

**Date :** March 07, 2018

**CERTIFICATE OF ANALYSIS - GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 18B20-PLG27-1-CC

**Customer identification :** Fir Needle

**Type :** Essential oil

**Source :** *Abies sibirica*

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

**Analysis date :** March 01, 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:** Clear liquid

**Refractive index:**  $1.4700 \pm 0.0003$  (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
(3Z)-Hexenol	0.01	0.01	Aliphatic alcohol
Hexanol	0.01	0.02	Aliphatic alcohol
Santene	2.23	2.25	Monoterpene
Unknown	0.03	0.13*	Normonoterpene
Bornylene	tr	tr	Monoterpene
Tricyclene	1.88	1.88	Monoterpene
$\alpha$ -Thujene	0.10	[0.13]*	Monoterpene
$\alpha$ -Pinene	13.16	13.16	Monoterpene
Camphene	18.27*	18.27	Monoterpene
$\alpha$ -Fenchene	[18.27]*	0.04	Monoterpene
Thuja-2,4(10)-diene	0.04	0.05*	Monoterpene
meta-Cymene	0.05	0.87*	Monoterpene
Sabinene	9.68*	[0.05]*	Monoterpene
$\beta$ -Pinene	[9.68]*	9.67	Monoterpene
Unknown	0.01		Monoterpene
Myrcene	0.82	[0.87]*	Monoterpene
$\alpha$ -Phellandrene	0.15*	0.13	Monoterpene
2-Carene	[0.15]*	0.01	Monoterpene
$\Delta$ 3-Carene	12.53*	12.56	Monoterpene
(3Z)-Hexenyl acetate	[12.53]*	0.01	Aliphatic ester
$\alpha$ -Terpinene	0.09	0.07	Monoterpene
para-Cymene	9.17	0.24	Monoterpene
Limonene	[9.17]*	5.53	Monoterpene
$\beta$ -Phellandrene	[9.17]*	3.51*	Monoterpene
1,8-Cineole	[9.17]*	[3.51]*	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.02	tr	Monoterpene
(E)- $\beta$ -Ocimene	tr	0.01	Monoterpene
$\gamma$ -Terpinene	0.13	0.13	Monoterpene
Fenchone	0.02	0.03	Aliphatic alcohol
Isoterpinolene	0.03	0.04	Monoterpene
Terpinolene	0.87	0.84	Monoterpene
para-Cymenene	0.06*	0.05	Monoterpene
$\gamma$ -Campholenal	[0.06]*	0.02	Aliphatic alcohol
Unknown	0.02		Unknown
Unknown	0.01		Unknown
Linalool	0.04	0.04	Monoterpenic alcohol
$\alpha$ -Thujone	0.03	0.02	Monoterpenic ketone
endo-Fenchol	0.05	0.04	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.03	0.04	Monoterpenic alcohol
$\alpha$ -Campholenal	0.01	0.01	Monoterpenic aldehyde
trans-Pinocarveol	0.08	0.13*	Monoterpenic alcohol
Camphor	0.23	0.22	Monoterpenic ketone
Camphene hydrate	0.14	0.12	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.01	0.52*	Monoterpenic alcohol
Isoborneol	0.03	0.02	Monoterpenic alcohol
Pinocarvone	0.02	0.03	Monoterpenic ketone
Borneol	1.48	1.86*	Monoterpenic alcohol

