Date : September 21, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 20I18-PTH09
Customer identification : Peppermint Western - USA - PF010598R
Type : Essential oil
Source : *Mentha x piperita* ct. rectified
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 : Fanny Charlier, B. Sc., chimiste à l'entraînement
Analysis date : September 21, 2020

Checked and approved by :

Alexis St-Gelais, M. Sc., chimiste 2013-174

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4629 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. This peppermint oil has been redistilled to increase 1,8-cineole content.

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Analysis summary – Consolidated contents

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

Identification	%	Class
Isobutanol	tr	Aliphatic alcohol
Isoamyl alcohol	0.08	Aliphatic alcohol
2-Methylbutanol	0.09	Aliphatic alcohol
Ethyl 2-methylbutyrate	0.04	Aliphatic ester
(3*Z*)-Hexenol	0.13	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.06	Furan
Hashishene	0.01	Monoterpene
α-Thujene	0.19	Monoterpene
α-Pinene	2.60	Monoterpene
Camphene	0.03	Monoterpene
3-Methylcyclohexanone	0.16	Aliphatic ketone
Thuja-2,4(10)-diene	0.01	Monoterpene
Benzaldehyde	tr	Simple phenolic
β-Pinene	4.54	Monoterpene
Sabinene	2.37	Monoterpene
trans-2-para-Menthene	0.01	Monoterpene
Octen-3-ol	0.30	Aliphatic alcohol
Octan-3-one	0.08	Aliphatic ketone
Myrcene	1.15	Monoterpene
α-Phellandrene	0.06	Monoterpene
Pseudolimonene	0.06	Monoterpene
Octanal	tr	Aliphatic aldehyde
Octan-3-ol	0.69	Aliphatic alcohol
Δ3-Carene	0.01	Monoterpene
α-Terpinene	1.39	Monoterpene
para-Cymene	0.39	Monoterpene
Limonene	6.31	Monoterpene
1,8-Cineole	19.31	Monoterpenic ether
(*Z*)-β-Ocimene	1.24	Monoterpene
(*E*)-β-Ocimene	0.30	Monoterpene
γ-Terpinene	1.71	Monoterpene
cis-Sabinene hydrate	1.56	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.03	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
Terpinolene	0.39	Monoterpene
para-Cymenene	0.02	Monoterpene
trans-Sabinene hydrate	0.10	Monoterpenic alcohol
Linalool	0.28	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.06	Aliphatic ester
Nonanal	0.01	Aliphatic aldehyde
Amyl isovalerate	0.07	Aliphatic ester
endo-Fenchol	tr	Monoterpenic alcohol
Octen-3-yl acetate	0.02	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.06	Monoterpenic alcohol
Octan-3-yl acetate	0.05	Aliphatic ester

allo-Ocimene	0.02	Monoterpene
Camphor	0.02	Monoterpenic ketone
Isopulegol	0.08	Monoterpenic alcohol
Menthone	15.05	Monoterpenic ketone
Citronellal	0.04	Monoterpenic aldehyde
Isomenthone	1.97	Monoterpenic ketone
Menthofuran	3.10	Monoterpenic ether
Borneol	0.29	Monoterpenic alcohol
neo-Menthol	1.96	Monoterpenic alcohol
δ-Terpineol	0.11	Monoterpenic alcohol
Terpinen-4-ol	0.51	Monoterpenic alcohol
Menthol	20.36	Monoterpenic alcohol
Isomenthol	0.26	Monoterpenic alcohol
para-Cymen-8-ol	0.06	Monoterpenic alcohol
α-Terpineol	0.22	Monoterpenic alcohol
neoiso-Menthol	0.02	Monoterpenic alcohol
Myrtenol	0.01	Monoterpenic alcohol
Methylchavicol	0.02	Phenylpropanoid
trans-Dihydrocarvone	0.01	Monoterpenic ketone
Unknown	0.01	Unknown
trans-Piperitol	0.01	Monoterpenic alcohol
trans-Carveol	0.01	Monoterpenic alcohol
Citronellol	0.02	Monoterpenic alcohol
Pulegone	1.11	Monoterpenic ketone
Carvone	0.03	Monoterpenic ketone
Piperitone	0.29	Monoterpenic ketone
Isopiperitenone	0.01	Monoterpenic ketone
neo-Menthyl acetate	0.17	Monoterpenic ester
Decanol	0.01	Aliphatic alcohol
2-Ethylmenthone?	0.06	Aliphatic ketone
Dihydroedulan I	0.03	Terpenic ether
Menthyl acetate	3.22	Monoterpenic ester
Dihydroedulan II	0.16	Terpenic ether
Isomenthyl acetate	0.02	Monoterpenic alcohol
Bicycloelemene	0.01	Sesquiterpene
Piperitenone	0.01	Monoterpenic ketone
Menthofurolactone isomer II	0.01	Monoterpenic lactone
α-Cubebene	0.01	Sesquiterpene
Menthofurolactone	0.05	Aliphatic alcohol
Eugenol	0.01	Phenylpropanoid
α-Copaene	0.03	Sesquiterpene
1,5-diepi-β-Bourbonene	0.02	Sesquiterpene
β-Bourbonene	0.04	Sesquiterpene
β-Elemene	0.07	Sesquiterpene
Unknown	0.03	Unknown
Unknown	0.02	Sesquiterpene
β-Caryophyllene	1.14	Sesquiterpene
β-Ylangene	0.02	Sesquiterpene
β-Copaene	0.03	Sesquiterpene
Isogermacrene D	0.02	Sesquiterpene
α-Humulene	0.05	Sesquiterpene
Muurola-4,11-diene	0.02	Sesquiterpene

