
4.33
4.13
4.08
3.99
3.90
3.84
3.67
3.34
3.24
3.06
2.99
2.60
2.56
2.29
2.10
2.00
0.98
0.96
0.62
0.59
0.54
0.50
0.42
0.38
14.36
13.38
13.35
13.29
13.23
13.18
12.59


DB-WAX
Time (min)
Intensity (×10^5)
12.22
12.14
11.47
11.25
10.93
10.79
10.77
10.50
10.43
10.38
10.06
10.05
10.00
9.95
9.88
9.84
9.79
9.70
9.60
9.55
9.54
9.51
9.37
9.29
9.25
9.07
8.99
8.97
8.94
8.76
8.64
8.59
8.42
8.35
8.30
8.24
8.20
8.15
8.01
7.76
7.70
7.46
7.37
7.31
7.12
7.09
7.05
7.03
6.94
6.83
6.70
6.59
6.36
6.09
5.89
5.81
5.75
5.48
5.25
4.72
4.69
4.45
4.28
4.11
3.98
3.80
3.78
3.48
3.47
3.31
3.18
2.95
2.87
2.81
2.77
2.27
2.12
2.09
1.69
1.66
1.55
1.41
1.35
0.86
0.76
0.74
16.49
15.90
15.53
15.49
15.25
15.21
14.96
14.45
14.03
13.82
12.79
12.71

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.38	519	tr	0.86	910	tr
Isobutyral	0.42	531	tr			
2-Methyl-3-buten-2-ol	0.50	592	tr			
Isobutanol	0.54	619	tr	2.12	1068	tr
Isovaleral	0.60	640	0.02	0.76*	888	0.02
2-Methylbutyral	0.62	650	0.01	0.74	881	0.01
Isoamyl alcohol	0.96	735	0.02	3.48†	1180	[0.03]
2-Methylbutanol	0.98	738	0.01	3.47†	1178	0.03
Ethyl 2-methylbutyrate	2.00	850	0.01	1.66	1022	tr
(3*Z*)-Hexenol	2.10	857	0.01	5.81	1350	0.01
Hexanol	2.29	873	tr	5.48	1326	0.01
trans-2,5-Diethyltetrahydrofuran	2.56	895	0.03	1.55	1011	0.04
Nonane	2.60	898	tr	0.76*	888	[0.02]
α-Thujene	2.99	925	0.05	1.41	998	0.05
α-Pinene	3.06	930	0.72	1.35	989	0.71
Camphene	3.24*	942	0.04	1.69	1025	0.02
3-Methylcyclohexanone	3.24*	942	[0.04]	4.72	1270	0.02
Thuja-2,4(10)-diene	3.34	948	0.01	2.27*	1083	0.46
β-Pinene	3.67*	970	1.47	2.09	1064	1.03
Sabinene	3.67*	970	[1.47]	2.27*	1083	[0.46]
Octen-3-ol	3.84	981	0.08	6.83	1423	0.08
Octan-3-one	3.90	985	0.03	3.98*†	1217	0.07
Myrcene	3.99	991	0.17	2.87	1132	0.17
Octan-3-ol	4.08	997	0.15	6.10	1370	0.15
α-Phellandrene	4.13*	1000	0.05	2.77	1124	0.04
Pseudolimonene	4.13*	1000	[0.05]	2.81	1128	0.02
α-Terpinene	4.33	1013	0.24	2.95	1138	0.23
para-Cymene	4.44	1020	0.24	4.11	1226	0.23
Limonene	4.54*	1026	6.51	3.18	1156	1.92
1,8-Cineole	4.54*	1026	[6.51]	3.31	1166	4.49
(*Z*)-β-Ocimene	4.74	1038	0.15	3.78	1202	0.15
(*E*)-β-Ocimene	4.89	1048	0.04	3.98*†	1217	[0.07]
γ-Terpinene	5.01	1056	0.42	3.80	1204	0.42
cis-Sabinene hydrate	5.13	1063	0.34	6.94*	1430	2.60
cis-Linalool oxide (fur.)	5.22	1069	0.01	6.59	1405	0.01
Octanol	5.31	1075	0.01	8.24	1527	0.05
para-Cymenene	5.46*	1085	0.14	6.36	1389	0.02
Terpinolene	5.46*	1085	[0.14]	4.28	1238	0.14
trans-Sabinene hydrate	5.62	1094	0.04	8.01	1510	0.04
Linalool	5.71	1100	0.18	8.15*	1520	6.50
Nonanal	5.76	1103	0.01	5.89	1355	0.01
2-Methylbutyl 2-methylbutyrate	5.78	1105	0.06	4.45	1251	0.07
Amyl isovalerate	5.86	1110	0.05	4.69	1268	0.04
Octen-3-yl acetate	5.94	1115	0.02	5.75	1345	0.01

