Date : August 20, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19F05-PTH04-1-SCC
Customer identification : Spearmint Org - India - S4010485R
Type : Essential oil
Source : *Mentha spicata*
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 : June 12, 2019

Checked and approved by :

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

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

This report is an update of the version first issued on June 18, 2019 to indicatively present comparison to a standard.

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Physicochemical data

Physical aspect: Light yellow liquid
Refractive index: 1.4889 ± 0.0003 (20 °C)

NF T 75-245-1:2007 - Oil of spearmint, native type

Compound	Min. %	Max. %	Observed %	Complies?
Viridiflorol	0.1	0.5	0.1	Yes
β-Bourbonene	1.0	2.0	0.9	No
(Z)-Jasmone	0.2	0.7	0.1	No
cis-Carvyl acetate	0.1	0.6	0.2	Yes
Dihydrocarvyl acetate	0.1	0.6	0.2	Yes
Carvone	60.0	70.0	59.5	No
cis-Dihydrocarvone	1.0	2.5	1.0	Yes
cis-Sabinene hydrate	0.5	1.0	0.3	No
Menthone		0.2	0.3	No
Octan-3-ol	0.6	1.4	0.4	No
Limonene	9.0	15.0	18.5	No
Refractive index	1.4840	1.4910	1.4889	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	%	Classe
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Methyl 2-methylbutyrate	0.01	Aliphatic ester
(2*E*)-Hexenal	0.01	Aliphatic aldehyde
(3*Z*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.09	Furan
Hashishene	0.10	Monoterpene
α-Thujene	0.06	Monoterpene
α-Pinene	0.88	Monoterpene
3-Methylcyclohexanone	0.13	Aliphatic ketone
Camphene	0.04	Monoterpene
α-Fenchene	0.02	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
Benzaldehyde	0.01	Simple phenolic
Sabinene	0.49	Monoterpene
β-Pinene	1.19	Monoterpene
Octen-3-ol	0.06	Aliphatic alcohol
Octan-3-one	0.09	Aliphatic ketone
Myrcene	1.58	Monoterpene
Octan-3-ol	0.44	Aliphatic alcohol
Pseudolimonene	0.06	Monoterpene
α-Phellandrene	0.02	Monoterpene
Δ3-Carene	0.03	Monoterpene
α-Terpinene	0.15	Monoterpene
Carvomenthene	0.02	Aliphatic alcohol
para-Cymene	0.29	Monoterpene
Limonene	18.53	Monoterpene
β-Phellandrene	1.76*	Monoterpene
1,8-Cineole	[1.76]*	Monoterpenic ether
(*Z*)-β-Ocimene	0.07	Monoterpene
(*E*)-β-Ocimene	0.05	Monoterpene
γ-Terpinene	0.26	Monoterpene
cis-Sabinene hydrate	0.31	Monoterpenic alcohol
Octanol	0.07	Aliphatic alcohol
Terpinolene	0.11	Monoterpene
trans-Linalool oxide (fur.)	tr	Monoterpenic alcohol
para-Cymenene	0.04	Monoterpene
trans-Sabinene hydrate	0.04	Monoterpenic alcohol
Linalool	0.05	Monoterpenic alcohol
Nonanal	0.02	Aliphatic aldehyde
2-Methylbutyl 2-methylbutyrate	0.01	Aliphatic ester
endo-Fenchol	0.02	Monoterpenic alcohol
Octen-3-yl acetate	0.02	Aliphatic ester

