

**Date :** March 31, 2023

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 23C24-PTH03

**Customer identification :** Peppermint - India - P50114R

**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 :** Amélie Simard, Analyste

**Analysis date :** March 28, 2023

Checked and approved by :

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Alexis St-Gelais, Ph. D., Chimiste 2013-174

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4598 \pm 0.0003$  (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
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
(3Z)-Hexenol	0.01	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.03	Furan
Hashishene	0.01	Monoterpene
$\alpha$ -Thujene	0.06	Monoterpene
$\alpha$ -Pinene	0.98	Monoterpene
<i>trans</i> -3-Methylcyclohexanol	0.04	Aliphatic alcohol
Camphene	0.02	Monoterpene
3-Methylcyclohexanone	tr	Aliphatic ketone
$\alpha$ -Fenchene	0.01	Monoterpene
Thuja-2,4(10)-diene	0.02	Monoterpene
$\beta$ -Pinene	1.26	Monoterpene
Sabinene	0.33	Monoterpene
<i>cis</i> -para-Menthane	0.04	Monoterpene
Octen-3-ol	0.02	Aliphatic alcohol
<i>cis</i> -Carane	0.03	Monoterpene
Octan-3-one	0.02	Aliphatic ketone
<i>trans</i> -para-Menthane	tr	Monoterpene
Myrcene	0.10	Monoterpene
Octan-3-ol	0.25	Aliphatic alcohol
$\alpha$ -Phellandrene	0.01	Monoterpene
Pseudolimonene	0.02	Monoterpene
$\Delta^3$ -Carene	0.02	Monoterpene
$\alpha$ -Terpinene	0.12	Monoterpene
para-Cymene	0.23	Monoterpene
Limonene	2.71	Monoterpene
1,8-Cineole	5.62	Monoterpenic ether
2-Ethylhexanol	0.02	Aliphatic alcohol
(Z)- $\beta$ -Ocimene	0.07	Monoterpene
(E)- $\beta$ -Ocimene	0.05	Monoterpene
$\gamma$ -Terpinene	0.13	Monoterpene
<i>cis</i> -Sabinene hydrate	0.12	Monoterpenic alcohol
para-Mentha-3,8-diene	0.02	Monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Octanol	0.04	Aliphatic alcohol
Isoterpinolene	0.02	Monoterpene
Terpinolene	0.07	Monoterpene
para-Cymenene	0.02	Monoterpene
<i>trans</i> -Sabinene hydrate	0.02	Monoterpenic alcohol
Linalool	0.16	Monoterpenic alcohol
Nonan-3-ol	0.01	Aliphatic alcohol
2-Methylbutyl 2-methylbutyrate	0.02	Aliphatic ester