Isopinocampnone	[1.48]	0.02	Monoterpenic ketone
Terpinen-4-ol	0.18	0.13	Monoterpenic alcohol
Cryptone	0.07	[0.13]*	Normonoterpenic ketone
meta-Cymen-8-ol	0.03	0.02	Monoterpenic alcohol
para-Cymen-8-ol	0.09	0.11	Monoterpenic alcohol
$\alpha$ -Terpineol	0.44	[1.86]*	Monoterpenic alcohol
Myrtenol	0.06	0.04	Monoterpenic alcohol
Verbenone	0.03	0.04	Monoterpenic ketone
Unknown	0.08	0.07	Oxygenated monoterpene
endo-Fenchyl acetate	0.04	0.03	Monoterpenic ester
Thymol methyl ether	0.02	0.85*	Monoterpenic ether
Citronellol	0.05	0.04	Monoterpenic alcohol
Carvone	0.03	0.04	Monoterpenic ketone
Piperitone	0.05	0.05	Monoterpenic ketone
Phellandral	0.04	0.04	Monoterpenic aldehyde
Isopulegyl acetate	0.02		Monoterpenic ester
Bornyl acetate	23.14	22.84	Monoterpenic ester
2-Undecanone	0.04	0.03	Aliphatic ketone
Thymol	0.01	0.02	Monoterpenic alcohol
Isohexyl isocaproate	0.02	0.01	Aliphatic ester
$\alpha$ -Longipinene	0.03	0.03	Sesquiterpene
Citronellyl acetate	0.04	0.04	Monoterpenic ester
Neryl acetate	0.06	[0.28]	Monoterpenic ester
$\alpha$ -Copaene	0.02	0.01	Sesquiterpene
Geranyl acetate	0.17	0.17	Monoterpenic ester
Longifolene	0.16*	0.15	Sesquiterpene
$\beta$ -Longipinene	[0.16]*	0.01	Sesquiterpene
Methyleugenol	0.02	0.02	Phenylpropanoid
Dodecanal	0.05	0.09*	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.86	[0.85]*	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.02	[0.85]*	Sesquiterpene
$\alpha$ -Humulene	0.50	[0.52]*	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.02	0.03	Sesquiterpene
$\gamma$ -Himachalene	0.03	0.02	Sesquiterpene
Unknown	0.08		Sesquiterpene
$\beta$ -Himachalene	0.07	[1.86]*	Sesquiterpene
$\alpha$ -Murolene	0.03	0.04	Sesquiterpene
( <i>Z</i> )- $\alpha$ -Bisabolene	0.02	0.02	Sesquiterpene
$\beta$ -Bisabolene	0.20	0.28	Sesquiterpene
( <i>Z</i> )- $\gamma$ -Bisabolene	0.04	[0.09]*	Sesquiterpene
$\delta$ -Cadinene	0.03	0.04	Sesquiterpene
( <i>E</i> )- $\gamma$ -Bisabolene	0.05	0.06	Sesquiterpene
( <i>E</i> )-Nerolidol	0.02	0.03	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.13*	0.03	Sesquiterpenic ether
Caryophyllene oxide	[0.13]*	0.11	Sesquiterpenic ether
Humulene epoxide II	0.06	0.07	Sesquiterpenic ether
Selin-6-en-4 $\alpha$ -ol?	0.03		Sesquiterpenic alcohol
$\alpha$ -Bisabolol	0.15	0.14	Sesquiterpenic alcohol
<b>Total identified</b>	<b>98.64%</b>	<b>98.31%</b>	

