Date : March 16, 2021

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 21B23-FEP23
Customer identification : Peppermint - India - 51304-01
Type : Essential oil
Source : *Mentha x piperita*
Customer : Fern & Petal

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 : Alexis St-Gelais, M. Sc., chimiste
Analysis date : March 16, 2021

Checked and approved by :

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

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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: Clear liquid
Refractive index: 1.4600 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

This sample contains a trace of tetrahydrolinalool, which is not expected in peppermint oil. We recommend this observation is considered when evaluating this batch.

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Analysis summary – Consolidated contents

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

Identification	%	Class
Isobutyral	tr	Aliphatic aldehyde
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Ethyl 2-methylbutyrate	tr	Aliphatic ester
(3*Z*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.04	Furan
Hashishene	tr	Monoterpene
α-Thujene	0.03	Monoterpene
α-Pinene	0.69	Monoterpene
3-Methylcyclohexanone	0.15	Aliphatic ketone
Camphene	0.03	Monoterpene
α-Fenchene	0.01	Monoterpene
Thuja-2,4(10)-diene	tr	Monoterpene
Sabinene	0.37	Monoterpene
β-Pinene	0.96	Monoterpene
cis-para-Menthane	0.01	Monoterpene
Octen-3-ol	0.04	Aliphatic alcohol
cis-Carane	0.02	Monoterpene
Octan-3-one	0.03	Aliphatic ketone
trans-para-Menthane	0.04	Monoterpene
Myrcene	0.13	Monoterpene
Octan-3-ol	0.14	Aliphatic alcohol
α-Phellandrene	0.02	Monoterpene
Pseudolimonene	0.02	Monoterpene
Δ3-Carene	0.04	Monoterpene
α-Terpinene	0.11	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	0.16	Monoterpene
Limonene	1.94	Monoterpene
1,8-Cineole	5.44	Monoterpenic ether
(*Z*)-β-Ocimene	0.07	Monoterpene
(*E*)-β-Ocimene	0.02	Monoterpene
γ-Terpinene	0.16	Monoterpene
cis-Sabinene hydrate	0.19	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.06	Aliphatic alcohol
Terpinolene	0.07	Monoterpene
para-Cymenene	0.02	Monoterpene
trans-Sabinene hydrate	0.02	Monoterpenic alcohol
Linalool	0.12	Monoterpenic alcohol
Nonan-3-ol	0.02	Aliphatic alcohol
2-Methylbutyl 2-methylbutyrate	0.03	Aliphatic ester

Octen-3-yl acetate	0.01	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.03	Monoterpenic alcohol
Octan-3-yl acetate	0.01	Aliphatic ester
Dihydrolinalool	0.01	Synthetic
trans-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
trans-Sabinol	0.02	Monoterpenic alcohol
cis-α-Dihydroterpineol	0.12	Monoterpenic alcohol
Isopulegol	0.04	Monoterpenic alcohol
Menthone	23.20	Monoterpenic ketone
para-Menthan-4-ol isomer	0.04	Monoterpenic alcohol
Menthofuran	2.18	Monoterpenic ether
Isomenthone	4.02	Monoterpenic ketone
Borneol	0.07	Monoterpenic alcohol
neo-Menthol	3.29	Monoterpenic alcohol
Lavandulol	0.03	Monoterpenic alcohol
δ-Terpineol	0.08	Monoterpenic alcohol
Menthol	43.62	Monoterpenic alcohol
Terpinen-4-ol	0.28	Monoterpenic alcohol
Isomenthol	0.32	Monoterpenic alcohol
neoiso-Menthol	0.10	Monoterpenic alcohol
α-Terpineol	0.14	Monoterpenic alcohol
Methylchavicol	0.01	Phenylpropanoid
trans-Piperitol	0.01	Monoterpenic alcohol
Unknown	0.02	Unknown
Citronellol	0.02	Monoterpenic alcohol
Pulegone	0.90	Monoterpenic ketone
Carvone	0.05	Monoterpenic ketone
(2*E*)-Hexenyl isovalerate	0.02	Aliphatic ester
Piperitone	0.23	Monoterpenic ketone
neo-Menthyl acetate	0.15	Monoterpenic ester
Decanol	0.02	Aliphatic alcohol
Dihydroedulan I	0.04	Terpenic ether
Dihydroedulan II	0.04	Terpenic ether
Thymol	0.03	Monoterpenic alcohol
Menthyl acetate	4.46	Monoterpenic ester
Isomenthyl acetate	0.12	Monoterpenic alcohol
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Bicycloelemene	0.01	Sesquiterpene
Menthofurolactone isomer I	0.01	Monoterpenic lactone
Piperitenone	0.01	Monoterpenic ketone
α-Cubebene	0.04	Sesquiterpene
Eugenol	0.02	Phenylpropanoid
Isodauca-4,7(14)-diene?	0.01	Sesquiterpene
α-Ylangene	0.01	Sesquiterpene
α-Copaene	0.12	Sesquiterpene
β-Bourbonene	0.09	Sesquiterpene
1,5-diepi-β-Bourbonene	0.01	Sesquiterpene
β-Elemene	0.03	Sesquiterpene
Longifolene	0.02	Sesquiterpene
Isocaryophyllene	0.02	Sesquiterpene
β-Caryophyllene	2.45	Sesquiterpene

