



## GC/MS BATCH NUMBER: B30104

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**ESSENTIAL OIL:** BERGAMOT  
**BOTANICAL NAME:** CITRUS BERGAMIA  
**ORIGIN:** FRANCE

KEY CONSTITUENTS PRESENT IN THIS BATCH BERGAMOT OF OIL	%
LIMONENE	37.3
LINALYL ACETATE	30.6
LINALOOL	11.7
γ-TERPINENE	6.6
β-PINENE	6.1

Comments from Robert Tisserand: Delicate, citrus-tea odor quality. Constituents are in expected amounts for bergapten-free Bergamot oil.

**Date :** May 25, 2018

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 18E18-PTH4-1-CC

**Customer identification :** Bergamot BF - France - B3010483R

**Type :** Essential oil

**Source :** *Citrus bergamia*

**Customer :** Plant Therapy

**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 :** Sylvain Mercier, M. Sc., Chimiste

**Analysis date :** May 25, 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:** Faintly yellow liquid

**Refractive index:**  $1.4633 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Tricyclene	tr	tr	Monoterpene
$\alpha$ -Thujene	0.15	0.15	Monoterpene
$\alpha$ -Pinene	0.91	0.91	Monoterpene
Camphene	0.02*	0.02	Monoterpene
$\alpha$ -Fenchene	[0.02]*	tr	Monoterpene
Sabinene	6.97*	0.91	Monoterpene
$\beta$ -Pinene	[6.97]*	6.08	Monoterpene
Myrcene	0.93	0.94	Monoterpene
$\alpha$ -Phellandrene	0.03*	0.02	Monoterpene
Pseudolimonene	[0.03]*	0.02	Monoterpene
Octanal	0.07	0.07	Aliphatic aldehyde
$\Delta^3$ -Carene	0.01	0.01	Monoterpene
$\alpha$ -Terpinene	0.13	0.14	Monoterpene
para-Cymene	37.27*	0.33	Monoterpene
Limonene	[37.27]*	37.02	Monoterpene
1,8-Cineole	[37.27]*	0.17	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.05	6.68*	Monoterpene
(E)- $\beta$ -Ocimene	0.12	0.12	Monoterpene
$\gamma$ -Terpinene	6.61	[6.68]*	Monoterpene
cis-Sabinene hydrate	0.02	0.03	Monoterpenic alcohol
cis-Linalool oxide (fur.)	tr	tr	Monoterpenic alcohol
trans-Linalool oxide (fur.)	0.34*	tr	Monoterpenic alcohol
Terpinolene	[0.34]*	0.34	Monoterpene
trans-Sabinene hydrate	0.01	0.01	Monoterpenic alcohol
Linalool	11.78*	11.74	Monoterpenic alcohol
Nonanal	[11.78]*	0.03	Aliphatic aldehyde
cis-Limonene oxide	0.01	0.01	Monoterpenic ether
trans-Limonene oxide	tr	0.01	Monoterpenic ether
Camphor	0.01	0.01	Monoterpenic ketone
Citronellal	0.05	0.05	Monoterpenic aldehyde
Terpinen-4-ol	0.03	0.03	Monoterpenic alcohol
$\alpha$ -Terpineol	0.08	0.08*	Monoterpenic alcohol
$\gamma$ -Terpineol	0.01	0.01	Monoterpenic alcohol
Unknown	tr		Unknown
Decanal	0.08	0.08	Aliphatic aldehyde
Octyl acetate	0.11	0.11	Aliphatic ester
Nerol	0.10	0.09	Monoterpenic alcohol
Citronellol	tr	0.01	Monoterpenic alcohol
Neral	0.26	0.24	Monoterpenic aldehyde
Geraniol	30.81*	0.08	Monoterpenic alcohol
Linalyl acetate	[30.81]*	30.64*	Monoterpenic ester
Unknown	tr		Unknown
Geranial	0.42	0.36	Monoterpenic aldehyde
Bornyl acetate	0.02	[30.64]*	Monoterpenic ester
Unknown	0.01		Unknown
cis-para-Mentha-2,8-diene-1-hydroperoxide	0.01		Monoterpenic peroxide
trans-para-Mentha-2,8-diene-1-	0.01		Monoterpenic peroxide

