

Date : April 07, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 20C27-PTH11

Customer identification : Spearmint - USA - S3010798R

Type : Essential oil

Source : *Mentha spicata*

Customer : Plant Therapy

ANALYSIS

Method: PC-MAT-007 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID (in French); identifications validated by GC-MS.

Analyst : Sylvain Mercier, M. Sc., Chimiste

Analysis date : April 02, 2020

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid

Refractive index: 1.4906 ± 0.0003 (20 °C)

NFT 75-245-1:2007 - OIL OF SPEARMINT, NATIVE TYPE

Compound	Min. %	Max. %	Observed %	Complies?
Viridiflorol	0.1	0.5	0.3	Yes
β-Bourbonene	1.0	2.0	1.7	Yes
(Z)-Jasmone	0.2	0.7	0.4	Yes
cis-Carvyl acetate	0.1	0.6	0.5	Yes
Dihydrocarvyl acetate	0.1	0.6	0.4	Yes
Carvone	60.0	70.0	67.5	Yes
cis-Dihydrocarvone	1.0	2.5	1.2	Yes
cis-Sabinene hydrate	0.5	1.0	1.0	Yes
Menthone		0.2	0.1	Yes
Octan-3-ol	0.6	1.4	0.8	Yes
Limonene	9.0	15.0	9.0	Yes
Refractive index	1.4840	1.4910	1.4906	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for native spearmint oil.

ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Classe
Isobutanol	tr	Aliphatic alcohol
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Isoamyl alcohol	0.02	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Methyl 2-methylbutyrate	0.01	Aliphatic ester
Hexanal	tr	Aliphatic aldehyde
(2E)-Hexenal	0.03	Aliphatic aldehyde
(3Z)-Hexenol	0.04	Aliphatic alcohol
(2E)-Hexenol	0.03	Aliphatic alcohol
Hexanol	0.02	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.05	Furan
Hashishene	0.07	Monoterpene
α -Thujene	0.03	Monoterpene
α -Pinene	0.35	Monoterpene
Camphene	0.01	Monoterpene
3-Methylcyclohexanone	0.01	Aliphatic ketone
Thuja-2,4(10)-diene	0.01	Monoterpene
Benzaldehyde	0.01	Simple phenolic
Sabinene	0.34	Monoterpene
β -Pinene	0.48	Monoterpene
Octen-3-one	tr	Aliphatic ketone
Octen-3-ol	0.01	Aliphatic alcohol
Octan-3-one	0.03	Aliphatic ketone
Myrcene	1.85	Monoterpene
Octan-3-ol	0.82	Aliphatic alcohol
α -Phellandrene	0.01	Monoterpene
Pseudolimonene	0.03	Monoterpene
Octanal	0.03	Aliphatic aldehyde
Δ^3 -Carene	tr	Monoterpene
α -Terpinene	0.21	Monoterpene
para-Cymene	0.09	Monoterpene
Carvomenthene	tr	Aliphatic alcohol
Limonene	8.99	Monoterpene
β -Phellandrene	0.03	Monoterpene
1,8-Cineole	1.63	Monoterpenic ether
2-Ethylhexanol	0.01	Aliphatic alcohol
(Z)- β -Ocimene	0.16	Monoterpene
(E)- β -Ocimene	0.08	Monoterpene
γ -Terpinene	0.38	Monoterpene
<i>cis</i> -Sabinene hydrate	0.98	Monoterpenic alcohol
para-Mentha-3,8-diene	tr	Monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.04	Aliphatic alcohol
Terpinolene	0.12	Monoterpene
para-Cymenene	0.03	Monoterpene

