

Date : January 23, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19A10-ORA06-1-CC

Customer identification : Pine

Type : Essential oil

Source : *Pinus nigra*

Customer : Organic Aromas Inc.

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 : Alexis St-Gelais, M. Sc., chimiste

Analysis date : January 22, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear Liquid

Refractive index: 1.4705 ± 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	0.05*	Simple phenolic
Santene	0.07	0.07	Monoterpene
Bornylene	tr	tr	Monoterpene
Hashishene	0.01	53.13*	Monoterpene
Tricyclene	0.13	0.13	Monoterpene
α -Thujene	0.04	[0.05]*	Monoterpene
α -Pinene	53.43	[53.13]*	Monoterpene
Camphene	1.23*	1.19	Monoterpene
α -Fenchene	[1.23]*	0.04	Monoterpene
Thuja-2,4(10)-diene	0.04	0.05*	Monoterpene
Unknown	0.02		Monoterpene
meta-Cymene	0.03	4.96*	Monoterpene
β -Pinene	9.91*	9.77	Monoterpene
Sabinene	[9.91]*	0.01	Monoterpene
Unknown	0.11	0.07	Monoterpene
cis-Carane	0.01	tr	Monoterpene
Myrcene	4.97	[4.96]*	Monoterpene
2-Carene	0.07	0.09*	Monoterpene
trans-Carane?	0.02	[0.05]*	Monoterpene
α -Phellandrene	0.37	0.29	Monoterpene
Δ 3-Carene	11.01	10.97	Monoterpene
α -Terpinene	0.33*	0.33*	Monoterpene
1,4-Cineole	[0.33]*	[0.33]*	Monoterpenic ether
Carvomenthene	0.03	[0.09]*	Aliphatic alcohol
para-Cymene	1.25	1.25*	Monoterpene
Limonene	9.38	8.31	Monoterpene
(Z)- β -Ocimene	0.01	0.01	Monoterpene
Unknown	0.01		Monoterpene
(E)- β -Ocimene	0.02	0.02	Monoterpene
γ -Terpinene	0.04	0.05	Monoterpene
Unknown	0.02	0.02	Oxygenated monoterpene
Isoterpinolene	0.01*	[1.25]*	Monoterpene
Unknown	[0.01]*	0.01	Oxygenated monoterpene
Terpinolene	0.44*	0.42	Monoterpene
para-Cymenene	[0.44]*	0.02	Monoterpene
α -Pinene oxide	0.04	0.03	Monoterpenic ether
Unknown	0.01		Unknown
Verbenol analog?	0.05	0.85*	Monoterpenic alcohol
endo-Fenchol	0.06	0.07*	Monoterpenic alcohol
α -Campholenal	0.02*	0.02	Monoterpenic aldehyde
exo-Fenchol	[0.02]*		Monoterpenic alcohol
cis-Limonene oxide	0.01*	0.01	Monoterpenic ether
4-Hydroxy-4-methylcyclohex-2-enone	[0.01]*	0.04*	Aliphatic alcohol
1-Terpineol	0.10*	[0.07]*	Monoterpenic alcohol
trans-Pinocarveol	[0.10]*	0.10	Monoterpenic alcohol
cis-Verbenol	0.02	0.02	Monoterpenic alcohol
Epoxyterpinolene	0.16*	0.02	Monoterpenic ether