hydroperoxide			
para-Mentha-1,8-diene-4-hydroperoxide	tr		Monoterpenic peroxide
Linalyl propionate	0.04	0.04	Monoterpenic ester
$\alpha$ -Terpinyl acetate	0.20	0.20	Monoterpenic ester
Unknown	0.03		Monoterpenic ester
Neryl acetate	0.31	0.32	Monoterpenic ester
Geranyl acetate	0.28	0.29	Monoterpenic ester
Dodecanal	0.01	0.02	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.38	0.46*	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.09	[0.46]*	Sesquiterpene
$\alpha$ -Humulene	0.01	0.01	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.02	0.01	Sesquiterpene
Germacrene D	0.01	[0.08]*	Sesquiterpene
( <i>Z</i> )- $\alpha$ -Bisabolene	0.01	0.01	Sesquiterpene
Hodiendiol derivative II	0.01		Oxygenated monoterpene
$\beta$ -Bisabolene	0.13	0.13	Sesquiterpene
( <i>E</i> )-Nerolidol	tr		Sesquiterpenic alcohol
Caryophyllene oxide	tr	tr	Sesquiterpenic ether
$\alpha$ -Bisabolol	0.01	0.01	Sesquiterpenic alcohol
Citropten	0.03	0.05	Furanocoumarin
Unknown	tr		Unknown
<b>Total identified</b>	<b>98.97%</b>	<b>99.12%</b>	

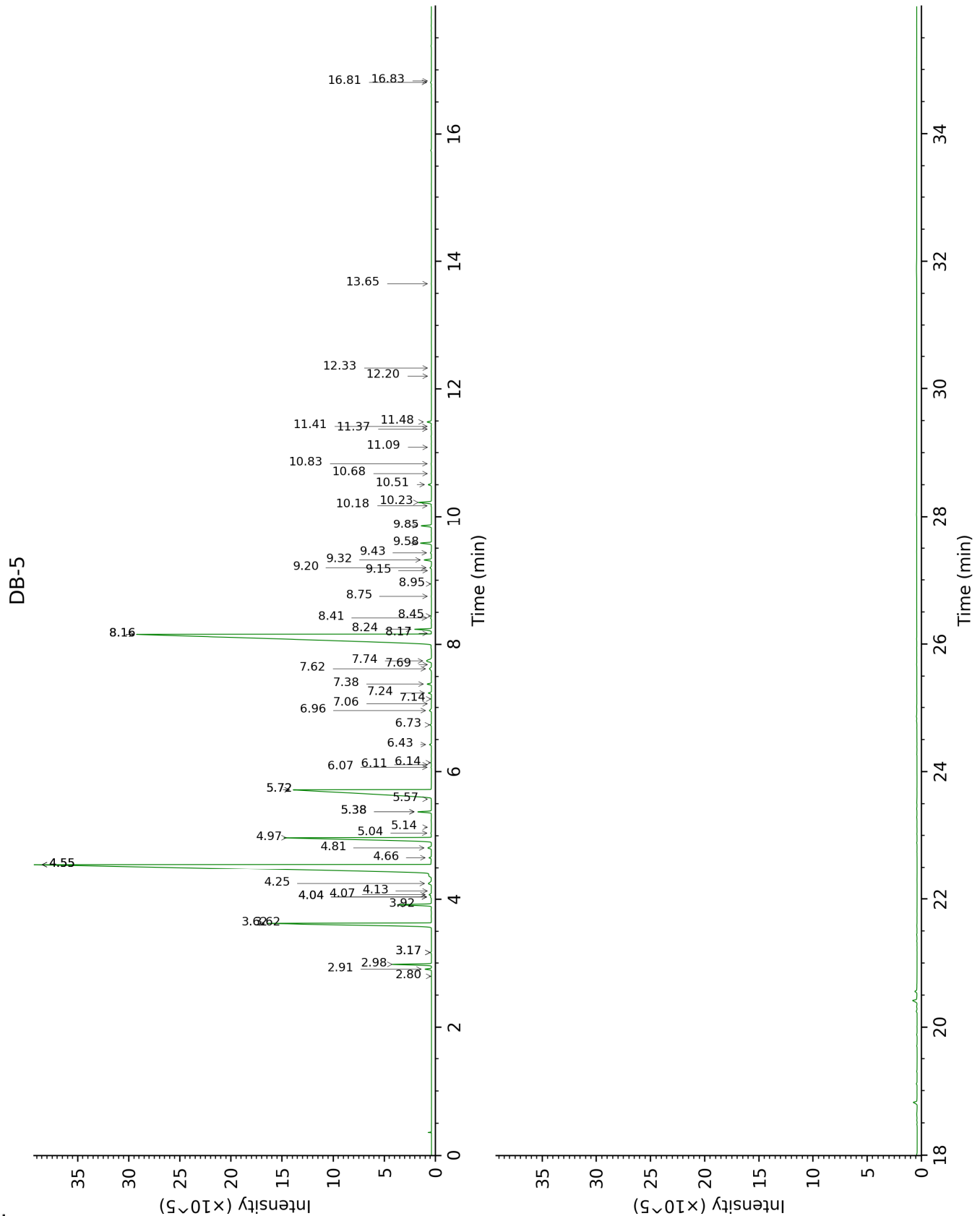
\*: Two or more compounds are coeluting on this column