Amyl isovalerate	0.01	Aliphatic ester
<i>cis</i> -para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
Octan-3-yl acetate	0.01	Aliphatic ester
Camphor	0.01	Monoterpenic ketone
<i>trans</i> -para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
Isopulegol	0.11	Monoterpenic alcohol
Menthone	24.38	Monoterpenic ketone
<i>cis</i> - $\alpha$ -Dihydroterpineol	0.01	Monoterpenic alcohol
para-Menthan-4-ol isomer	0.02	Monoterpenic alcohol
Menthofuran	1.61	Monoterpenic ether
Isomenthone	3.48	Monoterpenic ketone
$\delta$ -Terpineol	0.06	Monoterpenic alcohol
neo-Menthol	3.56	Monoterpenic alcohol
Terpinen-4-ol	0.17	Monoterpenic alcohol
Menthol	40.57	Monoterpenic alcohol
Isomenthol	0.22	Monoterpenic alcohol
para-Cymen-8-ol	0.02	Monoterpenic alcohol
neoiso-Menthol	0.13	Monoterpenic alcohol
$\alpha$ -Terpineol	0.17	Monoterpenic alcohol
Methylchavicol	0.02	Phenylpropanoid
Unknown	0.01	Unknown
<i>trans</i> -Piperitol	0.02	Monoterpenic alcohol
Decanal	0.02	Aliphatic aldehyde
Pulegone	0.59	Monoterpenic ketone
Citronellol	0.01	Monoterpenic alcohol
Carvone	0.04	Monoterpenic ketone
Piperitone	0.25	Monoterpenic ketone
neo-Menthyl acetate	0.11	Monoterpenic ester
Decanol	0.03	Aliphatic alcohol
2-Ethylmenthone?	0.06	Aliphatic ketone
Dihydroedulan I	0.01	Terpenic ether
Menthyl acetate	5.56	Monoterpenic ester
Dihydroedulan II	0.03	Terpenic ether
Thymol	0.02	Monoterpenic alcohol
Isomenthyl acetate	0.08	Monoterpenic alcohol
Bicycloelemene	0.05	Sesquiterpene
Piperitenone	0.01	Monoterpenic ketone
Eugenol	0.02	Phenylpropanoid
$\alpha$ -Ylangene	0.01	Sesquiterpene
$\alpha$ -Copaene	0.02	Sesquiterpene
$\beta$ -Bourbonene	0.09	Sesquiterpene
1,5-diepi- $\beta$ -Bourbonene	0.01	Sesquiterpene
$\beta$ -Cubebene	0.01	Sesquiterpene
$\beta$ -Elemene	0.04	Sesquiterpene
Unknown	0.02	Unknown
Isocaryophyllene	0.02	Sesquiterpene
$\beta$ -Caryophyllene	3.27	Sesquiterpene
$\beta$ -Ylangene	0.04	Sesquiterpene
$\beta$ -Copaene	0.02	Sesquiterpene
Aromadendrene	0.02	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.01	Sesquiterpene
Isogermacrene D	0.01	Sesquiterpene

α-Humulene	0.06	Sesquiterpene
(E)-β-Farnesene	0.09	Sesquiterpene
9-epi-β-Caryophyllene	0.01	Sesquiterpene
γ-Murolene	0.02	Sesquiterpene
Germacrene D	0.37	Sesquiterpene
Menthylactone	0.03	Monoterpenic lactone
Bicyclogermacrene	tr	Sesquiterpene
Viridiflorene	0.09	Sesquiterpene
α-Murolene	0.02	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
δ-Cadinene	0.04	Sesquiterpene
Isocaryophyllene epoxide B	0.01	Sesquiterpenic ether
Spathulenol	0.03	Sesquiterpenic alcohol
Caryophyllene oxide	0.06	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Viridiflorol	0.07	Sesquiterpenic alcohol
<b>Consolidated total</b>	<b>98.81%</b>	

