

**Date :** November 16, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 21K02-PTH01

**Customer identification :** Peppermint ORGANIC - P40110202R

**Type :** Essential oil

**Source :** *Mentha x piperita*

**Customer :** Plant Therapy

*ANALYSIS*

**Method:** PC-MAT-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 :** Sarah-Eve Tremblay, M. Sc. A., Chimiste

**Analysis date :** November 10, 2021

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Faintly yellow liquid

**Refractive index:**  $1.4614 \pm 0.0003$  (20 °C; method PC-MAT-016)

*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
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
(3Z)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.04	Furan
Nonane	tr	Alkane
Hashishene	0.01	Monoterpene
$\alpha$ -Thujene	0.04	Monoterpene
$\alpha$ -Pinene	0.85	Monoterpene
3-Methylcyclohexanone	0.02	Aliphatic ketone
Camphene	0.04	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
$\beta$ -Pinene	1.12	Monoterpene
Sabinene	0.41	Monoterpene
Octen-3-ol	0.04	Aliphatic alcohol
Octan-3-one	0.03	Aliphatic ketone
<i>cis</i> -Carane	0.02	Monoterpene
<i>trans</i> -para-Menthane	0.02	Monoterpene
Myrcene	0.36	Monoterpene
Octan-3-ol	0.20	Aliphatic alcohol
Pseudolimonene	0.06	Monoterpene
$\alpha$ -Phellandrene	0.04	Monoterpene
$\Delta^3$ -Carene	0.04	Monoterpene
$\alpha$ -Terpinene	0.19	Monoterpene
para-Cymene	0.24	Monoterpene
Limonene	2.38	Monoterpene
1,8-Cineole	5.18	Monoterpenic ether
2-Ethylhexanol	0.02	Aliphatic alcohol
(Z)- $\beta$ -Ocimene	0.12	Monoterpene
(E)- $\beta$ -Ocimene	0.04	Monoterpene
$\gamma$ -Terpinene	0.24	Monoterpene
<i>cis</i> -Sabinene hydrate	0.20	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.03	Aliphatic alcohol
para-Cymenene	0.02	Monoterpene
Terpinolene	0.09	Monoterpene
<i>trans</i> -Sabinene hydrate	0.03	Monoterpenic alcohol
Linalool	0.14	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.04	Aliphatic ester
Amyl isovalerate	0.03	Aliphatic ester
<i>cis</i> -para-Menth-2-en-1-ol	0.03	Monoterpenic alcohol
Octan-3-yl acetate	0.03	Aliphatic ester
Camphor	0.06	Monoterpenic ketone
<i>trans</i> -Sabinol	0.01	Monoterpenic alcohol
Isopulegol	0.18	Monoterpenic alcohol

