



## GC/MS BATCH NUMBER: B30105

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**ESSENTIAL OIL:** BERGAMOT  
**BOTANICAL NAME:** CITRUS AURANTIUM  
**ORIGIN:** ITALY

KEY CONSTITUENTS PRESENT IN THIS BATCH OF BERGAMOT OIL	%
LINALYL ACETATE	33.3
LIMONENE	33.3
LINALOOL	13.5
γ-TERPINENE	6.5
β-PINENE	6.5

Comments from Robert Tisserand: Very fine clean, mellow-citrus 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 :** 18E16-PTH3-1-CC

**Customer identification :** Bergamot - Italy - B3010583R

**Type :** Essential oil

**Source :** *Citrus aurantium* var. *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 24, 2018

Checked and approved by :

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

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*This report is digitally signed, it is only considered valid if the digital signature is intact.*

*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4620 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Ethanol	tr	tr	Aliphatic alcohol
Tricyclene	tr	tr	Monoterpene
$\alpha$ -Thujene	0.16	0.16	Monoterpene
$\alpha$ -Pinene	0.97	0.97	Monoterpene
Camphene	0.02*	0.02	Monoterpene
$\alpha$ -Fenchene	[0.02]*	tr	Monoterpene
Sabinene	7.30*	0.84	Monoterpene
$\beta$ -Pinene	[7.30]*	6.46	Monoterpene
Myrcene	0.78	0.78	Monoterpene
$\alpha$ -Phellandrene	0.04*	0.01	Monoterpene
Pseudolimonene	[0.04]*	0.03	Monoterpene
Octanal	0.03	0.03	Aliphatic aldehyde
$\Delta^3$ -Carene	0.01	0.01	Monoterpene
$\alpha$ -Terpinene	0.12	0.13	Monoterpene
Limonene	33.50*	33.26	Monoterpene
$\beta$ -Phellandrene	[33.50]*	0.11	Monoterpene
1,8-Cineole	[33.50]*	0.01	Monoterpenic ether
para-Cymene	[33.50]*	0.28	Monoterpene
(Z)- $\beta$ -Ocimene	0.07	6.61*	Monoterpene
(E)- $\beta$ -Ocimene	0.18	0.18	Monoterpene
$\gamma$ -Terpinene	6.51	[6.61]*	Monoterpene
cis-Sabinene hydrate	0.01	0.05*	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.03	0.03	Monoterpenic alcohol
Isoterpinolene	0.02	0.02	Monoterpene
Terpinolene	0.38*	0.35	Monoterpene
trans-Linalool oxide (fur.)	[0.38]*	[0.05]*	Monoterpenic alcohol
Linalool	13.52*	13.51	Monoterpenic alcohol
Nonanal	[13.52]*	0.04	Aliphatic aldehyde
cis-Limonene oxide	0.01	0.01	Monoterpenic ether
trans-Limonene oxide	0.01	0.01	Monoterpenic ether
Camphor	0.01	0.01	Monoterpenic ketone
Citronellal	0.02	0.02	Monoterpenic aldehyde
Terpinen-4-ol	0.01	0.01	Monoterpenic alcohol
$\alpha$ -Terpineol	0.21	0.20	Monoterpenic alcohol
Unknown	tr		Unknown
Decanal	0.04	0.04	Aliphatic aldehyde
Octyl acetate	0.17	0.17	Aliphatic ester
Nerol	0.05	0.04	Monoterpenic alcohol
Citronellol	0.01	tr	Monoterpenic alcohol
Neral	0.20	0.19	Monoterpenic aldehyde
Geraniol	33.48*	tr	Monoterpenic alcohol
Linalyl acetate	[33.48]*	33.35*	Monoterpenic ester
Geranial	0.39	0.29	Monoterpenic aldehyde
Bornyl acetate	0.02	[33.35]*	Monoterpenic ester
Unknown	0.01		Unknown
cis-para-Mentha-2,8-diene-1-hydroperoxide	tr		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	0.03	0.03	Monoterpenic ester
$\alpha$ -Terpinyl acetate	0.09	0.09	Monoterpenic ester
Unknown	0.04		Monoterpenic ester
Neryl acetate	0.28	0.28	Monoterpenic ester
Geranyl acetate	0.29	0.29	Monoterpenic ester
Dodecanal	0.01	0.02	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.16	0.16	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.05	0.05	Sesquiterpene
$\alpha$ -Humulene	tr	tr	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.01	tr	Sesquiterpene
Germacrene D	0.01	tr	Sesquiterpene
Hodiendiol derivative II	0.01		Oxygenated monoterpene
$\beta$ -Bisabolene	0.08	0.08	Sesquiterpene
Caryophyllene oxide	tr	0.01	Sesquiterpenic ether
$\alpha$ -Bisabolol	tr	tr	Sesquiterpenic alcohol
<b>Total identified</b>	<b>99.33%</b>	<b>99.27%</b>	