β-Copaene	0.04	Sesquiterpene
Menthofurolactone isomer III	0.02	Monoterpenic lactone
Isogermacrene D	0.05	Sesquiterpene
α-Humulene	0.08	Sesquiterpene
ε-Muurolene?	0.07	Sesquiterpene
(*E*)-β-Farnesene	0.03	Sesquiterpene
Germacrene D	0.40	Sesquiterpene
Viridiflorene	0.06	Sesquiterpene
Bicyclogermacrene	0.09	Sesquiterpene
γ-Cadinene	0.03	Sesquiterpene
δ-Cadinene	0.05	Sesquiterpene
Menthofurolactone analog	tr	Monoterpenic lactone
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Caryophyllene oxide	0.05	Sesquiterpenic ether
Viridiflorol	0.07	Sesquiterpenic alcohol
Mint sulfide?	0.01	Sesquiterpenic sulfide
Consolidated total	**98.97%**	

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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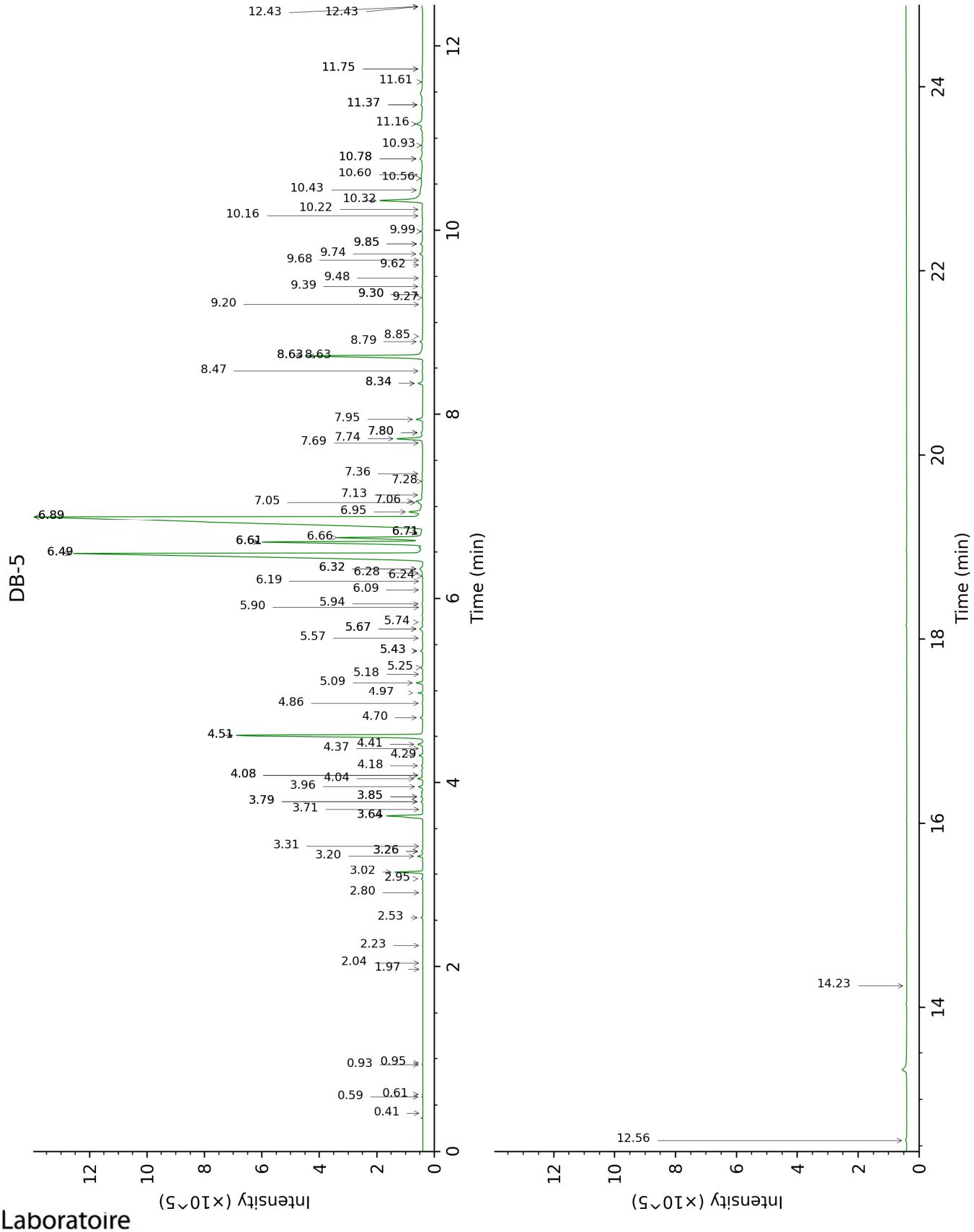
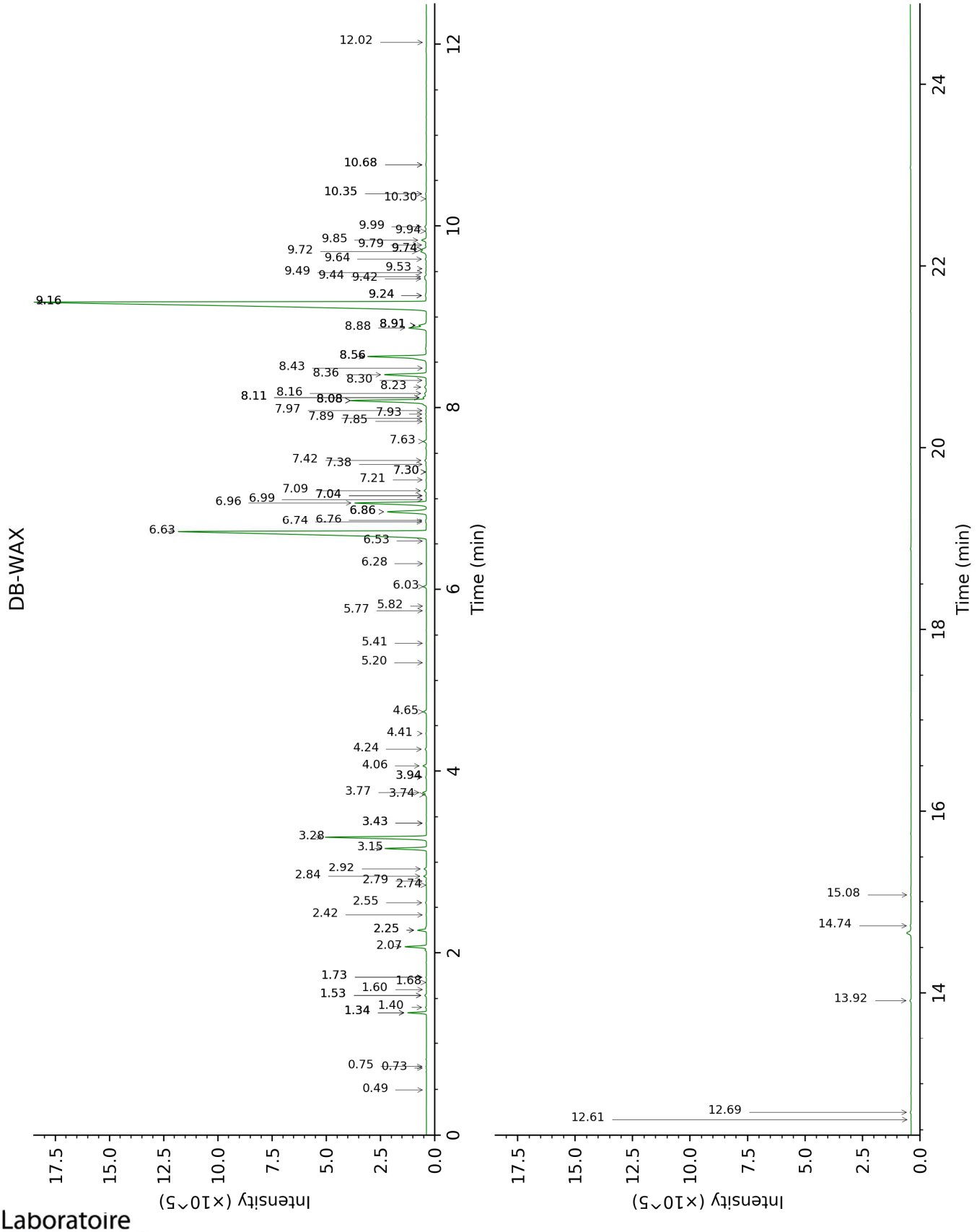

