Date : November 26, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 20K20-PTH05
Customer identification : Peppermint Western - PF0106208R
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 : Sylvain Mercier, M. Sc., Chimiste
Analysis date : November 23, 2020

Checked and approved by :

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

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Méthode certifiée ISO 17025:2017 Certified method

Laboratoire PhytoChemia
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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.4616 ± 0.0003 (20 °C; method PC-MAT-016)

NF T 75-210:2007 & ISO 856:2006 - OIL OF PEPPERMINT - USA

Compound	Min. %	Max. %	Observed %	Complies?
β-Caryophyllene	1.0	2.5	2.1	Yes
Menthyl acetate	3.0	6.5	5.2	Yes
Pulegone	0.5	2.5	1.0	Yes
Menthol	36.0	46.0	41.2	Yes
neo-Menthol	2.5	4.5	3.7	Yes
Menthofuran	1.5	6.0	2.2	Yes
Isomenthone	2.0	4.5	3.0	Yes
Menthone	15.0	25.0	20.0	Yes
cis-Sabinene hydrate	0.5	2.3	1.1	Yes
Limonene	1.0	2.5	1.5	Yes
1,8-Cineole	4.0	6.0	4.4	Yes
Octan-3-ol	0.1	0.4	0.4	Yes
Refractive index	1.459	1.465	1.462	Yes

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

Compound	Min. %	Max. %	Observed %	Complies?
Carvone		1.0	0.1	Yes
Pulegone		3.0	1.0	Yes
Menthol	30.0	55.0	41.2	Yes
Menthyl acetate	2.8	10.0	5.2	Yes
Isomenthone	1.5	10.0	3.0	Yes
Menthofuran	1.0	8.0	2.2	Yes
Menthone	14.0	32.0	20.0	Yes
1,8-Cineole	3.5	8.0	4.4	Yes
Limonene	1.0	3.5	1.5	Yes
Total isopulegol		0.20	0.10	Yes
Refractive index	1.457	1.467	1.462	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method.

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
Penten-3-ol	tr	Aliphatic alcohol
2-Ethylfuran	tr	Furan
Isoamyl alcohol	0.03	Aliphatic alcohol
2-Methylbutanol	0.04	Aliphatic alcohol
(3*Z*)-Hexenol	0.03	Aliphatic alcohol
(2*E*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.02	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.02	Furan
α-Thujene	0.04	Monoterpene
α-Pinene	0.56	Monoterpene
3-Methylcyclohexanone	0.01	Aliphatic ketone
α-Fenchene	0.01	Monoterpene
Camphene	0.01	Monoterpene
Thuja-2,4(10)-diene	tr	Monoterpene
β-Pinene	0.85	Monoterpene
Sabinene	0.41	Monoterpene
Octen-3-ol	0.18	Aliphatic alcohol
Octan-3-one	0.03	Aliphatic ketone
Myrcene	0.19	Monoterpene
Octan-3-ol	0.40	Aliphatic alcohol
α-Phellandrene	0.02	Monoterpene
Pseudolimonene	tr	Monoterpene
α-Terpinene	0.32	Monoterpene
para-Cymene	0.11	Monoterpene
Limonene	1.47	Monoterpene
1,8-Cineole	4.43	Monoterpenic ether
(*Z*)-β-Ocimene	0.28	Monoterpene
(*E*)-β-Ocimene	0.08	Monoterpene
γ-Terpinene	0.53	Monoterpene
cis-Sabinene hydrate	1.11	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
Terpinolene	0.16	Monoterpene
para-Cymenene	0.02	Monoterpene
trans-Sabinene hydrate	0.10	Monoterpenic alcohol
Linalool	0.30	Monoterpenic alcohol
Nonan-3-ol	0.04	Aliphatic alcohol
2-Methylbutyl 2-methylbutyrate	0.06	Aliphatic ester
Amyl isovalerate	0.12	Aliphatic ester
Octen-3-yl acetate	0.02	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.08	Monoterpenic alcohol
Octan-3-yl acetate	0.05	Aliphatic ester
trans-Sabinol	0.08	Monoterpenic alcohol

