

**Date :** June 22, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 21F17-PTH02

**Customer identification :** Peppermint - India - P50112214R

**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 :** Seydou Ka, Ph. D., Chimiste

**Analysis date :** June 17, 2021

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*Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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

#### PHYSICOCHEMICAL DATA

**Physical aspect:** Clear liquid

**Refractive index:** 1.4588 ± 0.0003 (20 °C; method PC-MAT-016)

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

Compound	Min. %	Max. %	Observed %	Complies?
Limonene	1.0	3.5	2.6	Yes
1,8-Cineole	3.5	8.0	5.4	Yes
Menthone	14.0	32.0	26.6	Yes
Menthofuran	1.0	8.0	1.2	Yes
Isomenthone	1.5	10.0	4.0	Yes
Menthyl acetate	2.8	10.0	5.4	Yes
Menthol	30.0	55.0	41.7	Yes
Pulegone		3.0	0.7	Yes
Carvone		1.0	0	Yes
Total isopulegol		0.20	0.03	Yes
<b>Refractive index</b>	1.457	1.467	1.459	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
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Isoamyl alcohol	tr	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
(3Z)-Hexenol	0.01	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.02	Furan
Hashishene	0.01	Monoterpene
$\alpha$ -Thujene	0.04	Monoterpene
$\alpha$ -Pinene	0.80	Monoterpene
3-Methylcyclohexanone	0.01	Aliphatic ketone
Camphene	0.02	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
$\beta$ -Pinene	1.05	Monoterpene
Sabinene	0.23	Monoterpene
Octen-3-ol	0.02	Aliphatic alcohol
<i>cis</i> -Carane	0.01	Monoterpene
Octan-3-one	0.01	Aliphatic ketone
Myrcene	0.23	Monoterpene
Octan-3-ol	0.26	Aliphatic alcohol
$\alpha$ -Phellandrene	0.04	Monoterpene
Pseudolimonene	0.01	Monoterpene
$\alpha$ -Terpinene	0.05	Monoterpene
<i>para</i> -Cymene	0.24	Monoterpene
Limonene	2.61	Monoterpene
1,8-Cineole	5.39	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.04	Monoterpene
(E)- $\beta$ -Ocimene	0.03	Monoterpene
$\gamma$ -Terpinene	0.20	Monoterpene
<i>cis</i> -Sabinene hydrate	0.06	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	tr	Monoterpenic alcohol
Octanol	0.04	Aliphatic alcohol
<i>para</i> -Cymenene	0.01	Monoterpene
Terpinolene	0.03	Monoterpene
<i>trans</i> -Sabinene hydrate	0.01	Monoterpenic alcohol
Nonan-3-ol	0.01	Aliphatic alcohol
Linalool	0.09	Monoterpenic alcohol
Amyl isovalerate	0.02	Aliphatic ester
<i>cis</i> - <i>para</i> -Menth-2-en-1-ol	0.02	Monoterpenic alcohol
allo-Ocimene	0.01	Monoterpene
<i>trans</i> -Sabinol	0.07	Monoterpenic alcohol
Isopulegol	0.03	Monoterpenic alcohol
<i>cis</i> - $\alpha$ -Dihydroterpineol	0.08	Monoterpenic alcohol
Menthone	26.59	Monoterpenic ketone
<i>para</i> -Menth-4-ol isomer	0.17	Monoterpenic alcohol
Isomenthone	4.03	Monoterpenic ketone