trans-para-Mentha-2,8-dien-1-ol	0.05	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.06	Monoterpenic alcohol
Octan-3-yl acetate	0.11	Aliphatic ester
cis-Limonene oxide	0.05	Monoterpenic ether
trans-Limonene oxide	0.05	Monoterpenic ether
cis-para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
trans-Pinocarveol	0.06	Monoterpenic alcohol
Isopulegol	0.04	Monoterpenic alcohol
Menthone	0.29	Monoterpenic ketone
Isomenthone	0.11	Monoterpenic ketone
Menthofuran	0.01	Monoterpenic ether
neo-Menthol	0.19	Monoterpenic alcohol
Menthol	0.93	Monoterpenic alcohol
Terpinen-4-ol	0.53	Monoterpenic alcohol
α-Terpineol	0.25	Monoterpenic alcohol
neoiso-Menthol	0.08	Monoterpenic alcohol
cis-Dihydrocarvone	0.98	Monoterpenic ketone
neo-Dihydrocarveol	0.18	Monoterpenic alcohol
Dihydrocarveol	0.06	Monoterpenic alcohol
trans-Isopiperitenol	0.01	Monoterpenic alcohol
Methylchavicol	0.05	Phenylpropanoid
trans-Dihydrocarvone	0.31	Monoterpenic ketone
trans-Piperitol	0.01	Monoterpenic alcohol
Unknown	0.01	Unknown
iso-Dihydrocarveol ?	0.03	Monoterpenic alcohol
trans-Carveol	0.02	Monoterpenic alcohol
cis-Carveol	0.46	Monoterpenic alcohol
Pulegone	0.03	Monoterpenic ketone
Carvone	59.54	Monoterpenic ketone
Piperitone	0.17	Monoterpenic ketone
Isopiperitenone	0.10	Monoterpenic ketone
neo-Menthyl acetate	0.02	Monoterpenic ester
trans-Carvone oxide	0.09	Monoterpenic ketone
Decanol	0.08	Aliphatic alcohol
Dihydroedulan I	0.06	Terpenic ether
Menthyl acetate	0.11	Monoterpenic ester
Dihydroedulan II	0.03	Terpenic ether
Isomenthyl acetate	0.03	Monoterpenic alcohol
neo-Dihydrocarvyl acetate	0.01	Monoterpenic ester
Dihydrocarvyl acetate	0.24	Monoterpenic ester
Bicycloelemene	0.04	Sesquiterpene
α-Cubebene	0.01	Sesquiterpene
Evodone	0.02	Monoterpenic ketone
Menthofurolactone	0.04	Aliphatic alcohol
iso-Dihydrocarvyl acetate	0.03	Monoterpenic ester
cis-Carvyl acetate	0.21	Monoterpenic ester
α-Copaene	0.04	Sesquiterpene
β-Bourbonene	0.93	Sesquiterpene
1,5-diepi-β-Bourbonene	0.10	Sesquiterpene
β-Elemene	0.10	Sesquiterpene
(*Z*)-Jasmone	0.15	Jasmonate
Unknown	0.01	Unknown

Unknown	0.06	Sesquiterpene
β-Caryophyllene	0.90	Sesquiterpene
β-Copaene	0.20	Sesquiterpene
Isogermacrene D	0.03	Sesquiterpene
α-Humulene	0.17	Sesquiterpene
(*E*)-β-Farnesene	0.28	Sesquiterpene
Unknown	0.07	Sesquiterpene
Germacrene D	0.51	Sesquiterpene
Viridiflorene	0.06	Sesquiterpene
α-Muurolene	0.05	Sesquiterpene
γ-Cadinene	0.03	Sesquiterpene
δ-Cadinene	0.06	Sesquiterpene
α-Cadinene	0.01	Sesquiterpene
(*E*)-Nerolidol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.08	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Viridiflorol	0.08	Sesquiterpenic alcohol
Isospathulenol	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.02	Sesquiterpenic alcohol
meta-Camphorene	0.02	Diterpene
Consolidated total	**96.95%**	

