

**Date :** August 28, 2020

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 20E13-PTH03

**Customer identification :** Peppermint Organic - Indian - P4010795R

**Type :** Essential oil

**Source :** *Mentha x piperita*

**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 :** May 20, 2020

Checked and approved by :

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

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*This report is an update of the initial version issued on May 28, 2020, to add the standard comparison tables.*

PHYSICOCHEMICAL DATA

**Physical aspect:** Faintly yellow liquid

**Refractive index:** 1.4603 ± 0.0003 (20 °C; method PC-MAT-016)

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

Compound	Min. %	Max. %	Observed %	Complies?
Carvone		1.0	0.1	Yes
Pulegone		3.0	0.7	Yes
Menthol	30.0	55.0	35.2	Yes
Menthyl acetate	2.8	10.0	8.3	Yes
Isomenthone	1.5	10.0	3.6	Yes
Menthofuran	1.0	8.0	2.1	Yes
Menthone	14.0	32.0	20.0	Yes
1,8-Cineole	3.5	8.0	5.2	Yes
Limonene	1.0	3.5	2.0	Yes
Total isopulegol		0.20	0.13	Yes
<b>Refractive index</b>	1.457	1.467	1.460	Yes

NFT 75-210:2007 & ISO 856:2006 - OIL OF PEPPERMINT - "OTHER ORIGINS"

Compound	Min. %	Max. %	Observed %	Complies?
β-Caryophyllene	1.0	3.5	2.2	Yes
Menthyl acetate	2.0	8.0	8.3	No
Pulegone	0.5	3.0	0.7	Yes
Menthol	32.0	49.0	35.2	Yes
neo-Menthol	2.0	6.0	4.2	Yes
Menthofuran	1.0	8.0	2.1	Yes
Isomenthone	2.0	8.0	3.6	Yes
Menthone	13.0	28.0	20.0	Yes
cis-Sabinene hydrate	0.5	2.0	0.4	No
Limonene	1.0	3.0	2.0	Yes
1,8-Cineole	3.0	8.0	5.2	Yes
Octan-3-ol	0.1	0.5	0.2	Yes
<b>Refractive index</b>	1.459	1.465	1.460	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
Ethanol	tr	Aliphatic alcohol
Isobutyral	tr	Aliphatic aldehyde
Isobutanol	tr	Aliphatic alcohol
Isovaleral	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Ethylfuran	0.01	Furan
Isoamyl alcohol	0.03	Aliphatic alcohol
2-Methylbutanol	0.02	Aliphatic alcohol
Ethyl 2-methylbutyrate	tr	Aliphatic ester
(3Z)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.04	Furan
Heptanal	0.01	Aliphatic aldehyde
Hashishene	0.01	Monoterpene
$\alpha$ -Thujene	0.06	Monoterpene
$\alpha$ -Pinene	0.82	Monoterpene
Unknown	0.01	Monoterpene
<i>trans</i> -3-Methylcyclohexanol	0.02	Aliphatic alcohol
Camphene	0.02	Monoterpene
3-Methylcyclohexanone	0.28	Aliphatic ketone
Thuja-2,4(10)-diene	0.01	Monoterpene
<i>cis</i> -para-Menthane	0.02	Monoterpene
$\beta$ -Pinene	1.39	Monoterpene
Sabinene	0.61	Monoterpene
Octen-3-ol	0.09	Aliphatic alcohol
Octan-3-one	0.03	Aliphatic ketone
<i>trans</i> -para-Menthane	tr	Monoterpene
<i>cis</i> -Carane	0.01	Monoterpene
Myrcene	0.36	Monoterpene
Octan-3-ol	0.18	Aliphatic alcohol
Octanal	0.01	Aliphatic aldehyde
$\alpha$ -Phellandrene	0.07	Monoterpene
Pseudolimonene	0.03	Monoterpene
$\Delta^3$ -Carene	0.01	Monoterpene
$\alpha$ -Terpinene	0.28	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	0.25	Monoterpene
Limonene	1.98	Monoterpene
1,8-Cineole	5.16	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.20	Monoterpene
(E)- $\beta$ -Ocimene	0.06	Monoterpene
$\gamma$ -Terpinene	0.52	Monoterpene
<i>cis</i> -Sabinene hydrate	0.36	Monoterpenic alcohol
para-Mentha-3,8-diene	0.01	Monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.02	Monoterpenic alcohol