Menthofuran	1.19	Monoterpenic ether
neo-Menthol	3.27	Monoterpenic alcohol
δ-Terpineol	0.04	Monoterpenic alcohol
Menthol	41.66	Monoterpenic alcohol
Terpinen-4-ol	0.41	Monoterpenic alcohol
Isomenthol	0.40	Monoterpenic alcohol
neiso-Menthol	0.06	Monoterpenic alcohol
α-Terpineol	0.08	Monoterpenic alcohol
Methylchavicol	0.02	Phenylpropanoid
Unknown	0.02	Unknown
Citronellol	0.01	Monoterpenic alcohol
Pulegone	0.68	Monoterpenic ketone
Piperitone	0.13	Monoterpenic ketone
Decanol	0.02	Aliphatic alcohol
2-Ethylmenthone?	0.08	Aliphatic ketone
Dihydroedulan I	0.02	Terpenic ether
Dihydroedulan II	0.02	Terpenic ether
Menthyl acetate	5.35	Monoterpenic ester
Thymol	0.01	Monoterpenic alcohol
Isomenthyl acetate	0.05	Monoterpenic alcohol
Bicycloelemene	0.05	Sesquiterpene
α-Cubebene	0.01	Sesquiterpene
Eugenol	0.01	Phenylpropanoid
α-Copaene	0.02	Sesquiterpene
β-Bourbonene	0.05	Sesquiterpene
β-Elemene	0.02	Sesquiterpene
Unknown	tr	Unknown
Unknown	0.02	Sesquiterpene
β-Caryophyllene	2.63	Sesquiterpene
β-Copaene	0.01	Sesquiterpene
Isogermacrene D	0.01	Sesquiterpene
α-Humulene	0.03	Sesquiterpene
(E)-β-Farnesene	0.05	Sesquiterpene
Germacrene D	0.21	Sesquiterpene
Menthylactone	0.01	Monoterpenic lactone
Bicyclogermacrene	0.04	Sesquiterpene
Viridiflorene	0.01	Sesquiterpene
α-Murolene	0.01	Sesquiterpene
δ-Cadinene	0.02	Sesquiterpene
Caryophyllene oxide	0.03	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Viridiflorol	0.03	Sesquiterpenic alcohol
<b>Consolidated total</b>	<b>99.37%</b>	

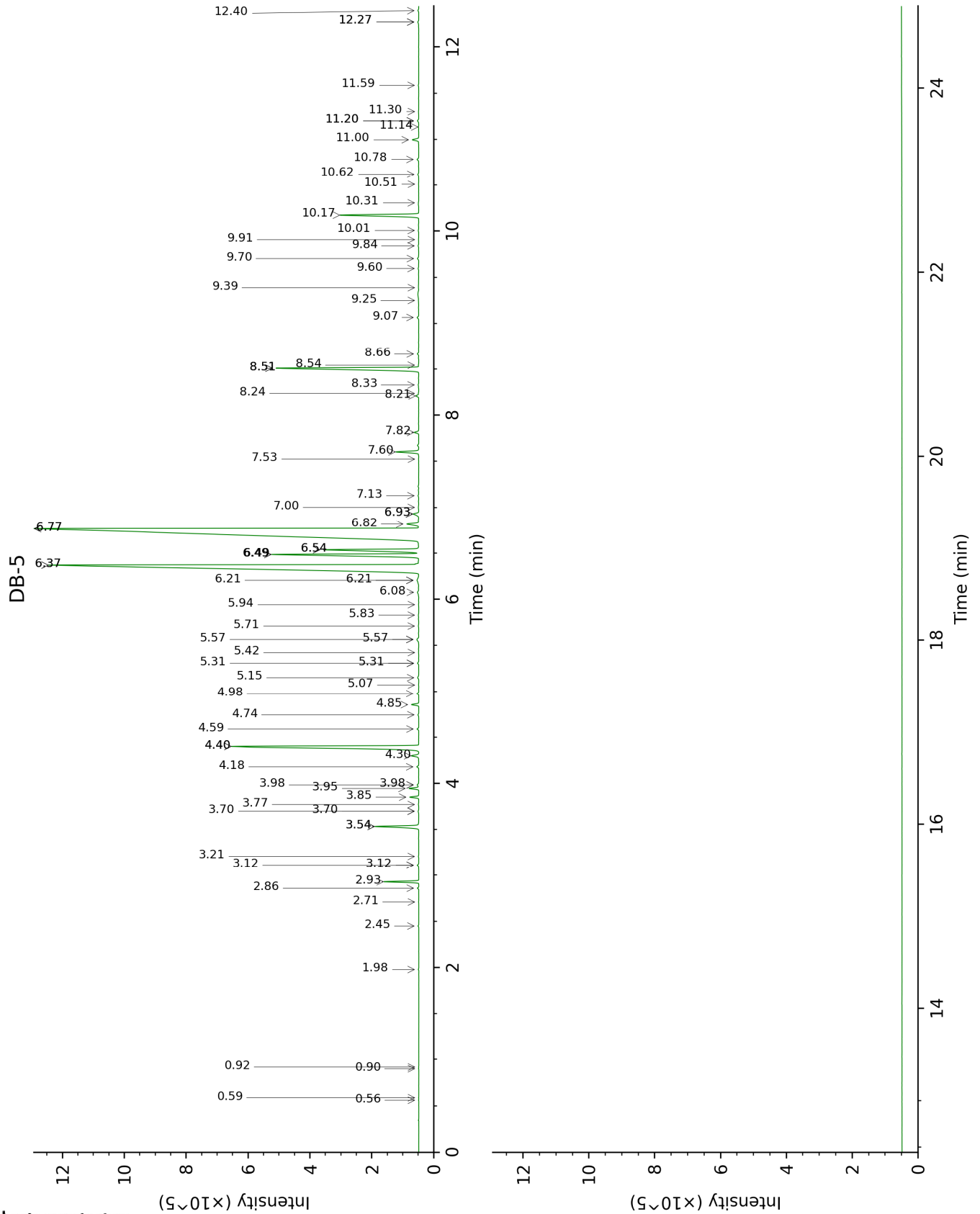
tr: The compound has been detected below 0.005% of total signal.