<i>trans</i> -Verbenol	[0.16]*	0.13*	Monoterpenic alcohol
Camphene hydrate	0.01*	0.02	Monoterpenic alcohol
Unknown	[0.01]*	0.13*	Unknown
Phellandrenol analog I	0.02		Monoterpenic alcohol
Pinocarvone	0.02	0.03	Monoterpenic ketone
Borneol	0.08	0.64*	Monoterpenic alcohol
<i>trans</i> -2-Caren-4-ol?	0.01		Monoterpenic alcohol
Terpinen-4-ol	0.05	0.04	Monoterpenic alcohol
meta-Cymen-8-ol	0.03*	0.01	Monoterpenic alcohol
Cryptone	[0.03]*	0.01	Normonoterpenic ketone
para-Cymen-8-ol	0.07	0.08	Monoterpenic alcohol
α -Terpineol	0.59	[0.64]*	Monoterpenic alcohol
Myrtenal	0.05	0.04	Monoterpenic aldehyde
Myrtenol	0.03	0.05*	Monoterpenic alcohol
Verbenone	0.07*	0.05	Monoterpenic ketone
Unknown	[0.07]*	[0.05]*	Oxygenated monoterpene
Car-2-en-4-one?	0.03*	0.01	Monoterpenic ketone
<i>trans</i> -Carveol	[0.03]*	0.02	Monoterpenic alcohol
Unknown	[0.03]*		Unknown
<i>cis</i> -Carveol	0.02*	0.01	Monoterpenic alcohol
Thymol methyl ether	[0.02]*	2.05*	Monoterpenic ether
Unknown	0.03*	0.04	Oxygenated monoterpene
Carvone	[0.03]*	0.03	Monoterpenic ketone
<i>trans</i> -Ascaridole glycol	0.02	0.06*	Monoterpenic alcohol
Unknown	0.01		Unknown
<i>cis</i> -Ascaridole glycol?	0.77*	0.03	Monoterpenic alcohol
Bornyl acetate	[0.77]*	[0.85]*	Monoterpenic ester
Car-3-en-5-one	0.02	0.02*	Monoterpenic ketone
Unknown	0.04*		Unknown
Unknown	[0.04]*		Unknown
α -Longipinene	0.08	[0.13]*	Sesquiterpene
α -Cubebene	0.04	[0.13]*	Sesquiterpene
Longicyclene	0.03	0.02	Sesquiterpene
α -Ylangene	0.01	0.01	Sesquiterpene
α -Copaene	0.11	0.11	Sesquiterpene
Sativene	0.03	0.02	Sesquiterpene
Longifolene	0.66	0.70	Sesquiterpene
Methyleugenol	0.02		Phenylpropanoid
β -Ylangene	1.97*	0.01	Sesquiterpene
β -Caryophyllene	[1.97]*	[2.05]*	Sesquiterpene
α -Humulene	0.16	0.19	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.02	[0.13]*	Sesquiterpene
γ -Murolene	0.02	0.03	Sesquiterpene
Germacrene D	0.01	0.02	Sesquiterpene
α -Murolene	0.04	0.03	Sesquiterpene
β -Bisabolene	0.03*	0.01	Sesquiterpene
γ -Cadinene	[0.03]*	0.03	Sesquiterpene
δ -Cadinene	0.15	0.13	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.02	0.02	Sesquiterpene
Isocaryophyllene epoxide B	0.06*	[0.02]*	Sesquiterpenic ether
α -Elemol	[0.06]*	[0.04]*	Sesquiterpenic alcohol
Caryophyllene oxide	0.29*	0.25	Sesquiterpenic ether

Caryophyllene oxide isomer	[0.29]*	0.06	Sesquiterpenic ether
Humulene epoxide I	0.01	0.01	Sesquiterpenic ether
Humulene epoxide II	0.03	0.03	Sesquiterpenic ether
10-epi- γ -Eudesmol	0.01	[0.06]*	Sesquiterpenic alcohol
Caryophylladienol I	0.01	0.01	Sesquiterpenic alcohol
τ -Cadinol	0.02	0.01	Sesquiterpenic alcohol
β -Eudesmol	0.02	0.05	Sesquiterpenic alcohol
α -Eudesmol	0.02	0.05*	Sesquiterpenic alcohol
Bulnesol	0.04	[0.05]*	Sesquiterpenic alcohol
Unknown	0.01		Unknown
Beyerene	0.02	0.05	Diterpene
meta-Camphorene	0.03		Diterpene
para-Camphorene	0.02	0.02	Diterpene
Unknown	0.05		Unknown
Total identified	99.29%	97.66%	