<i>cis</i> - $\alpha$ -Dihydroterpineol	0.03	Monoterpenic alcohol
Menthone	25.02	Monoterpenic ketone
Isomenthone	4.61	Monoterpenic ketone
Menthofuran	2.43	Monoterpenic ether
neo-Menthol	3.38	Monoterpenic alcohol
$\delta$ -Terpineol	0.06	Monoterpenic alcohol
Terpinen-4-ol	0.02	Monoterpenic alcohol
Menthol	32.92	Monoterpenic alcohol
Isomenthol	0.77	Monoterpenic alcohol
para-Cymen-8-ol	0.08	Monoterpenic alcohol
$\alpha$ -Terpineol	0.32	Monoterpenic alcohol
Myrtenal	0.02	Monoterpenic aldehyde
neoiso-Menthol	0.16	Monoterpenic alcohol
Myrtenol	0.02	Monoterpenic alcohol
Methylchavicol	0.07	Phenylpropanoid
<i>trans</i> -Isopiperitenol	0.02	Monoterpenic alcohol
Unknown	tr	Unknown
<i>trans</i> -Piperitol	0.01	Monoterpenic alcohol
Decanal	0.02	Aliphatic aldehyde
iso-Dihydrocarveol ?	0.01	Monoterpenic alcohol
<i>trans</i> -Carveol	0.02	Monoterpenic alcohol
<i>cis</i> -Isocarveol	0.01	Monoterpenic alcohol
(3Z)-Hexenyl 2-methylbutyrate	0.03	Aliphatic ester
Citronellol	0.08	Monoterpenic alcohol
Pulegone	0.97	Monoterpenic ketone
(3Z)-Hexenyl isovalerate	0.03	Aliphatic ester
Carvone	0.08	Monoterpenic ketone
Piperitone	0.73	Monoterpenic ketone
<i>cis</i> -Carvone oxide	0.03	Monoterpenic ketone
Isopiperitenone	0.02	Monoterpenic ketone
neo-Menthyl acetate	0.17	Monoterpenic ester
Decanol	0.48	Aliphatic alcohol
2-Ethylmenthone?	0.06	Aliphatic ketone
Dihydroedulan I	0.03	Terpenic ether
Menthyl acetate	4.85	Monoterpenic ester
Dihydroedulan II	0.03	Terpenic ether
Thymol	0.09	Monoterpenic alcohol
Isomenthyl acetate	0.14	Monoterpenic alcohol
Unknown	0.01	Unknown
neoiso-Menthyl acetate?	0.01	Monoterpenic ester
Bicycloelemene	0.20	Sesquiterpene
Piperitenone	0.02	Monoterpenic ketone
Menthofuro lactone isomer II	0.01	Monoterpenic lactone
$\alpha$ -Cubebene	0.01	Sesquiterpene
Evodone	0.02	Monoterpenic ketone
Eugenol	0.04	Phenylpropanoid
Dihydroeugenol	0.02	Phenylpropanoid
$\alpha$ -Copaene	0.04	Sesquiterpene
1,5-diepi- $\beta$ -Bourbonene	0.02	Sesquiterpene
$\beta$ -Bourbonene	0.33	Sesquiterpene
$\beta$ -Cubebene	0.02	Sesquiterpene
$\beta$ -Elemene	0.25	Sesquiterpene

Unknown	0.02	Unknown
Longifolene	0.08	Sesquiterpene
Unknown	0.04	Sesquiterpene
Isocaryophyllene	0.03	Sesquiterpene
Methyleugenol	0.04	Phenylpropanoid
$\beta$ -Caryophyllene	3.20	Sesquiterpene
$\beta$ -Ylangene	0.16	Sesquiterpene
$\beta$ -Copaene	0.04	Sesquiterpene
Unknown	0.22	Unknown
Aromadendrene	0.06	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.03	Sesquiterpene
Isogermacrene D	0.10	Sesquiterpene
$\alpha$ -Humulene	0.33	Sesquiterpene
allo-Aromadendrene	0.04	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.18	Sesquiterpene
$\gamma$ -Muurolene	0.04	Sesquiterpene
Germacrene D	0.62	Sesquiterpene
Menthylactone	0.01	Monoterpenic lactone
Viridiflorene	0.23	Sesquiterpene
$\alpha$ -Muurolene	0.03	Sesquiterpene
$\gamma$ -Cadinene	0.03	Sesquiterpene
$\delta$ -Cadinene	0.08	Sesquiterpene
$\alpha$ -Cadinene	0.01	Sesquiterpene
Isocaryophyllene epoxide B	0.01	Sesquiterpenic ether
( <i>E</i> )-Nerolidol	0.01	Sesquiterpenic alcohol
Spathulenol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Caryophyllene oxide	0.06	Sesquiterpenic ether
Viridiflorol	0.10	Sesquiterpenic alcohol
Isospathulenol	tr	Sesquiterpenic alcohol
$\tau$ -Cadinol	0.01	Sesquiterpenic alcohol
$\alpha$ -Cadinol	tr	Sesquiterpenic alcohol
Mint sulfide?	0.01	Sesquiterpenic sulfide
meta-Camphorene	tr	Diterpene
<b>Consolidated total</b>	<b>97.37%</b>	