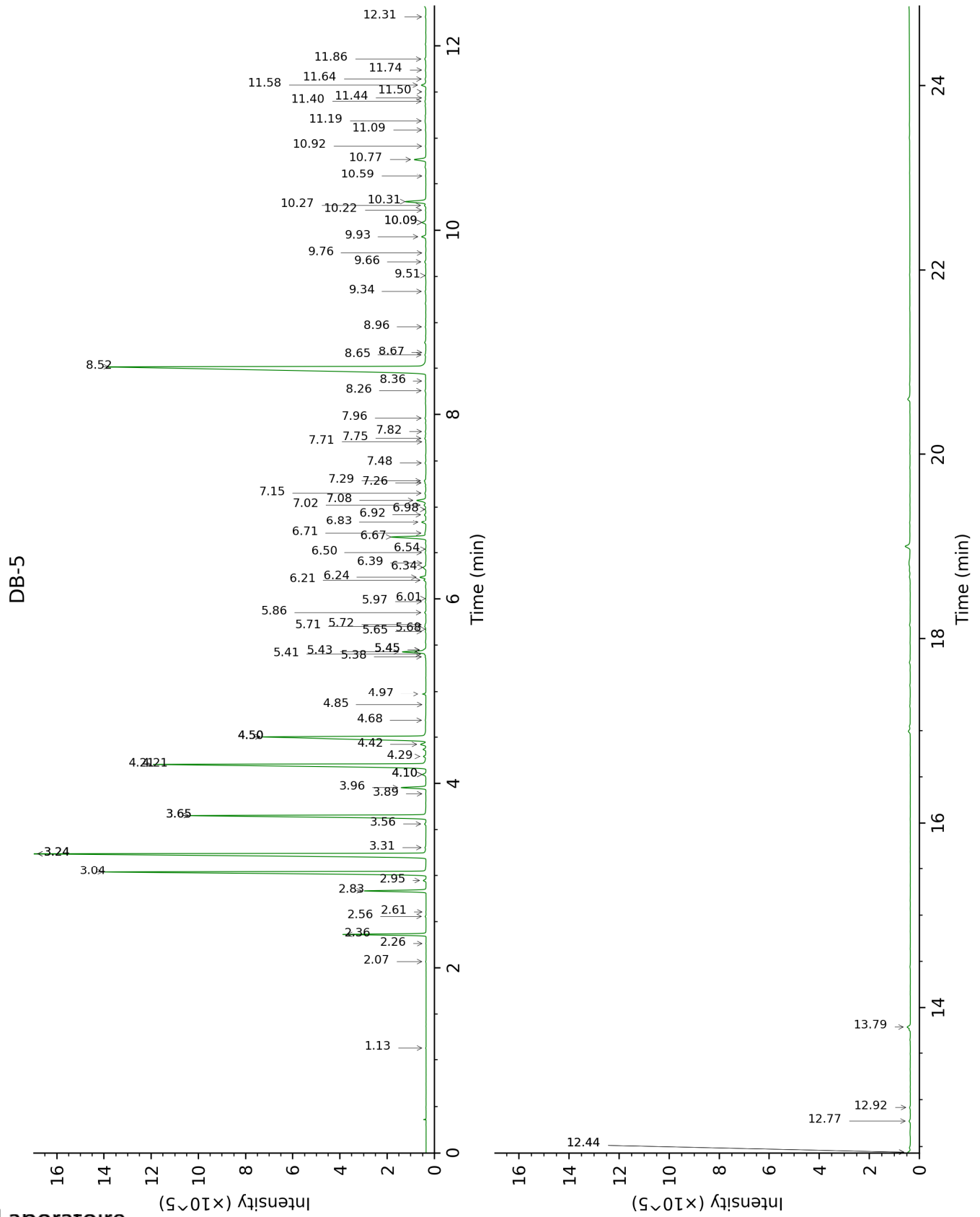
\*: Two or more compounds are coeluting on this column