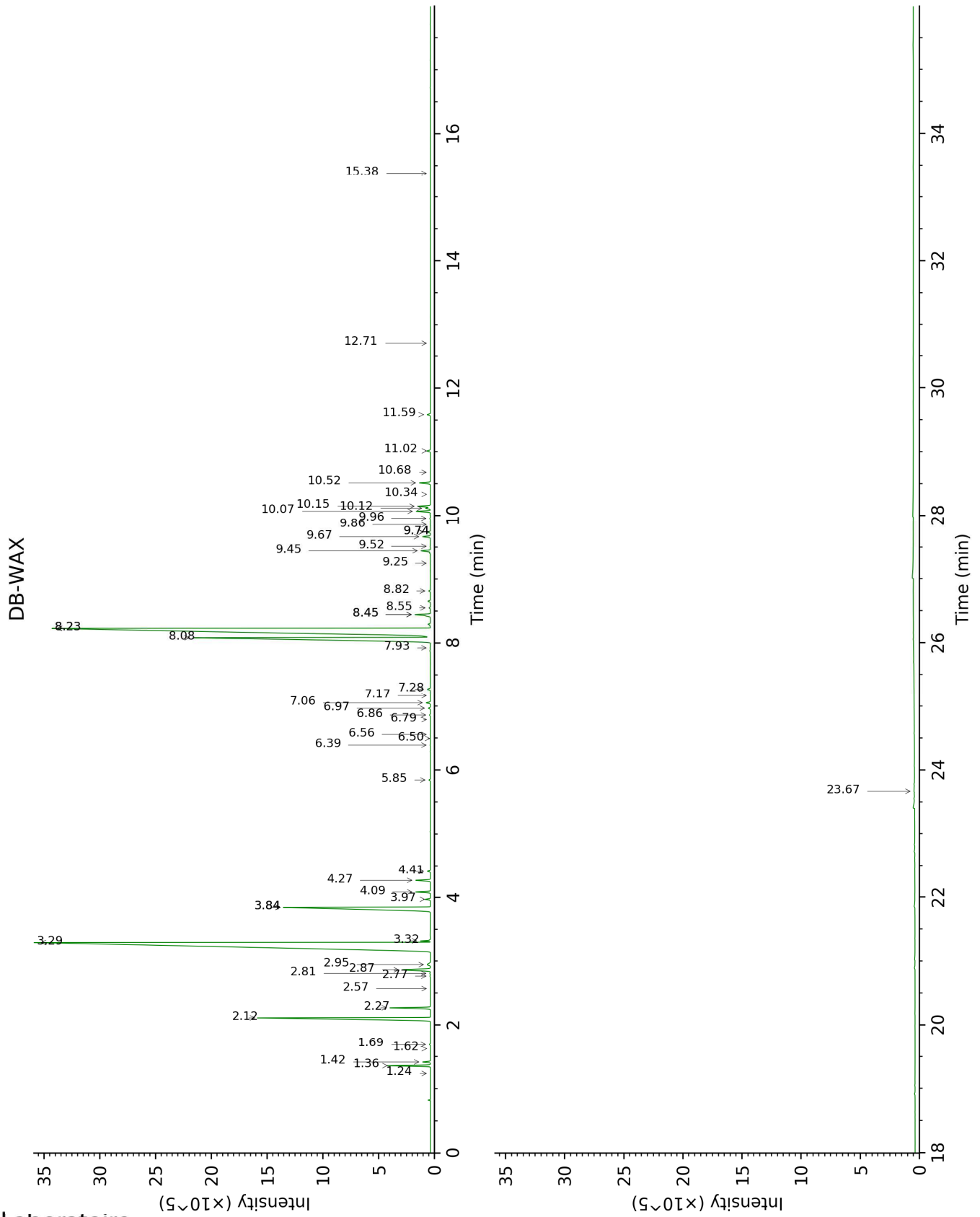
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Tricyclene	2.80	917	tr	1.24	976	tr
$\alpha$ -Thujene	2.91	924	0.15	1.42	1004	0.15
$\alpha$ -Pinene	2.98	930	0.91	1.36	995	0.91
Camphene	3.17*	942	0.02	1.69	1031	0.02
$\alpha$ -Fenchene	3.17*	942	[0.02]	1.62	1025	tr
Sabinene	3.62*	973	6.97	2.27	1089	0.91
$\beta$ -Pinene	3.62*	973	[6.97]	2.12	1073	6.08
Myrcene	3.92	992	0.93	2.87	1138	0.94
$\alpha$ -Phellandrene	4.04*	1000	0.03	2.77	1130	0.02
Pseudolimonene	4.04*	1000	[0.03]	2.81	1134	0.02
Octanal	4.07	1003	0.07	4.41	1254	0.07
$\Delta$ 3-Carene	4.13	1007	0.01	2.57	1115	0.01
$\alpha$ -Terpinene	4.25	1014	0.13	2.95	1144	0.14
para-Cymene	4.55*	1033	37.27	4.09	1231	0.33
Limonene	4.55*	1033	[37.27]	3.29	1171	37.02
1,8-Cineole	4.55*	1033	[37.27]	3.32	1173	0.17
(Z)- $\beta$ -Ocimene	4.66	1040	0.05	3.84*	1213	6.68
(E)- $\beta$ -Ocimene	4.81	1050	0.12	3.97	1222	0.12
$\gamma$ -Terpinene	4.97	1060	6.61	3.84*	1213	[6.68]
