

**Date :** March 06, 2018

**CERTIFICATE OF ANALYSIS - GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 18B20-PLG17-1-CC

**Customer identification :** Balsam Fir

**Type :** Essential oil

**Source :** *Abies balsamea* ct. Eastern / Low thymol

**Customer :** Plant Guru

**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 :** Sarah-Eve Tremblay, M. Sc. A., Chimiste

**Analysis date :** February 28, 2018

Checked and approved by :

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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:**  $1.4738 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Toluene	0.01	0.01*	Simple phenolic
Hexanal	tr*	tr	Aliphatic aldehyde
Octane	[tr]*		Alkane
(3Z)-Hexenol	0.01	0.02	Aliphatic alcohol
Hexanol	0.01	0.03	Aliphatic alcohol
Santene	1.48	1.50*	Monoterpene
Unknown	0.01	[0.01]*	Normonoterpene
Bornylene	0.01	[1.50]*	Monoterpene
Tricyclene	0.80	0.81	Monoterpene
$\alpha$ -Thujene	0.15	0.17	Monoterpene
$\alpha$ -Pinene	15.87	15.80	Monoterpene
$\alpha$ -Fenchene	5.58*	0.09	Monoterpene
Camphene	[5.58]*	5.47	Monoterpene
Thuja-2,4(10)-diene	0.05	0.11*	Monoterpene
meta-Cymene	0.04	1.81*	Monoterpene
Sabinene	32.17*	[0.11]*	Monoterpene
$\beta$ -Pinene	[32.17]*	31.99	Monoterpene
Myrcene	1.76	[1.81]*	Monoterpene
$\alpha$ -Phellandrene	0.15*	0.14	Monoterpene
2-Carene	[0.15]*	0.01	Monoterpene
$\Delta$ 3-Carene	14.55*	14.50	Monoterpene
(3Z)-Hexenyl acetate	[14.55]*	0.02	Aliphatic ester
$\alpha$ -Terpinene	0.13	0.12	Monoterpene
Hexyl acetate	0.06	0.04	Aliphatic ester
para-Cymene	0.25	0.30	Monoterpene
Limonene	12.03*	6.97	Monoterpene
1,8-Cineole	[12.03]*	5.10*	Monoterpenic ether
$\beta$ -Phellandrene	[12.03]*	[5.10]*	Monoterpene
(Z)- $\beta$ -Ocimene	0.01	0.01	Monoterpene
(E)- $\beta$ -Ocimene	0.01	0.01	Monoterpene
$\gamma$ -Terpinene	0.22	0.22	Monoterpene
Unknown	0.01	0.01	Oxygenated monoterpene
meta-Cymenene	0.08*	0.01	Monoterpene
Fenchone	[0.08]*	0.07	Aliphatic alcohol
Terpinolene	1.18*	0.99	Monoterpene
para-Cymenene	[1.18]*	0.08	Monoterpene
$\gamma$ -Campholenal	[1.18]*	0.01	Aliphatic alcohol
$\alpha$ -Thujone	0.08*	0.01	Monoterpenic ketone
Linalool	[0.08]*	0.11	Monoterpenic alcohol
endo-Fenchol	0.11	0.11	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.03	0.03	Monoterpenic alcohol
$\alpha$ -Campholenal	0.01	0.01	Monoterpenic aldehyde
trans-Pinocarveol	0.14	0.19*	Monoterpenic alcohol
Camphor	0.19	0.17	Monoterpenic ketone
Camphene hydrate	0.12		Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.02	0.05	Monoterpenic alcohol
Isoborneol	0.04	0.03*	Monoterpenic alcohol
Pinocarvone	0.04	0.03	Monoterpenic ketone