Octanol	0.01	Aliphatic alcohol
para-Cymenene	0.02	Monoterpene
Terpinolene	0.17	Monoterpene
<i>trans</i> -Sabinene hydrate	0.04	Monoterpenic alcohol
Linalool	0.21	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.07	Aliphatic ester
Amyl isovalerate	0.06	Aliphatic ester
Octen-3-yl acetate	0.01	Aliphatic ester
<i>cis</i> -para-Menth-2-en-1-ol	0.07	Monoterpenic alcohol
Octan-3-yl acetate	0.02	Aliphatic ester
allo-Ocimene	tr	Monoterpene
<i>trans</i> -Sabinol	0.07	Monoterpenic alcohol
Isopulegol	0.13	Monoterpenic alcohol
Menthone	19.95	Monoterpenic ketone
Isomenthone	3.65	Monoterpenic ketone
Menthofuran	2.06	Monoterpenic ether
neo-Menthol	4.19	Monoterpenic alcohol
$\delta$ -Terpineol	0.13	Monoterpenic alcohol
Lavandulol	0.06	Monoterpenic alcohol
Terpinen-4-ol	1.32	Monoterpenic alcohol
Menthol	35.19	Monoterpenic alcohol
Isomenthol	0.71	Monoterpenic alcohol
para-Cymen-8-ol	0.04	Monoterpenic alcohol
$\alpha$ -Terpineol	0.24	Monoterpenic alcohol
neoiso-Menthol	0.27	Monoterpenic alcohol
Myrtenal	0.02	Monoterpenic aldehyde
Methylchavicol	0.03	Phenylpropanoid
Myrtenol	0.01	Monoterpenic alcohol
<i>trans</i> -Isopiperitenol	0.01	Monoterpenic alcohol
Unknown	0.01	Unknown
<i>trans</i> -Piperitol	0.01	Monoterpenic alcohol
Decanal	0.02	Aliphatic aldehyde
<i>trans</i> -Carveol	0.01	Monoterpenic alcohol
<i>cis</i> -Carveol	0.02	Monoterpenic alcohol
Pulegone	0.69	Monoterpenic ketone
Citronellol	0.02	Monoterpenic alcohol
Carvone	0.14	Monoterpenic ketone
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Piperitone	0.54	Monoterpenic ketone
<i>cis</i> -Carvone oxide	0.01	Monoterpenic ketone
neo-Menthyl acetate	0.66	Monoterpenic ester
Decanol	0.01	Aliphatic alcohol
Dihydroedulan I	0.11	Terpenic ether
Menthyl acetate	8.34	Monoterpenic ester
Dihydroedulan II	0.08	Terpenic ether
Thymol	0.05	Monoterpenic alcohol
Isomenthyl acetate	0.43	Monoterpenic alcohol
Bicycloelemene	0.01	Sesquiterpene
<i>trans</i> -Carvyl acetate	0.01	Monoterpenic ester
Piperitenone	0.01	Monoterpenic ketone
$\alpha$ -Cubebene	0.02	Sesquiterpene