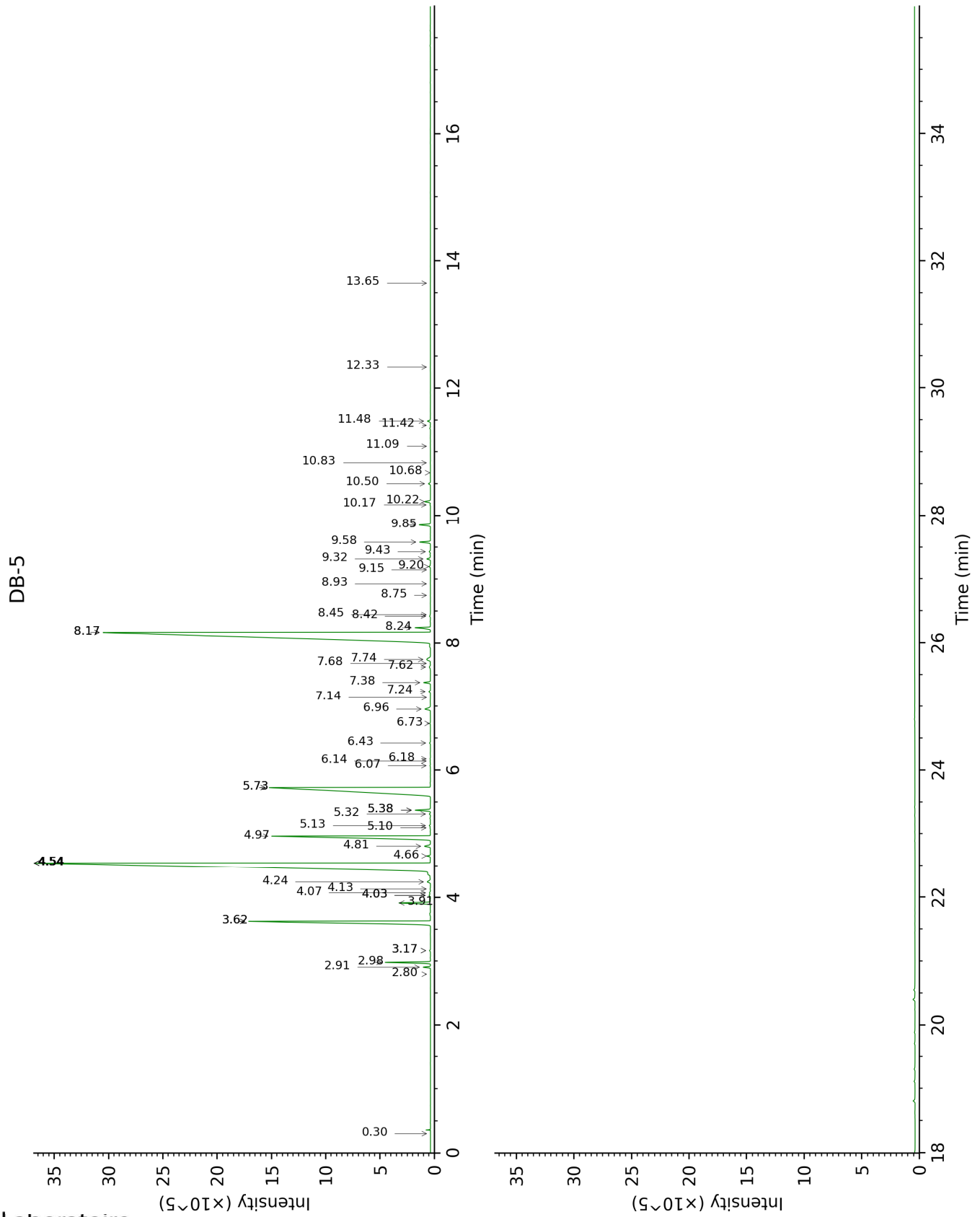
\*: Two or more compounds are coeluting on this column

