

**Date :** January 04, 2019

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 18L19-BUB03-1-CC

**Customer identification :** Peppermint Essential Oil - India - 10003

**Type :** Essential oil

**Source :** *Mentha x piperita*

**Customer :** Buhbli Organics

**ANALYSIS**

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID (in French); identifications validated by GC-MS.

**Analyst :** Benoit Roger, Ph. D.

**Analysis date :** December 21, 2018

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4605 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Isoamyl alcohol	0.01	0.01*	Aliphatic alcohol
2-Methylbutanol	tr	[0.01]*	Aliphatic alcohol
Hexanal	0.01		Aliphatic aldehyde
Hexanol	0.01	0.02	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.03	0.04	Furan
Hashishene	tr	0.03*	Monoterpene
$\alpha$ -Thujene	0.03	[0.03]*	Monoterpene
$\alpha$ -Pinene	0.79	0.78	Monoterpene
<i>trans</i> -3-Methylcyclohexanol	0.01	0.03*	Aliphatic alcohol
$\alpha$ -Fenchene	0.11*	0.01	Monoterpene
Camphene	[0.11]*	0.03	Monoterpene
3-Methylcyclohexanone	[0.11]*	0.09*	Aliphatic ketone
Thuja-2,4(10)-diene	0.01	0.41*	Monoterpene
Sabinene	1.65*	[0.41]*	Monoterpene
$\beta$ -Pinene	[1.65]*	1.19	Monoterpene
Octen-3-ol	0.04	0.05	Aliphatic alcohol
Octan-3-one	0.02	0.02	Aliphatic ketone
Myrcene	0.16	0.16	Monoterpene
Octan-3-ol	0.21	0.21	Aliphatic alcohol
$\alpha$ -Phellandrene	0.05*	0.03	Monoterpene
Pseudolimonene	[0.05]*	0.01	Monoterpene
$\alpha$ -Terpinene	0.14	0.14	Monoterpene
para-Cymene	0.18	0.16	Monoterpene
Limonene	7.22*	2.40	Monoterpene
$\beta$ -Phellandrene	[7.22]*	4.77*	Monoterpene
1,8-Cineole	[7.22]*	[4.77]*	Monoterpenic ether
2-Ethylhexanol	0.03	0.04	Aliphatic alcohol
( <i>Z</i> )- $\beta$ -Ocimene	0.09	0.08	Monoterpene
( <i>E</i> )- $\beta$ -Ocimene	0.04	0.03	Monoterpene
$\gamma$ -Terpinene	0.25	0.26	Monoterpene
<i>cis</i> -Sabinene hydrate	0.20	3.19*	Monoterpenic alcohol
para-Mentha-3,8-diene	0.01	tr	Monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.01	0.01	Monoterpenic alcohol
Octanol	0.23	0.58*	Aliphatic alcohol
Terpinolene	0.11*	0.09	Monoterpene
para-Cymenene	[0.11]*	0.02	Monoterpene
<i>trans</i> -Sabinene hydrate	0.03	0.03	Monoterpenic alcohol
Linalool	0.13	0.11	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.03	0.03	Aliphatic ester
Amyl isovalerate	0.04	[0.09]*	Aliphatic ester
<i>cis</i> -para-Menth-2-en-1-ol	0.03	6.16*	Monoterpenic alcohol
Octan-3-yl acetate	0.01	0.01	Aliphatic ester
allo-Ocimene	0.01	0.01	Monoterpene
Camphor	0.02	0.04	Monoterpenic ketone
Isopulegol	0.14*	[0.58]*	Monoterpenic alcohol
neo-Isopulegol	[0.14]*	[0.58]*	Monoterpenic alcohol
Menthone	24.36	24.29	Monoterpenic ketone
Borneol	7.17*	0.98*	Monoterpenic alcohol