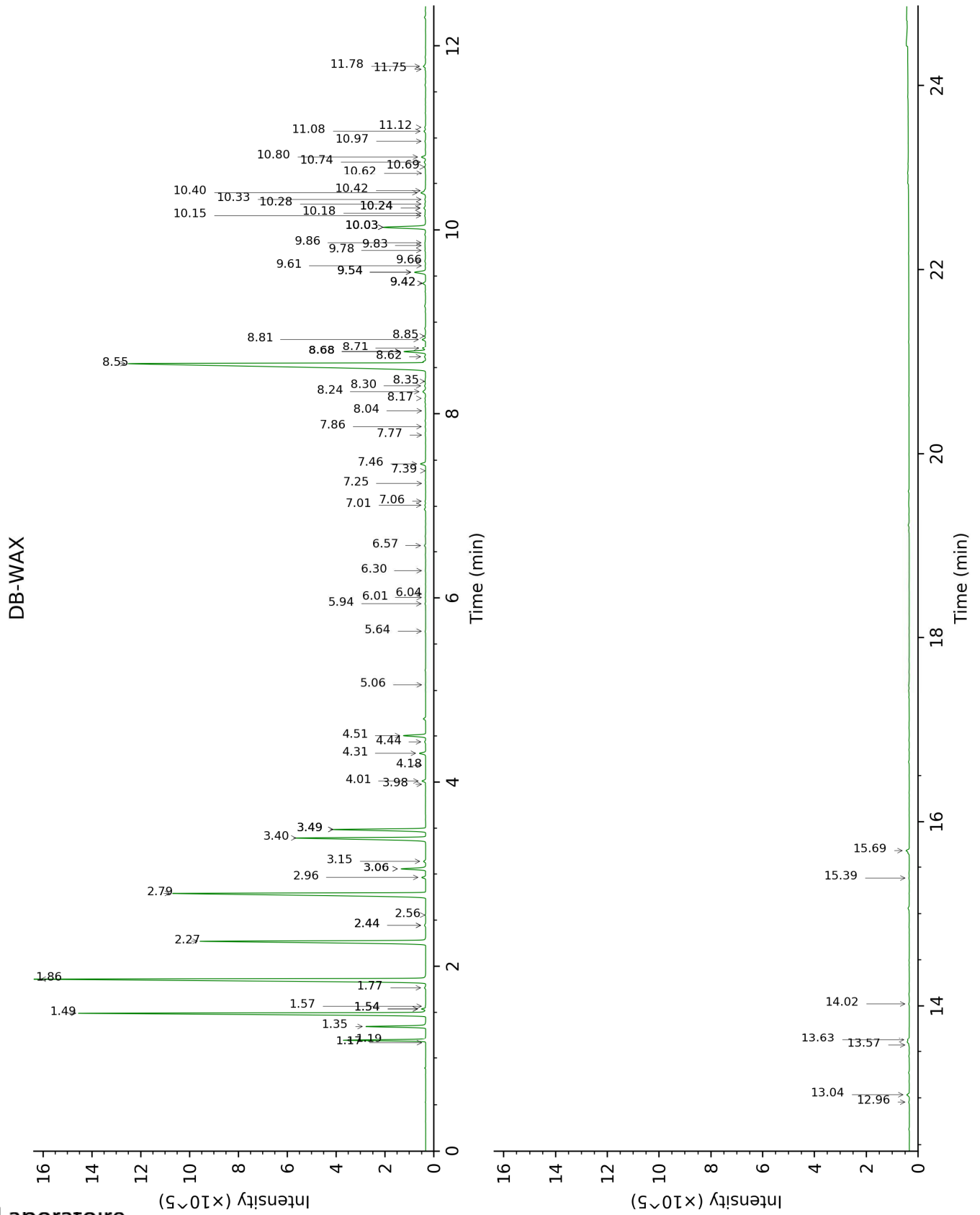
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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
(3Z)-Hexenol	2.07	852	0.01	6.04	1351	0.01
Hexanol	2.26	869	0.01	5.64	1322	0.02
Santene	2.36	877	2.23	1.19	951	2.25
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]	2.56	894	0.03	1.54*	1002	0.13
Bornylene	2.61	898	tr	1.17	946	tr
Tricyclene	2.83	913	1.88	1.35	975	1.88
$\alpha$ -Thujene	2.95	921	0.10	1.54*	1002	[0.13]
$\alpha$ -Pinene	3.04	927	13.16	1.49	997	13.16
Camphene	3.24*	940	18.27	1.86	1033	18.27
$\alpha$ -Fenchene	3.24*	940	[18.27]	1.77	1024	0.04
Thuja-2,4(10)- diene	3.31	945	0.04	2.44*	1087	0.05
meta-Cymene	3.56	962	0.05	3.06*	1135	0.87
Sabinene	3.66*	968	9.68	2.44*	1087	[0.05]
$\beta$ -Pinene	3.66*	968	[9.68]	2.27	1071	9.67
Unknown [m/z 91, 119 (65), 109 (51), 134 (47)]	3.89	984	0.01			
Myrcene	3.96	988	0.82	3.06*	1135	[0.87]
$\alpha$ -Phellandrene	4.10*	997	0.15	2.96	1128	0.13
2-Carene	4.10*	997	[0.15]	2.56	1097	0.01
$\Delta$ 3-Carene	4.21*	1004	12.53	2.79	1114	12.56
(3Z)-Hexenyl acetate	4.21*	1004	[12.53]	5.06	1281	0.01
$\alpha$ -Terpinene	4.29	1010	0.09	3.14	1141	0.07
para-Cymene	4.42†	1018	9.17	4.31	1228	0.24
Limonene	4.50*†	1023	[9.17]	3.40	1161	5.53
$\beta$ -Phellandrene	4.50*†	1023	[9.17]	3.49*	1168	3.51
1,8-Cineole	4.50*†	1023	[9.17]	3.49*	1168	[3.51]
(Z)- $\beta$ -Ocimene	4.68	1034	0.02	3.98	1204	tr
(E)- $\beta$ -Ocimene	4.85	1045	tr	4.18	1219	0.01
$\gamma$ -Terpinene	4.97	1052	0.13	4.01	1207	0.13
Fenchone	5.38	1078	0.02	5.94	1343	0.03
Isoterpinolene	5.41	1080	0.03	4.44	1237	0.04
Terpinolene	5.43	1081	0.87	4.51	1241	0.84
para-Cymenene	5.45*	1082	0.06	6.57	1388	0.05
$\gamma$ -Campholenal	5.45*	1082	[0.06]	6.01	1348	0.02
Unknown [m/z 109, 43 (65), 95 (54), 119 (50), 91 (47)... 149 (8)...]	5.65	1095	0.02			
Unknown [m/z 79, 94 (87), 77 (25), 91 (21), 93	5.68	1096	0.01			