*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total
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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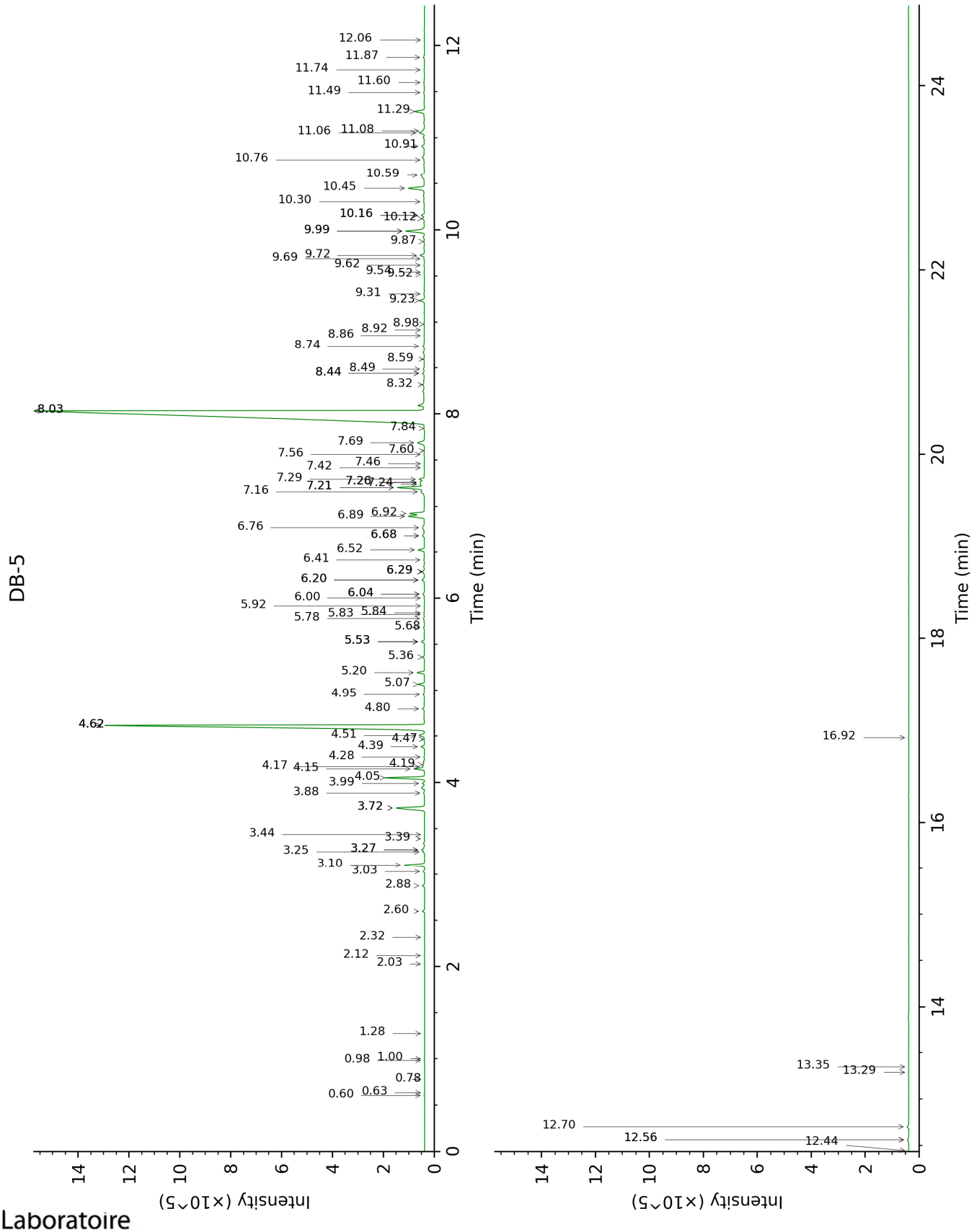
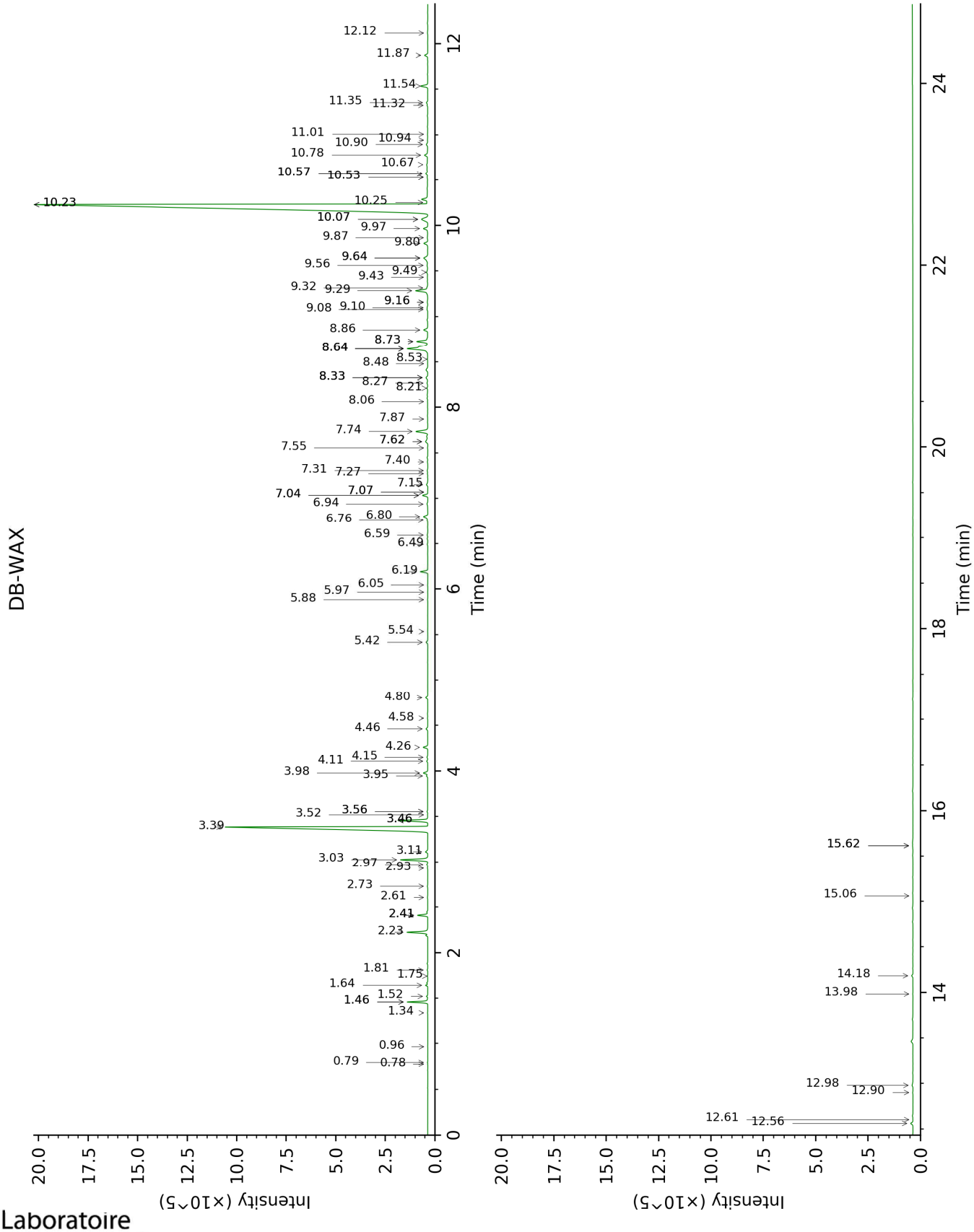