<i>cis</i> -Sabinene hydrate	5.04	1064	0.02	6.86	1432	0.03
<i>cis</i> -Linalool oxide (fur.)	5.14	1070	tr	6.50	1404	tr
<i>trans</i> -Linalool oxide (fur.)	5.38*	1086	0.34	6.79	1426	tr
Terpinolene	5.38*	1086	[0.34]	4.27	1244	0.34
<i>trans</i> -Sabinene hydrate	5.57	1098	0.01	7.93	1511	0.01
Linalool	5.72*	1107	11.78	8.08	1523	11.74
Nonanal	5.72*	1107	[11.78]	5.85	1357	0.03
<i>cis</i> -Limonene oxide	6.07	1130	0.01	6.39	1397	0.01
<i>trans</i> -Limonene oxide	6.11	1132	tr	6.56	1409	0.01
Camphor	6.14	1135	0.01	7.17	1454	0.01
Citronellal	6.43	1153	0.05	6.97	1440	0.05
Terpinen-4-ol	6.73	1173	0.03	8.55	1560	0.03
$\alpha$ -Terpineol	6.96	1187	0.08	9.74*	1654	0.08
$\gamma$ -Terpineol	7.06	1194	0.01	9.86	1664	0.01
Unknown [m/z 43, 71 (80), 67 (55), 59 (51), 68 (44), 41 (43)...]	7.14	1199	tr			
Decanal	7.24	1205	0.08	7.28	1462	0.08
Octyl acetate	7.38	1215	0.11	7.06	1446	0.11
Nerol	7.62	1231	0.10	11.02	1761	0.09
Citronellol	7.69	1235	tr	10.68	1733	0.01
Neral	7.74	1239	0.26	9.44	1631	0.24