Myrtenyl methyl ether	0.02	0.01	Monoterpenic ether
Borneol	0.41	1.56*	Monoterpenic alcohol
Isopinocampone	0.09	0.04	Monoterpenic ketone
Terpinen-4-ol	0.31	0.27	Monoterpenic alcohol
meta-Cymen-8-ol	0.07	0.08*	Monoterpenic alcohol
Cryptone	0.03	[0.19]*	Normonoterpenic ketone
para-Cymen-8-ol	0.07	[0.08]*	Monoterpenic alcohol
$\alpha$ -Terpineol	1.20	[1.56]*	Monoterpenic alcohol
Myrtenol	0.13*	0.08	Monoterpenic alcohol
Myrtenal	[0.13]*	0.07	Monoterpenic aldehyde
Methylchavicol	0.01	0.01	Phenylpropanoid
Verbenone	0.11	0.10*	Monoterpenic ketone
endo-Fenchyl acetate	0.02	0.01	Monoterpenic ester
Thymol methyl ether	0.06*	0.08*	Monoterpenic ether
Citronellol	[0.06]*	0.09*	Monoterpenic alcohol
Carvone	0.02	0.03	Monoterpenic ketone
Piperitone	0.14	0.13*	Monoterpenic ketone
Phellandral	0.09	0.03	Monoterpenic aldehyde
Isopulegyl acetate	0.01		Monoterpenic ester
Bornyl acetate	7.11	7.01	Monoterpenic ester
2-Undecanone	0.01	0.01	Aliphatic ketone
Thymol	0.06	0.05	Monoterpenic alcohol
Isohexyl isocaproate	0.01	tr	Aliphatic ester
Myrtenyl acetate	0.01	0.02	Monoterpenic ester
$\alpha$ -Longipinene	0.05	0.05	Sesquiterpene
Citronellyl acetate	0.04	[0.03]*	Monoterpenic ester
$\alpha$ -Copaene	0.03	0.01	Sesquiterpene
$\beta$ -Bourbonene	0.02	0.01	Sesquiterpene
Geranyl acetate	0.01	0.04	Monoterpenic ester
Sativene	0.01	0.02	Sesquiterpene
Longifolene	0.22*	0.27	Sesquiterpene
$\beta$ -Longipinene	[0.22]*	0.01	Sesquiterpene
Methyleugenol	0.02		Phenylpropanoid
$\beta$ -Caryophyllene	0.25	0.24	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.05	[0.08]*	Sesquiterpene
$\alpha$ -Humulene	0.14	0.12	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.03	0.03	Sesquiterpene
$\gamma$ -Muurolene	0.04	[0.10]*	Sesquiterpene
$\beta$ -Selinene	0.01	[0.13]*	Sesquiterpene
$\alpha$ -Selinene	0.04	0.03	Sesquiterpene
$\beta$ -Himachalene	0.03	0.03	Sesquiterpene
( <i>Z</i> )- $\alpha$ -Bisabolene	0.03	0.02	Sesquiterpene
$\beta$ -Bisabolene	0.30	0.32	Sesquiterpene
$\delta$ -Cadinene	0.05	0.06	Sesquiterpene
( <i>E</i> )- $\alpha$ -Bisabolene	0.08	[0.09]*	Sesquiterpene
( <i>E</i> )-Nerolidol	0.01	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.04	0.03	Sesquiterpenic ether
Humulene epoxide II	0.02		Sesquiterpenic ether
Manoyl oxide	0.01		Diterpenic ether
18-Norabieta-8,11,13-triene?	0.01		Norditerpene
( <i>Z</i> )-Abienol	0.03	0.01	Diterpenic alcohol
<b>Total identified</b>	<b>98.93%</b>	<b>98.13%</b>	