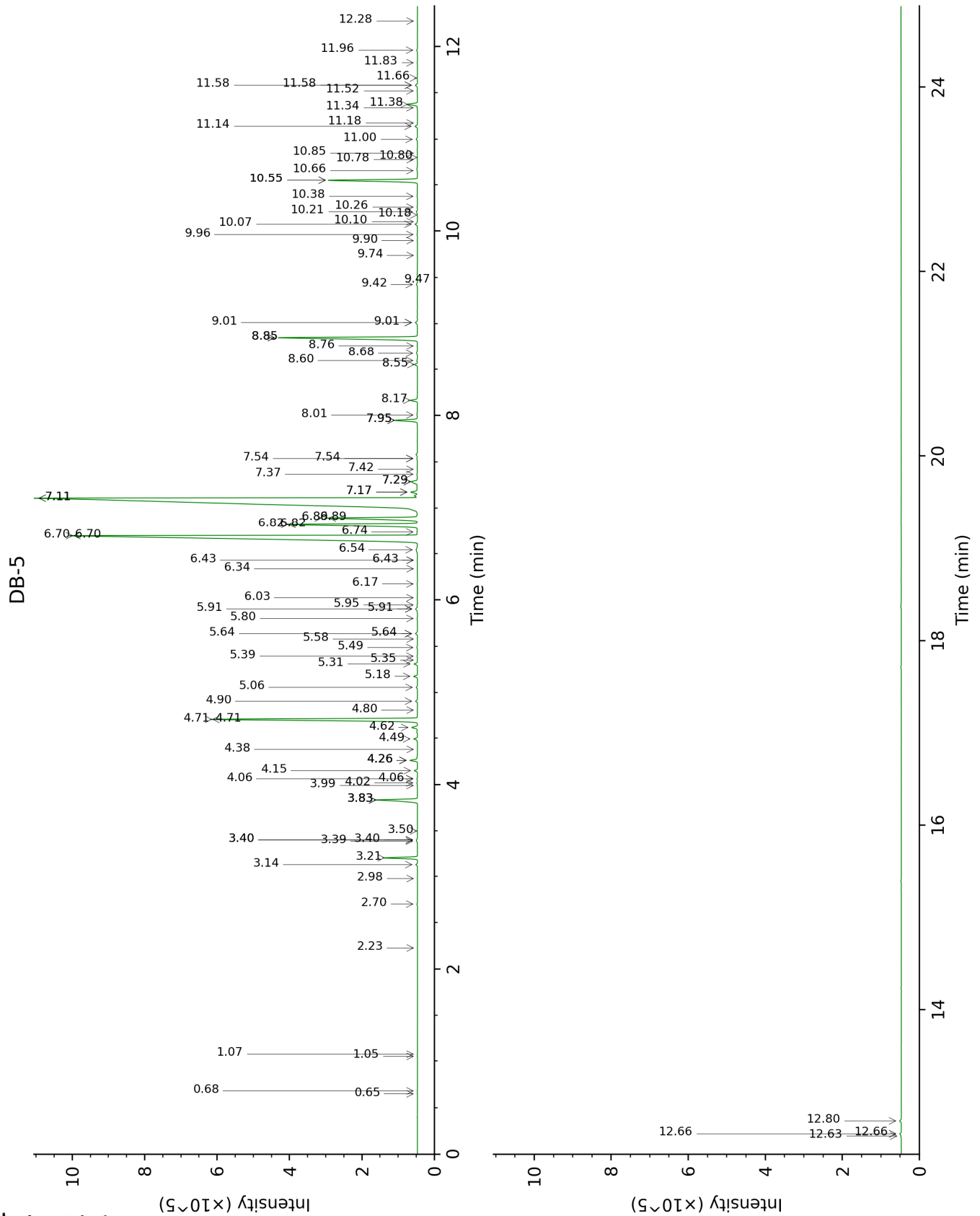
tr: The compound has been detected below 0.005% of total signal.