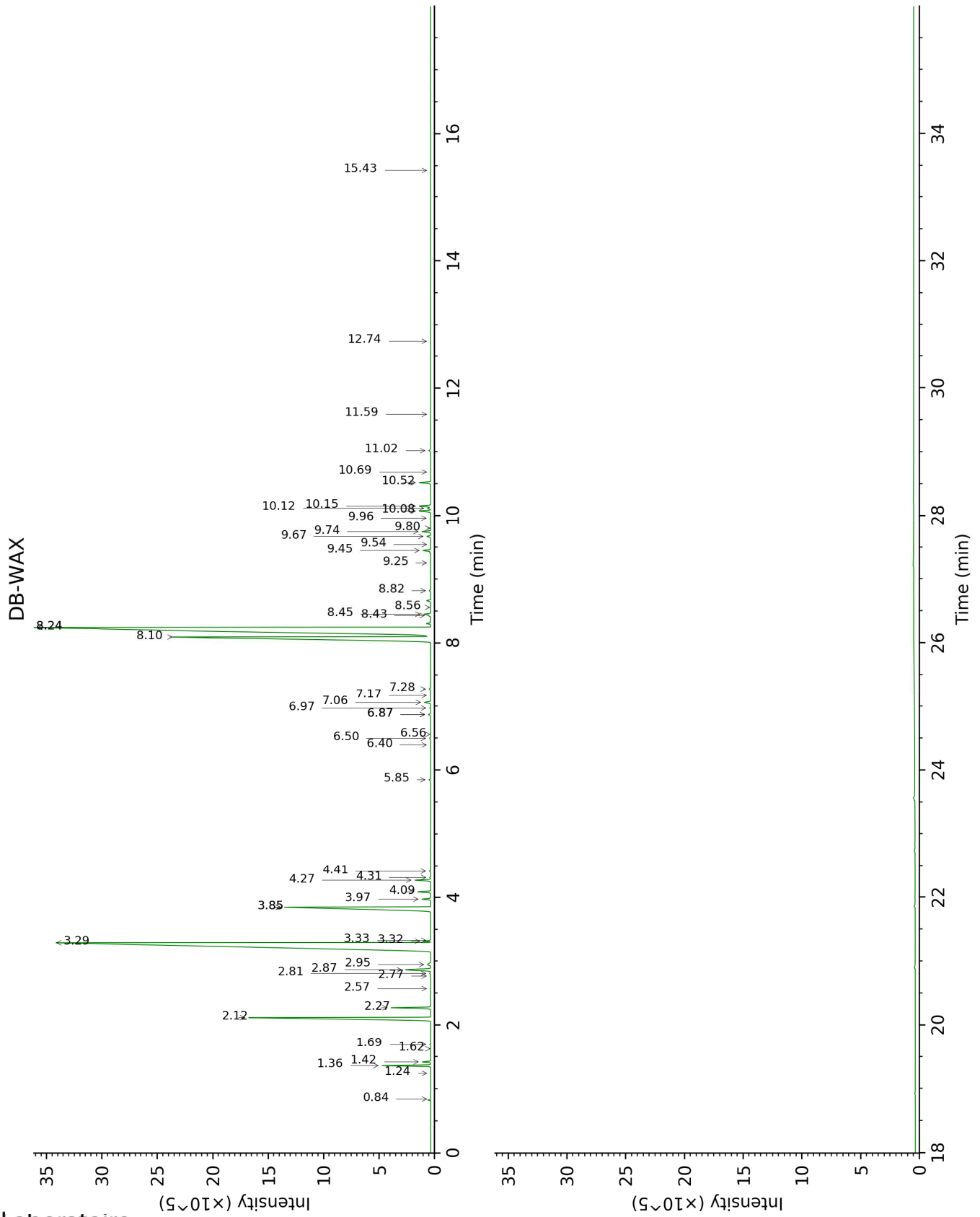
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Ethanol	0.30	495	tr	0.84	905	tr
Tricyclene	2.80	914	tr	1.24	971	tr
$\alpha$ -Thujene	2.91	922	0.16	1.42	1000	0.16
$\alpha$ -Pinene	2.98	927	0.97	1.36	991	0.97
Camphene	3.17*	939	0.02	1.69	1027	0.02
$\alpha$ -Fenchene	3.17*	939	[0.02]	1.62	1020	tr
Sabinene	3.62*	970	7.30	2.27	1085	0.84
$\beta$ -Pinene	3.62*	970	[7.30]	2.12	1070	6.46
Myrcene	3.91	989	0.78	2.87	1134	0.78
$\alpha$ -Phellandrene	4.03*	997	0.04	2.77	1126	0.01
Pseudolimonene	4.03*	997	[0.04]	2.81	1130	0.03
Octanal	4.07	1000	0.03	4.41	1249	0.03
$\Delta^3$ -Carene	4.13	1004	0.01	2.57	1111	0.01
$\alpha$ -Terpinene	4.24	1011	0.12	2.95	1140	0.13
Limonene	4.54*	1030	33.50	3.29	1166	33.26
$\beta$ -Phellandrene	4.54*	1030	[33.50]	3.32	1168	0.11
1,8-Cineole	4.54*	1030	[33.50]	3.33	1170	0.01
para-Cymene	4.54*	1030	[33.50]	4.09	1226	0.28
(Z)- $\beta$ -Ocimene	4.66	1037	0.07	3.85*	1208	6.61
(E)- $\beta$ -Ocimene	4.81	1047	0.18	3.97	1217	0.18
$\gamma$ -Terpinene	4.97	1057	6.51	3.85*	1208	[6.61]
<i>cis</i> -Sabinene hydrate	5.10	1065	0.01	6.87*	1426	0.05
<i>cis</i> -Linalool oxide (fur.)	5.13	1067	0.03	6.50	1399	0.03
Isoterpinolene	5.32	1079	0.02	4.31	1242	0.02
Terpinolene	5.38*	1083	0.38	4.27	1238	0.35
<i>trans</i> -Linalool oxide (fur.)	5.38*	1083	[0.38]	6.87*	1426	[0.05]
Linalool	5.73*	1105	13.52	8.10	1518	13.51
Nonanal	5.73*	1105	[13.52]	5.85	1352	0.04
<i>cis</i> -Limonene oxide	6.07	1127	0.01	6.40	1391	0.01
<i>trans</i> -Limonene oxide	6.14	1132	0.01	6.56	1403	0.01
Camphor	6.18	1134	0.01	7.17	1449	0.01
Citronellal	6.43	1150	0.02	6.97	1434	0.02
Terpinen-4-ol	6.73	1170	0.01	8.56	1554	0.01
$\alpha$ -Terpineol	6.96	1184	0.21	9.74	1648	0.20
Unknown [m/z 43, 71 (80), 67 (55), 59 (51), 68 (44), 41 (43)...]	7.14	1196	tr			
Decanal	7.24	1202	0.04	7.28	1457	0.04
Octyl acetate	7.38	1212	0.17	7.06	1440	0.17
Nerol	7.62	1228	0.05	11.02	1754	0.04
Citronellol	7.68	1232	0.01	10.69	1726	tr
Neral	7.74	1236	0.20	9.45	1624	0.19