<i>trans</i> -Linalool oxide (fur.)	tr	Monoterpenic alcohol
<i>trans</i> -Sabinene hydrate	0.09	Monoterpenic alcohol
2-Methylbutyl isovalerate?	0.01	Aliphatic ester
Linalool	0.08	Monoterpenic alcohol
Nonanal	0.01	Aliphatic aldehyde
2-Methylbutyl 2-methylbutyrate	0.03	Aliphatic ester
endo-Fenchol	tr	Monoterpenic alcohol
Octen-3-yl acetate	0.01	Aliphatic ester
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.10	Monoterpenic alcohol
Octan-3-yl acetate	0.22	Aliphatic ester
<i>cis</i> -Limonene oxide	0.01	Monoterpenic ether
<i>cis</i> -para-Mentha-2,8-dien-1-ol	0.07	Monoterpenic alcohol
<i>trans</i> -Pinocarveol	0.05	Monoterpenic alcohol
<i>trans</i> -Limonene oxide	0.05	Monoterpenic ether
Camphor	0.04	Monoterpenic ketone
Isopulegol	0.04	Monoterpenic alcohol
Menthone	0.05	Monoterpenic ketone
Isomenthone	0.02	Monoterpenic ketone
Unknown	0.03	Unknown
neo-Menthol	0.21	Monoterpenic alcohol
Menthol	0.10	Monoterpenic alcohol
Terpinen-4-ol	0.74	Monoterpenic alcohol
Isomenthol	tr	Monoterpenic alcohol
neoiso-Menthol	0.08	Monoterpenic alcohol
<i>cis</i> -Dihydrocarvone	1.23	Monoterpenic ketone
Myrtenol	0.01	Monoterpenic alcohol
neo-Dihydrocarveol	0.53	Monoterpenic alcohol
Methylchavicol	0.02	Phenylpropanoid
<i>trans</i> -Dihydrocarvone	0.16	Monoterpenic ketone
Dihydrocarveol	0.37	Monoterpenic alcohol
<i>trans</i> -Isopiperitenol	0.02	Monoterpenic alcohol
iso-Dihydrocarveol ?	0.02	Monoterpenic alcohol
<i>trans</i> -Carveol	0.40	Monoterpenic alcohol
<i>cis</i> -Carveol	0.35	Monoterpenic alcohol
Carvone	67.47	Monoterpenic ketone
Piperitone	0.15	Monoterpenic ketone
Isopiperitenone	0.06	Monoterpenic ketone
neo-Menthyl acetate	0.02	Monoterpenic ester
<i>trans</i> -Carvone oxide	0.09	Monoterpenic ketone
2-Ethylmenthone?	0.02	Aliphatic ketone
Dihydroedulan I	0.06	Terpenic ether
Menthyl acetate	0.08	Monoterpenic ester
Dihydroedulan II	0.02	Terpenic ether
neo-Dihydrocarvyl acetate	0.01	Monoterpenic ester
Dihydrocarvyl acetate	0.39	Monoterpenic ester
α -Cubebene	0.04	Sesquiterpene
Eugenol	0.07	Phenylpropanoid
<i>cis</i> -Caryyl acetate	0.51	Monoterpenic ester
α -Copaene	0.06	Sesquiterpene
β -Bourbonene	1.69	Sesquiterpene
1,5-diepi- β -Bourbonene	0.12	Sesquiterpene
β -Elemene	0.10	Sesquiterpene

(Z)-Jasmone	0.40	Jasmonate
Isocaryophyllene	0.06	Sesquiterpene
β -Caryophyllene	1.09	Sesquiterpene
β -Ylangene	0.13	Sesquiterpene
β -Copaene	0.18	Sesquiterpene
Isogermacrene D	0.18	Sesquiterpene
α -Humulene	0.10	Sesquiterpene
allo-Aromadendrene	0.02	Sesquiterpene
Unknown	0.11	Sesquiterpene
(E)- β -Farnesene	0.85	Sesquiterpene
Germacrene D	1.09	Sesquiterpene
Viridiflorene	0.02	Sesquiterpene
Bicyclogermacrene	0.01	Sesquiterpene
α -Muurolene	0.09	Sesquiterpene
γ -Cadinene	0.03	Sesquiterpene
δ -Cadinene	0.07	Sesquiterpene
α -Cadinene	0.01	Sesquiterpene
(E)-Nerolidol	0.01	Sesquiterpenic alcohol
Spathulenol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.04	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Viridiflorol	0.26	Sesquiterpenic alcohol
τ -Cadinol	0.01	Sesquiterpenic alcohol
τ -Muurolol	0.01	Sesquiterpenic alcohol
α -Muurolol	0.01	Sesquiterpenic alcohol
α -Cadinol	0.02	Sesquiterpenic alcohol
meta-Camphorene	0.01	Diterpene
Consolidated total	98.07%	