Menthofuran	[7.17]*	[3.19]*	Monoterpenic ether
Isomenthone	[7.17]*	4.12	Monoterpenic ketone
neo-Menthol	3.87	3.83	Monoterpenic alcohol
δ-Terpineol	35.28	0.16	Monoterpenic alcohol
Terpinen-4-ol	[35.28]*	0.50*	Monoterpenic alcohol
Menthol	[35.28]*	34.46	Monoterpenic alcohol
Isomenthol	0.58	1.00	Monoterpenic alcohol
para-Cymen-8-ol	0.05	0.03	Monoterpenic alcohol
neoiso-Menthol	0.71*	0.30	Monoterpenic alcohol
α-Terpineol	[0.71]*	[0.98]*	Monoterpenic alcohol
Myrtenol	0.06*	0.01	Monoterpenic alcohol
cis-Piperitol	[0.06]*	0.32	Monoterpenic alcohol
Methylchavicol	0.02*	0.31*	Phenylpropanoid
trans-Isopiperitenol	[0.02]*	0.09*	Monoterpenic alcohol
Unknown	0.04		Unknown
trans-Piperitol	0.03	0.05	Monoterpenic alcohol
Unknown	0.06		Unknown
(3Z)-Hexenyl 2-methylbutyrate	0.04	0.04	Aliphatic ester
Pulegone	0.87*	0.49	Monoterpenic ketone
Citronellol	[0.87]*	0.32*	Monoterpenic alcohol
Carvone	0.07	0.11	Monoterpenic ketone
Piperitone	0.86	0.87	Monoterpenic ketone
neo-Menthyl acetate	0.55*	0.30	Monoterpenic ester
Decanol	[0.55]*	[0.32]*	Aliphatic alcohol
2-Ethylmenthone?	0.02		Aliphatic ketone
Dihydroedulan I	0.05	0.07*	Terpenic ether
Menthyl acetate	6.03*	[6.16]*	Monoterpenic ester
Dihydroedulan II	[6.03]*	0.04	Terpenic ether
Isomenthyl acetate	0.20	0.19	Monoterpenic alcohol
Bicycloelemene	0.15	0.13	Sesquiterpene
α-Cubebene	0.02	[0.03]*	Sesquiterpene
Menthofuroolactone	0.06*	0.01	Aliphatic alcohol
Evodone	[0.06]*		Monoterpenic ketone
α-Copaene	0.06	[0.07]*	Sesquiterpene
β-Bourbonene	0.28	0.28	Sesquiterpene
1,5-diepi-β-Bourbonene	0.02	0.08	Sesquiterpene
β-Elemene	0.14	[0.50]*	Sesquiterpene
Unknown	0.03		Unknown
Isocaryophyllene	0.03	0.01	Sesquiterpene
β-Caryophyllene	3.38	3.26	Sesquiterpene
β-Copaene	0.13	0.11	Sesquiterpene
trans-α-Bergamotene	0.04	[0.50]*	Sesquiterpene
Isogermacrene D	0.06	0.07	Sesquiterpene
α-Humulene	0.43	[0.31]*	Sesquiterpene
Muurola-4,11-diene	0.02	0.21	Sesquiterpene
(E)-β-Farnesene	0.13	0.13	Sesquiterpene
Germacrene D	0.49	[0.98]*	Sesquiterpene
Menthallactone	0.03	0.02	Monoterpenic lactone
Bicyclogermacrene	0.23*	0.13*	Sesquiterpene
Viridiflorene	[0.23]*	0.04	Sesquiterpene
ε-Amorphene	0.08*	0.07	Sesquiterpene
5-Methyl-2,4-diisopropylphenol	[0.08]*	0.01	Terpene derivative

$\alpha$ -Muurolene	[0.08]*	[0.13]*	Sesquiterpene
$\gamma$ -Cadinene	0.03	[0.09]*	Sesquiterpene
$\delta$ -Cadinene	0.09	[0.09]*	Sesquiterpene
( <i>E</i> )-Nerolidol	0.01	0.01	Sesquiterpenic alcohol
Spathulenol	0.01	0.01	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.07*	0.05*	Sesquiterpenic ether
Caryophyllene oxide	[0.07]*	[0.05]*	Sesquiterpenic ether
Viridiflorol	0.04	0.05	Sesquiterpenic alcohol
<b>Total identified</b>	<b>98.94%</b>	<b>98.88%</b>	