Unknown	0.02	Unknown
Eugenol	0.06	Phenylpropanoid
$\alpha$ -Ylangene	0.01	Sesquiterpene
$\alpha$ -Copaene	0.05	Sesquiterpene
$\beta$ -Bourbonene	0.19	Sesquiterpene
1,5-diepi- $\beta$ -Bourbonene	0.02	Sesquiterpene
$\beta$ -Cubebene	0.03	Sesquiterpene
$\beta$ -Elemene	0.09	Sesquiterpene
Unknown	0.03	Unknown
(Z)-Jasmone	0.03	Jasmonate
Unknown	0.05	Sesquiterpene
Isocaryophyllene	0.02	Sesquiterpene
$\beta$ -Ylangene	0.09	Sesquiterpene
$\beta$ -Caryophyllene	2.22	Sesquiterpene
$\beta$ -Copaene	0.04	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.02	Sesquiterpene
Isogermacrene D	0.02	Sesquiterpene
$\alpha$ -Humulene	0.12	Sesquiterpene
Muurola-4,11-diene	0.04	Sesquiterpene
(E)- $\beta$ -Farnesene	0.29	Sesquiterpene
Germacrene D	1.46	Sesquiterpene
Menthylactone	0.04	Monoterpenic lactone
Viridiflorene	0.03	Sesquiterpene
Bicyclgermacrene	0.22	Sesquiterpene
5-Methyl-2,4-diisopropylphenol	0.01	Terpene derivative
$\alpha$ -Muurolene	0.02	Sesquiterpene
$\gamma$ -Cadinene	0.02	Sesquiterpene
$\delta$ -Cadinene	0.07	Sesquiterpene
$\alpha$ -Cadinene	0.01	Sesquiterpene
(E)- $\alpha$ -Bisabolene	0.01	Sesquiterpene
Spathulenol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Caryophyllene oxide	0.05	Sesquiterpenic ether
Viridiflorol	0.16	Sesquiterpenic alcohol
Isospathulenol	0.02	Sesquiterpenic alcohol
$\tau$ -Cadinol	0.02	Sesquiterpenic alcohol
$\alpha$ -Eudesmol	0.02	Sesquiterpenic alcohol
$\alpha$ -Cadinol	0.03	Sesquiterpenic alcohol
Unknown	0.02	Unknown
meta-Camphorene	0.01	Diterpene
<b>Consolidated total</b>	<b>98.78%</b>	

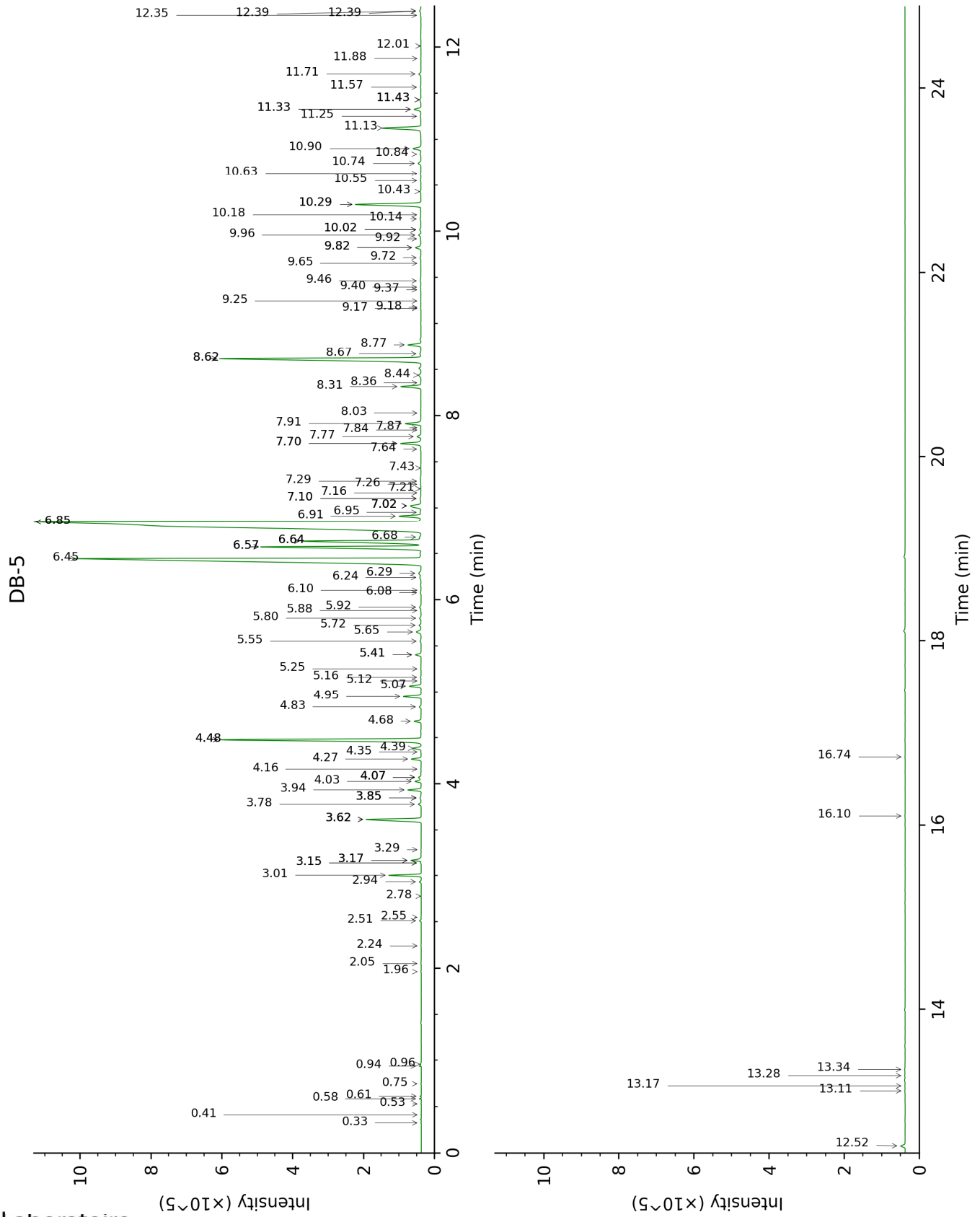
tr: The compound has been detected below 0.005% of total signal.