DB-5
12.43
12.43
11.75
11.61
11.37
11.16
10.93
10.78
10.60
10.56
10.43
10.32
10.22
10.16
9.99
9.85
9.74
9.68
9.62
9.48
9.39
9.30
9.27
9.20
8.85
8.79
8.63
8.63
8.47
8.34
7.95
7.80
7.74
7.69
7.36
7.28
7.13
7.06
7.05
6.95
6.89
6.71
6.66
6.61
6.49
6.32
6.28
6.24
6.19
6.09
5.94
5.90
5.74
5.67
5.57
5.43
5.25
5.18
5.09
4.97
4.86
4.70
4.51
4.41
4.37
4.29
4.18
4.08
4.04
3.96
3.85
3.79
3.71
3.64
3.31
3.26
3.20
3.02
2.95
2.80
2.53
2.23
2.04
1.97
0.95
0.93
0.61
0.59
0.41
Time (min)
Intensity (×10^5)
14.23
12.56
Time (min)
Intensity (×10^5)


DB-WAX
Time (min)
Intensity (×10^5)
12.02
10.68
10.35
10.30
9.99
9.94
9.85
9.79
9.74
9.72
9.64
9.53
9.49
9.44
9.42
9.24
9.16
8.88
8.91
8.56
8.43
8.36
8.30
8.23
8.11
8.16
8.08
7.97
7.89
7.85
7.93
7.63
7.42
7.38
7.30
7.21
7.09
7.04
6.96
6.99
6.86
6.74
6.76
6.63
6.53
6.28
6.03
5.77
5.82
5.41
5.20
4.65
4.41
4.24
4.06
3.94
3.77
3.74
3.43
3.28
3.15
2.92
2.84
2.79
2.74
2.55
2.42
2.25
2.07
1.73
1.68
1.60
1.53
1.40
1.34
0.75
0.73
0.49
15.08
14.74
13.92
12.69
12.61