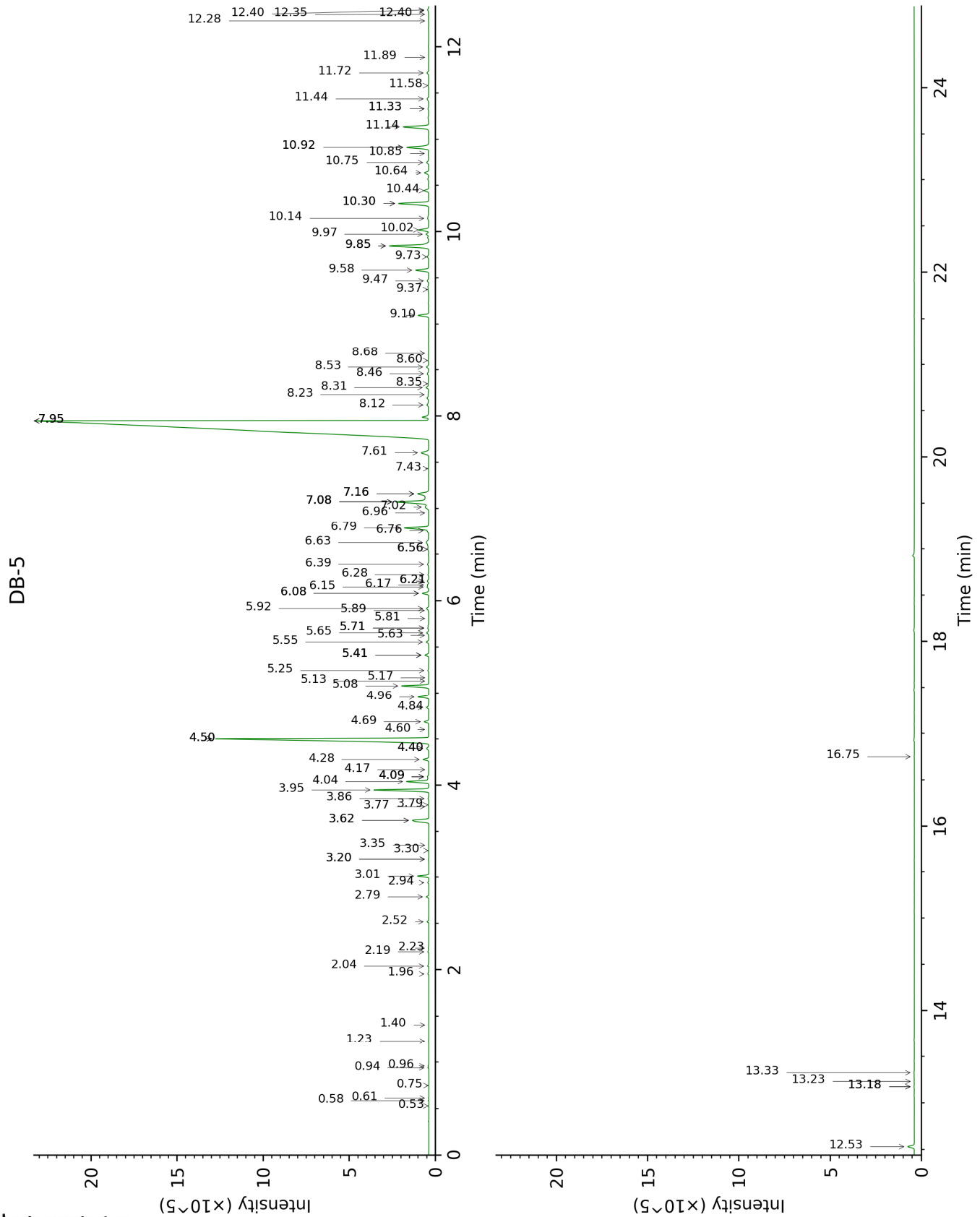
tr: The compound has been detected below 0.005% of total signal.