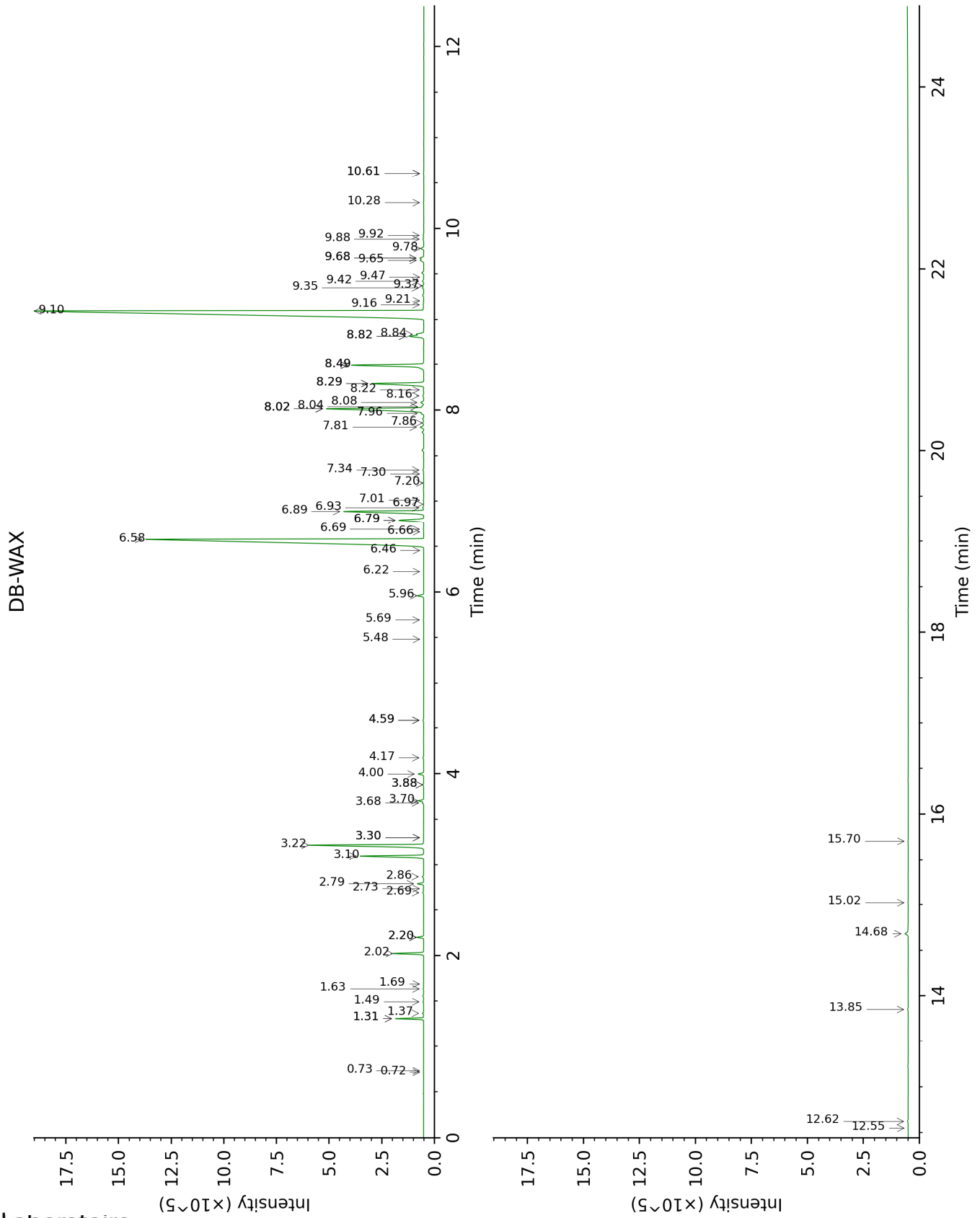
Note: no correction factor was applied

**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	%
Isovaleral	0.56	642	tr	0.73	888	tr
2-Methylbutyral	0.59	653	tr	0.72	881	tr
Isoamyl alcohol	0.90	731	tr	3.30*	1175	0.01
2-Methylbutanol	0.92	734	tr	3.30*	1175	[0.01]
(3Z)-Hexenol	1.98	856	0.01	5.69	1350	0.02
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.45	896	0.02	1.49	1012	0.02
Hashishene	2.71	916	0.01	1.31*	991	0.79
$\alpha$ -Thujene	2.86	926	0.04	1.37	999	0.03
$\alpha$ -Pinene	2.93	930	0.80	1.31*	991	[0.79]
3-Methylcyclohexanone	3.12*	943	0.04	4.59*	1274	0.03
Camphene	3.12*	943	[0.04]	1.63	1026	0.02
Thuja-2,4(10)-diene	3.21	949	0.01	2.20*	1084	0.24
$\beta$ -Pinene	3.54*	971	1.34	2.02	1066	1.05
Sabinene	3.54*	971	[1.34]	2.20*	1084	[0.24]
Octen-3-ol	3.70*	983	0.02	6.69	1423	0.02
<i>cis</i> -Carane	3.70*	983	[0.02]	1.69	1032	0.01
Octan-3-one	3.77	988	0.01	3.88*	1220	0.03
Myrcene	3.85	993	0.23	2.79	1134	0.22
Octan-3-ol	3.95	999	0.26	5.96	1370	0.26
$\alpha$ -Phellandrene	3.98*	1002	0.05	2.69	1126	0.04
Pseudolimonene	3.98*	1002	[0.05]	2.73	1130	0.01