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutyral	0.41	537	tr	0.49	782	tr
Isovaleral	0.59	642	0.01	0.75	887	0.01
2-Methylbutyral	0.62	652	0.01	0.73	880	0.01
Isoamyl alcohol	0.93	731	0.01	3.43*	1179	0.03
2-Methylbutanol	0.95	734	0.01	3.43*	1179	[0.03]
Ethyl 2-methylbutyrate	1.97	848	tr	1.68	1027	0.02
(3*Z*)-Hexenol	2.04	854	0.01	5.77	1349	0.01
Hexanol	2.23	870	0.01	5.41	1323	0.01
trans-2,5-Diethyltetrahydrofuran	2.53	895	0.04	1.53*	1013	0.07
Hashishene	2.80	915	tr	1.34*	991	0.68
α-Thujene	2.95	925	0.03	1.40	1000	0.03
α-Pinene	3.02	930	0.69	1.34*	991	[0.68]
3-Methylcyclohexanone	3.20	942	0.15	4.65	1268	0.16
Camphene	3.26*	945	0.04	1.73*	1033	0.02
α-Fenchene	3.26*	945	[0.04]	1.60	1019	0.01
Thuja-2,4(10)-diene	3.31	949	tr	2.25*	1084	0.38
Sabinene	3.64*	970	1.32	2.25*	1084	[0.38]
β-Pinene	3.64*	970	[1.32]	2.07	1066	0.96
cis-para-Menthane	3.71	975	0.01	1.34*	991	[0.68]
Octen-3-ol	3.79*	981	0.06	6.74	1420	0.04
cis-Carane	3.79*	981	[0.06]	1.73*	1033	[0.02]
Octan-3-one	3.85*	984	0.06	3.94*	1217	0.05
trans-para-Menthane	3.85*	984	[0.06]	1.53*	1013	[0.07]
Myrcene	3.96	992	0.13	2.84	1133	0.12
Octan-3-ol	4.04	997	0.14	6.03	1368	0.15
α-Phellandrene	4.08*	1000	0.05	2.79	1129	0.02
Pseudolimonene	4.08*	1000	[0.05]	2.74	1125	0.02
Δ3-Carene	4.18	1006	0.04	2.55	1110	0.04
α-Terpinene	4.29	1014	0.11	2.92	1139	0.11
Carvomenthene	4.37	1018	0.01	2.42	1100	0.02
para-Cymene	4.41	1021	0.16	4.06	1226	0.17
Limonene	4.51*	1027	7.48	3.15	1157	1.94
1,8-Cineole	4.51*	1027	[7.48]	3.28	1167	5.44
(*Z*)-β-Ocimene	4.70	1039	0.07	3.74	1203	0.07
(*E*)-β-Ocimene	4.86	1049	0.02	3.94*	1217	[0.05]
γ-Terpinene	4.98	1056	0.16	3.77	1205	0.18
cis-Sabinene hydrate	5.09	1064	0.19	6.86*	1429	2.37
cis-Linalool oxide (fur.)	5.18	1069	0.01	6.53	1404	0.01
Octanol	5.25	1074	0.06	8.11*	1524	0.17
Terpinolene	5.43*	1085	0.07	4.24	1239	0.07
para-Cymenene	5.43*	1085	[0.07]	6.28	1386	0.02
trans-Sabinene hydrate	5.57	1094	0.02	7.89	1506	0.04
Linalool	5.67*	1100	0.14	8.08*	1521	4.63
Nonan-3-ol	5.67*	1100	[0.14]	7.30*	1462	0.03