DB-5
Time (min)
Intensity (×10^5)
12.06
11.87
11.74
11.60
11.49
11.29
11.06
11.08
10.91
10.76
10.59
10.45
10.30
10.16
10.12
9.99
9.87
9.69
9.72
9.62
9.54
9.52
9.31
9.23
8.98
8.92
8.86
8.74
8.59
8.49
8.44
8.32
8.03
7.84
7.69
7.60
7.56
7.46
7.42
7.29
7.26
7.24
7.21
7.16
6.92
6.89
6.76
6.68
6.52
6.41
6.29
6.20
6.04
6.00
5.92
5.84
5.83
5.78
5.68
5.53
5.36
5.20
5.07
4.95
4.80
4.62
4.51
4.47
4.39
4.28
4.19
4.17
4.15
4.05
3.99
3.88
3.72
3.44
3.39
3.25
3.27
3.10
3.03
2.88
2.60
2.32
2.12
2.03
1.28
0.98
1.00
0.78
0.60
0.63
16.92
13.35
13.29
12.70
12.56
12.44


DB-WAX
Time (min)
Intensity (×10^5)
12.12
11.87
11.54
11.35
11.32
11.01
10.90
10.94
10.78
10.67
10.57
10.53
10.23
10.25
10.07
9.97
9.87
9.80
9.64
9.56
9.43
9.49
9.32
9.29
9.16
9.08
9.10
8.86
8.73
8.64
8.48
8.53
8.33
8.27
8.21
8.06
7.87
7.74
7.62
7.55
7.40
7.31
7.27
7.15
7.04
7.07
6.94
6.76
6.80
6.59
6.49
6.19
6.05
5.97
5.88
5.54
5.42
4.80
4.58
4.46
4.26
4.11
4.15
3.98
3.95
3.52
3.56
3.46
3.39
3.11
3.03
2.97
2.93
2.73
2.61
2.41
2.23
1.81
1.75
1.64
1.52
1.46
1.34
0.96
0.79
0.78
15.62
15.06
14.18
13.98
12.98
12.90
12.61
12.56

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.60	639	0.01	0.79	888	0.01
2-Methylbutyral	0.63	650	0.01	0.78	882	0.01
2-Ethylfuran	0.78	705	tr	0.96	920	tr
Isoamyl alcohol	0.98	734	0.01	3.56*	1179	0.03
2-Methylbutanol	1.00	737	0.01	3.56*	1179	[0.03]
Methyl 2-methylbutyrate	1.28	775	0.01	1.34	978	0.01
(2*E*)-Hexenal	2.03	848	0.01	3.52	1176	0.01
(3*Z*)-Hexenol	2.12	856	0.01	5.88	1342	0.02
Hexanol	2.32	872	0.01	5.54	1316	0.01
trans-2,5-Diethyltetrahydrofuran	2.60	895	0.09	1.64	1014	0.10
Hashishene	2.88	914	0.10	1.46*	996	0.97
α-Thujene	3.03	924	0.06	1.52	1002	0.06
α-Pinene	3.10	929	0.88	1.46*	996	[0.97]
3-Methylcyclohexanone	3.25†	939	0.20	4.80	1273	0.13
Camphene	3.27*†	940	[0.20]	1.81	1030	0.04
α-Fenchene	3.27*†	940	[0.20]	1.74	1023	0.02
Thuja-2,4(10)-diene	3.39	948	0.01	2.41*	1088	0.54
Benzaldehyde	3.44	951	0.01	7.56	1465	0.02
Sabinene	3.72*	970	1.67	2.41*	1088	[0.54]
β-Pinene	3.72*	970	[1.67]	2.23	1070	1.19
Octen-3-ol	3.88	981	0.06	6.94	1419	0.08
Octan-3-one	3.99	988	0.09	4.11	1221	0.06
Myrcene	4.05	992	1.58	3.03	1137	1.57
Octan-3-ol	4.15	998	0.44	6.19	1364	0.42
Pseudolimonene	4.17†	999	0.13	2.97	1133	0.06
α-Phellandrene	4.19†	1001	[0.13]	2.93	1130	0.02
Δ3-Carene	4.28	1006	0.03	2.73	1114	0.03
α-Terpinene	4.39	1013	0.15	3.11	1144	0.14
Carvomenthene	4.47	1018	0.02	2.61	1104	0.03
para-Cymene	4.51	1020	0.29	4.26	1232	0.27
Limonene	4.62*	1027	20.29	3.39	1165	18.53
β-Phellandrene	4.62*	1027	[20.29]	3.46*	1171	1.64
1,8-Cineole	4.62*	1027	[20.29]	3.46*	1171	[1.64]
(*Z*)-β-Ocimene	4.80	1039	0.07	3.95	1209	0.07
(*E*)-β-Ocimene	4.95	1048	0.05	4.15	1224	0.05
γ-Terpinene	5.07	1056	0.26	3.98	1211	0.27
cis-Sabinene hydrate	5.20	1064	0.31	7.04*	1426	0.32
Octanol	5.36	1074	0.07	8.33*	1524	0.16
Terpinolene	5.53*	1085	0.14	4.46	1247	0.11
trans-Linalool oxide (fur.)	5.53*	1085	[0.14]	7.07*	1429	0.01
para-Cymenene	5.53*	1085	[0.14]	6.49	1386	0.04
trans-Sabinene hydrate	5.68	1094	0.04	8.06	1504	0.03
Linalool	5.78	1100	0.05	8.21	1515	0.06