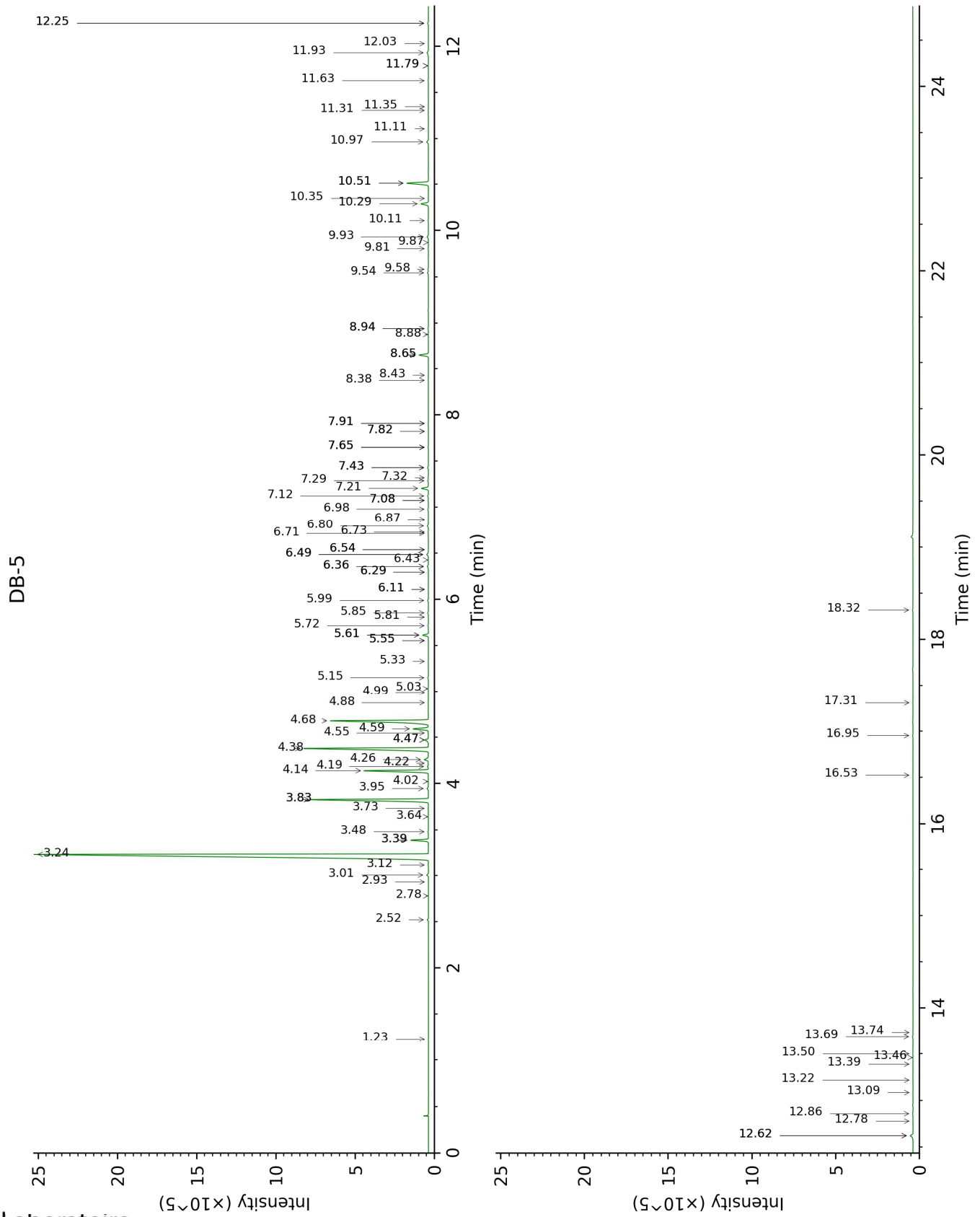
*: Two or more compounds are coeluting on this column