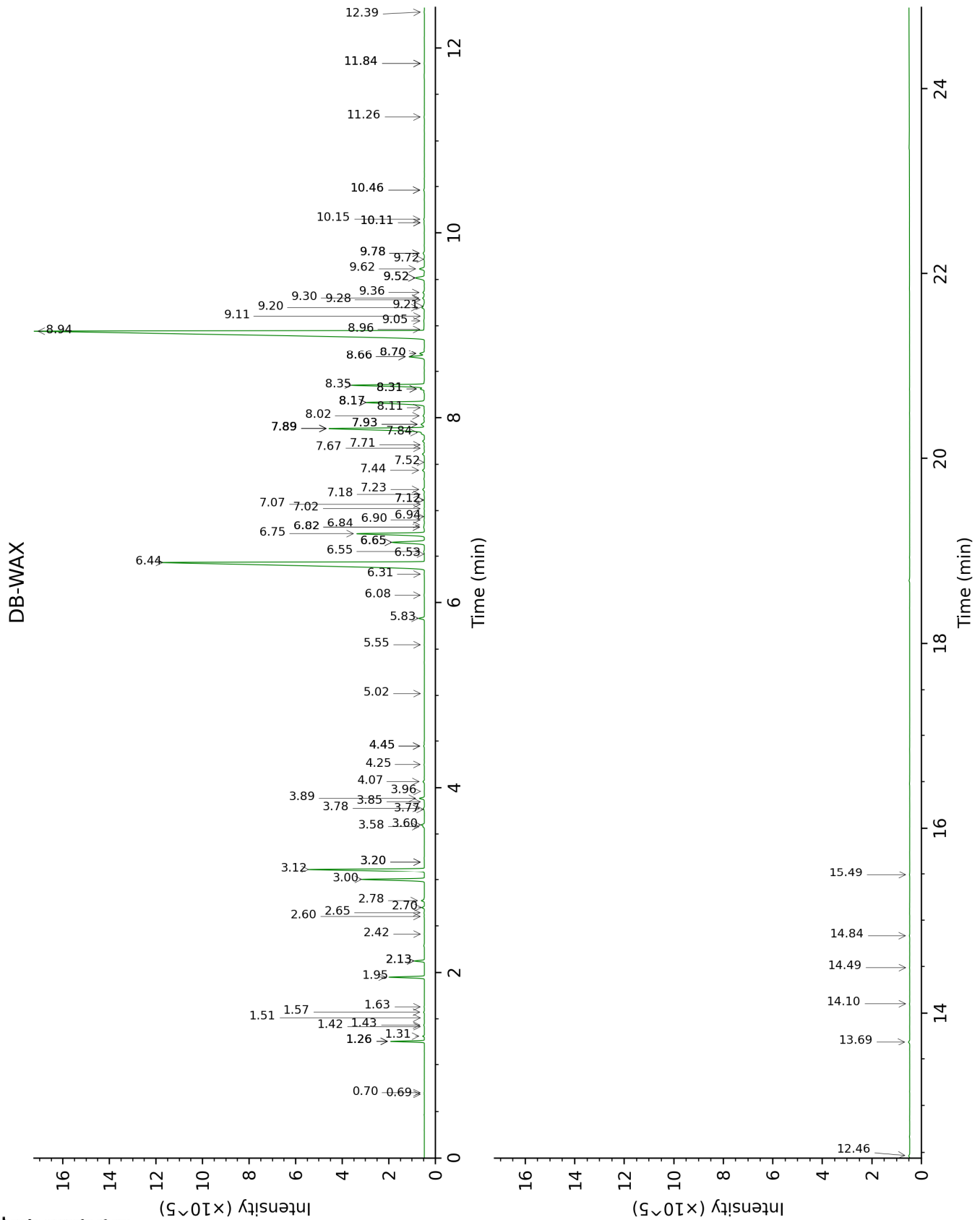
Note: no correction factor was applied

**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	0.65	641	tr	0.70	888	tr
2-Methylbutyral	0.68	651	tr	0.68	881	tr
Isoamyl alcohol	1.05	733	0.01	3.20*	1175	0.01
2-Methylbutanol	1.08	736	tr	3.20*	1175	[0.01]
(3Z)-Hexenol	2.23	858	0.01	5.55	1348	0.01
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.70	896	0.03	1.43	1012	0.02
Hashishene	2.98	916	0.01	1.26*	992	0.97
$\alpha$ -Thujene	3.14	926	0.06	1.32	1000	0.05
$\alpha$ -Pinene	3.21	931	0.98	1.26*	992	[0.97]
<i>trans</i> -3-Methylcyclohexanol	3.39†	943	0.08	6.55	1421	0.04
Camphene	3.40*†	944	[0.08]	1.57	1026	0.02
3-Methylcyclohexanone	3.40*†	944	[0.08]	4.45*	1273	0.04
$\alpha$ -Fenchene	3.40*†	944	[0.08]	1.51	1020	0.01
Thuja-2,4(10)-diene	3.50	950	0.02	2.13*	1084	0.35
$\beta$ -Pinene	3.84*	972	1.63	1.95	1066	1.26
Sabinene	3.84*	972	[1.63]	2.13*	1084	[0.35]
<i>cis</i> -para-Menthane	3.84*	972	[1.63]	1.26*	992	[0.97]
Octen-3-ol	3.99	982	0.02	6.53	1419	0.01
<i>cis</i> -Carane	4.02	984	0.03	1.63	1032	0.01
Octan-3-one	4.06*	987	0.03	3.77	1221	0.02
<i>trans</i> -para-Menthane	4.06*	987	[0.03]	1.42	1010	tr
Myrcene	4.15	993	0.10	2.70	1134	0.10
Octan-3-ol	4.26*	1000	0.29	5.83	1368	0.25
$\alpha$ -Phellandrene	4.26*	1000	[0.29]	2.60	1126	0.01
Pseudolimonene	4.26*	1000	[0.29]	2.65	1130	0.02
$\Delta^3$ -Carene	4.38	1008	0.02	2.42	1111	0.01
$\alpha$ -Terpinene	4.49	1015	0.12	2.78	1140	0.12
para-Cymene	4.62	1023	0.23	3.89	1230	0.21
Limonene	4.70*	1028	8.35	3.00	1159	2.71
1,8-Cineole	4.70*	1028	[8.35]	3.12	1168	5.62
2-Ethylhexanol	4.80	1034	0.02	7.02	1457	0.02
(Z)- $\beta$ -Ocimene	4.90	1040	0.07	3.58	1206	0.06
(E)- $\beta$ -Ocimene	5.06	1050	0.05	3.78	1221	0.04
$\gamma$ -Terpinene	5.18	1058	0.13	3.60	1208	0.13
<i>cis</i> -Sabinene hydrate	5.31	1066	0.12	6.65*	1429	1.73
para-Mentha-3,8-diene	5.35	1069	0.02	3.85	1227	0.01
<i>cis</i> -Linalool oxide (fur.)	5.40	1071	0.02	6.31	1403	0.02
Octanol	5.49	1077	0.04	7.93*	1526	0.22
Isoterpinolene	5.58	1083	0.02	3.96	1236	0.01
Terpinolene	5.64*	1086	0.08	4.07	1244	0.07
para-Cymenene	5.64*	1086	[0.08]	6.08	1386	0.02
<i>trans</i> -Sabinene hydrate	5.80	1097	0.02	7.67	1506	0.02
Linalool	5.90*	1103	0.10	7.84	1519	0.16