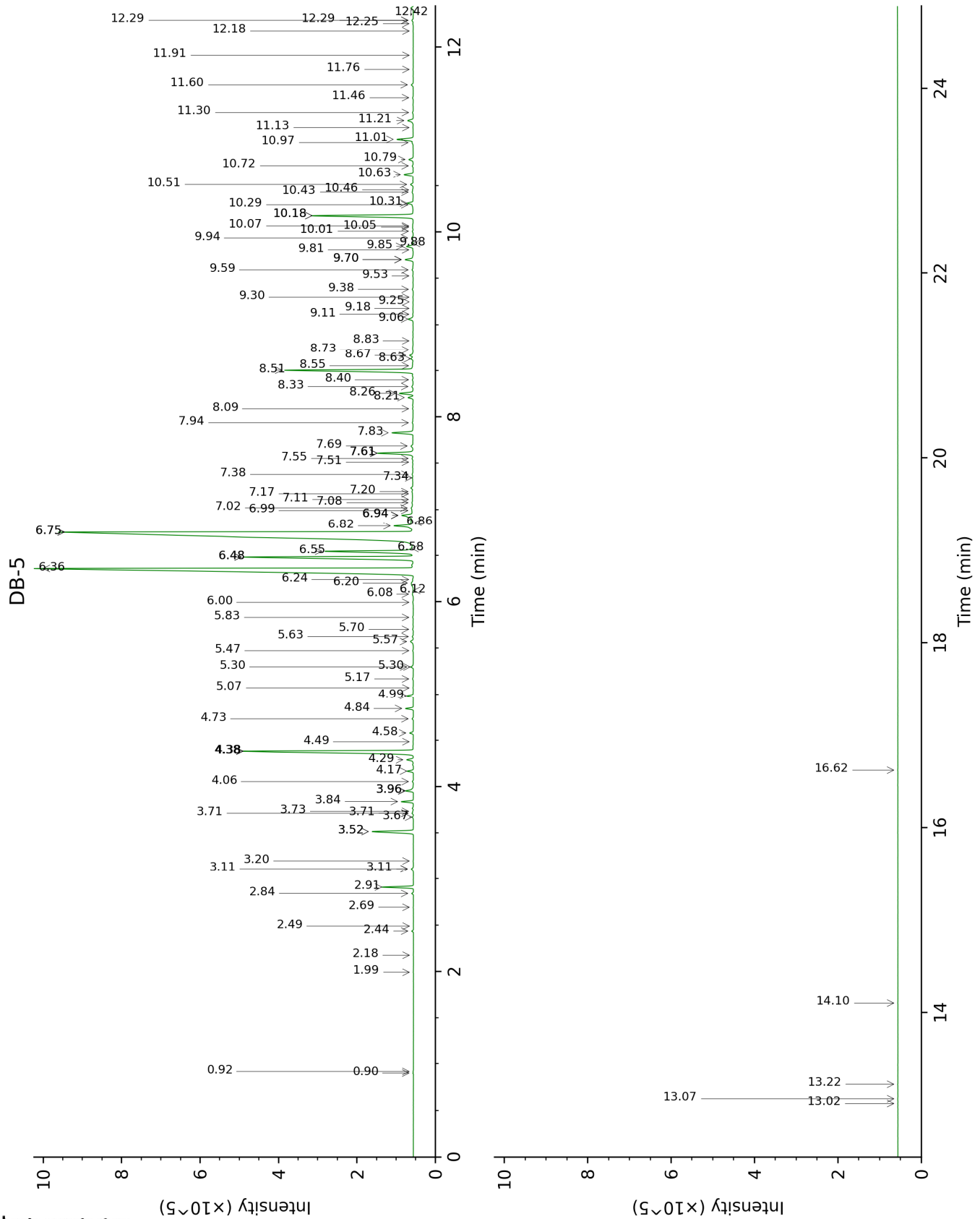
tr: The compound has been detected below 0.005% of total signal.

