

**Date :** April 08, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 21C23-PTH05

**Customer identification :** Bergamot Mint - USA - BT0103206R

**Type :** Essential oil

**Source :** *Mentha citrata*

**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, M. Sc.

**Analysis date :** April 07, 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:**  $1.4600 \pm 0.0003$  (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
Isobutyral	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.02	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
(2E)-Hexenal	tr	Aliphatic aldehyde
(3Z)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.01	Furan
Nonane	tr	Alkane
$\alpha$ -Thujene	0.02	Monoterpene
$\alpha$ -Pinene	0.10	Monoterpene
Camphene	0.01	Monoterpene
Benzaldehyde	tr	Simple phenolic
$\beta$ -Pinene	0.59	Monoterpene
Sabinene	0.10	Monoterpene
Octen-3-ol	0.09	Aliphatic alcohol
Octan-3-one	0.01	Aliphatic ketone
<i>trans</i> -Dehydroxylinalool oxide	0.04	Monoterpenic ether
Myrcene	0.83	Monoterpene
Octan-3-ol	0.08	Aliphatic alcohol
$\alpha$ -Phellandrene	0.02	Monoterpene
<i>cis</i> -Dehydroxylinalool oxide	0.01	Monoterpenic ether
$\alpha$ -Terpinene	0.02	Monoterpene
para-Cymene	0.17	Monoterpene
Limonene	0.57	Monoterpene
1,8-Cineole	0.35	Monoterpenic ether
(Z)- $\beta$ -Ocimene	1.11	Monoterpene
(E)- $\beta$ -Ocimene	0.76	Monoterpene
$\gamma$ -Terpinene	0.17	Monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.05	Monoterpenic alcohol
$\alpha$ -Pinene oxide analog	0.01	Monoterpenic ether
Terpinolene	0.15	Monoterpene
<i>trans</i> -Linalool oxide (fur.)	0.06	Monoterpenic alcohol
Linalool	40.34	Monoterpenic alcohol
Octen-3-yl acetate	0.28	Aliphatic ester
Octan-3-yl acetate	0.27	Aliphatic ester
<i>trans</i> -Pinocarveol	0.01	Monoterpenic alcohol
(Z)-Myroxide	0.01	Monoterpenic ether
Isopulegol	0.01	Monoterpenic alcohol
Menthone	0.11	Monoterpenic ketone
Pinocamphone	0.02	Monoterpenic ketone
Isomenthone	0.03	Monoterpenic ketone
neo-Menthol	0.03	Monoterpenic alcohol
Isopinocamphone	0.79	Monoterpenic ketone
Menthol	0.48	Monoterpenic alcohol

Terpinen-4-ol	0.06	Monoterpenic alcohol
para-Cymen-8-ol	0.01	Monoterpenic alcohol
$\alpha$ -Terpineol	1.91	Monoterpenic alcohol
Myrtenal	0.04	Monoterpenic aldehyde
Hodiendiol	0.07	Monoterpenic alcohol
Methylchavicol	0.01	Phenylpropanoid
Nerol	0.38	Monoterpenic alcohol
Thymol methyl ether	0.02	Monoterpenic ether
Carvone	0.24	Monoterpenic ketone
Carvacrol methyl ether	0.01	Monoterpenic ether
Geraniol	0.99	Monoterpenic alcohol
Linalyl acetate	38.88	Monoterpenic ester
<i>cis</i> -Linalool oxide acetate (pyr.)	0.02	Monoterpenic ester
Menthyl acetate	0.04	Monoterpenic ester
Dihydroedulan II	0.01	Terpenic ether
Carvacrol	0.03	Monoterpenic alcohol
Myrtenyl acetate	0.04	Monoterpenic ester
Hodiendiol derivative	0.02	Oxygenated monoterpene
$\alpha$ -Cubebene	0.03	Sesquiterpene
Unknown	0.07	Oxygenated monoterpene
Citronellyl acetate	0.04	Monoterpenic ester
Neryl acetate	0.62	Monoterpenic ester
$\alpha$ -Copaene	0.02	Sesquiterpene
$\beta$ -Bourbonene	0.06	Sesquiterpene
Geranyl acetate	1.20	Monoterpenic ester
$\beta$ -Elemene	0.10	Sesquiterpene
Unknown	0.10	Unknown
( <i>Z</i> )-Jasmone	0.05	Jasmonate
Unknown	0.01	Sesquiterpene
$\beta$ -Caryophyllene	3.28	Sesquiterpene
$\alpha$ -Humulene	0.13	Sesquiterpene
allo-Aromadendrene	0.05	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.26	Sesquiterpene
Germacrene D	0.76	Sesquiterpene
$\delta$ -Amorphene	0.06	Sesquiterpene
$\beta$ -Dihydroagarofuran	0.05	Sesquiterpenic ether
$\gamma$ -Cadinene	0.05	Sesquiterpene
$\delta$ -Cadinene	0.05	Sesquiterpene
$\alpha$ -Elemol	0.30	Sesquiterpenic alcohol
( <i>E</i> )-Nerolidol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.04	Sesquiterpenic ether
Caryophyllene oxide	0.07	Sesquiterpenic ether
Viridiflorol	0.39	Sesquiterpenic alcohol
Ledol?	0.01	Oxygenated sesquiterpene
10-epi- $\gamma$ -Eudesmol	0.02	Sesquiterpenic alcohol
$\gamma$ -Eudesmol	0.07	Sesquiterpenic alcohol
$\beta$ -Eudesmol	0.09	Sesquiterpenic alcohol
$\alpha$ -Eudesmol	0.09	Sesquiterpenic alcohol
Precocene II	0.08	Chromane
<b>Consolidated total</b>	<b>98.71%</b>	

