

Date : December 13, 2018

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 18L12-PTH01-1-CC

Customer identification : Fir Needle - Siberia - F20104610R

Type : Essential oil

Source : *Abies sibirica*

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 : December 13, 2018

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4695 ± 0.0003 (20 °C)

ISO 10869:2011 - OIL OF FIR NEEDLE, SIBERIAN

Compound	Min. %	Max. %	Observed %	Complies?
α-Humulene	0.3	0.9	0.6	Yes
Borneol	1.0	3.0	2.3	Yes
Isobornyl acetate		0.1	0.1	Yes
β-Caryophyllene	0.5	2.0	1.1	Yes
Bornyl acetate	20.0	35.0	25.4	Yes
β-Phellandrene	1.5	5.0	4.0	Yes
Limonene	4.0	10.0	4.7	Yes
Δ3-Carene	9.0	15.0	12.7	Yes
β-Pinene	1.0	3.5	2.3	Yes
Camphene	15.0	26.0	22.4	Yes
α-Pinene	10.0	22.0	12.5	Yes
Tricyclene	1.5	3.5	2.2	Yes
Santene	1.5	3.5	2.5	Yes
Refractive index	1.4680	1.4730	1.4695	Yes

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	0.01	Aliphatic aldehyde
Hexanol	0.01	tr	Aliphatic alcohol
Santene	2.49	2.45*	Monoterpene
Unknown	0.04	0.12*	Normoterpene
Bornylene	tr	[2.45]*	Monoterpene
Tricyclene	2.24	2.27	Monoterpene
α -Thujene	0.08	[0.12]*	Monoterpene
α -Pinene	12.46	12.26	Monoterpene
Camphene	22.70*	22.44	Monoterpene
α -Fenchene	[22.70]*	0.04	Monoterpene
Thuja-2,4(10)-diene	0.02	0.02*	Monoterpene
meta-Cymene	0.05	0.16*	Monoterpene
β -Pinene	2.35*	2.29	Monoterpene
Sabinene	[2.35]*	[0.02]*	Monoterpene
cis-Carane	tr	tr	Monoterpene
Unknown	0.01		Monoterpene
Myrcene	0.58	0.61	Monoterpene
2-Carene	0.01	0.01	Monoterpene
α -Phellandrene	0.31*	0.29	Monoterpene
Pseudolimonene	[0.31]*	0.01	Monoterpene
(3Z)-Hexenyl acetate	12.91*	0.01	Aliphatic ester
Δ 3-Carene	[12.91]*	12.72	Monoterpene
α -Terpinene	0.16	[0.16]*	Monoterpene
Carvomenthene	0.02	0.01	Aliphatic alcohol
para-Cymene	0.09	0.10	Monoterpene
Limonene	8.87*	4.73	Monoterpene
β -Phellandrene	[8.87]*	4.00*	Monoterpene
1,8-Cineole	[8.87]*	[4.00]*	Monoterpenic ether
γ -Terpinene	0.19	0.19	Monoterpene
meta-Cymenene	0.02	0.02	Monoterpene
para-Cymenene	1.42*	0.04	Monoterpene
γ -Campholenal	[1.42]*	0.02	Aliphatic alcohol
Terpinolene	[1.42]*	1.25	Monoterpene
α -Thujone	0.02	0.01	Monoterpenic ketone
Linalool	0.03	0.03	Monoterpenic alcohol
endo-Fenchol	0.03	0.04	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.03	0.03	Monoterpenic alcohol
α -Campholenal	0.02	0.02	Monoterpenic aldehyde
trans-Pinocarveol	0.03	0.03	Monoterpenic alcohol
Camphor	0.25	0.23	Monoterpenic ketone
Camphene hydrate	0.11	1.24*	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.02	0.01	Monoterpenic alcohol
Isoborneol	0.03	0.03	Monoterpenic alcohol
Myrtenyl methyl ether	0.01		Monoterpenic ether
Pinocarvone	0.02	0.01	Monoterpenic ketone
Borneol	2.29	2.61*	Monoterpenic alcohol
Isopinocampone	0.02	0.01	Monoterpenic ketone