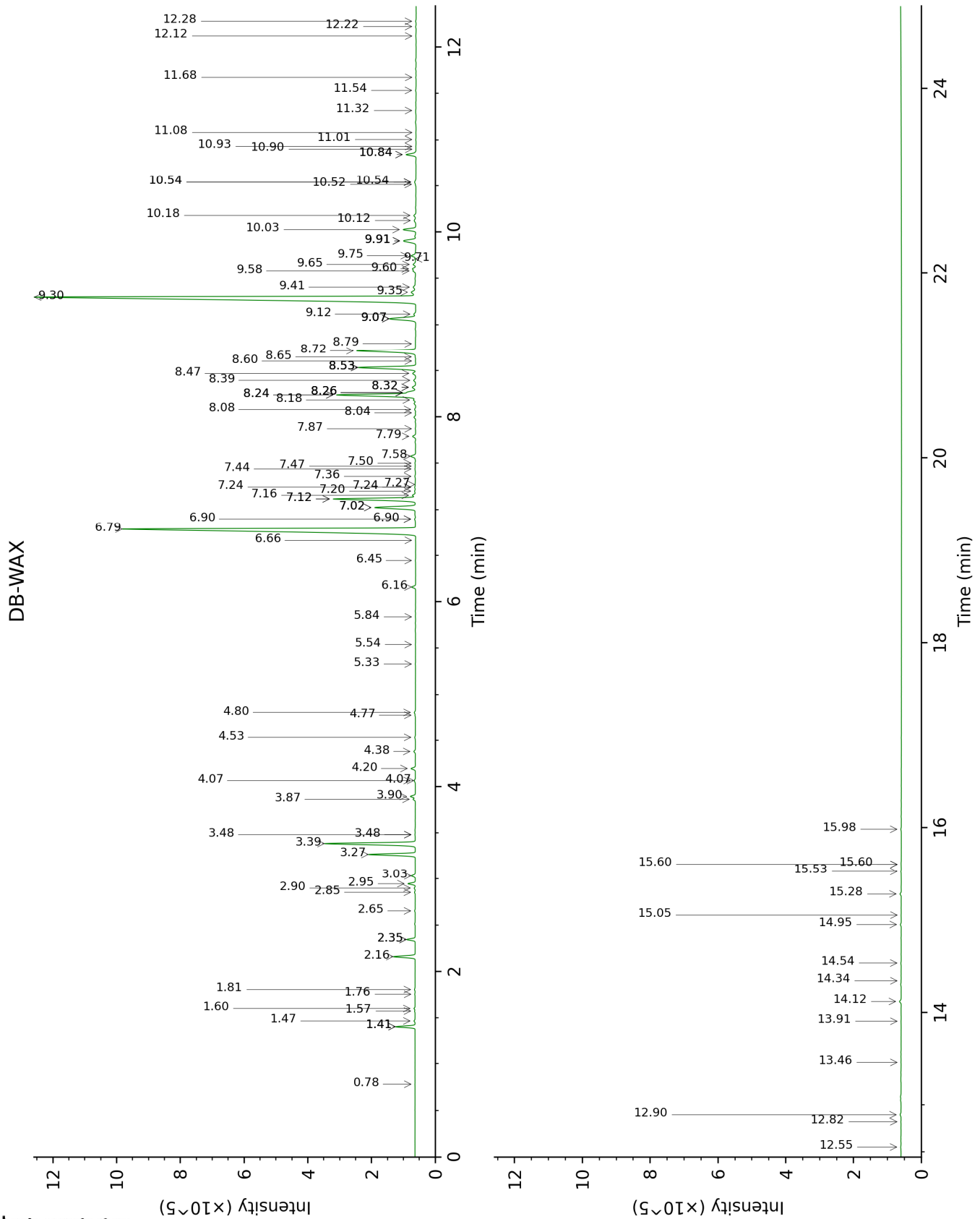
Note: no correction factor was applied

**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	%
Isoamyl alcohol	0.90	731	0.01	3.48*	1176	0.03
2-Methylbutanol	0.92	734	0.01	3.48*	1176	[0.03]
(3Z)-Hexenol	1.99	858	0.01	5.84	1346	0.01
Hexanol	2.18	874	0.01	5.54	1325	0.01
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.44	896	0.04	1.60	1010	0.05
Nonane	2.49	901	tr	0.78	888	tr
Hashishene	2.69	915	0.01	1.41*	991	0.88
$\alpha$ -Thujene	2.84	925	0.04	1.47	997	0.05
$\alpha$ -Pinene	2.91	930	0.85	1.41*	991	[0.88]
3-Methylcyclohexanone	3.11*	944	0.09	4.77	1274	0.02
Camphene	3.11*	944	[0.09]	1.81	1030	0.04
Thuja-2,4(10)-diene	3.20	949	0.01	2.35*	1084	0.42
$\beta$ -Pinene	3.52*	971	1.54	2.16	1065	1.12
Sabinene	3.52*	971	[1.54]	2.35*	1084	[0.42]
Octen-3-ol	3.67	981	0.04	6.90*	1422	0.08
Octan-3-one	3.71*	984	0.04	4.07*	1221	0.07
<i>cis</i> -Carane	3.71*	984	[0.04]	1.76	1025	0.02
<i>trans</i> -para-Menthane	3.74	986	0.02	1.58	1007	0.02
Myrcene	3.84	993	0.36	2.95	1133	0.35
Octan-3-ol	3.96*	1001	0.31	6.16	1369	0.20
Pseudolimonene	3.96*	1001	[0.31]	2.90	1129	0.06