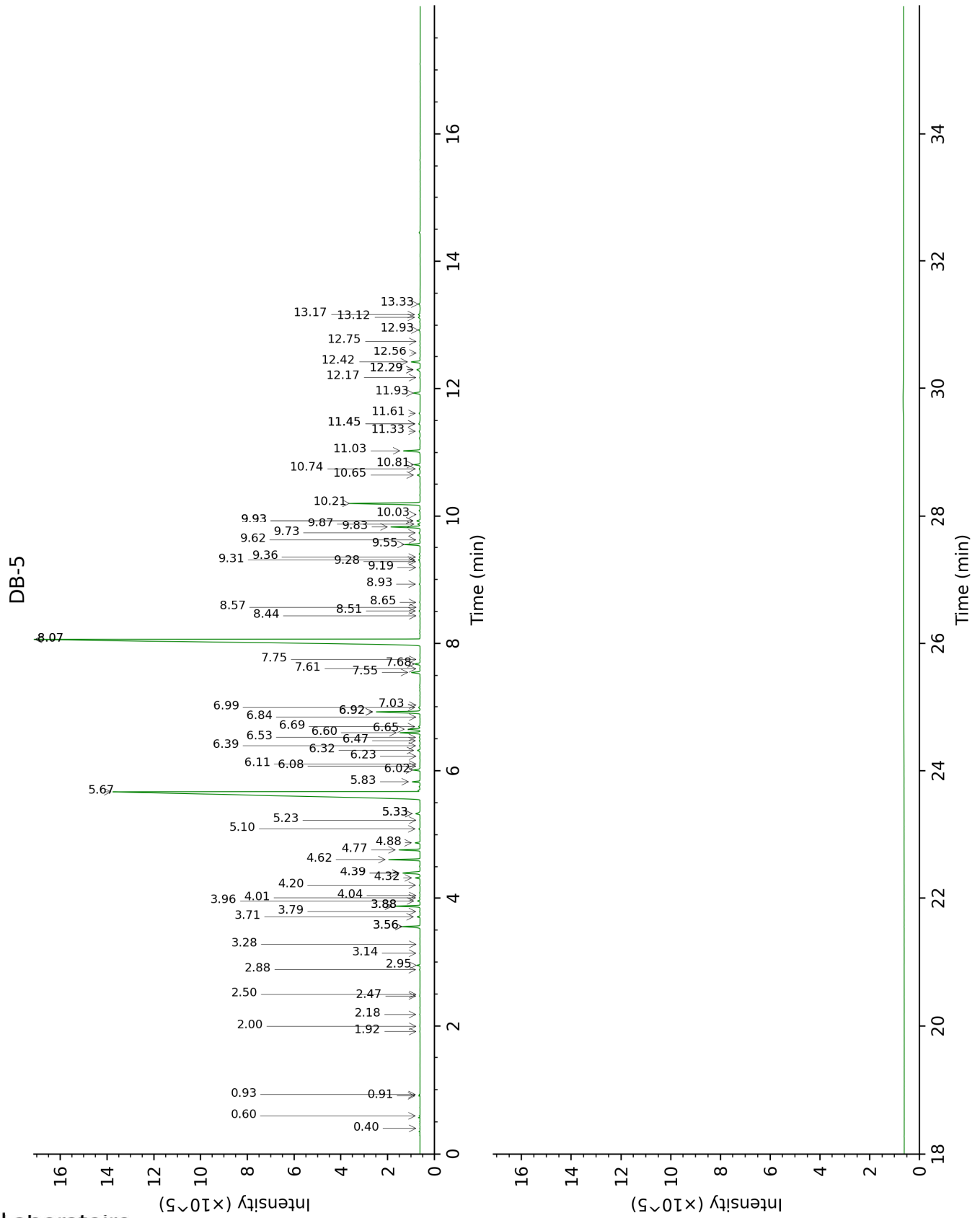
tr: The compound has been detected below 0.005% of total signal.