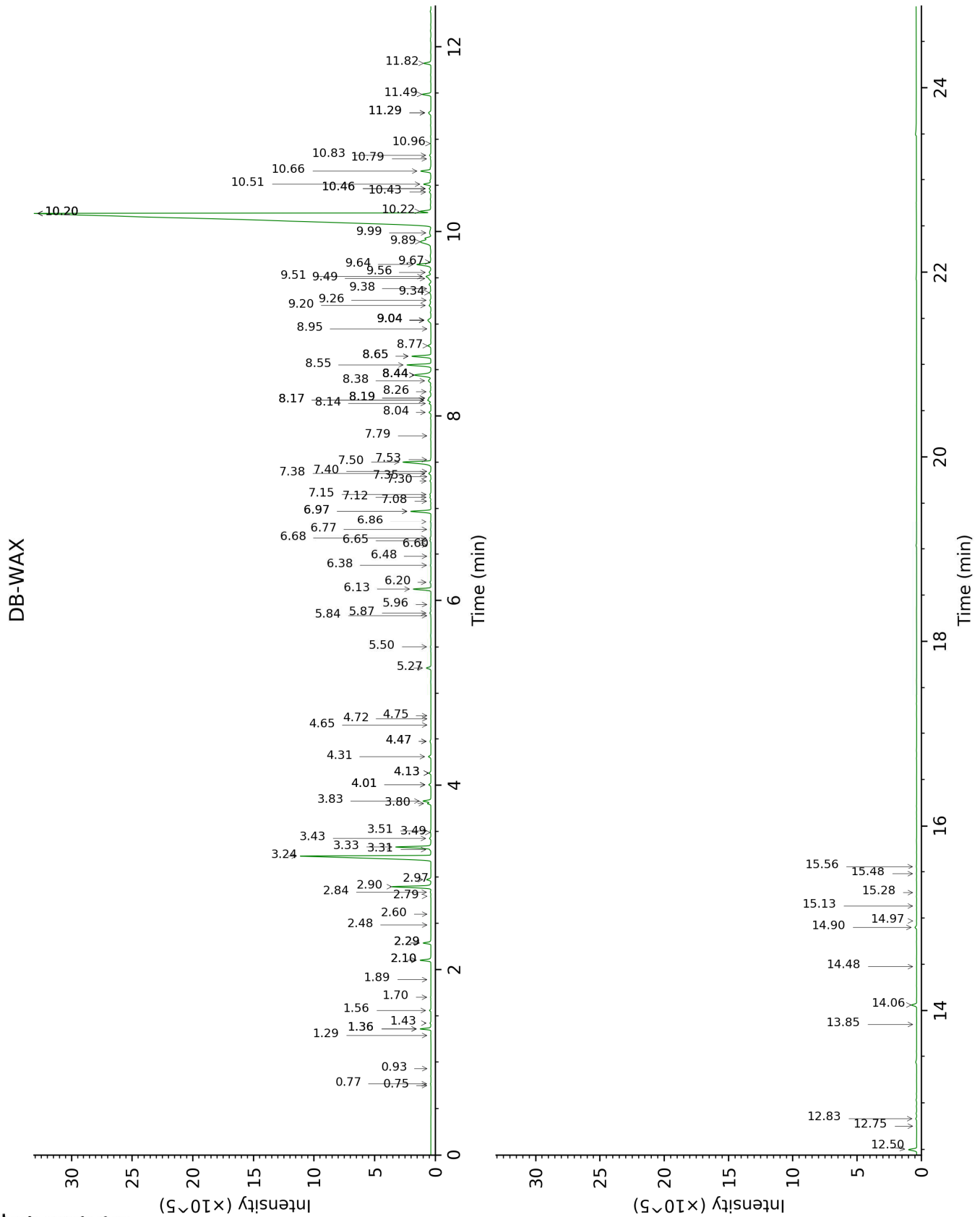
Note: no correction factor was applied

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.

This page was intentionally left blank. The following pages present the complete data of the analysis.





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutanol	0.53	615	tr	2.10*	1066	0.49
Isovaleral	0.58	639	0.01	0.77	891	0.01
2-Methylbutyral	0.61	651	0.01	0.75	884	0.01
2-Ethylfuran	0.75	707	tr	0.93	920	tr
Isoamyl alcohol	0.94	736	0.02	3.49†	1180	0.04
2-Methylbutanol	0.96	739	0.01	3.51†	1181	[0.04]
Methyl 2-methylbutyrate	1.23	777	0.01	1.29	980	tr
Hexanal	1.40	802	tr	1.89	1045	tr
(2E)-Hexenal	1.96	849	0.03	3.43	1174	0.07
(3Z)-Hexenol	2.04	856	0.04	5.87	1350	0.05
(2E)-Hexenol	2.20	869	0.03	6.20	1374	0.05
Hexanol	2.23	872	0.02	5.50	1324	0.02
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.52	896	0.05	1.56	1012	0.05
Hashishene	2.79	915	0.07	1.36*	992	0.42
α-Thujene	2.94	925	0.03	1.42	999	0.03
α-Pinene	3.01	930	0.35	1.36*	992	[0.42]
Camphene	3.20*	942	0.01	1.70	1027	0.01
3-Methylcyclohexanone	3.20*	942	[0.01]	4.72	1268	0.01
Thuja-2,4(10)-diene	3.30	948	0.01	2.29*	1084	0.34