(16), 95 (12), 138 (8)]						
Linalool	5.71	1098	0.04	8.30	1517	0.04
$\alpha$ -Thujone	5.72	1100	0.03	6.30	1369	0.02
endo-Fenchol	5.86	1108	0.05	8.62	1541	0.04
<i>cis</i> -para-Menth-2-en-1-ol	5.97	1115	0.03	8.35	1521	0.04
$\alpha$ -Campholenal	6.01	1118	0.01	7.25	1438	0.01
<i>trans</i> -Pinocarveol	6.20	1130	0.08	9.42*	1604	0.13
Camphor	6.24	1132	0.23	7.46	1454	0.22
Camphene hydrate	6.34	1139	0.14	8.71	1548	0.12
meta-Mentha-4,6-dien-8-ol	6.39	1142	0.01	9.54*	1613	0.52
Isoborneol	6.50	1149	0.03	9.61	1619	0.02
Pinocarvone	6.54	1152	0.02	8.17	1507	0.03
Borneol	6.67†	1160	1.48	10.03*	1652	1.86
Isopinocampone	6.71†	1163	[1.48]	7.86	1484	0.02
Terpinen-4-ol	6.83	1170	0.18	8.81	1556	0.13
Cryptone	6.92	1176	0.07	9.42*	1604	[0.13]
meta-Cymen-8-ol	6.98	1180	0.03	11.75	1795	0.02
para-Cymen-8-ol	7.02	1182	0.09	11.78	1798	0.11
$\alpha$ -Terpineol	7.08	1186	0.44	10.03*	1652	[1.86]
Myrtenol	7.15	1191	0.06	11.12	1742	0.04
Verbenone	7.26	1198	0.03	9.86	1639	0.04
Unknown [m/z 109, 91 (100), 81 (88), 94 (75), 119 (74), 96 (73), 41 (63)... 150 (2)]	7.29	1199	0.08	11.08	1739	0.07
endo-Fenchyl acetate	7.48	1212	0.04	7.06	1424	0.03
Thymol methyl ether	7.71	1227	0.02	8.68*	1546	0.85
Citronellol	7.74	1230	0.05	10.97	1730	0.04
Carvone	7.82	1235	0.03	10.28	1673	0.04
Piperitone	7.96	1244	0.05	10.15	1662	0.05
Phellandral	8.26	1264	0.04	10.18	1664	0.04
Isopulegyl acetate	8.36	1271	0.02			
Bornyl acetate	8.52	1281	23.14	8.55	1536	22.84
2-Undecanone	8.65	1290	0.04	8.85	1559	0.03
Thymol	8.67	1292	0.01	15.39	2133	0.02
Isohexyl isocaproate	8.96	1311	0.02	7.77	1477	0.01
$\alpha$ -Longipinene	9.34	1338	0.03	7.01	1421	0.03
Citronellyl acetate	9.51	1350	0.04	9.66	1623	0.04
Neryl acetate	9.66	1361	0.06	10.42†	1684	[0.28]
$\alpha$ -Copaene	9.76	1367	0.02	7.39	1448	0.01
Geranyl acetate	9.93	1380	0.17	10.80	1715	0.17
Longifolene	10.08*	1391	0.16	8.24	1512	0.15
$\beta$ -Longipinene	10.08*	1391	[0.16]	8.04	1496	0.01