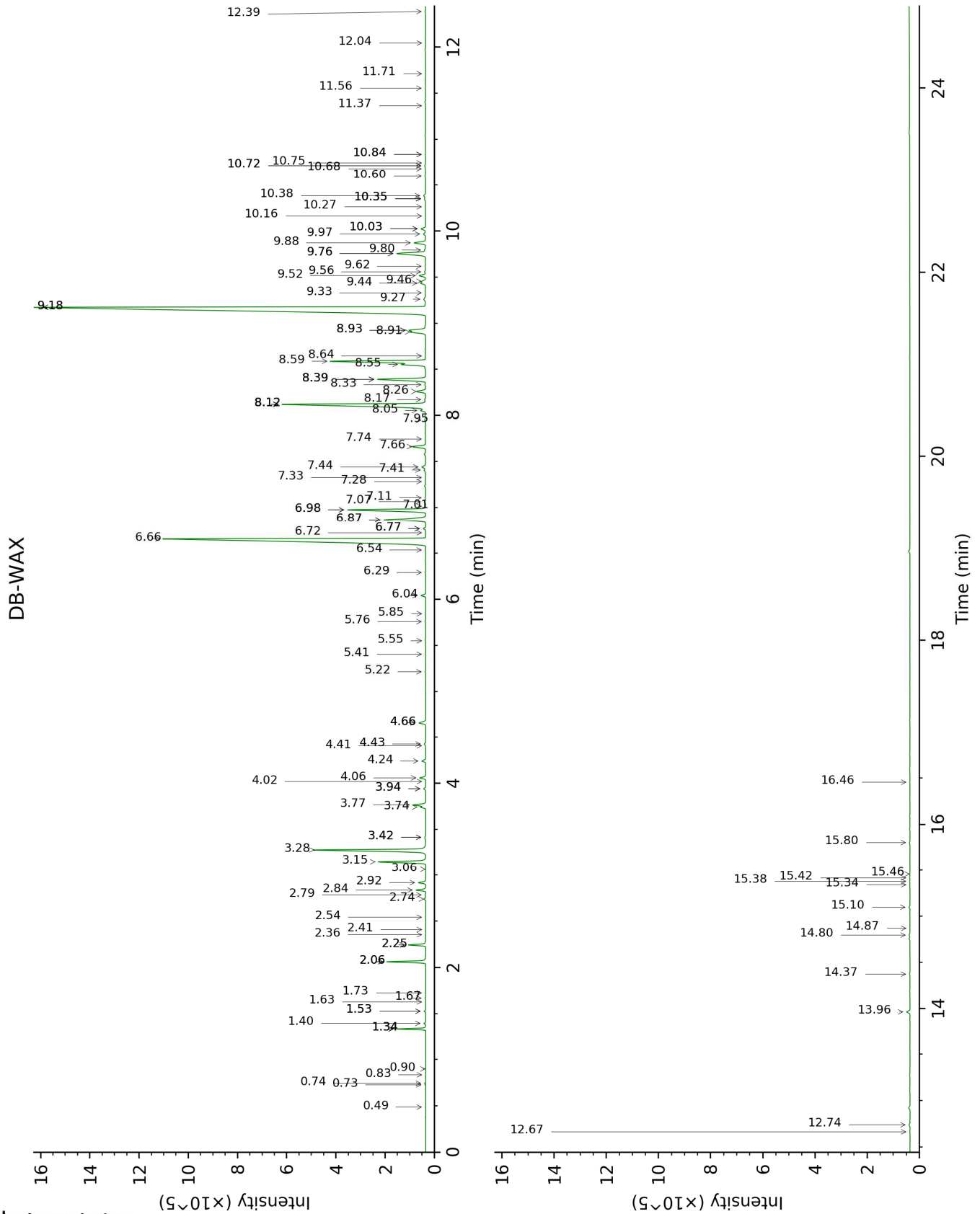
Note: no correction factor was applied

**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	%
Ethanol	0.33	521	tr	0.83	907	tr
Isobutyral	0.41	530	tr	0.49	781	0.01
Isobutanol	0.53	616	tr	2.06*	1064	1.39
Isovaleral	0.58	640	0.02	0.74	885	0.02
2-Methylbutyral	0.61	651	0.01	0.73	879	0.01
2-Ethylfuran	0.75	706	0.01	0.90	917	tr
Isoamyl alcohol	0.94	736	0.03	3.42*	1177	0.04
2-Methylbutanol	0.96	739	0.02	3.42*	1177	[0.04]
Ethyl 2-methylbutyrate	1.96	850	tr	1.63	1021	tr
(3Z)-Hexenol	2.05	857	0.01	5.85	1352	0.01
Hexanol	2.24	873	0.01	5.41	1320	0.02
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.51	896	0.04	1.53*	1011	0.04
Heptanal	2.55	899	0.01	3.06	1149	0.01
Hashishene	2.78	915	0.01	1.34*	989	0.81
$\alpha$ -Thujene	2.94	925	0.06	1.40	998	0.06
$\alpha$ -Pinene	3.01	930	0.82	1.34*	989	[0.81]
Unknown [m/z 91, 92 (47), 65 (11)... 134 (1)]	3.15*	939	0.02	2.36	1093	0.01
<i>trans</i> -3-Methylcyclohexanol	3.15*	939	[0.02]	6.72	1415	0.02
Camphene	3.17*	941	0.31	1.67	1025	0.02
3-Methylcyclohexanone	3.17*	941	[0.31]	4.66*	1269	0.34
Thuja-2,4(10)-diene	3.29	948	0.01	2.24*	1082	0.62