Isopulegol	0.10	Monoterpenic alcohol
Menthone	19.96	Monoterpenic ketone
Isomenthone	2.96	Monoterpenic ketone
Menthofuran	2.21	Monoterpenic ether
δ-Terpineol	0.17	Monoterpenic alcohol
neo-Menthol	3.65	Monoterpenic alcohol
Terpinen-4-ol	0.98	Monoterpenic alcohol
Menthol	41.25	Monoterpenic alcohol
Isomenthol	0.77	Monoterpenic alcohol
para-Cymen-8-ol	0.05	Monoterpenic alcohol
α-Terpineol	0.20	Monoterpenic alcohol
neoiso-Menthol	0.22	Monoterpenic alcohol
Methylchavicol	0.05	Phenylpropanoid
Unknown	0.01	Unknown
trans-Piperitol	0.02	Monoterpenic alcohol
Citronellol	0.02	Monoterpenic alcohol
Pulegone	1.03	Monoterpenic ketone
Carvone	0.06	Monoterpenic ketone
Piperitone	0.56	Monoterpenic ketone
Isopiperitenone	0.01	Monoterpenic ketone
Decanol	0.03	Aliphatic alcohol
neo-Menthyl acetate	0.25	Monoterpenic ester
2-Ethylmenthone?	0.01	Aliphatic ketone
Dihydroedulan I	0.04	Terpenic ether
Menthyl acetate	5.20	Monoterpenic ester
Dihydroedulan II	0.05	Terpenic ether
Isomenthyl acetate	0.26	Monoterpenic alcohol
Bicycloelemene	0.02	Sesquiterpene
α-Cubebene	0.01	Sesquiterpene
α-Copaene	0.05	Sesquiterpene
β-Bourbonene	0.35	Sesquiterpene
β-Cubebene	0.02	Sesquiterpene
β-Elemene	0.09	Sesquiterpene
Unknown	0.03	Unknown
(*Z*)-Jasmone	0.01	Jasmonate
Unknown	0.02	Sesquiterpene
Isocaryophyllene	0.02	Sesquiterpene
β-Caryophyllene	2.09	Sesquiterpene
β-Copaene	0.05	Sesquiterpene
trans-α-Bergamotene	0.01	Sesquiterpene
Isogermacrene D	0.03	Sesquiterpene
α-Humulene	0.09	Sesquiterpene
(*E*)-β-Farnesene	0.39	Sesquiterpene
Germacrene D	2.01	Sesquiterpene
Bicyclogermacrene	0.26	Sesquiterpene
Viridiflorene	0.02	Sesquiterpene
5-Methyl-2,4-diisopropylphenol	0.01	Terpene derivative
α-Muurolene	0.05	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
δ-Cadinene	0.08	Sesquiterpene
Spathulenol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.03	Sesquiterpenic ether

Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Viridiflorol	0.22	Sesquiterpenic alcohol
α-Cadinol	0.01	Sesquiterpenic alcohol
Mint sulfide?	0.01	Sesquiterpenic sulfide
Consolidated total	**98.41%**	