$\alpha$ -Phellandrene	3.96*	1001	[0.31]	2.86	1126	0.04
$\Delta$ 3-Carene	4.06	1007	0.04	2.65	1110	0.03
$\alpha$ -Terpinene	4.17	1014	0.19	3.03	1140	0.20
para-Cymene	4.29	1022	0.24	4.20	1230	0.23
Limonene	4.38*	1028	7.57	3.27	1159	2.38
1,8-Cineole	4.38*	1028	[7.57]	3.39	1168	5.18
2-Ethylhexanol	4.48	1034	0.02	7.44	1462	0.08
(Z)- $\beta$ -Ocimene	4.58	1040	0.12	3.86	1206	0.10
(E)- $\beta$ -Ocimene	4.73	1050	0.04	4.07*	1221	[0.07]
$\gamma$ -Terpinene	4.84	1057	0.24	3.90	1208	0.26
<i>cis</i> -Sabinene hydrate	4.98	1066	0.20	7.02*	1431	2.64
<i>cis</i> -Linalool oxide (fur.)	5.07	1071	0.01	6.66	1405	0.01
Octanol	5.17	1077	0.03	8.32*	1528	0.23
para-Cymenene	5.30*	1086	0.10	6.45	1389	0.02
Terpinolene	5.30*	1086	[0.10]	4.38	1244	0.09
<i>trans</i> -Sabinene hydrate	5.47	1097	0.03	8.04	1507	0.02
Linalool	5.57	1103	0.14	8.18	1517	0.11
2-Methylbutyl 2-methylbutyrate	5.63	1106	0.04	4.53	1256	0.05
Amyl isovalerate	5.70	1111	0.03	4.80	1276	0.08
<i>cis</i> -para-Menth-2-en-1-ol	5.83	1120	0.03	8.24*	1522	4.98
Octan-3-yl acetate	6.00	1130	0.03	5.33	1310	0.01
Camphor	6.08	1136	0.06	7.27	1450	0.04