Nonan-3-ol	5.90*	1103	[0.10]	7.12*	1464	0.02

2-Methylbutyl 2-methylbutyrate	5.95	1106	0.02	4.25	1258	0.02
Amyl isovalerate	6.03	1111	0.01	4.45*	1273	[0.04]
cis-para-Menth-2-en-1-ol	6.18	1120	0.02	7.89*	1522	5.58
Octan-3-yl acetate	6.34	1131	0.01	5.02	1309	0.01
Camphor	6.43*	1136	0.02	6.94	1450	0.01
trans-para-Menth-2-en-1-ol	6.43*	1136	[0.02]	8.70*	1586	0.23
Isopulegol	6.54	1144	0.11	7.89*	1522	[5.58]
Menthone	6.70*	1153	24.39	6.44	1413	24.38
cis- $\alpha$ -Dihydroterpineol	6.70*	1153	[24.39]	7.93*	1526	[0.22]
para-Menthan-4-ol isomer	6.74	1156	0.02	7.71	1508	0.02
Menthofuran	6.82*	1161	5.09	6.65*	1429	[1.73]
Isomenthone	6.82*	1161	[5.09]	6.75	1436	3.48
$\delta$ -Terpineol	6.89*	1166	3.61	9.21	1627	0.06
neo-Menthol	6.89*	1166	[3.61]	8.35	1559	3.56
Terpinen-4-ol	7.11*†	1180	41.30	8.31*	1556	0.19
Menthol	7.11*†	1180	[41.30]	8.94	1605	40.57
Isomenthol	7.18*	1184	0.25	8.66*	1583	0.82
para-Cymen-8-ol	7.18*	1184	[0.25]	11.26	1799	0.02
neoiso-Menthol	7.29*	1191	0.30	9.20	1626	0.13
$\alpha$ -Terpineol	7.29*	1191	[0.30]	9.52*	1652	0.55
Methylchavicol	7.37	1196	0.02	9.05	1614	0.07
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.42	1200	0.01			
trans-Piperitol	7.54*	1207	0.05	10.11*	1701	0.04
Decanal	7.54*	1207	[0.05]	7.07	1460	0.02
Pulegone	7.95*	1234	0.80	8.66*	1583	[0.82]
Citronellol	7.95*	1234	[0.80]	10.46*	1731	0.04
Carvone	8.01	1238	0.04	9.72	1668	0.03
Piperitone	8.17	1249	0.25	9.62	1660	0.25
neo-Menthyl acetate	8.55	1275	0.11	7.44	1488	0.10
Decanol	8.60	1278	0.03	10.46*	1731	[0.04]
2-Ethylmenthone?	8.68	1283	0.06			
Dihydroedulan I	8.76	1289	0.01	6.84	1443	0.02
Menthyl acetate	8.85*	1295	5.59	7.89*	1522	[5.58]
Dihydroedulan II	8.85*	1295	[5.59]	7.18	1468	0.03
Thymol	9.01*	1306	0.09	14.84	2133	0.02
Isomenthyl acetate	9.01*	1306	[0.09]	8.02	1533	0.08
Bicycloelemene	9.42	1334	0.05	6.82*	1441	0.05
Piperitenone	9.47	1338	0.01	11.84*	1850	0.02
Eugenol	9.74	1357	0.02	14.49	2098	0.02
$\alpha$ -Ylangene	9.90	1368	0.01	6.82*	1441	[0.05]
$\alpha$ -Copaene	9.96	1372	0.02	6.90	1448	0.02
$\beta$ -Bourbonene	10.08	1380	0.09	7.23	1472	0.09
1,5-diepi- $\beta$ -Bourbonene	10.10	1382	0.01	7.12*	1464	[0.02]
$\beta$ -Cubebene	10.18	1387	0.01	7.52	1494	0.01