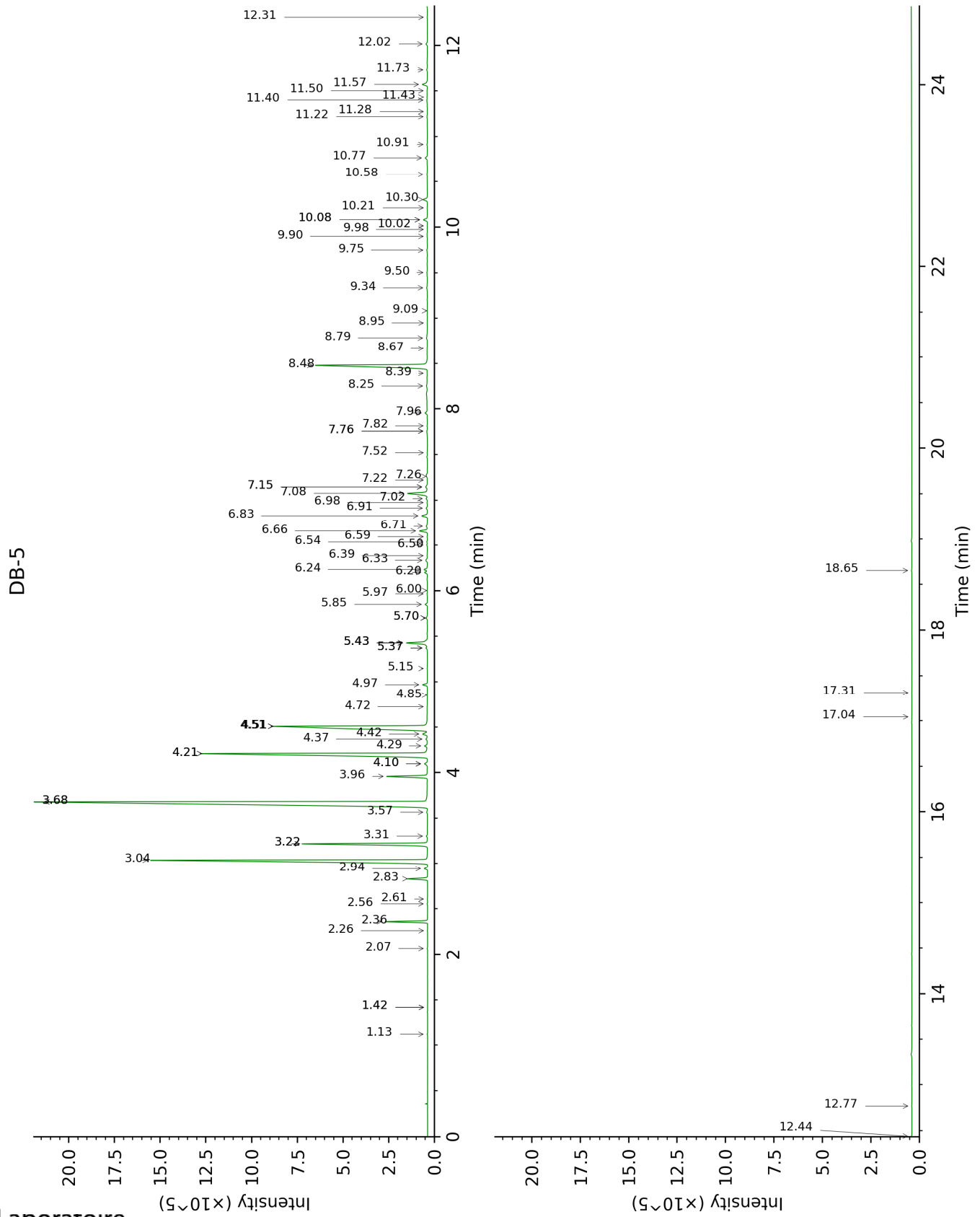
\*: Two or more compounds are coeluting on this column