$\alpha$ -Terpinene	4.18	1014	0.05	2.86	1140	0.05
para-Cymene	4.30	1022	0.24	4.00	1229	0.22
Limonene	4.40*	1029	8.08	3.10	1159	2.61
1,8-Cineole	4.40*	1029	[8.08]	3.22	1169	5.39
(Z)- $\beta$ -Ocimene	4.59	1041	0.04	3.68	1206	0.04
(E)- $\beta$ -Ocimene	4.74	1050	0.03	3.88*	1220	[0.03]
$\gamma$ -Terpinene	4.85	1057	0.20	3.70	1207	0.21
<i>cis</i> -Sabinene hydrate	4.98	1065	0.06	6.79*	1431	1.25
<i>cis</i> -Linalool oxide (fur.)	5.07	1071	tr	6.46	1406	0.01
Octanol	5.15	1076	0.04	8.08	1528	0.15
para-Cymenene	5.31*	1086	0.04	6.22	1389	0.01
Terpinolene	5.31*	1086	[0.04]	4.18	1243	0.03
<i>trans</i> -Sabinene hydrate	5.42	1094	0.01	7.86	1511	0.05
Nonan-3-ol	5.57*	1103	0.10	7.20	1461	0.01
Linalool	5.57*	1103	[0.10]	7.96	1519	0.09
Amyl isovalerate	5.71	1112	0.02	4.59*	1274	[0.03]
<i>cis</i> -para-Menth-2-en-1-ol	5.83	1120	0.02	8.02*	1523	5.43
allo-Ocimene	5.94	1127	0.01	5.48	1335	tr
<i>trans</i> -Sabinol	6.08	1136	0.07	9.68*†	1654	[0.35]
Isopulegol	6.21*	1144	0.12	8.02*	1523	[5.43]
<i>cis</i> - $\alpha$ -Dihydroterpineol	6.21*	1144	[0.12]	8.04	1524	0.08
Menthone	6.37*	1155	26.81	6.58	1415	26.59