β-Elemene	10.21	1390	0.04	8.17*	1544	3.32
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.26	1393	0.02			
Isocaryophyllene	10.38	1402	0.02	7.89*	1522	[5.58]
β-Caryophyllene	10.55*	1414	3.31	8.17*	1544	[3.32]
β-Ylangene	10.55*	1414	[3.31]	7.89*	1522	[5.58]
β-Copaene	10.66	1423	0.02	8.11	1540	0.03
Aromadendrene	10.78	1432	0.02	8.31*	1556	[0.19]
<i>trans</i> -α-Bergamotene	10.80	1433	0.01	8.17*	1544	[3.32]
Isogermacrene D	10.85	1437	0.01	8.70*	1586	[0.23]
α-Humulene	11.00	1448	0.06	8.96	1607	0.06
( <i>E</i> )-β-Farnesene	11.14	1458	0.09	9.30	1634	0.11
9-epi-β-Caryophyllene	11.18	1461	0.01	9.11	1618	0.02
γ-Murolene	11.34	1473	0.02	9.28	1633	0.01
Germacrene D	11.38	1476	0.37	9.52*	1652	[0.55]
Menthylactone	11.52	1487	0.03	15.49	2199	0.02
Bicyclogermacrene	11.58*	1491	0.09	9.78*	1674	0.08
Viridiflorene	11.58*	1491	[0.09]	9.36	1639	0.09
α-Murolene	11.66	1497	0.02	9.78*	1674	[0.08]
γ-Cadinene	11.83	1510	0.02	10.11*	1701	[0.04]
δ-Cadinene	11.96	1520	0.04	10.15	1704	0.04
Isocaryophyllene epoxide B	12.28	1545	0.01	11.84*	1850	[0.02]
Spathulenol	12.63	1573	0.03	14.10	2061	0.02
Caryophyllene oxide	12.66*	1575	0.06	12.46	1906	0.06
Caryophyllene oxide isomer	12.66*	1575	[0.06]	12.39	1900	0.02
Viridiflorol	12.80	1586	0.07	13.69	2021	0.07
<b>Total identified</b>		<b>99.47%</b>			<b>98.90%</b>	
<b>Total reported</b>		<b>99.49%</b>			<b>98.90%</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