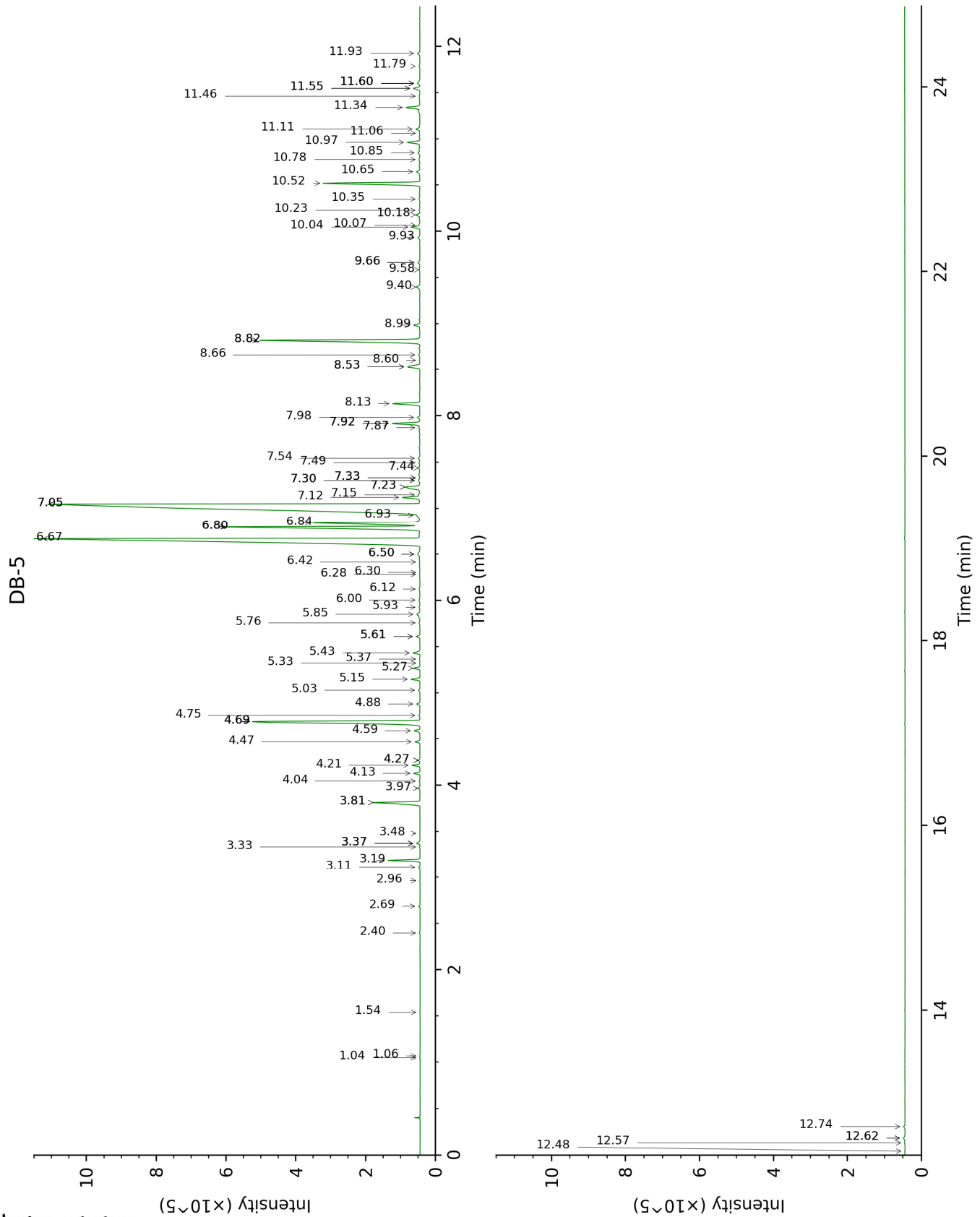
\*: Two or more compounds are coeluting on this column