para-Menthan-4-ol isomer	6.37*	1155	[26.81]	7.81	1507	0.17
Isomenthone	6.49*	1163	5.23	6.89	1438	4.03
Menthofuran	6.49*	1163	[5.23]	6.79*	1431	[1.25]
neo-Menthol	6.54*	1166	3.31	8.49*	1560	3.48
δ-Terpineol	6.54*	1166	[3.31]	9.37	1629	0.04
Menthol	6.77*	1181	42.07	9.10	1607	41.66
Terpinen-4-ol	6.77*	1181	[42.07]	8.49*	1560	[3.48]
Isomenthol	6.82	1184	0.40	8.82*†	1585	1.02
neoiso-Menthol	6.93*	1192	0.21	9.35	1628	0.06
α-Terpineol	6.93*	1192	[0.21]	9.65†	1652	0.35
Methylchavicol	7.00	1196	0.02	9.21	1616	0.01
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.13	1205	0.02			
Citronellol	7.53	1232	0.01	10.61*	1731	0.03
Pulegone	7.60	1237	0.68	8.82*†	1585	[1.02]
Piperitone	7.82	1251	0.13	9.78	1662	0.13
Decanol	8.21†	1278	0.10	10.61*	1731	[0.03]
2-Ethylmenthone?	8.24†	1280	[0.10]			
Dihydroedulan I	8.33	1286	0.02	6.97	1444	0.01
Dihydroedulan II	8.51*	1299	5.37	7.30	1469	0.02
Menthyl acetate	8.51*	1299	[5.37]	8.02*	1523	[5.43]
Thymol	8.54	1301	0.01	15.02	2135	0.01
Isomenthyl acetate	8.66	1306	0.05	8.16	1534	0.05
Bicycloelemene	9.07	1334	0.05	6.93	1441	0.04
α-Cubebene	9.25	1347	0.01	6.66	1421	0.01
Eugenol	9.39	1357	0.01	14.68	2101	0.17
α-Copaene	9.60	1372	0.02	7.01	1447	0.02
β-Bourbonene	9.70	1380	0.05	7.34	1472	0.04
β-Elemene	9.84	1389	0.02	8.29*	1544	2.63
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	9.91	1394	tr			
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.01	1401	0.02			
β-Caryophyllene	10.17	1413	2.63	8.29*	1544	[2.63]
β-Copaene	10.31	1423	0.01	8.22	1539	0.03
Isogermacrene D	10.51	1439	0.01	8.84†	1587	[1.02]
α-Humulene	10.62	1447	0.03	9.16	1612	0.04
(E)-β-Farnesene	10.78	1459	0.05	9.42	1633	0.06
Germacrene D	11.00	1475	0.21	9.68*†	1654	[0.35]
Menthylactone	11.14	1486	0.01	15.70	2203	0.01
Bicyclogermacrene	11.20*	1490	0.05	9.88	1671	0.04
Viridiflorene	11.20*	1490	[0.05]	9.47	1637	0.01
α-Murolene	11.30	1498	0.01	9.92	1674	0.03
δ-Cadinene	11.59	1520	0.02	10.28	1703	0.02
Caryophyllene oxide	12.27*	1574	0.03	12.62	1907	0.03

Caryophyllene oxide isomer	12.27*	1574	[0.03]	12.55	1900	0.01
Viridiflorol	12.40	1584	0.03	13.85	2021	0.03
<b>Total identified</b>		<b>99.61%</b>			<b>99.31%</b>	
<b>Total reported</b>		<b>99.66%</b>			<b>99.31%</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