Nonanal	5.82	1103	0.02	6.05	1354	0.02
2-Methylbutyl 2-methylbutyrate	5.84	1104	0.01	4.58	1256	0.02
endo-Fenchol	5.92	1109	0.02	8.53	1540	0.03
Octen-3-yl acetate	6.00	1115	0.02	5.97	1348	0.01
trans-para-Mentha-2,8-dien-1-ol	6.04*	1117	0.08	9.08	1583	0.05
cis-para-Menth-2-en-1-ol	6.04*	1117	[0.08]	8.26	1519	0.06
Octan-3-yl acetate	6.20*	1127	0.13	5.42	1308	0.11
cis-Limonene oxide	6.20*	1127	[0.13]	6.59	1393	0.05
trans-Limonene oxide	6.29*	1133	0.12	6.76	1406	0.05
cis-para-Mentha-2,8-dien-1-ol	6.29*	1133	[0.12]	9.64*	1628	0.46
trans-Pinocarveol	6.29*	1133	[0.12]	9.32	1602	0.06
Isopulegol	6.41	1141	0.04	8.33*	1524	[0.16]
Menthone	6.52	1148	0.29	6.80	1409	0.32
Isomenthone	6.68*	1158	0.12	7.15	1435	0.11
Menthofuran	6.68*	1158	[0.12]	7.07*	1429	[0.01]
neo-Menthol	6.76	1164	0.19	8.73*	1555	0.72
Menthol	6.89†	1172	1.49	9.29	1599	0.93
Terpinen-4-ol	6.92†	1174	[1.49]	8.73*	1555	[0.72]
α-Terpineol	7.16	1189	0.25	9.97	1654	0.31
neoiso-Menthol	7.21*	1192	1.33	9.56	1622	0.08
cis-Dihydrocarvone	7.21*	1192	[1.33]	8.64*†	1549	2.18
neo-Dihydrocarveol	7.24	1194	0.18	10.23*†	1676	59.77
Dihydrocarveol	7.26*†	1196	0.49	10.57*	1704	0.09
trans-Isopiperitenol	7.26*†	1196	[0.49]	10.53*	1701	0.02
Methylchavicol	7.26*†	1196	[0.49]	9.43	1611	0.05
trans-Dihydrocarvone	7.30†	1198	[0.49]	8.86	1565	0.31
trans-Piperitol	7.42	1206	0.01	10.53*	1701	[0.02]
Unknown [m/z 146, 145 (94), 43 (72), 99 (41), 81 (29), 115 (25), 86 (24)...]	7.46	1209	0.01			
iso-Dihydrocarveol ?	7.56	1216	0.03	10.94	1736	0.01
trans-Carveol	7.60	1219	0.02	11.54	1786	0.45
cis-Carveol	7.69	1225	0.46	11.87	1816	0.21
Pulegone	7.84	1235	0.03	9.10	1584	0.04
Carvone	8.03*†	1248	59.78	10.23*†	1676	[59.77]
Piperitone	8.03*†	1248	[59.78]	10.07*	1663	0.67
Isopiperitenone	8.32	1268	0.10	11.32	1768	0.04
neo-Menthyl acetate	8.44*	1276	0.11	7.87	1489	0.02
trans-Carvone oxide	8.44*	1276	[0.11]	11.35	1771	0.09
Decanol	8.49	1279	0.08	10.90	1732	0.09
Dihydroedulan I	8.59	1287	0.06	7.31	1447	0.05
Menthyl acetate	8.74	1296	0.11	8.33*	1524	[0.16]
Dihydroedulan II	8.86	1300	0.03	7.62*	1470	0.24
Isomenthyl acetate	8.92	1304	0.03	8.48	1536	0.01
neo-Dihydrocarvyl acetate	8.98	1308	0.01	9.16*	1589	0.05
Dihydrocarvyl acetate	9.24	1326	0.24	9.64*	1628	[0.46]