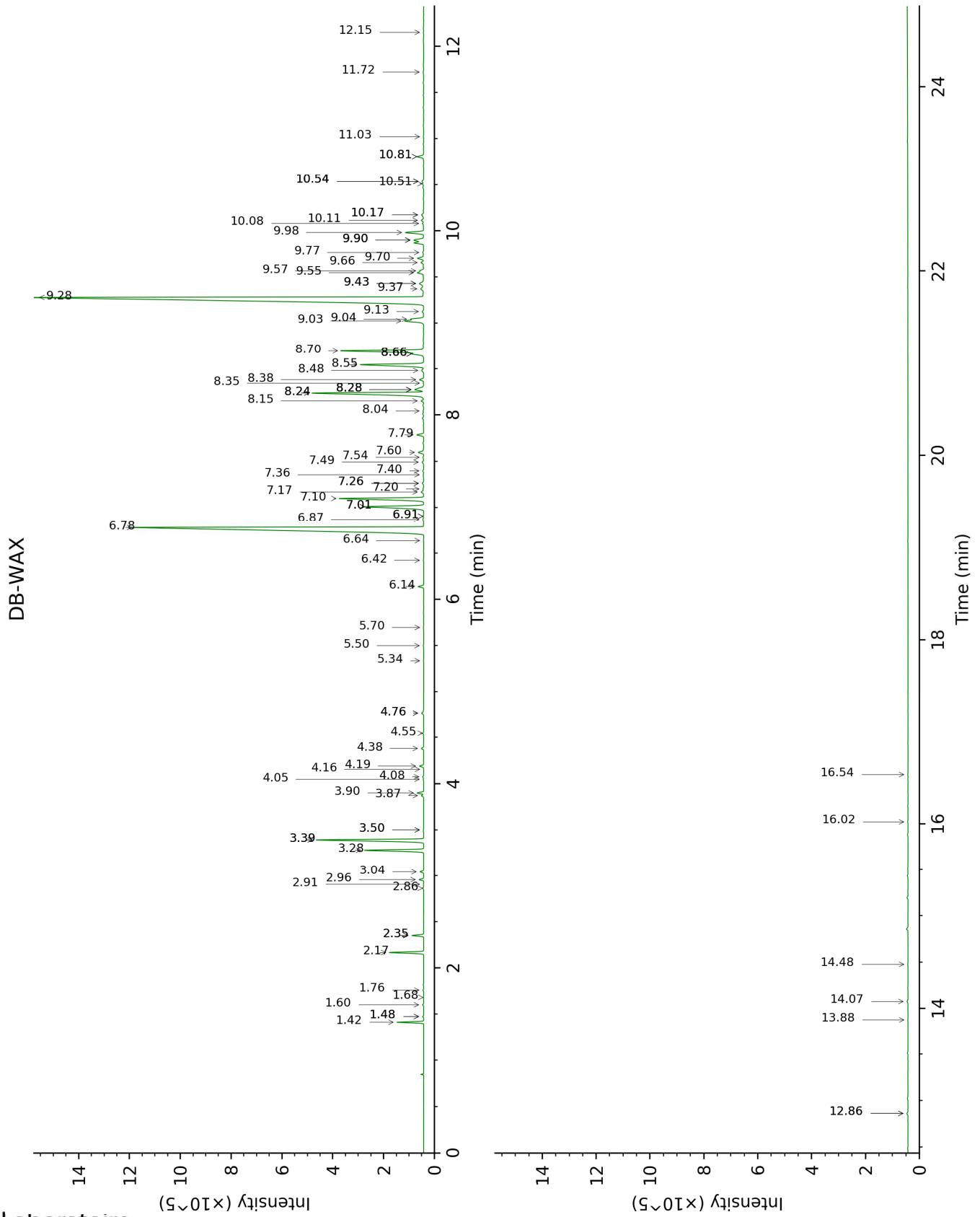
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isoamyl alcohol	1.04	731	0.01	3.50*	1175	0.01
2-Methylbutanol	1.06	734	tr	3.50*	1175	[0.01]
Hexanal	1.54	798	0.01			
Hexanol	2.40	870	0.01	5.50	1319	0.02
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.69	894	0.03	1.60	1012	0.04
Hashishene	2.96	914	tr	1.48*	1000	0.03
$\alpha$ -Thujene	3.11	924	0.03	1.48*	1000	[0.03]
$\alpha$ -Pinene	3.19	929	0.79	1.42	990	0.78
<i>trans</i> -3-Methylcyclohexanol	3.33	938	0.01	6.91*	1421	0.03
$\alpha$ -Fenchene	3.37*	941	0.11	1.68	1019	0.01
Camphene	3.37*	941	[0.11]	1.76	1026	0.03
3-Methylcyclohexanone	3.37*	941	[0.11]	4.76*	1271	0.09
Thuja-2,4(10)-diene	3.48	948	0.01	2.35*	1082	0.41
Sabinene	3.81*	970	1.65	2.35*	1082	[0.41]
$\beta$ -Pinene	3.81*	970	[1.65]	2.17	1065	1.19
Octen-3-ol	3.97	980	0.04	6.87	1418	0.05
Octan-3-one	4.04	985	0.02	4.05	1217	0.02
Myrcene	4.13	991	0.16	2.96	1132	0.16
Octan-3-ol	4.22	996	0.21	6.14	1365	0.21
$\alpha$ -Phellandrene	4.27*	1000	0.05	2.86	1125	0.03
Pseudolimonene	4.27*	1000	[0.05]	2.91	1128	0.01
$\alpha$ -Terpinene	4.47	1013	0.14	3.04	1138	0.14
para-Cymene	4.59	1020	0.18	4.19	1228	0.16
Limonene	4.69*	1026	7.22	3.28	1157	2.40
$\beta$ -Phellandrene	4.69*	1026	[7.22]	3.39*	1166	4.77
1,8-Cineole	4.69*	1026	[7.22]	3.39*	1166	[4.77]
2-Ethylhexanol	4.75	1030	0.03	7.40	1457	0.04
( <i>Z</i> )- $\beta$ -Ocimene	4.88	1038	0.09	3.87	1204	0.08
( <i>E</i> )- $\beta$ -Ocimene	5.03	1048	0.04	4.08	1219	0.03
$\gamma$ -Terpinene	5.15	1056	0.25	3.90	1206	0.26
<i>cis</i> -Sabinene hydrate	5.27	1063	0.20	7.01*	1428	3.19
para-Mentha-3,8-diene	5.32	1066	0.01	4.16	1225	tr
<i>cis</i> -Linalool oxide (fur.)	5.37	1069	0.01	6.64	1401	0.01
Octanol	5.43	1073	0.23	8.28*	1523	0.58
Terpinolene	5.61*	1085	0.11	4.38	1242	0.09
para-Cymenene	5.61*	1085	[0.11]	6.42	1385	0.02
<i>trans</i> -Sabinene hydrate	5.76	1094	0.03	8.04	1506	0.03
Linalool	5.85	1100	0.13	8.15	1514	0.11
2-Methylbutyl 2-methylbutyrate	5.93	1105	0.03	4.55	1254	0.03
Amyl isovalerate	6.00	1110	0.04	4.76*	1271	[0.09]
<i>cis</i> -para-Menth-2-en-1-ol	6.12	1117	0.03	8.24*	1520	6.16
Octan-3-yl acetate	6.28	1128	0.01	5.34	1308	0.01