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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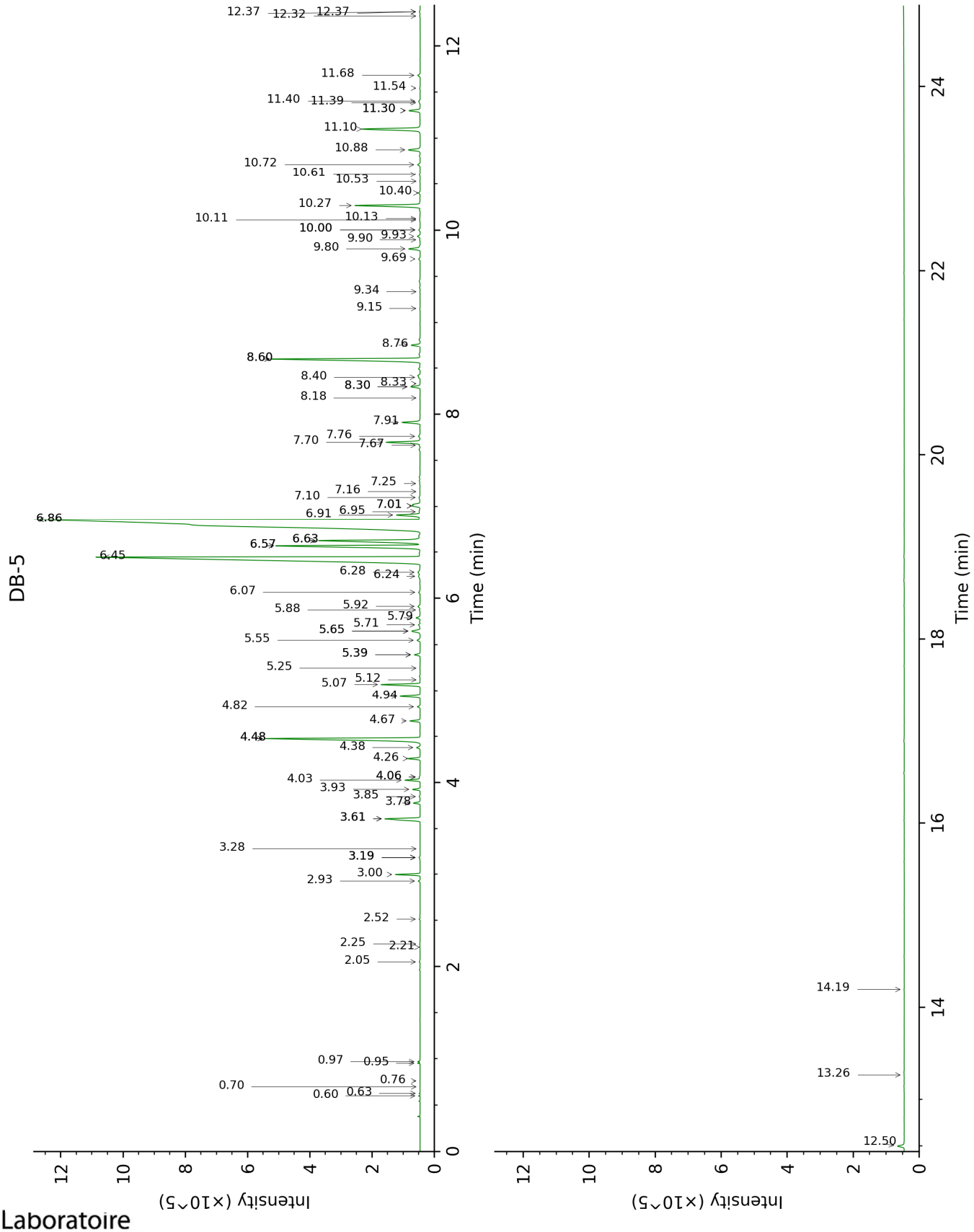
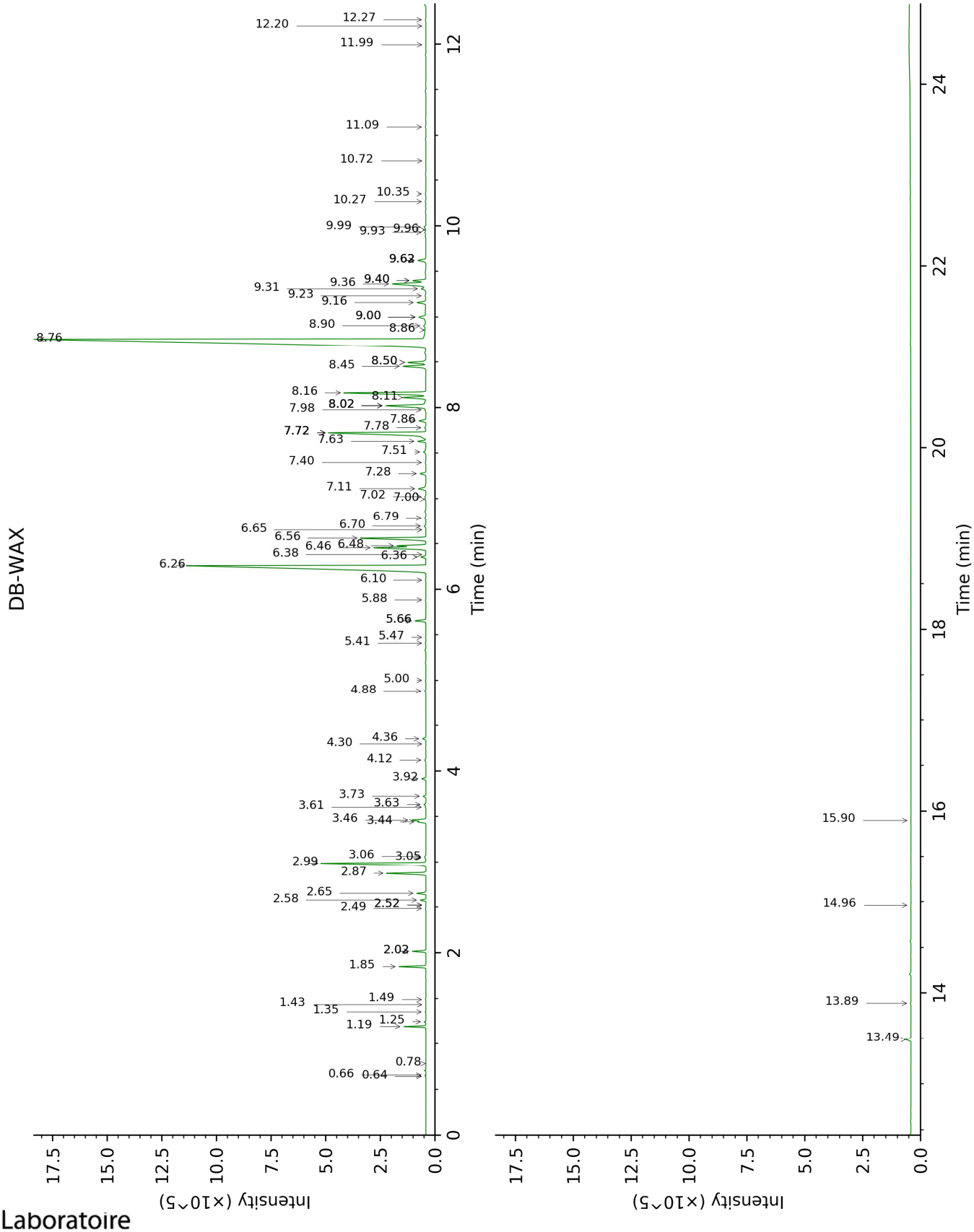