Geraniol	8.17*	1265	33.48	11.59	1803	tr
Linalyl acetate	8.17*	1265	[33.48]	8.24*	1530	33.35
Geranial	8.24	1270	0.39	10.08	1675	0.29
Bornyl acetate	8.42	1282	0.02	8.24*	1530	[33.35]
Unknown [m/z 43, 121 (74), 93 (42), 95 (38), 107 (29), 41 (29), 136 (28)...]	8.44	1283	0.01			
<i>cis</i> -para-Mentha- 2,8-diene-1- hydroperoxide	8.75	1304	tr			
<i>trans</i> -para- Mentha-2,8- diene-1- hydroperoxide	8.93	1317	0.01			
para-Mentha- 1,8-diene-4- hydroperoxide	9.15	1332	tr			
Linalyl propionate	9.20	1336	0.03	8.82	1574	0.03
$\alpha$ -Terpinyl acetate	9.32	1344	0.09	9.67	1642	0.09
Unknown [m/z 43, 121 (52), 93 (48), 79 (33), 41 (30), 136 (26), 81 (25)...]	9.43	1352	0.04			
Neryl acetate	9.58	1363	0.28	10.16	1681	0.28
Geranyl acetate	9.85	1382	0.29	10.52	1712	0.29
Dodecanal	10.17	1405	0.01	9.96	1666	0.02
$\beta$ -Caryophyllene	10.22	1409	0.16	8.45	1546	0.16
<i>trans</i> - $\alpha$ - Bergamotene	10.50	1430	0.05	8.43	1544	0.05
$\alpha$ -Humulene	10.68	1443	tr	9.25	1608	tr
( <i>E</i> )- $\beta$ -Farnesene	10.83	1454	0.01	9.54	1632	tr
Germacrene D	11.09	1474	0.01	9.80	1652	tr
Hodiendiol derivative II	11.42	1498	0.01			
$\beta$ -Bisabolene	11.48	1503	0.08	10.12	1679	0.08
Caryophyllene oxide	12.33	1570	tr	12.74	1905	0.01
$\alpha$ -Bisabolol	13.65	1678	tr	15.43	2163	tr
<b>Total identified</b>		<b>99.33%</b>			<b>99.27%</b>	
<b>Total reported</b>		<b>99.38%</b>			<b>99.27%</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