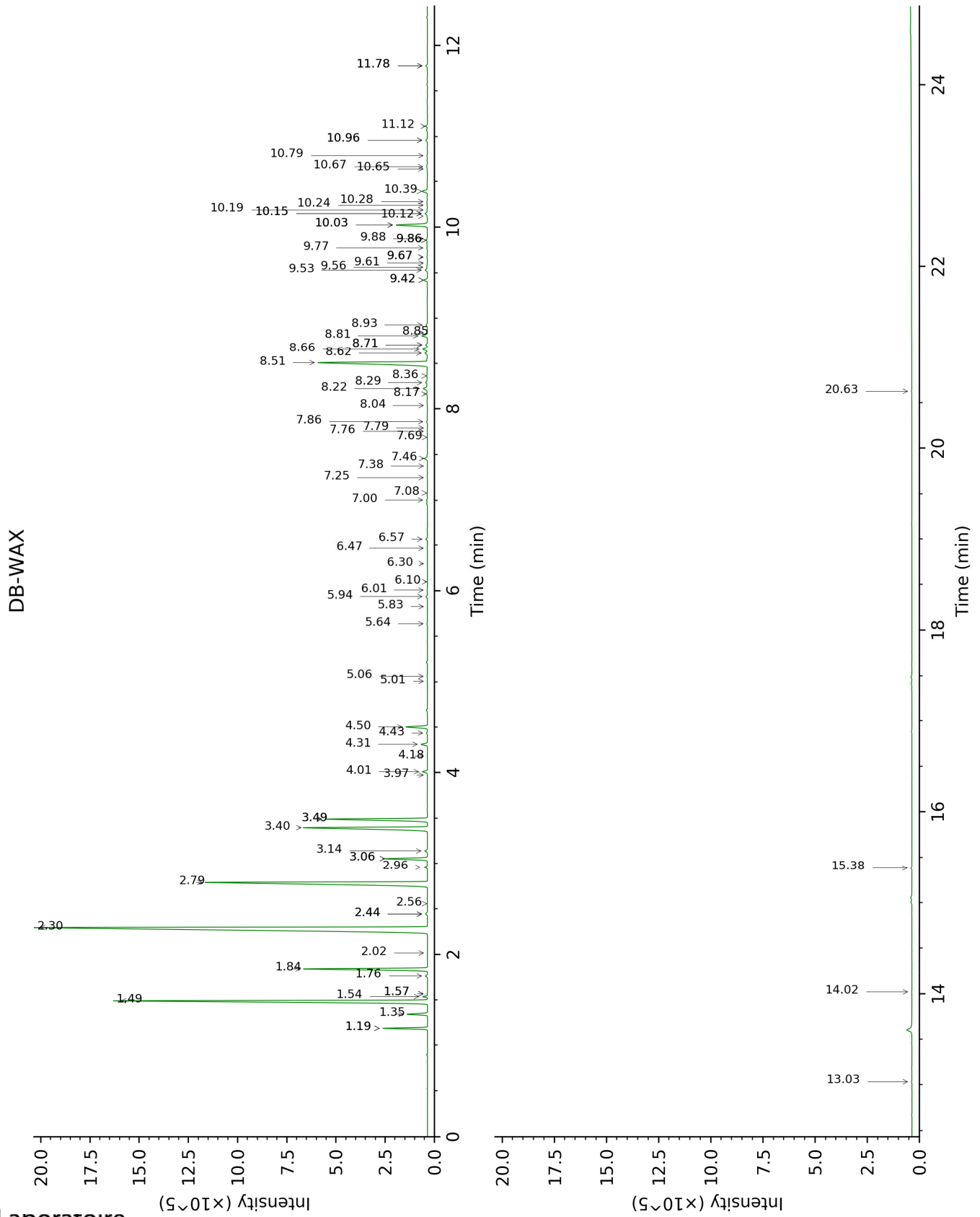
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Toluene	1.13	753	0.01	1.57*	1005	0.01
Hexanal	1.42*	796	tr	2.02	1047	tr
Octane	1.42*	796	[tr]			
(3Z)-Hexenol	2.07	852	0.01	6.01	1348	0.02
Hexanol	2.26	868	0.01	5.64	1322	0.03
Santene	2.36	877	1.48	1.19*	950	1.50
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]	2.56	893	0.01	1.57*	1005	[0.01]
Bornylene	2.61	898	0.01	1.19*	950	[1.50]
Tricyclene	2.83	913	0.80	1.35	975	0.81
$\alpha$ -Thujene	2.94	921	0.15	1.54	1002	0.17
$\alpha$ -Pinene	3.04	927	15.87	1.49	997	15.80
$\alpha$ -Fenchene	3.22*	939	5.58	1.76	1023	0.09
Camphene	3.22*	939	[5.58]	1.84	1031	5.47
Thuja-2,4(10)- diene	3.30	945	0.05	2.44*	1087	0.11
meta-Cymene	3.57	962	0.04	3.06*	1135	1.81
Sabinene	3.68*	970	32.17	2.44*	1087	[0.11]
$\beta$ -Pinene	3.68*	970	[32.17]	2.30	1073	31.99
Myrcene	3.96	988	1.76	3.06*	1135	[1.81]
$\alpha$ -Phellandrene	4.10*	997	0.15	2.96	1127	0.14
2-Carene	4.10*	997	[0.15]	2.56	1097	0.01
$\Delta$ 3-Carene	4.21*	1005	14.55	2.79	1114	14.50
(3Z)-Hexenyl acetate	4.21*	1005	[14.55]	5.06	1281	0.02
$\alpha$ -Terpinene	4.29	1010	0.13	3.14	1141	0.12
Hexyl acetate	4.37	1014	0.06	4.44	1236	0.04
para-Cymene	4.42	1018	0.25	4.31	1228	0.30
Limonene	4.51*	1023	12.03	3.40	1161	6.97
1,8-Cineole	4.51*	1023	[12.03]	3.49*	1168	5.10
$\beta$ -Phellandrene	4.51*	1023	[12.03]	3.49*	1168	[5.10]
(Z)- $\beta$ -Ocimene	4.72	1037	0.01	3.97	1204	0.01
(E)- $\beta$ -Ocimene	4.85	1045	0.01	4.18	1218	0.01
$\gamma$ -Terpinene	4.97	1052	0.22	4.01	1206	0.22
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.15	1064	0.01	5.01	1277	0.01
meta-Cymenene	5.37*	1078	0.08	6.47	1381	0.01
Fenchone	5.37*	1078	[0.08]	5.94	1343	0.07
Terpinolene	5.43*	1081	1.18	4.50	1241	0.99
para-Cymenene	5.43*	1081	[1.18]	6.57	1388	0.08
$\gamma$ -Campholenal	5.43*	1081	[1.18]	6.10	1355	0.01
$\alpha$ -Thujone	5.70*	1098	0.08	6.30	1369	0.01
Linalool	5.70*	1098	[0.08]	8.29	1516	0.11