DB-5
Time (min)
Intensity (×10^5)
12.37
12.32
12.37
11.68
11.54
11.40
11.39
11.30
11.10
10.88
10.72
10.61
10.53
10.40
10.27
10.11
10.13
10.00
9.90
9.93
9.80
9.69
9.34
9.15
8.76
8.60
8.40
8.30
8.33
8.18
7.91
7.70
7.76
7.67
7.25
7.10
7.16
7.01
6.91
6.95
6.86
6.57
6.63
6.45
6.28
6.24
6.07
5.88
5.92
5.79
5.65
5.71
5.55
5.39
5.25
5.07
5.12
4.94
4.82
4.67
4.48
4.38
4.26
4.03
4.06
3.93
3.85
3.78
3.61
3.28
3.19
2.93
3.00
2.52
2.25
2.21
2.05
0.97
0.95
0.76
0.70
0.60
0.63
14.19
13.26
12.50


DB-WAX
Time (min)
Intensity (×10^5)
12.20
12.27
11.99
11.09
10.72
10.27
10.35
9.99
9.93
9.96
9.62
9.31
9.36
9.40
9.23
9.16
9.00
8.90
8.86
8.76
8.45
8.50
8.16
8.11
7.98
8.02
7.86
7.72
7.78
7.63
7.51
7.40
7.28
7.11
7.02
7.00
6.79
6.65
6.70
6.56
6.46
6.48
6.38
6.36
6.26
6.10
5.88
5.66
5.41
5.47
5.00
4.88
4.30
4.36
4.12
3.92
3.73
3.61
3.63
3.46
3.44
3.06
2.99
3.05
2.87
2.65
2.58
2.49
2.52
2.02
1.85
1.49
1.43
1.35
1.25
1.19
0.78
0.66
0.64
15.90
14.96
13.89
13.49