<i>cis</i> -para-Menthane	3.62*	970	2.02	1.34*	989	[0.81]
$\beta$ -Pinene	3.62*	970	[2.02]	2.06*	1064	[1.39]
Sabinene	3.62*	970	[2.02]	2.24*	1082	[0.62]
Octen-3-ol	3.78	981	0.09	6.77*	1419	0.10
Octan-3-one	3.85*	985	0.05	3.94*	1217	0.09
<i>trans</i> -para-Menthane	3.85*	985	[0.05]	1.53*	1011	[0.04]
<i>cis</i> -Carane	3.85*	985	[0.05]	1.72	1030	0.01
Myrcene	3.94	991	0.36	2.84	1131	0.37
Octan-3-ol	4.03	997	0.18	6.04	1366	0.20
Octanal	4.07*	1000	0.10	4.41	1251	0.01
$\alpha$ -Phellandrene	4.07*	1000	[0.10]	2.74	1124	0.07
Pseudolimonene	4.07*	1000	[0.10]	2.79	1127	0.03
$\Delta^3$ -Carene	4.16	1006	0.01	2.54	1108	0.01
$\alpha$ -Terpinene	4.27	1013	0.28	2.92	1138	0.29
Carvomenthene	4.35	1018	0.01	2.41	1098	0.01
para-Cymene	4.39	1020	0.25	4.06	1225	0.25
Limonene	4.48*	1026	7.15	3.15	1156	1.98
1,8-Cineole	4.48*	1026	[7.15]	3.28	1166	5.16
(Z)- $\beta$ -Ocimene	4.68	1038	0.20	3.74	1202	0.18
(E)- $\beta$ -Ocimene	4.84	1048	0.06	3.94*	1217	[0.09]
$\gamma$ -Terpinene	4.95	1055	0.52	3.77	1204	0.55
<i>cis</i> -Sabinene hydrate	5.07	1063	0.36	6.87*	1426	2.42
para-Mentha-3,8-diene	5.12	1066	0.01	4.02	1222	0.01