<i>trans</i> -Sabinol	6.12	1138	0.01	9.91*	1652	0.96
Isopulegol	6.20	1143	0.18	8.26*	1523	0.36
<i>cis</i> - $\alpha$ -Dihydroterpineol	6.24	1146	0.03	8.32*	1528	[0.23]
Menthone	6.36	1153	25.02	6.79	1414	24.83
Isomenthone	6.48*	1161	7.12	7.12*	1438	4.81
Menthofuran	6.48*	1161	[7.12]	7.02*	1431	[2.64]
neo-Menthol	6.55	1165	3.38	8.72	1558	3.57
$\delta$ -Terpineol	6.58	1167	0.06	9.60	1628	0.20
Terpinen-4-ol	6.75*	1179	34.05	8.65	1553	0.02
Menthol	6.75*	1179	[34.05]	9.30	1603	32.92
Isomenthol	6.82	1183	0.77	9.07*	1585	1.85
para-Cymen-8-ol	6.86	1186	0.08	11.68	1799	0.02
$\alpha$ -Terpineol	6.94*	1191	0.55	9.91*	1652	[0.96]
Myrtenal	6.94*	1191	[0.55]	8.80	1564	0.02
neoiso-Menthol	6.94*	1191	[0.55]	9.58	1626	0.16
Myrtenol	6.99	1194	0.02	11.01	1742	0.02
Methylchavicol	7.02	1196	0.07	9.41	1612	0.27
<i>trans</i> -Isopiperitenol	7.08	1199	0.02	10.52	1701	0.02
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.11	1202	tr			
<i>trans</i> -Piperitol	7.17	1206	0.01	10.54*	1703	0.11
Decanal	7.20	1207	0.02	7.36	1456	0.08
iso-Dihydrocarveol ?	7.34	1217	0.01	10.93	1736	0.01
<i>trans</i> -Carveol	7.38	1220	0.02	11.54	1786	0.04
<i>cis</i> -Isocarveol	7.51	1228	0.01	12.12	1838	0.05
(3Z)-Hexenyl 2-methylbutyrate	7.55	1231	0.03	7.16	1441	0.19
Citronellol	7.61*	1235	1.24	10.84*	1728	0.57
Pulegone	7.61*	1235	[1.24]	9.07*	1585	[1.85]
(3Z)-Hexenyl isovalerate	7.61*	1235	[1.24]	7.24*	1448	0.07
Carvone	7.69	1240	0.08	10.12	1669	0.15
Piperitone	7.83	1250	0.73	10.03	1661	0.75
<i>cis</i> -Carvone oxide	7.94	1257	0.03	11.08	1748	0.02
Isopiperitenone	8.09	1267	0.02	11.32	1768	0.03
neo-Menthyl acetate	8.21	1275	0.17	7.79	1488	0.18
Decanol	8.26	1278	0.48	10.84*	1728	[0.57]
2-Ethylmenthone?	8.33	1283	0.06			
Dihydroedulan I	8.40	1288	0.03	7.20	1444	0.07
Menthyl acetate	8.50	1295	4.85	8.24*	1522	[4.98]
Dihydroedulan II	8.55	1298	0.03	7.50	1466	0.06
Thymol	8.63	1303	0.09	15.28	2132	0.07
Isomenthyl acetate	8.67	1306	0.14	8.40	1533	0.13
Unknown [m/z 43, 136 (55), 121 (55), 107 (48), 93 (48), 81 (30), 79 (29)...]	8.73	1310	0.01			
neoiso-Menthyl acetate?	8.83	1317	0.01			
Bicycloelemene	9.06	1334	0.20	7.12*	1438	[4.81]