endo-Fenchol	5.85	1108	0.11	8.62	1541	0.11
cis-para-Menth-2-en-1-ol	5.97	1115	0.03	8.36	1522	0.03
$\alpha$ -Campholenal	6.00	1117	0.01	7.25	1438	0.01
trans-Pinocarveol	6.20	1130	0.14	9.42*	1603	0.19
Camphor	6.24	1132	0.19	7.46	1454	0.17
Camphene hydrate	6.34	1138	0.12			
meta-Mentha-4,6-dien-8-ol	6.39	1142	0.02	9.56	1615	0.05
Isoborneol	6.50	1149	0.04	9.67*	1624	0.03
Pinocarvone	6.54	1151	0.04	8.17	1506	0.03
Myrtenyl methyl ether	6.60	1155	0.02	5.83	1335	0.01
Borneol	6.66	1159	0.41	10.02*	1652	1.56
Isopinocampone	6.71	1162	0.09	7.86	1483	0.04
Terpinen-4-ol	6.83	1170	0.31	8.81	1556	0.27
meta-Cymen-8-ol	6.91	1176	0.07	11.78*	1798	0.08
Cryptone	6.98	1179	0.03	9.42*	1603	[0.19]
para-Cymen-8-ol	7.02	1182	0.07	11.78*	1798	[0.08]
$\alpha$ -Terpineol	7.08	1186	1.20	10.02*	1652	[1.56]
Myrtenol	7.15*	1190	0.13	11.12	1742	0.08
Myrtenal	7.15*	1190	[0.13]	8.93	1565	0.07
Methylchavicol	7.22	1195	0.01	9.61	1618	0.01
Verbenone	7.26	1198	0.11	9.86*†	1639	0.10
endo-Fenchyl acetate	7.52	1215	0.02	7.08	1426	0.01
Thymol methyl ether	7.76*	1231	0.06	8.71*	1548	0.08
Citronellol	7.76*	1231	[0.06]	10.96*	1729	0.09
Carvone	7.82	1235	0.02	10.28	1673	0.03
Piperitone	7.96	1244	0.14	10.15*	1662	0.13
Phellandral	8.25	1264	0.09	10.24	1670	0.03
Isopulegyl acetate	8.39	1273	0.01			
Bornyl acetate	8.48	1279	7.11	8.51	1533	7.01
2-Undecanone	8.67	1291	0.01	8.85	1559	0.01
Thymol	8.78	1299	0.06	15.38	2133	0.05
Isohexyl isocaproate	8.95	1311	0.01	7.79	1478	tr
Myrtenyl acetate	9.08	1320	0.01	9.88	1640	0.02
$\alpha$ -Longipinene	9.34	1338	0.05	7.00	1420	0.05
Citronellyl acetate	9.50	1350	0.04	9.67*	1624	[0.03]
$\alpha$ -Copaene	9.75	1367	0.03	7.38	1448	0.01
$\beta$ -Bourbonene	9.90	1378	0.02	7.69	1471	0.01
Geranyl acetate	9.98	1383	0.01	10.79	1715	0.04
Sativene	10.02	1386	0.01	7.76	1476	0.02
Longifolene	10.08*	1390	0.22	8.22	1511	0.27
$\beta$ -Longipinene	10.08*	1390	[0.22]	8.04	1497	0.01
Methyleugenol	10.21	1400	0.02			
$\beta$ -Caryophyllene	10.30	1406	0.25	8.66	1544	0.24
trans- $\alpha$ -	10.58	1427	0.05	8.71*	1548	[0.08]