<i>cis</i> -Linalool oxide (fur.)	5.16	1069	0.02	6.54	1402	0.03
Octanol	5.25	1075	0.01	8.17	1524	0.05
para-Cymenene	5.41*	1084	0.18	6.29	1384	0.02
Terpinolene	5.41*	1084	[0.18]	4.24	1238	0.17
<i>trans</i> -Sabinene hydrate	5.55	1094	0.04	7.95	1507	0.05
Linalool	5.65	1100	0.21	8.05	1515	0.23
2-Methylbutyl 2-methylbutyrate	5.72	1104	0.07	4.43	1252	0.06
Amyl isovalerate	5.80	1110	0.06	4.66*	1269	[0.34]
Octen-3-yl acetate	5.88	1115	0.01	5.76	1346	0.03
<i>cis</i> -para-Menth-2-en-1-ol	5.92	1117	0.07	8.12*	1520	8.51
Octan-3-yl acetate	6.08	1127	0.02	5.22	1306	0.03
allo-Ocimene	6.10	1129	tr	5.55	1330	0.01
<i>trans</i> -Sabinol	6.24	1138	0.07	9.80	1653	0.04
Isopulegol	6.29	1141	0.13	8.12*	1520	[8.51]
Menthone	6.45	1151	19.95	6.66	1410	19.87
Isomenthone	6.57*	1160	5.68	6.98*	1434	3.66
Menthofuran	6.57*	1160	[5.68]	6.87*	1426	[2.42]
neo-Menthol	6.64*	1164	4.61	8.59†	1556	[5.51]
δ-Terpineol	6.64*	1164	[4.61]	9.44†	1624	0.40
Lavandulol	6.68	1166	0.06	9.56	1634	0.06
Terpinen-4-ol	6.85*	1178	36.51	8.55†	1554	5.51
Menthol	6.85*	1178	[36.51]	9.18*	1602	35.23
Isomenthol	6.91	1182	0.71	8.93*	1583	0.76
para-Cymen-8-ol	6.95	1185	0.04	11.56	1800	0.02
α-Terpineol	7.02*	1189	0.53	9.76*	1650	1.69
neoiso-Menthol	7.02*	1189	[0.53]	9.46†	1625	[0.40]
Myrtenal	7.02*	1189	[0.53]	8.64	1561	0.02
Methylchavicol	7.10*	1194	0.06	9.33	1615	0.03
Myrtenol	7.10*	1194	[0.06]	10.84*	1739	0.02
<i>trans</i> -Isopiperitenol	7.16	1198	0.01	10.35*	1698	0.07
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.21	1201	0.01			
<i>trans</i> -Piperitol	7.26	1204	0.01	10.35*	1698	[0.07]
Decanal	7.29	1207	0.02	7.28	1457	0.02
<i>trans</i> -Carveol	7.43	1216	0.01	11.37	1783	tr
<i>cis</i> -Carveol	7.64	1231	0.02	11.71	1814	tr
Pulegone	7.70*	1235	0.71	8.91	1581	0.69
Citronellol	7.70*	1235	[0.71]	10.72*	1728	0.04
Carvone	7.77	1240	0.14	9.97	1667	0.10
Unknown [m/z 121, 136 (66), 43 (48), 109 (48), 80 (30), 93 (29)...]	7.84	1245	0.01			
Unknown [m/z 112, 43 (70), 70 (63), 59 (53), 97 (46), 84 (25)...]	7.87	1246	0.01	10.26	1690	0.01
Piperitone	7.91	1250	0.54	9.88	1659	0.57
<i>cis</i> -Carvone oxide	8.03	1258	0.01	10.84*	1739	[0.02]