Bicycloelemene	9.31	1332	0.04	7.27	1444	0.03
α-Cubebene	9.52	1346	0.01	7.04*	1426	[0.32]
Evodone	9.54	1348	0.02	12.61	1881	0.01
Menthofurolactone	9.62	1353	0.04	12.12	1837	0.03
iso-Dihydrocarvyl acetate	9.69	1358	0.03			
cis-Carvyl acetate	9.72	1361	0.21	10.78	1722	0.20
α-Copaene	9.87	1371	0.04	7.40	1454	0.04
β-Bourbonene	9.99*	1379	1.03	7.74	1479	0.93
1,5-diepi-β-Bourbonene	9.99*	1379	[1.03]	7.62*	1470	[0.24]
β-Elemene	10.12	1389	0.10	8.64*†	1549	[2.18]
(*Z*)-Jasmone	10.16*	1391	0.16	12.56	1877	0.15
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.16*	1391	[0.16]			
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.30	1402	0.06			
β-Caryophyllene	10.45	1412	0.90	8.64*†	1549	[2.18]
β-Copaene	10.59	1423	0.20	8.64*†	1549	[2.18]
Isogermacrene D	10.76	1435	0.03	9.16*	1589	[0.05]
α-Humulene	10.91	1446	0.17	9.49	1616	0.12
(*E*)-β-Farnesene	11.06	1457	0.28	9.80	1641	0.28
Unknown [m/z 161, 105 (56), 91 (50), 93 (36), 119 (33), 79 (31)...204 (5)]	11.08	1459	0.07			
Germacrene D	11.29	1474	0.51	10.07*	1663	[0.67]
Viridiflorene	11.49	1489	0.06	9.87	1646	0.06
α-Muurolene	11.60	1497	0.05	10.25†	1678	[59.77]
γ-Cadinene	11.74	1508	0.03	10.57*	1704	[0.09]
δ-Cadinene	11.87	1519	0.06	10.67	1713	0.04
α-Cadinene	12.06	1533	0.01	11.01	1741	0.01
(*E*)-Nerolidol	12.44	1563	0.01	13.98	2008	0.01
Caryophyllene oxide	12.56*	1572	0.09	12.98	1914	0.08
Caryophyllene oxide isomer	12.56*	1572	[0.09]	12.90	1907	0.02
Viridiflorol	12.70	1583	0.08	14.18	2027	0.08
Isospathulenol	13.29	1630	0.01	15.62*	2167	0.04
τ-Cadinol	13.35	1635	0.02	15.06	2111	0.01
meta-Camphorene	16.92	1949	0.02	15.62*	2167	[0.04]
Total identified		**97.25%**			**97.02%**	
Total reported		**97.38%**			**97.02%**	

*: 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

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