(*E*)-β-Farnesene	0.19	Sesquiterpene
9-epi-β-Caryophyllene	0.01	Sesquiterpene
Unknown	0.01	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
Germacrene D	1.17	Sesquiterpene
Menthalactone	0.01	Monoterpenic lactone
Bicyclogermacrene	0.17	Sesquiterpene
Viridiflorene	0.01	Sesquiterpene
5-Methyl-2,4-diisopropylphenol	0.03	Terpene derivative
γ-Cadinene	0.01	Sesquiterpene
δ-Cadinene	0.04	Sesquiterpene
Spathulenol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.02	Sesquiterpenic ether
Viridiflorol	0.07	Sesquiterpenic alcohol
Isospathulenol	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
Benzyl benzoate	0.01	Phenolic ester
para-Camphorene	0.01	Diterpene
Consolidated total	**98.67%**	

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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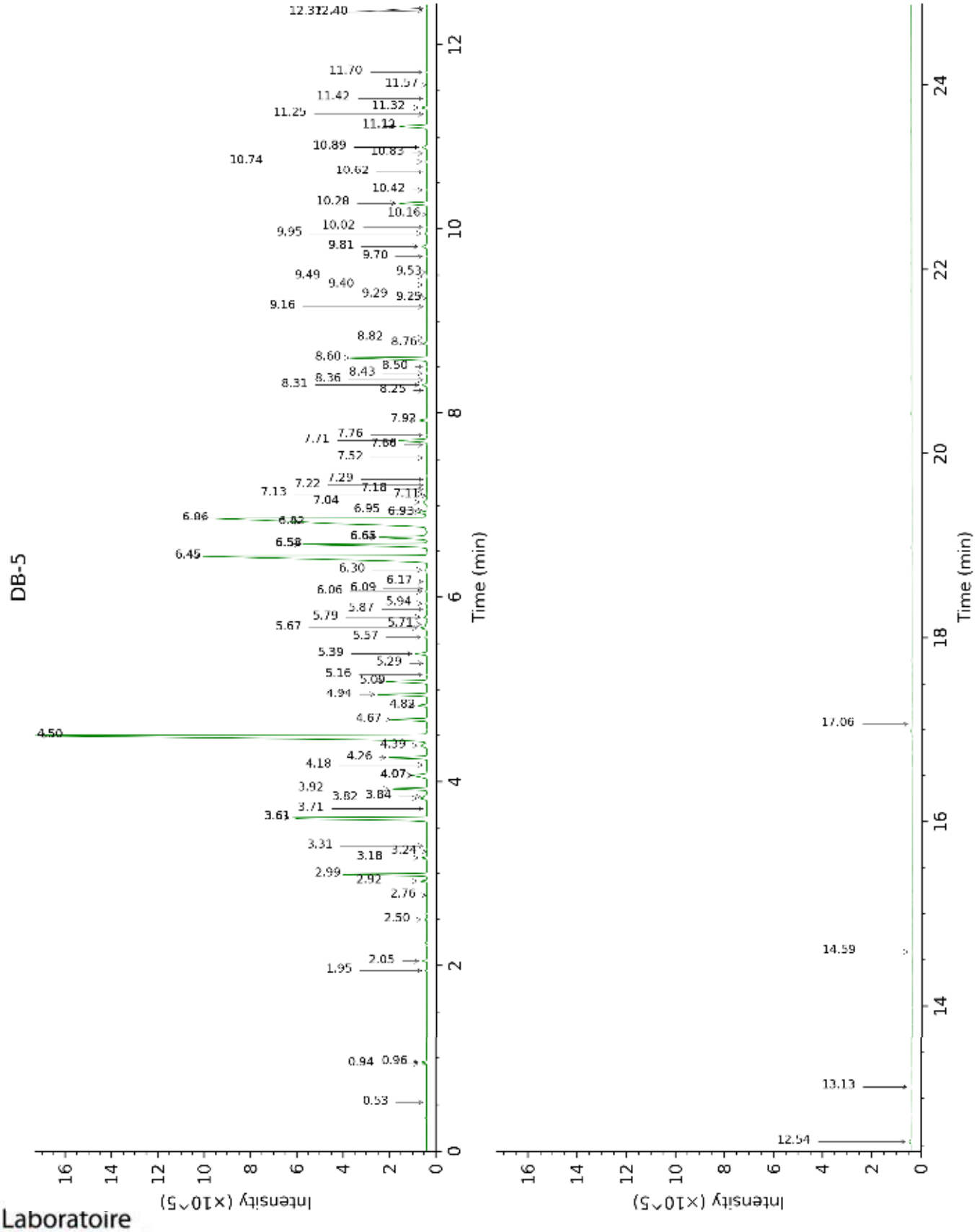
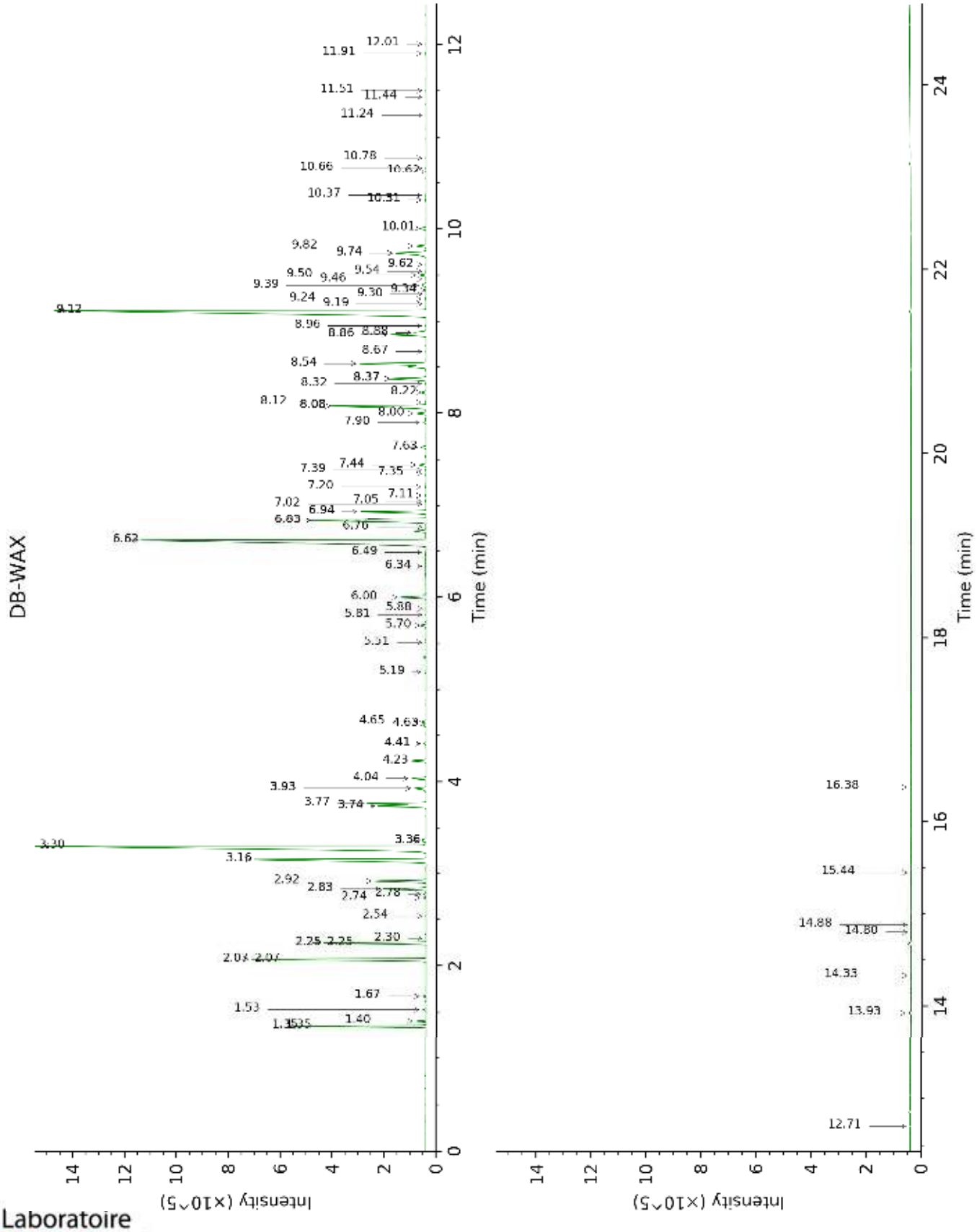