neo-Menthyl acetate	8.31	1277	0.66	7.66	1485	0.64
Decanol	8.36	1280	0.01	10.68	1726	0.02
Dihydroedulan I	8.44	1286	0.11	7.07	1441	0.07
Menthyl acetate	8.62*	1298	8.42	8.12*	1520	[8.51]
Dihydroedulan II	8.62*	1298	[8.42]	7.41	1466	0.08
Thymol	8.67	1302	0.05	15.10	2128	0.05
Isomenthyl acetate	8.77	1304	0.43	8.26	1531	0.45
Bicycloelemene	9.17	1332	0.01	7.02	1437	0.01
<i>trans</i> -Carvyl acetate	9.18	1333	0.01	10.16	1682	0.01
Piperitenone	9.25	1338	0.01	12.04	1843	0.01
$\alpha$ -Cubebene	9.37	1346	0.02	6.77*	1419	[0.10]
Unknown [m/z 43, 93 (40), 119 (38), 134 (30), 91 (25), 79 (23), 67 (19)...]	9.40	1348	0.02	10.60	1718	0.03
Eugenol	9.46	1353	0.06	14.80	2098	0.05
$\alpha$ -Ylangene	9.66	1366	0.01	6.98*	1434	[3.66]
$\alpha$ -Copaene	9.72	1371	0.05	7.11	1444	0.03
$\beta$ -Bourbonene	9.82*	1378	0.22	7.44	1469	0.19
1,5-diepi- $\beta$ -Bourbonene	9.82*	1378	[0.22]	7.33	1460	0.02
$\beta$ -Cubebene	9.92	1385	0.03	7.74	1491	0.02
$\beta$ -Elemene	9.96	1388	0.09	8.39*	1541	2.34
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.02*	1392	0.06			
( <i>Z</i> )-Jasmone	10.02*	1392	[0.06]	12.39	1873	0.03
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.14	1400	0.05			
Isocaryophyllene	10.18	1403	0.02	8.12*	1520	[8.51]
$\beta$ -Ylangene	10.29*	1412	2.32	8.12*	1520	[8.51]
$\beta$ -Caryophyllene	10.29*	1412	[2.32]	8.39*	1541	[2.34]
$\beta$ -Copaene	10.43	1422	0.04	8.33	1537	0.03
<i>trans</i> - $\alpha$ -Bergamotene	10.55	1431	0.02	8.39*	1541	[2.34]
Isogermacrene D	10.63	1437	0.02	8.93*	1583	[0.76]
$\alpha$ -Humulene	10.74	1445	0.12	9.26	1610	0.14
Muurola-4,11-diene	10.84	1453	0.04	9.18*	1602	[35.23]
( <i>E</i> )- $\beta$ -Farnesene	10.90	1457	0.29	9.52	1630	0.30
Germacrene D	11.13	1474	1.46	9.76*	1650	[1.69]
Menthylactone	11.25	1484	0.04	15.80	2199	0.03
Viridiflorene	11.33*	1489	0.25	9.62	1638	0.03
Bicyclgermacrene	11.33*	1489	[0.25]	10.03*	1671	0.23
5-Methyl-2,4-diisopropylphenol	11.43*	1497	0.06	16.46	2266	0.01
$\alpha$ -Muurolene	11.43*	1497	[0.06]	10.03*	1671	[0.23]
$\gamma$ -Cadinene	11.57	1507	0.02	10.35*	1698	[0.07]
$\delta$ -Cadinene	11.71	1518	0.07	10.38	1700	0.10
$\alpha$ -Cadinene	11.88	1531	0.01	10.75	1731	0.01
( <i>E</i> )- $\alpha$ -Bisabolene	12.01	1542	0.01	10.72*	1728	[0.04]

Spathulenol	12.34	1568	0.02	14.37	2057	0.03
Caryophyllene oxide isomer	12.39*	1572	0.07	12.67	1898	0.02
Caryophyllene oxide	12.39*	1572	[0.07]	12.74	1905	0.05
Viridiflorol	12.52	1582	0.16	13.96	2018	0.16
Isospathulenol	13.11	1630	0.02	15.42	2160	0.02
τ-Cadinol	13.17	1634	0.02	14.87	2106	0.01
α-Eudesmol	13.28	1643	0.02	15.34	2152	0.01
α-Cadinol	13.34	1649	0.03	15.46	2164	0.02
Unknown [m/z 123, 81 (96), 41 (74), 43 (64), 91 (62), 95 (57)...]	16.10	1889	0.02			
meta-Camphorene	16.74	1950	0.01	15.38	2156	0.02
<b>Total identified</b>		<b>98.98%</b>			<b>98.36%</b>	
<b>Total reported</b>		<b>99.12%</b>			<b>98.40%</b>	

\*: 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