Piperitenone	9.11	1337	0.02	12.22	1846	0.04
Menthofuroolactone isomer II	9.18	1342	0.01			
$\alpha$ -Cubebene	9.25	1347	0.01	6.90*	1422	[0.08]
Evodone	9.30	1350	0.02	12.55	1875	0.03
Eugenol	9.38	1356	0.04	14.95	2099	0.05
Dihydroeugenol	9.53	1366	0.02	14.34	2041	0.01
$\alpha$ -Copaene	9.59	1371	0.04	7.24*	1448	[0.07]
1,5-diepi- $\beta$ -Bourbonene	9.70*	1379	0.34	7.47	1464	0.02
$\beta$ -Bourbonene	9.70*	1379	[0.34]	7.58	1472	0.33
$\beta$ -Cubebene	9.81	1386	0.02	7.87	1494	0.02
$\beta$ -Elemene	9.85	1389	0.25	8.53*	1544	3.48
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	9.88	1391	0.02			
Longifolene	9.94	1395	0.08	8.08	1510	0.06
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.01	1400	0.04			
Isocaryophyllene	10.05	1404	0.03	8.26*	1523	[0.36]
Methyleugenol	10.07	1405	0.04	13.46	1958	tr
$\beta$ -Caryophyllene	10.18*	1413	3.86	8.53*	1544	[3.48]
$\beta$ -Ylangene	10.18*	1413	[3.86]	8.26*	1523	[0.36]
$\beta$ -Copaene	10.30	1422	0.04	8.47	1539	0.18
Unknown [m/z 177, 109 (32), 192 (26), 95 (25), 137 (23)]	10.31	1423	0.22			
Aromadendrene	10.43	1432	0.06	8.60	1549	0.02
<i>trans</i> - $\alpha$ -Bergamotene	10.46	1434	0.03	8.53*	1544	[3.48]
Isogermacrene D	10.51	1438	0.10	9.07*	1585	[1.85]
$\alpha$ -Humulene	10.63	1446	0.33	9.35	1607	0.38
allo-Aromadendrene	10.72	1453	0.04	9.12	1588	0.12
( <i>E</i> )- $\beta$ -Farnesene	10.79	1458	0.18	9.65	1631	0.19
$\gamma$ -Muuroolene	10.97	1472	0.04	9.71	1636	0.06
Germacrene D	11.01	1475	0.62	9.91*	1652	[0.96]
Menthylactone	11.13	1484	0.01	15.98	2203	0.04
Viridiflorene	11.21	1490	0.23	9.75	1639	0.29
$\alpha$ -Muuroolene	11.30	1496	0.03	10.18	1674	0.14
$\gamma$ -Cadinene	11.46	1508	0.03	10.54*	1703	[0.11]
$\delta$ -Cadinene	11.60	1519	0.08	10.54*	1703	[0.11]
$\alpha$ -Cadinene	11.76	1532	0.01	10.90	1733	0.01
Isocaryophyllene epoxide B	11.91	1544	0.01	12.28	1852	0.04
( <i>E</i> )-Nerolidol	12.18	1565	0.01	13.91	1999	0.01
Spathulenol	12.25	1571	0.02	14.54	2059	0.02
Caryophyllene oxide isomer	12.29*	1574	0.06	12.82	1900	0.01
Caryophyllene oxide	12.29*	1574	[0.06]	12.90	1906	0.06
Viridiflorol	12.42	1584	0.10	14.12	2020	0.10

Isospathulenol	13.02	1632	tr	15.60*	2164	0.02
τ-Cadinol	13.07	1636	0.01	15.05	2109	0.01
α-Cadinol	13.22	1649	tr	15.60*	2164	[0.02]
Mint sulfide?	14.10	1723	0.01			
meta-Camphorene	16.62	1950	tr	15.52	2156	0.02
<b>Total identified</b>		<b>99.04%</b>			<b>98.55%</b>	
<b>Total reported</b>		<b>99.32%</b>			<b>98.55%</b>	

\*: Two or more compounds are coeluting on this column

[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  
R.T.: Retention time (minutes)  
R.I.: Retention index