DB-5
Time (min)
Intensity (x10^5)
12.40
11.70
11.57
11.42
11.32
11.25
11.12
10.89
10.83
10.74
10.62
10.42
10.28
10.16
10.02
9.95
9.81
9.70
9.53
9.49
9.40
9.29
9.25
9.16
8.82
8.76
8.60
8.50
8.43
8.36
8.31
8.25
7.92
7.76
7.71
7.66
7.52
7.29
7.22
7.18
7.13
7.11
7.04
6.95
6.93
6.86
6.65
6.58
6.45
6.30
6.17
6.09
6.06
5.94
5.87
5.79
5.71
5.67
5.57
5.39
5.29
5.16
5.09
4.94
4.82
4.67
4.50
4.39
4.26
4.18
4.07
3.92
3.84
3.82
3.71
3.61
3.31
3.24
3.18
2.99
2.92
2.76
2.50
2.05
1.95
0.96
0.94
0.53
17.06
14.59
13.13
12.54


DB-WAX
Time (min)
Intensity (x10^5)
12.01
11.91
11.51
11.44
11.24
10.78
10.66
10.62
10.37
10.31
10.01
9.82
9.74
9.62
9.54
9.50
9.46
9.39
9.34
9.30
9.24
9.19
9.12
8.96
8.88
8.86
8.67
8.54
8.37
8.32
8.17
8.08
8.00
7.90
7.63
7.44
7.39
7.35
7.20
7.11
7.05
7.02
6.94
6.83
6.70
6.62
6.49
6.34
6.00
5.88
5.81
5.70
5.31
5.19
4.65
4.63
4.41
4.23
4.04
3.93
3.77
3.74
3.36
3.30
3.16
2.92
2.83
2.78
2.74
2.54
2.30
2.25
2.07
1.67
1.53
1.40
16.38
15.44
14.88
14.80
14.33
13.93
12.71