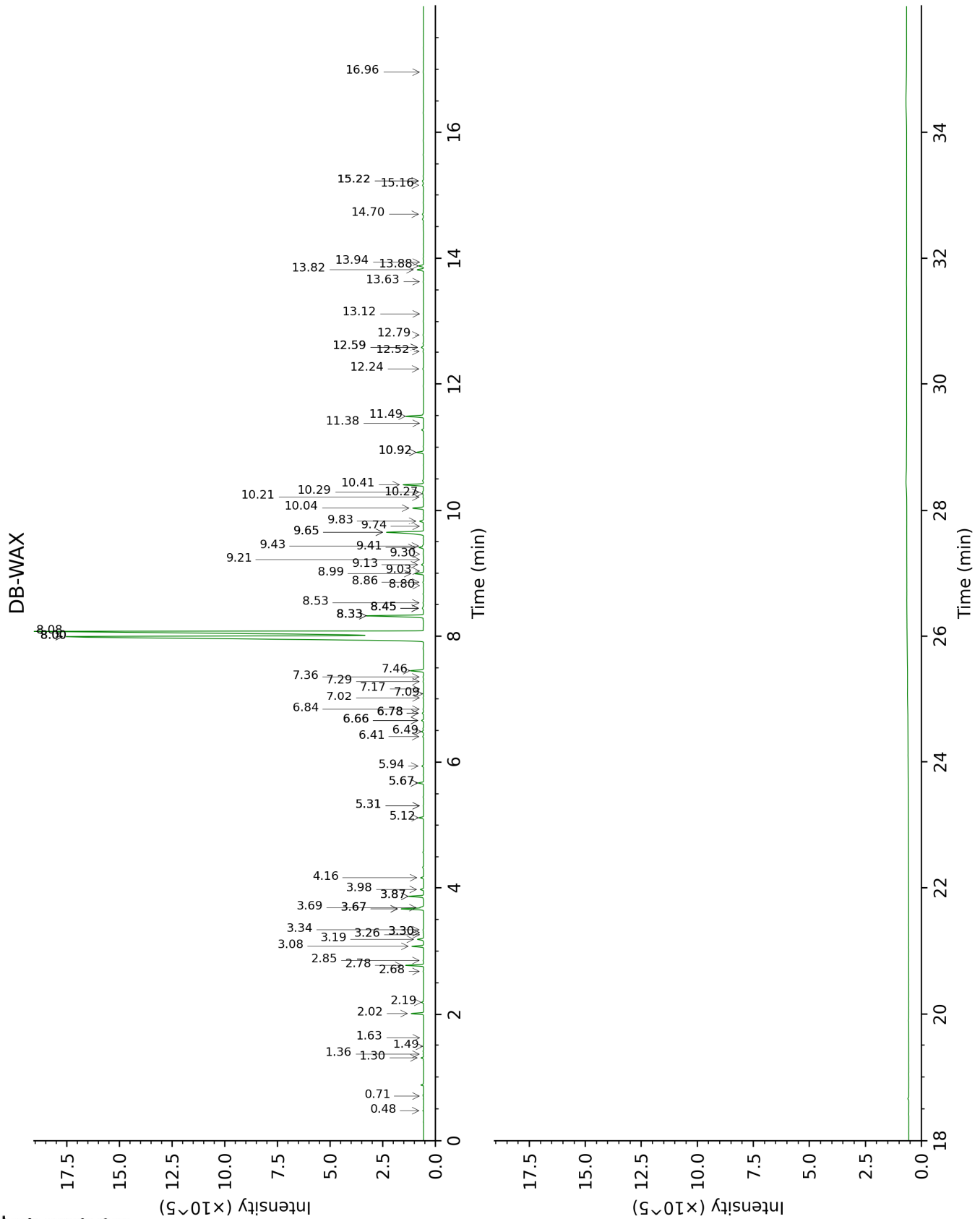
Note: no correction factor was applied

**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	%
Isobutyral	0.40	536	tr	0.48	784	0.02
2-Methylbutyral	0.60	651	0.01	0.71	879	0.01
Isoamyl alcohol	0.91	730	0.02	3.30*	1175	0.02
2-Methylbutanol	0.93	733	0.01	3.26	1172	0.01
(2E)-Hexenal	1.92	849	tr	3.30*	1175	[0.02]
(3Z)-Hexenol	2.00	856	0.01	5.67*	1349	0.28
Hexanol	2.18	872	0.01	5.31*	1323	0.02
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.47	897	0.01	1.49	1014	0.02
Nonane	2.50	899	tr			
$\alpha$ -Thujene	2.88	926	0.02	1.36	1001	0.01
$\alpha$ -Pinene	2.95	931	0.10	1.30	992	0.10
Camphene	3.14	944	0.01	1.63	1028	tr
Benzaldehyde	3.28	953	tr	7.17	1460	0.01
$\beta$ -Pinene	3.56*	972	0.68	2.02	1067	0.59
Sabinene	3.56*	972	[0.68]	2.19	1085	0.10
Octen-3-ol	3.71	982	0.09	6.66*	1421	0.10
Octan-3-one	3.79	988	0.01	3.87*	1219	0.77
<i>trans</i> -Dehydroxylinalool oxide	3.88*	994	0.84	3.34	1178	0.04
Myrcene	3.88*	994	[0.84]	2.78	1134	0.83
Octan-3-ol	3.96	999	0.08	5.94	1369	0.09
$\alpha$ -Phellandrene	4.01	1002	0.02	2.68	1127	0.03