2-Methylbutyl 2-methylbutyrate	5.74	1105	0.03	4.41	1251	0.03
Octen-3-yl acetate	5.90	1115	0.01	5.82	1353	0.01
cis-para-Menth-2-en-1-ol	5.94	1118	0.03	8.08*	1521	[4.63]
Octan-3-yl acetate	6.09	1128	0.01	5.20	1308	0.01
Dihydrolinalool	6.19	1134	0.01	7.85	1503	0.03
trans-para-Menth-2-en-1-ol	6.24	1137	0.02	8.91*†	1586	[1.40]
trans-Sabinol	6.28	1139	0.02	9.79	1657	0.06
cis-α-Dihydroterpineol	6.32*	1142	0.16	8.16	1527	0.12
Isopulegol	6.32*	1142	[0.16]	8.11*	1524	[0.17]
Menthone	6.49*	1153	23.56	6.64	1412	23.20
para-Menthan-4-ol isomer	6.49*	1153	[23.56]	7.93	1509	0.04
Menthofuran	6.61*	1161	6.08	6.86*	1429	[2.37]
Isomenthone	6.61*	1161	[6.08]	6.96	1436	4.02
Borneol	6.61*	1161	[6.08]	9.74*	1653	0.21
neo-Menthol	6.66	1164	3.29	8.56*	1559	3.57
Lavandulol	6.71*	1168	0.08	9.53	1636	0.03
δ-Terpineol	6.71*	1168	[0.08]	9.42	1627	0.08
Menthol	6.89*	1179	43.90	9.16*	1606	42.95
Terpinen-4-ol	6.89*	1179	[43.90]	8.56*	1559	[3.57]
Isomenthol	6.94	1183	0.32	8.91*†	1586	[1.40]
neoiso-Menthol	7.05†	1189	0.24	9.44	1629	0.10
α-Terpineol	7.06†	1190	[0.24]	9.74*	1653	[0.21]
Methylchavicol	7.13	1194	0.01	9.24*	1612	0.10
trans-Piperitol	7.28	1204	0.01	10.35*	1703	0.06
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.36	1210	0.02			
Citronellol	7.69	1232	0.02	10.68*	1730	0.05
Pulegone	7.74	1235	0.90	8.88†	1584	1.40
Carvone	7.80*	1240	0.07	9.94	1669	0.05
(2*E*)-Hexenyl isovalerate	7.80*	1240	[0.07]	7.21	1455	0.02
Piperitone	7.95	1250	0.23	9.84	1661	0.28
neo-Menthyl acetate	8.34*	1276	0.17	7.63	1487	0.15
Decanol	8.34*	1276	[0.17]	10.68*	1730	[0.05]
Dihydroedulan I	8.47	1285	0.04	7.04*	1442	0.03
Dihydroedulan II	8.63*	1296	4.53	7.38	1468	0.04
Thymol	8.63*	1296	[4.53]	15.08	2134	0.03
Menthyl acetate	8.63*	1296	[4.53]	8.08*	1521	[4.63]
Isomenthyl acetate	8.79	1307	0.12	8.23	1532	0.12
Unknown [m/z 43, 136 (55), 121 (55), 107 (48), 93 (48), 81 (30), 79 (29)...]	8.85	1312	0.01			
Unknown [m/z 124, 123 (43), 121 (35), 166 (30), 93 (30), 136 (17)...]	9.20	1332	0.01			

Bicycloelemene	9.27	1337	0.01	6.99	1439	0.01
Menthofurolactone isomer I	9.30*	1339	0.02			
Piperitenone	9.30*	1339	[0.02]	12.02	1846	0.01
α-Cubebene	9.39	1346	0.04	6.76	1422	0.04
Eugenol	9.48	1352	0.02	14.74	2100	0.05
Isodauca-4,7(14)-diene?	9.62	1362	0.01			
α-Ylangene	9.68	1366	0.01	7.04*	1442	[0.03]
α-Copaene	9.74	1370	0.12	7.09	1446	0.12
β-Bourbonene	9.85*	1378	0.10	7.42	1471	0.09
1,5-diepi-β-Bourbonene	9.85*	1378	[0.10]	7.30*	1462	[0.03]
β-Elemene	9.99	1388	0.03	8.43	1549	0.03
Longifolene	10.16	1399	0.02	7.97	1512	0.03
Isocaryophyllene	10.22	1404	0.02	8.08*	1521	[4.63]
β-Caryophyllene	10.32†	1411	2.38	8.36	1543	2.45
β-Copaene	10.43†	1420	[2.38]	8.30	1538	0.04
Menthofurolactone isomer III	10.56	1429	0.02			
Isogermacrene D	10.60	1432	0.05	8.91*†	1586	[1.40]
α-Humulene	10.78*	1446	0.15	9.24*	1612	[0.10]
ε-Muurolene?	10.78*	1446	[0.15]	9.16*	1606	[42.95]
(*E*)-β-Farnesene	10.93	1456	0.03	9.49	1632	0.04
Germacrene D	11.16	1474	0.40	9.72	1651	0.39
Viridiflorene	11.36*	1489	0.13	9.64	1644	0.06
Bicyclogermacrene	11.36*	1489	[0.13]	9.99	1673	0.09
γ-Cadinene	11.61	1508	0.03	10.30	1698	0.04
δ-Cadinene	11.75*	1519	0.05	10.35*	1703	[0.06]
Menthofurolactone analog	11.75*	1519	[0.05]			
Caryophyllene oxide isomer	12.43*	1572	0.08	12.61	1899	0.02
Caryophyllene oxide	12.43*	1572	[0.08]	12.69	1909	0.05
Viridiflorol	12.56	1582	0.07	13.92	2022	0.07
Mint sulfide?	14.23	1720	0.01			
Total identified		**99.01%**			**98.51%**	
Total reported		**99.06%**			**98.51%**	

*: 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