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.60	642	0.01	0.66	883	0.02
2-Methylbutyral	0.63	652	0.01	0.64	878	0.01
Penten-3-ol	0.70	679	tr	2.52*	1128	0.01
2-Ethylfuran	0.76	703	tr	0.78	918	tr
Isoamyl alcohol	0.95	733	0.03	3.06	1172	0.04
2-Methylbutanol	0.97	736	0.04	3.05	1171	0.04
(3*Z*)-Hexenol	2.05	857	0.03	5.48	1353	0.01
(2*E*)-Hexenol	2.21	870	0.01	5.66*	1366	0.41
Hexanol	2.25	873	0.02	5.00	1319	0.02
trans-2,5-Diethyltetrahydrofuran	2.52	896	0.02	1.35	1013	0.02
α-Thujene	2.93	925	0.04	1.25	1001	0.04
α-Pinene	3.00	930	0.56	1.19	991	0.57
3-Methylcyclohexanone	3.19*	943	0.03	4.30	1269	0.01
α-Fenchene	3.19*	943	[0.03]	1.43	1021	0.01
Camphene	3.19*	943	[0.03]	1.49	1027	0.01
Thuja-2,4(10)-diene	3.28	949	tr	2.02*	1082	0.42
β-Pinene	3.61*	971	1.26	1.85	1065	0.85
Sabinene	3.61*	971	[1.26]	2.02*	1082	[0.42]
Octen-3-ol	3.78	982	0.18	6.36	1417	0.19
Octan-3-one	3.85	987	0.03	3.61	1216	0.03
Myrcene	3.93	992	0.19	2.58	1133	0.19
Octan-3-ol	4.03	999	0.40	5.66*	1366	[0.41]
α-Phellandrene	4.06*	1001	0.03	2.49	1125	0.02
Pseudolimonene	4.06*	1001	[0.03]	2.52*	1128	[0.01]
α-Terpinene	4.26	1014	0.32	2.65	1139	0.32
para-Cymene	4.38	1022	0.11	3.73	1225	0.10
Limonene	4.48*	1028	5.78	2.87	1157	1.47
1,8-Cineole	4.48*	1028	[5.78]	2.99	1166	4.43
(*Z*)-β-Ocimene	4.67	1040	0.28	3.44	1204	0.27
(*E*)-β-Ocimene	4.82	1050	0.08	3.64	1218	0.07
γ-Terpinene	4.94	1057	0.53	3.46	1206	0.54
cis-Sabinene hydrate	5.07	1065	1.11	6.48†	1426	[3.38]
cis-Linalool oxide (fur.)	5.12	1068	0.01	6.10	1398	0.02
Octanol	5.25	1076	0.01	7.78	1524	0.06
Terpinolene	5.39*	1086	0.16	3.92	1240	0.16
para-Cymenene	5.39*	1086	[0.16]	5.88	1382	0.02
trans-Sabinene hydrate	5.55	1096	0.10	7.51	1504	0.10
Linalool	5.65*	1102	0.32	7.63	1513	0.30
Nonan-3-ol	5.65*	1102	[0.32]	7.00	1465	0.04
2-Methylbutyl 2-methylbutyrate	5.72	1106	0.06	4.12	1256	0.05
Amyl isovalerate	5.79	1111	0.12	4.36	1274	0.13
Octen-3-yl acetate	5.88	1117	0.02	5.41	1348	0.02
cis-para-Menth-2-en-1-ol	5.92	1119	0.08	7.72*	1520	5.40