Terpinen-4-ol	0.11	0.10	Monoterpenic alcohol
Cryptone	0.04	0.04	Normonoterpenic ketone
para-Cymen-8-ol	0.03	0.02	Monoterpenic alcohol
Myrtenal	0.27*	0.03	Monoterpenic aldehyde
α -Terpineol	[0.27]*	[2.61]*	Monoterpenic alcohol
Myrtenol	0.02	0.02	Monoterpenic alcohol
Verbenone	0.06	0.05*	Monoterpenic ketone
endo-Fenchyl acetate	0.03	0.02	Monoterpenic ester
Thymol methyl ether	0.06	[1.24]*	Monoterpenic ether
Nojigiku acetate	0.01	0.01	Monoterpenic ester
Carvone	0.02	0.03	Monoterpenic ketone
Geraniol	0.02	0.02	Monoterpenic alcohol
Phellandral	0.04	0.04	Monoterpenic aldehyde
Bornyl acetate	24.82*	25.36	Monoterpenic ester
Isobornyl acetate	[24.82]*	0.09	Monoterpenic ester
2-Undecanone	[24.82]*	0.04	Aliphatic ketone
Thymol	0.04	0.02	Monoterpenic alcohol
Isohexyl isocaproate	0.03	0.02	Aliphatic ester
Unknown	0.02		Unknown
α -Longipinene	0.02	0.02	Sesquiterpene
α -Terpinyl acetate	0.01	[2.61]*	Monoterpenic ester
Citronellyl acetate	0.04	0.04	Monoterpenic ester
Neryl acetate	0.05	0.22*	Monoterpenic ester
α -Ylangene	0.02	0.01	Sesquiterpene
α -Copaene	0.01	0.01	Sesquiterpene
Geranyl acetate	0.20	0.20	Monoterpenic ester
β -Longipinene	0.02	0.01	Sesquiterpene
Longifolene	0.13	0.11	Sesquiterpene
Methyleugenol	0.01	0.01	Phenylpropanoid
Dodecanal	0.15	0.15	Aliphatic aldehyde
β -Caryophyllene	1.08	[1.24]*	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.01	0.01	Sesquiterpene
α -Himachalene	0.04	0.06	Sesquiterpene
α -Humulene	0.62	0.63	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.02	[0.05]*	Sesquiterpene
γ -Himachalene	0.03	0.03	Sesquiterpene
Unknown	0.05	0.06	Sesquiterpene
β -Himachalene	0.03	0.02	Sesquiterpene
α -Murolene	0.02	0.03	Sesquiterpene
(<i>Z</i>)- α -Bisabolene	0.02	0.02	Sesquiterpene
β -Bisabolene	0.13	[0.22]*	Sesquiterpene
(<i>Z</i>)- γ -Bisabolene	0.05		Sesquiterpene
δ -Cadinene	0.03	0.02	Sesquiterpene
(<i>E</i>)- γ -Bisabolene	0.07	0.10	Sesquiterpene
(<i>E</i>)- α -Bisabolene	0.01	0.02	Sesquiterpene
(<i>E</i>)-Nerolidol	0.03	0.03	Sesquiterpenic alcohol
Caryophyllene oxide	0.03*	0.01	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.03]*	0.03	Sesquiterpenic ether
Selin-6-en-4 α -ol?	0.06	0.05	Sesquiterpenic alcohol
epi- α -Bisabolol	0.07	0.25	Sesquiterpenic alcohol
α -Bisabolol	0.19	[0.25]	Sesquiterpenic alcohol
Manoyl oxide	0.06	0.06	Diterpenic ether

13-epi-Manoyl oxide	0.03		Diterpenic ether
Manool	0.06	0.05	Diterpenic alcohol
Total identified	98.84%	98.50%	