<i>cis</i> -Dehydroxylinalool oxide	4.04	1005	0.01	3.67*	1204	1.13
$\alpha$ -Terpinene	4.20	1015	0.02	2.86	1140	0.03
para-Cymene	4.32	1022	0.17	3.98	1226	0.16
Limonene	4.39*	1027	0.91	3.08	1158	0.57
1,8-Cineole	4.39*	1027	[0.91]	3.19	1166	0.35
(Z)- $\beta$ -Ocimene	4.62	1041	1.11	3.67*	1204	[1.13]
(E)- $\beta$ -Ocimene	4.77	1051	0.76	3.87*	1219	[0.77]
$\gamma$ -Terpinene	4.88	1058	0.17	3.69	1206	0.14
<i>cis</i> -Linalool oxide (fur.)	5.10	1072	0.05	6.40	1402	0.05
$\alpha$ -Pinene oxide analog	5.23	1080	0.01	5.31*	1323	[0.02]
Terpinolene	5.33*	1087	0.22	4.16	1240	0.15
<i>trans</i> -Linalool oxide (fur.)	5.33*	1087	[0.22]	6.78*	1430	0.07
Linalool	5.68	1108	40.34	8.00*†	1522	79.27
Octen-3-yl acetate	5.83	1118	0.28	5.67*	1349	[0.28]
Octan-3-yl acetate	6.02	1130	0.27	5.12	1309	0.24
<i>trans</i> -Pinocarveol	6.08	1134	0.01	9.03	1604	0.01
(Z)-Myroxide	6.11	1136	0.01	6.78*	1430	[0.07]
Isopulegol	6.23	1144	0.01	8.00*†	1522	[79.27]
Menthone	6.32	1150	0.11	6.48	1408	0.10
Pinocamphone	6.39	1154	0.02	7.09	1454	0.02
Isomenthone	6.47	1160	0.03	6.84	1435	0.04
neo-Menthol	6.53	1163	0.03	8.45*	1558	0.11