allo-Ocimene	6.30	1129	0.01	5.70	1334	0.01
Camphor	6.42	1136	0.02	7.36	1454	0.04
Isopulegol	6.50*	1142	0.14	8.28*	1523	[0.58]
neo-Isopulegol	6.50*	1142	[0.14]	8.28*	1523	[0.58]
Menthone	6.67	1153	24.36	6.78	1412	24.29
Borneol	6.80*	1161	7.17	9.90*†	1651	0.98
Menthofuran	6.80*	1161	[7.17]	7.01*	1428	[3.19]
Isomenthone	6.80*	1161	[7.17]	7.10	1435	4.12
neo-Menthol	6.84	1164	3.87	8.70	1556	3.83
δ-Terpineol	6.93†	1169	35.28	9.57	1624	0.16
Terpinen-4-ol	7.05*†	1177	[35.28]	8.66*	1553	0.50
Menthol	7.05*†	1177	[35.28]	9.28	1601	34.46
Isomenthol	7.12	1182	0.58	9.03	1581	1.00
para-Cymen-8-ol	7.15	1184	0.05	11.72	1803	0.03
neoiso-Menthol	7.23*	1189	0.71	9.55	1622	0.30
α-Terpineol	7.23*	1189	[0.71]	9.90*†	1651	[0.98]
Myrtenol	7.30*	1194	0.06	11.02	1744	0.01
cis-Piperitol	7.30*	1194	[0.06]	9.70	1635	0.32
Methylchavicol	7.33*	1196	0.02	9.43*	1613	0.31
trans-Isopiperitenol	7.33*	1196	[0.02]	10.54*	1703	0.09
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.44	1203	0.04			
trans-Piperitol	7.49	1206	0.03	10.51	1700	0.05
Unknown [m/z 146, 145 (94), 43 (72), 99 (41), 81 (29), 115 (25), 86 (24)...]	7.54	1210	0.06			
(3Z)-Hexenyl 2-methylbutyrate	7.87	1232	0.04	7.20	1443	0.04
Pulegone	7.92*	1236	0.87	9.04	1582	0.49
Citronellol	7.92*	1236	[0.87]	10.81*	1726	0.32
Carvone	7.98	1240	0.07	10.11	1668	0.11
Piperitone	8.13	1250	0.86	9.98	1658	0.87
neo-Menthyl acetate	8.53*	1278	0.55	7.79	1486	0.30
Decanol	8.53*	1278	[0.55]	10.81*	1726	[0.32]
2-Ethylmenthone?	8.60	1282	0.02			
Dihydroedulan I	8.66	1286	0.05	7.26*	1447	0.07
Menthyl acetate	8.82*	1298	6.03	8.24*	1520	[6.16]
Dihydroedulan II	8.82*	1298	[6.03]	7.54	1468	0.04
Isomenthyl acetate	8.99	1303	0.20	8.38	1532	0.19
Bicycloelemene	9.40	1332	0.15	7.17	1440	0.13
α-Cubebene	9.58	1345	0.02	6.91*	1421	[0.03]
Menthofuroolactone	9.66*	1351	0.06	12.15	1841	0.01
Evodone	9.66*	1351	[0.06]			
α-Copaene	9.93	1370	0.06	7.26*	1447	[0.07]
β-Bourbonene	10.04	1378	0.28	7.60	1472	0.28
1,5-diepi-β-Bourbonene	10.07	1380	0.02	7.49	1464	0.08
β-Elemene	10.18	1388	0.14	8.66*	1553	[0.50]
Unknown [m/z 107,	10.23	1391	0.03			