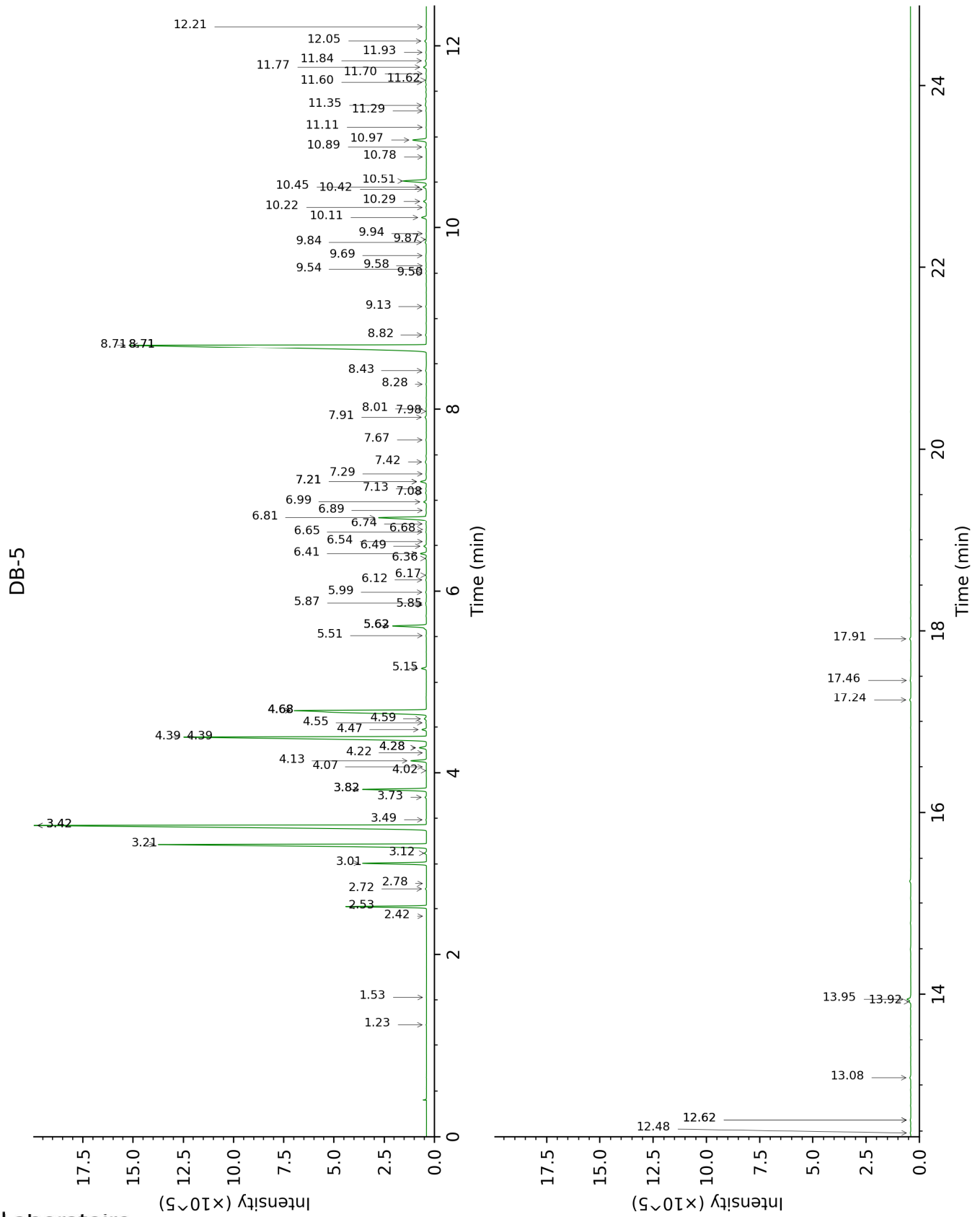
*: Two or more compounds are coeluting on this column