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutanol	0.53	620	tr	2.07*	1065	4.54
Isoamyl alcohol	0.94	732	0.08	3.36*†	1172	0.19
2-Methylbutanol	0.96	735	0.09	3.36*†	1172	[0.19]
Ethyl 2-methylbutyrate	1.95	849	0.04	1.67*	1025	0.07
(3*Z*)-Hexenol	2.05	858	0.13	5.70	1341	0.17
trans-2,5-Diethyltetrahydrofuran	2.50	896	0.06	1.53	1011	0.06
Hashishene	2.76	915	0.01	1.35*	990	2.55
α-Thujene	2.92	925	0.19	1.40	998	0.18
α-Pinene	2.99	930	2.60	1.35*	990	[2.55]
Camphene	3.18*	942	0.18	1.67*	1025	[0.07]
3-Methylcyclohexanone	3.18*	942	[0.18]	4.63†	1266	0.23
Thuja-2,4(10)-diene	3.24	947	0.01	2.30	1087	0.01
Benzaldehyde	3.30	951	tr	7.35	1462	0.01
β-Pinene	3.61*	971	7.07	2.07*	1065	[4.54]
Sabinene	3.61*	971	[7.07]	2.25*	1082	2.38
trans-2-para-Menthene	3.71	978	0.01	2.25*	1082	[2.38]
Octen-3-ol	3.82	985	0.30	6.83*	1424	4.96
Octan-3-one	3.84	987	0.08	3.93*	1215	0.38
Myrcene	3.92	992	1.15	2.83	1131	1.11
α-Phellandrene	4.07*	1002	0.81	2.78	1127	0.06
Pseudolimonene	4.07*	1002	[0.81]	2.74	1124	0.06
Octanal	4.07*	1002	[0.81]	4.41*	1250	0.07
Octan-3-ol	4.07*	1002	[0.81]	6.00	1363	0.69
Δ3-Carene	4.18	1009	0.01	2.54	1108	0.01
α-Terpinene	4.26	1014	1.39	2.92	1138	1.36
para-Cymene	4.39	1022	0.39	4.04	1223	0.38
Limonene	4.50*	1029	25.82	3.16	1157	6.31
1,8-Cineole	4.50*	1029	[25.82]	3.30	1168	19.31
(*Z*)-β-Ocimene	4.67	1040	1.24	3.74†	1201	2.88
(*E*)-β-Ocimene	4.82	1049	0.30	3.93*	1215	[0.38]
γ-Terpinene	4.94	1057	1.71	3.76†	1203	[2.88]
cis-Sabinene hydrate	5.09	1066	1.56	6.83*	1424	[4.96]
cis-Linalool oxide (fur.)	5.16	1071	0.03	6.49	1398	0.05
Octanol	5.29	1078	0.01	8.22	1529	0.16
Terpinolene	5.39*	1085	0.41	4.23	1237	0.39
para-Cymenene	5.39*	1085	[0.41]	6.34	1387	0.02
trans-Sabinene hydrate	5.57	1096	0.10	7.90	1504	0.09
Linalool	5.67	1103	0.28	8.00	1511	0.25
2-Methylbutyl 2-methylbutyrate	5.71*	1105	0.07	4.41*	1250	[0.07]
Nonanal	5.71*	1105	[0.07]	5.88	1354	0.01
Amyl isovalerate	5.79*	1110	0.11	4.65†	1267	[0.23]
endo-Fenchol	5.79*	1110	[0.11]	8.37*	1540	1.17
Octen-3-yl acetate	5.87	1115	0.02	5.81	1349	0.02