Benzaldehyde	3.35	952	0.01	7.40	1463	0.01
Sabinene	3.62*	970	0.83	2.29*	1084	[0.34]
β-Pinene	3.62*	970	[0.83]	2.10*	1066	[0.49]
Octen-3-one	3.77	980	tr	4.65	1264	tr
Octen-3-ol	3.79	981	0.01	6.86	1422	0.03
Octan-3-one	3.86	986	0.03	4.01*	1217	0.10
Myrcene	3.95	992	1.85	2.90	1134	1.84
Octan-3-ol	4.04	998	0.82	6.13	1369	0.80
α-Phellandrene	4.09*	1001	0.06	2.79	1126	0.01
Pseudolimonene	4.09*	1001	[0.06]	2.84	1129	0.03
Octanal	4.09*	1001	[0.06]	4.47*	1251	0.06
Δ3-Carene	4.17	1006	tr	2.60	1110	tr
α-Terpinene	4.28	1013	0.21	2.97	1140	0.20
para-Cymene	4.40*	1021	0.10	4.13*	1226	0.09
Carvomenthene	4.40*	1021	[0.10]	2.48	1102	tr
Limonene	4.50*	1027	10.72	3.24	1160	8.99
β-Phellandrene	4.50*	1027	[10.72]	3.31	1165	0.03
1,8-Cineole	4.50*	1027	[10.72]	3.33	1167	1.63
2-Ethylhexanol	4.60	1034	0.01	7.35	1458	0.01
(Z)-β-Ocimene	4.69	1039	0.16	3.80†	1203	0.54
(E)-β-Ocimene	4.84	1049	0.08	4.01*	1217	[0.10]
γ-Terpinene	4.96	1056	0.38	3.83†	1205	[0.54]
<i>cis</i> -Sabinene hydrate	5.08	1064	0.98	6.97*	1431	0.98
para-Mentha-3,8-diene	5.13	1067	tr	4.13*	1226	[0.09]
<i>cis</i> -Linalool oxide (fur.)	5.17	1069	0.01	6.60†	1403	0.05
Octanol	5.25	1074	0.04	8.26	1528	0.05