Octan-3-yl acetate	6.07	1129	0.05	4.88	1310	0.05
trans-Sabinol	6.24	1140	0.08	9.40*†	1654	[2.54]
Isopulegol	6.28	1143	0.10	7.72*	1520	[5.40]
Menthone	6.45	1154	19.96	6.26	1410	20.07
Isomenthone	6.57*	1162	5.17	6.56	1432	2.96
Menthofuran	6.57*	1162	[5.17]	6.46†	1425	3.38
δ-Terpineol	6.63*	1166	3.82	9.00*	1621	0.43
neo-Menthol	6.63*	1166	[3.82]	8.16	1554	3.65
Terpinen-4-ol	6.86*	1180	42.68	8.11	1550	0.98
Menthol	6.86*	1180	[42.68]	8.76	1601	41.25
Isomenthol	6.91	1184	0.77	8.50*	1580	0.78
para-Cymen-8-ol	6.95	1186	0.05	11.09	1796	0.02
α-Terpineol	7.01*†	1190	0.42	9.31	1646	0.20
neoiso-Menthol	7.01*†	1190	[0.42]	9.00*	1621	[0.43]
Methylchavicol	7.10	1196	0.05	8.86	1609	0.05
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.16	1200	0.01			
trans-Piperitol	7.25	1206	0.02	9.96	1699	0.01
Citronellol	7.66	1234	0.02	10.35	1733	0.03
Pulegone	7.70	1237	1.03	8.45	1577	1.04
Carvone	7.76	1241	0.06	9.62*	1672	0.37
Piperitone	7.91	1251	0.56	9.40*†	1654	[2.54]
Isopiperitenone	8.18	1269	0.01	10.72	1764	0.01
Decanol	8.30*	1278	0.28	10.27	1726	0.03
neo-Menthyl acetate	8.30*	1278	[0.28]	7.28	1486	0.25
2-Ethylmenthone?	8.33	1280	0.01			
Dihydroedulan I	8.40	1285	0.04	6.70	1442	0.07
Menthyl acetate	8.60*	1298	5.39	7.72*	1520	[5.40]
Dihydroedulan II	8.60*	1298	[5.39]	7.02	1467	0.05
Isomenthyl acetate	8.76	1305	0.26	7.86	1530	0.29
Bicycloelemene	9.15	1334	0.02	6.65	1439	0.01
α-Cubebene	9.34	1346	0.01	6.38	1419	0.01
α-Copaene	9.69	1372	0.05	6.79	1449	0.06
β-Bourbonene	9.80	1379	0.35	7.11	1474	0.39
β-Cubebene	9.90	1386	0.02	7.40	1495	0.03
β-Elemene	9.93	1389	0.09	8.02*	1543	2.12
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.00*	1394	0.05			
(*Z*)-Jasmone	10.00*	1394	[0.05]	11.99	1877	0.01
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.11	1402	0.02			
Isocaryophyllene	10.13	1402	0.02	7.72*	1520	[5.40]
β-Caryophyllene	10.27	1413	2.09	8.02*	1543	[2.12]
β-Copaene	10.40	1423	0.05	7.98	1540	0.04
trans-α-Bergamotene	10.53	1433	0.01	8.02*	1543	[2.12]
Isogermacrene D	10.61	1438	0.03	8.50*	1580	[0.78]

α-Humulene	10.72	1447	0.09	8.90	1613	0.15
(*E*)-β-Farnesene	10.88	1459	0.39	9.16	1634	0.39
Germacrene D	11.10	1475	2.01	9.36†	1650	2.54
Bicyclogermacrene	11.30*	1490	0.37	9.62*	1672	[0.37]
Viridiflorene	11.30*	1490	[0.37]	9.23	1640	0.02
5-Methyl-2,4-diisopropylphenol	11.39	1497	0.01	15.90	2263	0.01
α-Muurolene	11.40	1498	0.05	9.62*	1672	[0.37]
γ-Cadinene	11.54	1509	0.02	9.93	1697	0.05
δ-Cadinene	11.68	1520	0.08	9.99	1702	0.08
Spathulenol	12.32	1570	0.02	13.89	2057	0.02
Caryophyllene oxide	12.37*	1574	0.03	12.27	1902	0.03
Caryophyllene oxide isomer	12.37*	1574	[0.03]	12.20	1896	0.01
Viridiflorol	12.50	1584	0.22	13.49	2017	0.23
α-Cadinol	13.26	1646	0.01	14.96	2165	0.01
Mint sulfide?	14.19	1724	0.01			
Total identified		**98.92%**			**98.61%**	
Total reported		**98.94%**			**98.61%**	

*: 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