Isopinocampnone	6.60	1168	0.79	7.46	1481	0.78
Menthol	6.65	1171	0.48	8.99	1600	0.47
Terpinen-4-ol	6.69	1174	0.06	8.45*	1558	[0.11]
para-Cymen-8-ol	6.84	1183	0.01	11.38	1800	0.01
$\alpha$ -Terpineol	6.92*	1189	1.99	9.65*	1654	2.67
Myrtenal	6.92*	1189	[1.99]	8.53	1564	0.04
Hodiendiol	6.99	1193	0.07	12.59*	1908	0.14
Methylchavicol	7.03	1195	0.01	9.22	1618	0.01
Nerol	7.55	1230	0.38	10.92*	1760	0.41
Thymol methyl ether	7.61	1234	0.02	8.33*	1548	3.35
Carvone	7.68	1239	0.24	9.83	1669	0.23
Carvacrol methyl ether	7.76	1244	0.01	8.45*	1558	[0.11]
Geraniol	8.07*	1265	40.25	11.49	1810	0.99
Linalyl acetate	8.07*	1265	[40.25]	8.08†	1529	[79.27]
cis-Linalool oxide acetate (pyr.)	8.44	1290	0.02	8.86	1590	0.04
Menthyl acetate	8.51	1295	0.04	8.00*†	1522	[79.27]
Dihydroedulan II	8.57	1298	0.01	7.29	1468	0.03
Carvacrol	8.65	1304	0.03	15.22*	2161	0.09
Myrtenyl acetate	8.93	1324	0.04	9.43	1636	0.04
Hodiendiol derivative	9.19	1342	0.02	12.79	1926	0.04
$\alpha$ -Cubebene	9.28	1349	0.03	6.66*	1421	[0.10]
Unknown [m/z 43, 79 (47), 71 (31), 94 (27), 81 (23), 41 (22)... 197 (0)]	9.31	1350	0.07	10.92*	1760	[0.41]
Citronellyl acetate	9.36	1354	0.04	9.30	1626	0.02
Neryl acetate	9.55	1368	0.62	10.04	1686	0.62
$\alpha$ -Copaene	9.62	1373	0.02	7.02	1448	0.03
$\beta$ -Bourbonene	9.73	1380	0.06	7.36	1474	0.04
Geranyl acetate	9.83	1387	1.20	10.41	1717	1.16
$\beta$ -Elemene	9.87	1390	0.10	8.33*	1548	[3.35]
Unknown [m/z 119, 43 (57), 91 (50), 134 (36), 93 (29), 79 (28)...]	9.93*	1395	0.16			
(Z)-Jasmone	9.93*	1395	[0.16]	12.24	1876	0.05
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.03	1402	0.01			
$\beta$ -Caryophyllene	10.20	1414	3.28	8.33*	1548	[3.35]
$\alpha$ -Humulene	10.65	1448	0.13	9.14	1612	0.13
allo-Aromadendrene	10.74	1455	0.05	8.80	1586	0.01
(E)- $\beta$ -Farnesene	10.81	1460	0.26	9.41	1634	0.28
Germacrene D	11.03	1476	0.76	9.65*	1654	[2.67]
$\delta$ -Amorphene	11.33	1499	0.06	9.74	1662	0.03
$\beta$ -Dihydroagarofuran	11.45*	1508	0.07	10.27	1704	0.05
$\gamma$ -Cadinene	11.45*	1508	[0.07]	10.21	1700	0.05
$\delta$ -Cadinene	11.61	1520	0.05	10.29	1707	0.06
$\alpha$ -Elemol	11.93	1545	0.30	13.88	2029	0.29
(E)-Nerolidol	12.17	1564	0.02	13.63	2005	0.02
Caryophyllene oxide isomer	12.30*	1574	0.18	12.52	1901	0.04

Caryophyllene oxide	12.30*	1574	[0.18]	12.59*	1908	[0.14]
Viridiflorol	12.42	1584	0.39	13.82	2023	0.39
Ledol?	12.56	1595	0.01	13.12	1957	0.01
10-epi- $\gamma$ -Eudesmol	12.75	1610	0.02	13.94	2035	0.01
$\gamma$ -Eudesmol	12.93	1625	0.07	14.70	2108	0.08
$\beta$ -Eudesmol	13.12	1641	0.09	15.22*	2161	[0.09]
$\alpha$ -Eudesmol	13.17	1645	0.09	15.16	2154	0.06
Precocene II	13.33	1658	0.08	16.96	2342	0.02
<b>Total identified</b>		<b>99.04%</b>			<b>98.27%</b>	
<b>Total reported</b>		<b>99.12%</b>			<b>98.27%</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