Geraniol	8.16*	1267	30.81	11.58	1810	0.08
Linalyl acetate	8.16*	1267	[30.81]	8.23*	1535	30.64
Unknown [m/z 43, 111 (47), 93 (41), 55 (28), 67 (23), 41 (22)...]	8.17	1268	tr			
Geranial	8.24	1272	0.42	10.07	1682	0.36
Bornyl acetate	8.41	1284	0.02	8.23*	1535	[30.64]
Unknown [m/z 43, 121 (74), 93 (42), 95 (38), 107 (29), 41 (29), 136 (28)...]	8.45	1286	0.01			
<i>cis</i> -para-Mentha-2,8-diene-1-hydroperoxide	8.75	1307	0.01			
<i>trans</i> -para-Mentha-2,8-diene-1-hydroperoxide	8.94	1321	0.01			
para-Mentha-1,8-diene-4-hydroperoxide	9.15	1335	tr			
Linalyl propionate	9.20	1339	0.04	8.82	1580	0.04
$\alpha$ -Terpinyl acetate	9.32	1347	0.20	9.67	1649	0.20
Unknown [m/z 43, 121 (52), 93 (48), 79 (33), 41 (30), 136 (26), 81 (25)...]	9.43	1355	0.03			
Neryl acetate	9.58	1366	0.31	10.15	1688	0.32
Geranyl acetate	9.85	1385	0.28	10.52	1719	0.29
Dodecanal	10.18	1408	0.01	9.96	1673	0.02
$\beta$ -Caryophyllene	10.23	1412	0.38	8.45*	1552	0.46
<i>trans</i> - $\alpha$ -Bergamotene	10.51	1433	0.09	8.45*	1552	[0.46]
$\alpha$ -Humulene	10.68	1446	0.01	9.25	1615	0.01
( <i>E</i> )- $\beta$ -Farnesene	10.83	1457	0.02	9.52	1636	0.01
Germacrene D	11.09	1476	0.01	9.74*	1654	[0.08]
( <i>Z</i> )- $\alpha$ -Bisabolene	11.37	1498	0.01	10.34	1703	0.01
Hodiendiol derivative II	11.42	1501	0.01			
$\beta$ -Bisabolene	11.48	1506	0.13	10.12	1686	0.13
( <i>E</i> )-Nerolidol	12.20	1562	tr			
Caryophyllene oxide	12.33	1572	tr	12.71	1911	tr
$\alpha$ -Bisabolol	13.65	1681	0.01	15.38	2168	0.01
Citropten	16.81	1964	0.03	23.67	3163	0.05
Unknown [m/z 266, 43 (89), 44	16.83	1966	tr			

(67), 176 (49), 207 (44), 55 (38)...		
<b>Total identified</b>	<b>98.97%</b>	<b>99.12%</b>
<b>Total reported</b>	<b>99.02%</b>	<b>99.12%</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

R.T.: Retention time (minutes)

R.I.: Retention index