121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]						
Isocaryophyllene	10.35	1400	0.03	8.35	1529	0.01
β-Caryophyllene	10.52	1412	3.38	8.55	1544	3.26
β-Copaene	10.65	1422	0.13	8.48	1539	0.11
<i>trans</i> -α-Bergamotene	10.78	1432	0.04	8.66*	1553	[0.50]
Isogermacrene D	10.85	1438	0.06	9.13	1589	0.07
α-Humulene	10.97	1446	0.43	9.43*	1613	[0.31]
Muurola-4,11-diene	11.06	1454	0.02	9.37	1608	0.21
( <i>E</i> )-β-Farnesene	11.11	1457	0.13	9.66	1631	0.13
Germacrene D	11.34	1474	0.49	9.90*†	1651	[0.98]
Menthylactone	11.46	1484	0.03	16.02	2209	0.02
Bicyclgermacrene	11.55*	1490	0.23	10.17*	1673	0.13
Viridiflorene	11.55*	1490	[0.23]	9.77	1640	0.04
ε-Amorphene	11.60*	1494	0.08	10.08	1665	0.07
5-Methyl-2,4-diisopropylphenol	11.60*	1494	[0.08]	16.54	2262	0.01
α-Muurolene	11.60*	1494	[0.08]	10.17*	1673	[0.13]
γ-Cadinene	11.79	1508	0.03	10.54*	1703	[0.09]
δ-Cadinene	11.93	1519	0.09	10.54*	1703	[0.09]
( <i>E</i> )-Nerolidol	12.48	1563	0.01	13.88	1998	0.01
Spathulenol	12.57	1570	0.01	14.48	2055	0.01
Caryophyllene oxide isomer	12.62*	1574	0.07	12.86*	1904	0.05
Caryophyllene oxide	12.62*	1574	[0.07]	12.86*	1904	[0.05]
Viridiflorol	12.74	1584	0.04	14.08	2017	0.05
<b>Total identified</b>		<b>98.94%</b>			<b>98.88%</b>	
<b>Total reported</b>		<b>99.07%</b>			<b>98.88%</b>	

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

[xx]: Duplicate percentage due to coelutions, not taken account in the identified 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