Bergamotene						
$\alpha$ -Humulene	10.77	1441	0.14	9.53	1612	0.12
( <i>E</i> )- $\beta$ -Farnesene	10.92	1452	0.03	9.77	1632	0.03
$\gamma$ -Muurolene	11.22	1474	0.04	9.86*†	1639	[0.10]
$\beta$ -Selinene	11.28	1479	0.01	10.15*	1662	[0.13]
$\alpha$ -Selinene	11.40	1488	0.04	10.19	1665	0.03
$\beta$ -Himachalene	11.43	1490	0.03	10.12	1660	0.03
( <i>Z</i> )- $\alpha$ -Bisabolene	11.50	1496	0.03	10.65	1703	0.02
$\beta$ -Bisabolene	11.57	1501	0.30	10.39	1682	0.32
$\delta$ -Cadinene	11.73	1513	0.05	10.67	1705	0.06
( <i>E</i> )- $\alpha$ -Bisabolene	12.02	1535	0.08	10.96*	1729	[0.09]
( <i>E</i> )-Nerolidol	12.31	1558	0.01	14.02	2001	0.02
Caryophyllene oxide	12.44	1568	0.04	13.03	1910	0.03
Humulene epoxide II	12.77	1594	0.02			
Manoyl oxide	17.04	1969	0.01			
18-Norabieta-8,11,13-triene?	17.31	1994	0.01			
( <i>Z</i> )-Abienol	18.65	2128	0.03	20.63	2713	0.01
<b>Total identified</b>		<b>98.93%</b>			<b>98.13%</b>	
<b>Total reported</b>		<b>98.96%</b>			<b>98.14%</b>	

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

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