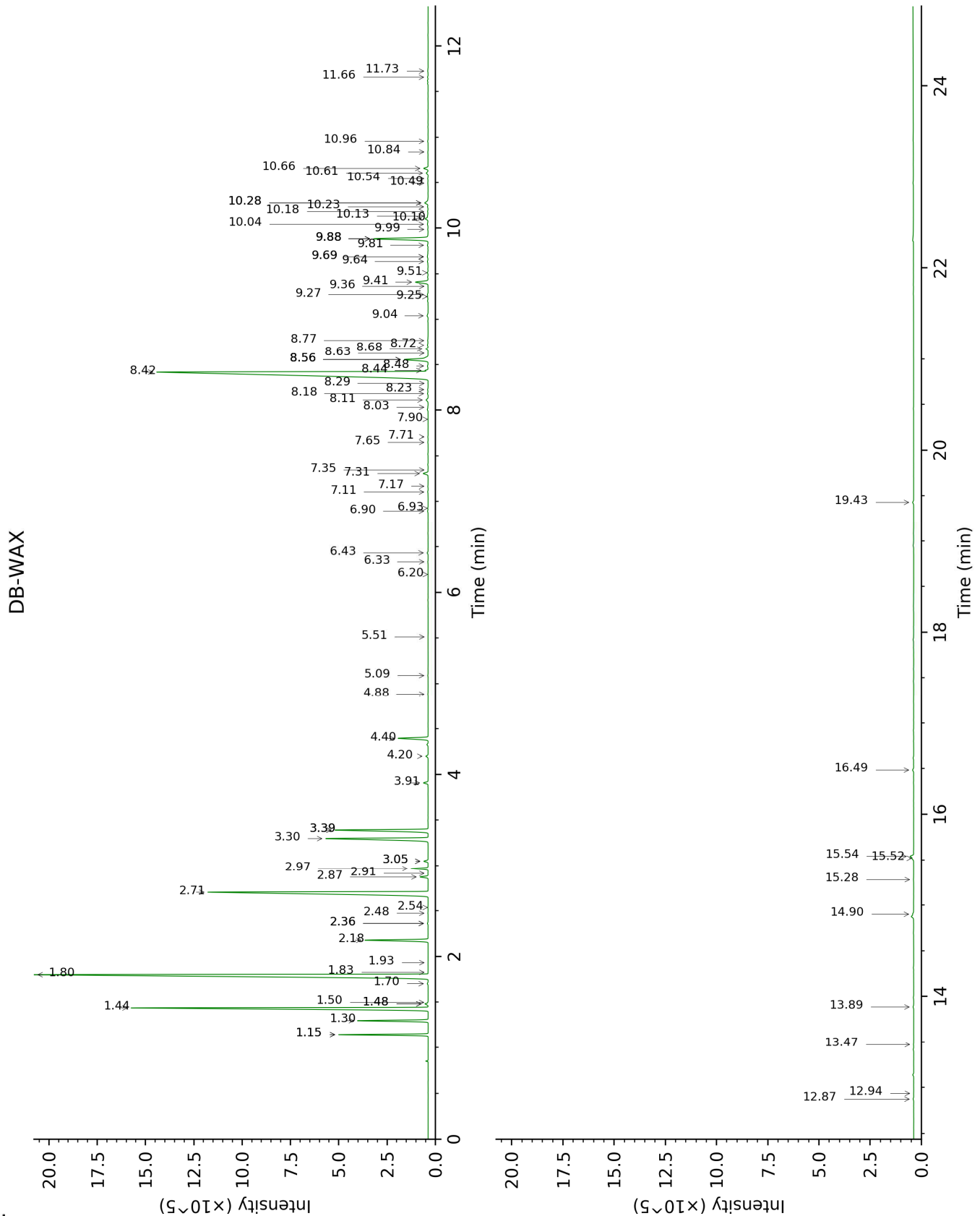
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	1.23	756	0.01	1.50	1002	0.01
Hexanal	1.53	796	tr	1.93	1042	0.01
Hexanol	2.42	872	0.01	5.51	1320	tr
Santene	2.53	881	2.49	1.15*	951	2.45
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]	2.72	897	0.04	1.48*	1000	0.12
Bornylene	2.78	902	tr	1.15*	951	[2.45]
Tricyclene	3.01	917	2.24	1.30	973	2.27
α -Thujene	3.12	924	0.08	1.48*	1000	[0.12]
α -Pinene	3.21	931	12.46	1.44	994	12.26
Camphene	3.42*	944	22.70	1.80	1030	22.44
α -Fenchene	3.42*	944	[22.70]	1.70	1021	0.04
Thuja-2,4(10)- diene	3.49	948	0.02	2.36*	1083	0.02
meta-Cymene	3.73	965	0.05	3.05*	1139	0.16
β -Pinene	3.82*	970	2.35	2.18	1066	2.29
Sabinene	3.82*	970	[2.35]	2.36*	1083	[0.02]
cis-Carane	4.02	984	tr	1.83	1033	tr
Unknown [m/z 91, 119 (65), 109 (51), 134 (47)]	4.07	987	0.01			
Myrcene	4.13	991	0.58	2.97	1133	0.61
2-Carene	4.22	997	0.01	2.48	1094	0.01
α -Phellandrene	4.28*	1000	0.31	2.87	1125	0.29
Pseudolimonene	4.28*	1000	[0.31]	2.91	1128	0.01
(3Z)-Hexenyl acetate	4.39*	1008	12.91	4.88	1280	0.01
Δ 3-Carene	4.39*	1008	[12.91]	2.71	1112	12.72
α -Terpinene	4.47	1013	0.16	3.05*	1139	[0.16]
Carvomenthene	4.55	1018	0.02	2.54	1100	0.01
para-Cymene	4.59	1020	0.09	4.20	1228	0.10
Limonene	4.68*	1026	8.87	3.30	1159	4.73
β -Phellandrene	4.68*	1026	[8.87]	3.39*	1166	4.00
1,8-Cineole	4.68*	1026	[8.87]	3.39*	1166	[4.00]
γ -Terpinene	5.15	1056	0.19	3.91	1206	0.19
meta-Cymenene	5.51	1078	0.02	6.34	1379	0.02
para-Cymenene	5.62*	1085	1.42	6.43	1386	0.04
γ -Campholenal	5.62*	1085	[1.42]	5.09	1296	0.02
Terpinolene	5.62*	1085	[1.42]	4.40	1243	1.25
α -Thujone	5.85	1100	0.02	6.20	1369	0.01
Linalool	5.87	1101	0.03	8.18	1516	0.03
endo-Fenchol	5.99	1109	0.03	8.48	1539	0.04
cis-para-Menth-2- en-1-ol	6.12	1117	0.03	8.23	1520	0.03
α -Campholenal	6.18	1121	0.02	7.11	1436	0.02
trans-Pinocarveol	6.36	1132	0.03	9.25	1599	0.03