cis-para-Menth-2-en-1-ol	5.98	1118	0.05	8.15*	1520	[6.50]
Octan-3-yl acetate	6.14	1128	0.03	5.25	1310	0.02
trans-para-Menth-2-en-1-ol	6.31*	1139	0.07	9.07	1590	0.01
trans-Sabinol	6.31*	1139	[0.07]	9.88	1656	0.05
Isopulegol	6.35	1142	0.14	8.20	1524	0.13
Menthone	6.51	1152	20.71	6.70	1413	20.37
Isomenthone	6.64*	1160	5.84	7.03	1437	3.52
Menthofuran	6.64*	1160	[5.84]	6.94*	1430	[2.60]
neo-Menthol	6.70	1164	3.73	8.64*†	1558	4.39
δ-Terpineol	6.74	1167	0.05	9.54	1628	0.13
Terpinen-4-ol	6.92*	1179	41.74	8.64*†	1558	[4.39]
Menthol	6.92*	1179	[41.74]	9.25	1604	40.32
Isomenthol	6.98	1183	0.52	8.99	1585	0.47
α-Terpineol	7.09*	1190	0.44	9.84	1652	0.26
neoiso-Menthol	7.09*	1190	[0.44]	9.51	1625	0.16
Myrtenal	7.09*	1190	[0.44]	8.76	1567	0.01
Methylchavicol	7.17*	1195	0.06	9.37	1615	0.03
Myrtenol	7.17*	1195	[0.06]	10.93	1742	0.02
trans-Isopiperitenol	7.23	1199	0.01	10.42*	1699	0.09
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.27	1202	0.01			
trans-Piperitol	7.32	1205	0.02	10.50	1706	0.02
Decanal	7.35	1207	0.02	7.31	1458	0.03
trans-Carveol	7.52	1219	0.01	11.47	1787	0.03
Citronellol	7.69	1230	0.02	10.76	1728	0.02
Pulegone	7.76	1235	0.99	8.98	1583	1.06
Carvone	7.83	1240	0.18	10.05†	1669	0.33
Piperitone	7.98	1250	0.45	9.95	1661	0.46
Isopiperitenone	8.24	1268	0.03	11.25	1769	0.02
neo-Menthyl acetate	8.38*	1278	0.55	7.70	1486	0.51
Decanol	8.38*	1278	[0.55]	10.79	1730	0.04
2-Ethylmenthone?	8.46	1284	0.03			
Dihydroedulan I	8.50	1286	0.06	7.10	1442	0.05
Menthyl acetate	8.68*	1299	6.40	8.15*	1520	[6.50]
Dihydroedulan II	8.68*	1299	[6.40]	7.46*	1468	0.22
Thymol	8.72	1302	0.05	15.22	2133	0.05
Isomenthyl acetate	8.84	1310	0.32	8.30	1532	0.34
Bicycloelemene	9.22	1331	0.01	7.06	1439	tr
Piperitenone	9.29	1337	0.01	12.14	1846	0.01
α-Copaene	9.78	1371	0.02	7.12	1444	0.02
β-Bourbonene	9.89*	1379	0.18	7.46*	1468	[0.22]
1,5-diepi-β-Bourbonene	9.89*	1379	[0.18]	7.36	1462	0.04
β-Cubebene	9.99	1386	0.01	7.76	1491	0.01
β-Elemene	10.03	1389	0.07	8.42*	1541	2.25
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105	10.08	1392	0.04			

(49)... 194 (1)]						
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.20	1401	0.04			
β-Ylangene	10.36*	1413	2.24	8.15*	1520	[6.50]
β-Caryophyllene	10.36*	1413	[2.24]	8.42*	1541	[2.25]
β-Copaene	10.50	1423	0.06	8.35	1536	0.04
Aromadendrene	10.62	1432	0.03	8.59	1554	0.04
Isogermacrene D	10.70	1438	0.02	8.94	1580	0.02
α-Humulene	10.81	1447	0.14	9.29	1608	0.10
(*E*)-β-Farnesene	10.96	1458	0.25	9.55	1629	0.23
γ-Muurolene	11.14	1471	0.12	9.60	1633	0.05
Germacrene D	11.19	1475	1.06	9.79	1648	1.05
Menthalactone	11.30	1483	0.06	15.90	2202	0.05
Bicyclogermacrene	11.39*	1490	0.23	10.06*†	1670	[0.33]
Viridiflorene	11.39*	1490	[0.23]	9.70	1641	0.04
5-Methyl-2,4-diisopropylphenol	11.44	1494	0.01	16.49	2263	0.01
α-Muurolene	11.50	1498	0.09	10.06*†	1670	[0.33]
ε-Amorphene	11.55	1502	0.02	10.00	1665	0.01
γ-Cadinene	11.63	1508	0.03	10.38	1696	0.05
δ-Cadinene	11.78	1520	0.08	10.42*	1699	[0.09]
Isocaryophyllene epoxide B	12.08	1544	0.02	12.22	1853	0.01
(*E*)-Nerolidol	12.33	1563	0.01	13.82	1998	0.01
Spathulenol	12.41	1570	0.03	14.45	2058	0.04
Caryophyllene oxide	12.46*	1574	0.08	12.79	1903	0.07
Caryophyllene oxide isomer	12.46*	1574	[0.08]	12.71	1896	0.02
Viridiflorol	12.59	1584	0.15	14.03	2018	0.14
Isospathulenol	13.18	1631	0.01	15.49	2160	0.01
τ-Cadinol	13.23	1636	0.02	14.96	2108	0.02
α-Muurolol	13.30	1641	0.02	15.25*	2136	0.05
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109)40)... 204 (35), 222 (2)]	13.35	1646	0.01	15.25*	2136	[0.05]
α-Cadinol	13.38	1648	0.02	15.53	2164	0.04
Mint sulfide?	14.36	1730	0.01			
Total identified		**98.93%**			**97.45%**	
Total reported		**99.03%**			**97.45%**	

*: 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