cis-para-Menth-2-en-1-ol	5.94	1119	0.06	8.08*	1518	3.30
Octan-3-yl acetate	6.06	1127	0.05	5.19	1304	0.05
allo-Ocimene	6.09	1129	0.02	5.51	1327	0.02
Camphor	6.17	1134	0.02	7.20	1451	0.05
Isopulegol	6.30	1142	0.08	8.12	1521	0.06
Menthone	6.45*	1152	15.04	6.62	1408	15.05
Citronellal	6.45*	1152	[15.04]	7.05	1440	0.04
Isomenthone	6.58*	1160	5.36	6.94	1431	1.97
Menthofuran	6.58*	1160	[5.36]	6.83*	1424	[4.96]
Borneol	6.58*	1160	[5.36]	9.74*	1649	1.31
neo-Menthol	6.65*	1165	2.07	8.54*	1553	1.98
δ-Terpineol	6.65*	1165	[2.07]	9.39	1620	0.11
Terpinen-4-ol	6.82†	1175	[21.13]	8.54*	1553	[1.98]
Menthol	6.86†	1178	[21.13]	9.12	1598	20.36
Isomenthol	6.93†	1182	21.13	8.88	1580	0.26
para-Cymen-8-ol	6.95	1184	0.06	11.51	1796	0.02
α-Terpineol	7.04*	1190	0.23	9.74*	1649	[1.31]
neoiso-Menthol	7.04*	1190	[0.23]	9.46	1626	0.02
Myrtenol	7.11	1194	0.01	10.78	1735	0.01
Methylchavicol	7.13	1195	0.02	9.34	1616	0.03
trans-Dihydrocarvone	7.18	1198	0.01	8.67	1563	0.02
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.22	1201	0.01			
trans-Piperitol	7.28	1205	0.01	10.32*	1696	0.05
trans-Carveol	7.52	1221	0.01	11.44	1791	0.01
Citronellol	7.66	1230	0.02	10.66	1725	0.02
Pulegone	7.71	1233	1.11	8.86	1578	1.18
Carvone	7.76	1237	0.03	10.01*	1670	0.21
Piperitone	7.92	1248	0.29	9.82	1655	0.29
Isopiperitenone	8.25	1269	0.01	11.24	1774	0.01
neo-Menthyl acetate	8.31	1273	0.17	7.63	1483	0.16
Decanol	8.36	1277	0.01	10.62	1722	0.01
2-Ethylmenthone?	8.43	1282	0.06			
Dihydroedulan I	8.50	1286	0.03	7.11*	1444	0.03
Menthyl acetate	8.60	1293	3.22	8.08*	1518	[3.30]
Dihydroedulan II	8.76	1303	0.16	7.44*	1469	0.21
Isomenthyl acetate	8.82	1307	0.02	8.32	1536	0.03
Bicycloelemene	9.16	1331	0.01	7.02	1438	0.01
Piperitenone	9.25	1338	0.01	12.01	1841	0.01
Menthofurolactone isomer II	9.29	1340	0.01			
α-Cubebene	9.40	1348	0.01	6.76	1418	0.02
Menthofurolactone	9.49	1354	0.05	11.91	1832	0.04
Eugenol	9.53	1357	0.01	14.80	2101	0.01
α-Copaene	9.70	1369	0.03	7.11*	1444	[0.03]
1,5-diepi-β-Bourbonene	9.81*	1377	0.23	7.39	1465	0.02
β-Bourbonene	9.81*	1377	[0.23]	7.44*	1469	[0.21]
β-Elemene	9.95	1387	0.07	8.37*	1540	[1.17]

Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.02	1392	0.03			
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.16	1401	0.02			
β-Caryophyllene	10.28*	1410	1.16	8.37*	1540	[1.17]
β-Ylangene	10.28*	1410	[1.16]	8.08*	1518	[3.30]
β-Copaene	10.42	1421	0.03	8.37*	1540	[1.17]
Isogermacrene D	10.62	1436	0.02	8.96	1586	0.03
α-Humulene	10.74	1444	0.05	9.24	1609	0.06
Muurola-4,11-diene	10.83	1451	0.02	9.19	1604	0.01
(*E*)-β-Farnesene	10.89*	1456	0.21	9.50	1630	0.19
9-epi-β-Caryophyllene	10.89*	1456	[0.21]	9.30	1613	0.01
Unknown [m/z 161, 105 (56), 91 (50), 93 (36), 119 (33), 79 (31)...204 (5)]	10.89*	1456	[0.21]			
γ-Muurolene	11.12*	1473	1.19	9.54	1633	0.02
Germacrene D	11.12*	1473	[1.19]	9.74*	1649	[1.31]
Menthalactone	11.25	1483	0.01			
Bicyclogermacrene	11.32*	1488	0.22	10.01*	1670	[0.21]
Viridiflorene	11.32*	1488	[0.22]	9.62	1639	0.01
5-Methyl-2,4-diisopropylphenol	11.42	1495	0.03	16.38	2260	0.02
γ-Cadinene	11.57	1506	0.01	10.32*	1696	[0.05]
δ-Cadinene	11.70	1517	0.04	10.37	1700	0.05
Spathulenol	12.37	1570	0.02	14.33	2055	0.01
Caryophyllene oxide	12.40	1572	0.02	12.71	1903	0.02
Viridiflorol	12.54	1583	0.07	13.93	2016	0.07
Isospathulenol	13.13*	1631	0.01	15.44	2164	0.01
τ-Cadinol	13.13*	1631	[0.01]	14.88	2108	0.01
Benzyl benzoate	14.59	1754	0.01			
para-Camphorene	17.06	1981	0.01			
Total identified		**99.15%**			**97.60%**	
Total reported		**99.21%**			**97.60%**	

*: 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