Camphor	6.41	1136	0.25	7.31	1451	0.23
Camphene hydrate	6.49	1141	0.11	8.56*	1545	1.24
meta-Mentha-4,6-dien-8-ol	6.54	1144	0.02	9.36	1608	0.01
Isoborneol	6.65	1151	0.03	9.51	1620	0.03
Myrtenyl methyl ether	6.68	1153	0.01			
Pinocarvone	6.74	1157	0.02	8.03	1505	0.01
Borneol	6.81	1162	2.29	9.88*	1650	2.61
Isopinocampone	6.89	1167	0.02	7.71	1480	0.01
Terpinen-4-ol	6.99	1173	0.11	8.68	1554	0.10
Cryptone	7.08	1180	0.04	9.27	1600	0.04
para-Cymen-8-ol	7.13	1183	0.03	11.66	1798	0.02
Myrtenal	7.21*	1188	0.27	8.77	1561	0.03
α-Terpineol	7.21*	1188	[0.27]	9.88*	1650	[2.61]
Myrtenol	7.29	1193	0.02	10.96	1738	0.02
Verbenone	7.42	1202	0.06	9.69*	1634	0.05
endo-Fenchyl acetate	7.66	1218	0.03	6.90	1420	0.02
Thymol methyl ether	7.91	1235	0.06	8.56*	1545	[1.24]
Nojigiku acetate	7.98	1240	0.01	8.29	1525	0.01
Carvone	8.01	1242	0.02	10.18	1674	0.03
Geraniol	8.28	1260	0.02	11.73	1804	0.02
Phellandral	8.42	1270	0.04	10.13	1670	0.04
Bornyl acetate	8.71*	1290	24.82	8.42	1534	25.36
Isobornyl acetate	8.71*	1290	[24.82]	8.44	1536	0.09
2-Undecanone	8.71*	1290	[24.82]	8.72	1557	0.04
Thymol	8.82	1298	0.04	15.28	2134	0.02
Isohexyl isocaproate	9.14	1313	0.03	7.65	1476	0.02
Unknown [m/z 121, 93 (84), 43 (81), 79 (48), 117 (40), 56 (37)...]	9.50	1339	0.02			
α-Longipinene	9.54	1343	0.02	6.93	1422	0.02
α-Terpinyl acetate	9.58	1345	0.01	9.88*	1650	[2.61]
Citronellyl acetate	9.69	1353	0.04	9.64	1630	0.04
Neryl acetate	9.84	1364	0.05	10.28*	1681	0.22
α-Ylangene	9.87	1366	0.02	7.17	1440	0.01
α-Copaene	9.94	1370	0.01	7.35	1454	0.01
Geranyl acetate	10.11	1383	0.20	10.66	1713	0.20
β-Longipinene	10.22	1391	0.02	7.90	1494	0.01
Longifolene	10.29	1396	0.13	8.11	1511	0.11
Methyleugenol	10.42	1405	0.01	13.47	1960	0.01
Dodecanal	10.44	1407	0.15	10.10	1667	0.15
β-Caryophyllene	10.51	1412	1.08	8.56*	1545	[1.24]
trans-α-Bergamotene	10.78	1432	0.01	8.63	1550	0.01
α-Himachalene	10.89	1441	0.04	9.04	1582	0.06
α-Humulene	10.97	1446	0.62	9.41	1611	0.63