Terpinolene	5.41*	1085	0.14	4.31	1239	0.12
para-Cymenene	5.41*	1085	[0.14]	6.38	1387	0.03
<i>trans</i> -Linalool oxide (fur.)	5.41*	1085	[0.14]	6.97*	1431	[0.98]
<i>trans</i> -Sabinene hydrate	5.55	1094	0.09	8.04	1510	0.09
2-Methylbutyl isovalerate?	5.63	1098	0.01	4.75	1271	0.01
Linalool	5.65	1100	0.08	8.14	1518	0.08
Nonanal	5.70*†	1104	0.06	5.96	1357	0.01
2-Methylbutyl 2-methylbutyrate	5.70*†	1104	[0.06]	4.47*	1251	[0.06]
endo-Fenchol	5.81	1110	tr	8.44*	1542	1.19
Octen-3-yl acetate	5.89	1116	0.01	5.84	1348	0.01
<i>trans</i> -para-Mentha-2,8-dien-1-ol	5.92	1117	0.10	9.04*	1588	0.26
Octan-3-yl acetate	6.08*	1128	0.24	5.27	1308	0.22
<i>cis</i> -Limonene oxide	6.08*	1128	[0.24]	6.48	1394	0.01
<i>cis</i> -para-Mentha-2,8-dien-1-ol	6.15	1132	0.07	9.56	1629	0.11
<i>trans</i> -Pinocarveol	6.17	1134	0.05	9.26	1605	0.05
<i>trans</i> -Limonene oxide	6.21*	1137	0.06	6.68	1409	0.05
Camphor	6.21*	1137	[0.06]	7.30	1455	0.04
Isopulegol	6.28	1141	0.04	8.19*†	1522	[0.31]
Menthone	6.39	1148	0.05	6.65†	1407	[0.05]
Isomenthone	6.56*	1159	0.06	7.08	1439	0.02
Unknown [m/z 93, 79 (83), 108 (61), 94 (58), 112 (56), 69 (51)...]	6.56*	1159	[0.06]			
neo-Menthol	6.63	1164	0.21	8.65*	1557	0.95
Menthol	6.76†	1172	1.02	9.20	1600	0.10
Terpinen-4-ol	6.79†	1174	[1.02]	8.65*	1557	[0.95]
Isomenthol	6.96	1185	tr	8.95	1580	0.01
neo-iso-Menthol	7.02†	1190	2.57	9.49	1624	0.08
<i>cis</i> -Dihydrocarvone	7.08*†	1193	[2.57]	8.55	1550	1.23
Myrtenol	7.08*†	1193	[2.57]	10.96	1744	0.01
neo-Dihydrocarveol	7.08*†	1193	[2.57]	10.22	1682	0.53
Methylchavicol	7.08*†	1193	[2.57]	9.38	1615	0.02
<i>trans</i> -Dihydrocarvone	7.16*†	1199	[2.57]	8.77	1566	0.16
Dihydrocarveol	7.16*†	1199	[2.57]	10.51	1707	0.37
<i>trans</i> -Isopiperitenol	7.16*†	1199	[2.57]	10.46*	1702	0.09
iso-Dihydrocarveol ?	7.43	1217	0.02	10.79	1730	0.02
<i>trans</i> -Carveol	7.60	1229	0.40	11.49	1789	0.41
<i>cis</i> -Carveol	7.95*†	1253	68.43	11.82	1818	0.35
Carvone	7.95*†	1253	[68.43]	10.20*	1680	67.57
Piperitone	7.95*†	1253	[68.43]	9.99	1664	0.15
Isopiperitenone	8.12	1265	0.06	11.29*	1772	0.16
neo-Menthyl acetate	8.23	1273	0.02	7.79	1491	0.01
<i>trans</i> -Carvone oxide	8.31	1278	0.09	11.29*	1772	[0.16]
2-Ethylmenthone?	8.35	1281	0.02			
Dihydroedulan I	8.46	1289	0.06	7.12	1442	0.05
Menthyl acetate	8.53	1294	0.08	8.19*†	1522	[0.31]