Methyleugenol	10.22	1400	0.02	13.57	1959	0.02
Dodecanal	10.27	1404	0.05	10.24*	1669	0.09
$\beta$ -Caryophyllene	10.31	1407	0.86	8.68*	1546	[0.85]
<i>trans</i> - $\alpha$ -Bergamotene	10.59	1427	0.02	8.68*	1546	[0.85]
$\alpha$ -Humulene	10.77	1441	0.50	9.54*	1613	[0.52]
( <i>E</i> )- $\beta$ -Farnesene	10.92	1452	0.02	9.78	1632	0.03
$\gamma$ -Himachalene	11.09	1465	0.03	9.83	1636	0.02
Unknown [m/z 91, 93 (92), 105 (71), 77 (69), 79 (68), 133 (63)... 204 (32)]	11.19	1472	0.08			
$\beta$ -Himachalene	11.40	1488	0.07	10.03*	1652	[1.86]
$\alpha$ -Muurolene	11.44	1491	0.03	10.33	1676	0.04
( <i>Z</i> )- $\alpha$ -Bisabolene	11.50	1496	0.02	10.62	1700	0.02
$\beta$ -Bisabolene	11.58	1501	0.20	10.40†	1682	0.28
( <i>Z</i> )- $\gamma$ -Bisabolene	11.64	1506	0.04	10.24*	1669	[0.09]
$\delta$ -Cadinene	11.74	1514	0.03	10.69	1706	0.04
( <i>E</i> )- $\gamma$ -Bisabolene	11.86	1523	0.05	10.74	1711	0.06
( <i>E</i> )-Nerolidol	12.31	1559	0.02	14.02	2001	0.03
Caryophyllene oxide isomer	12.44*	1568	0.13	12.96	1903	0.03
Caryophyllene oxide	12.44*	1568	[0.13]	13.04	1910	0.11
Humulene epoxide II	12.77	1595	0.06	13.63	1964	0.07
Selin-6-en-4 $\alpha$ -ol?	12.92	1606	0.03			
$\alpha$ -Bisabolol	13.79	1678	0.15	15.69	2164	0.14
<b>Total identified</b>		<b>98.64%</b>			<b>98.31%</b>	
<b>Total reported</b>		<b>98.87%</b>			<b>98.38%</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