(E)-β-Farnesene	11.11	1457	0.02	9.69*	1634	[0.05]
γ-Himachalene	11.29	1470	0.03	9.81	1644	0.03
Unknown [m/z 91, 93 (92), 105 (71), 77 (69), 79 (68), 133 (63)... 204 (32)]	11.35	1475	0.05	10.04	1662	0.06
β-Himachalene	11.60	1494	0.03	9.99	1658	0.02
α-Muurolene	11.62	1496	0.02	10.23	1678	0.03
(Z)-α-Bisabolene	11.70	1501	0.02	10.49	1699	0.02
β-Bisabolene	11.77	1506	0.13	10.28*	1681	[0.22]
(Z)-γ-Bisabolene	11.84	1512	0.05			
δ-Cadinene	11.93	1519	0.03	10.54	1703	0.02
(E)-γ-Bisabolene	12.05	1529	0.07	10.61	1709	0.10
(E)-α-Bisabolene	12.21	1542	0.01	10.84	1728	0.02
(E)-Nerolidol	12.48	1563	0.03	13.89	1999	0.03
Caryophyllene oxide	12.62*	1574	0.03	12.94	1911	0.01
Caryophyllene oxide isomer	12.62*	1574	[0.03]	12.87	1905	0.03
Selin-6-en-4α-ol?	13.08	1611	0.06	14.90	2096	0.05
epi-α-Bisabolol	13.92	1680	0.07	15.52†	2158	0.25
α-Bisabolol	13.95	1683	0.19	15.54†	2160	[0.25]
Manoyl oxide	17.24	1979	0.06	16.49	2257	0.06
13-epi-Manoyl oxide	17.46	2000	0.03			
Manool	17.91	2045	0.06	19.43	2582	0.05
Total identified		98.84%			98.50%	
Total reported		98.95%			98.55%	

*: 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