Dihydroedulan II	8.60	1299	0.02	7.53	1472	0.01
neo-Dihydrocarvyl acetate	8.68	1304	0.01	9.04*	1588	[0.26]
Dihydrocarvyl acetate	9.10	1335	0.39	9.51	1626	0.33
α -Cubebene	9.37	1348	0.04	6.77	1416	0.02
Eugenol	9.47	1354	0.07	14.90	2103	0.09
<i>cis</i> -Carvyl acetate	9.58	1362	0.51	10.66	1719	0.51
α -Copaene	9.73	1373	0.06	7.15	1444	0.06
β -Bourbonene	9.84*	1381	1.76	7.50	1470	1.69
1,5-diepi- β -Bourbonene	9.84*	1381	[1.76]	7.38	1461	0.12
β -Elemene	9.97	1390	0.10	8.44*	1542	[1.19]
(<i>Z</i>)-Jasmone	10.02	1393	0.40	12.50	1878	0.40
Isocaryophyllene	10.14	1402	0.06	8.17*†	1521	0.31
β -Caryophyllene	10.30*	1414	1.28	8.44*	1542	[1.19]
β -Ylangene	10.30*	1414	[1.28]	8.17*†	1521	[0.31]
β -Copaene	10.44	1424	0.18	8.38	1537	0.20
Isogermacrene D	10.64	1439	0.18	9.04*	1588	[0.26]
α -Humulene	10.75	1447	0.10	9.34	1612	0.08
allo-Aromadendrene	10.85	1454	0.02	9.04*	1588	[0.26]
Unknown [m/z 161, 105 (56), 91 (50), 93 (36), 119 (33), 79 (31)...204 (5)]	10.92*	1459	0.96			
(<i>E</i>)- β -Farnesene	10.92*	1459	[0.96]	9.64	1636	0.85
Germacrene D	11.14	1476	1.09	9.89	1656	1.07
Viridiflorene	11.33*	1490	0.03	9.67	1638	0.02
Bicyclogermacrene	11.33*	1490	[0.03]	10.20*	1680	[67.57]
α -Muurolene	11.44	1498	0.09	10.20*	1680	[67.57]
γ -Cadinene	11.58	1509	0.03	10.43	1700	0.09
δ -Cadinene	11.72	1520	0.07	10.46*	1702	[0.09]
α -Cadinene	11.89	1533	0.01	10.83	1733	0.07
(<i>E</i>)-Nerolidol	12.28	1564	0.01	13.85	2002	0.01
Spathulenol	12.35	1570	0.01	14.48	2062	0.01
Caryophyllene oxide	12.40*	1574	0.05	12.83	1908	0.04
Caryophyllene oxide isomer	12.40*	1574	[0.05]	12.75	1901	0.01
Viridiflorol	12.53	1584	0.26	14.06	2022	0.26
τ -Cadinol	13.18*	1636	0.02	14.97	2110	0.01
τ -Muurolol	13.18*	1636	[0.02]	15.13	2126	0.01
α -Muurolol	13.23	1641	0.01	15.28	2140	0.01
α -Cadinol	13.33	1648	0.02	15.56	2169	0.02
meta-Camphorene	16.75	1952	0.01	15.48	2161	0.02
Total identified		98.93%			97.97%	
Total reported		98.93%			97.97%	

*: 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