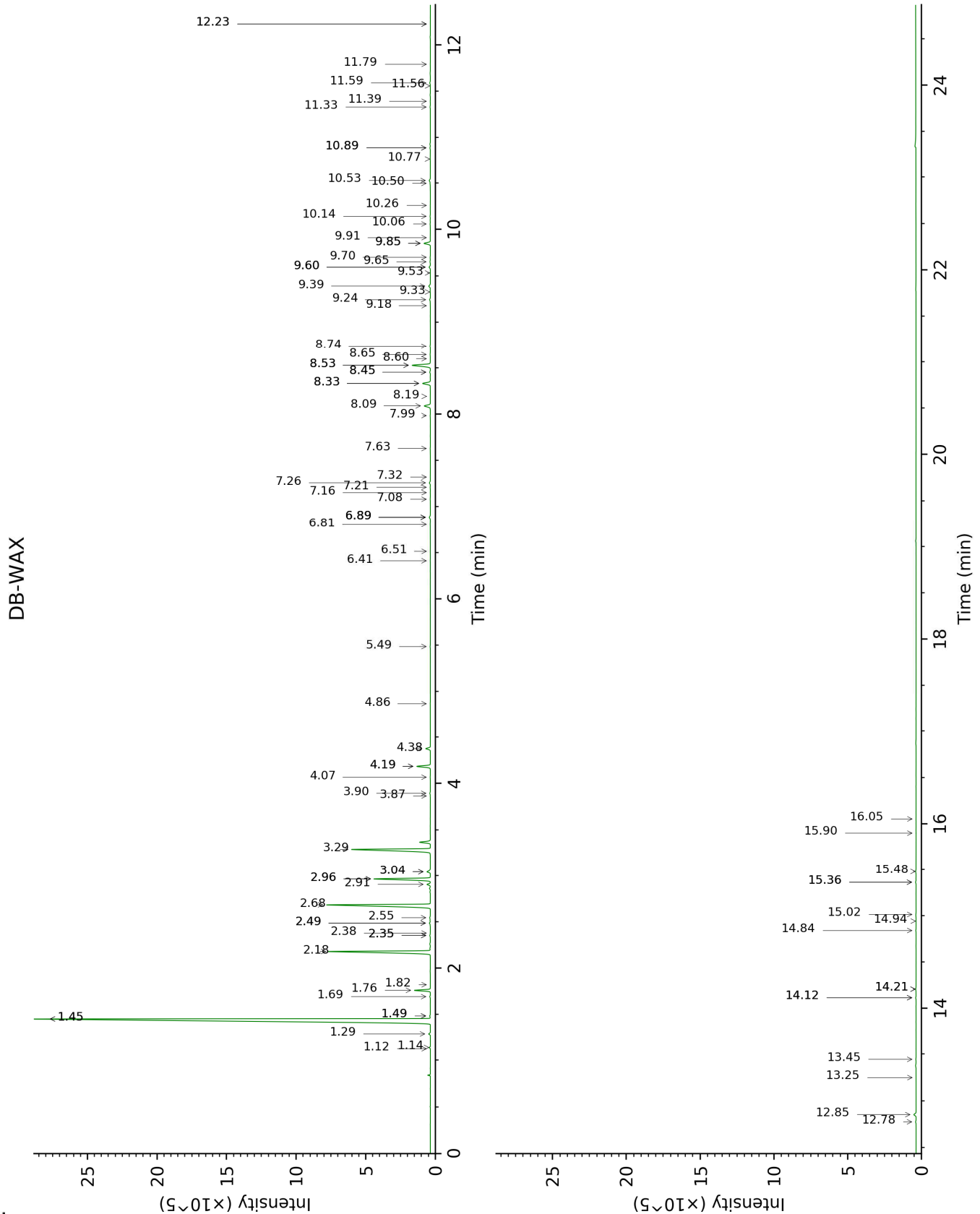
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	1.49*	1004	0.05
Santene	2.52	881	0.07	1.14	953	0.07
Bornylene	2.78	902	tr	1.12	951	tr
Hashishene	2.93	912	0.01	1.45*	999	53.13
Tricyclene	3.01	917	0.13	1.29	975	0.13
α -Thujene	3.12	925	0.04	1.49*	1004	[0.05]
α -Pinene	3.24	932	53.43	1.45*	999	[53.13]
Camphene	3.39*	942	1.23	1.76	1029	1.19
α -Fenchene	3.39*	942	[1.23]	1.69	1023	0.04
Thuja-2,4(10)-diene	3.48	948	0.04	2.35*	1086	0.05
Unknown [m/z 121, 93 (86), 79 (71), 67 (62), 55 (49)... 136 (24)]	3.64	959	0.02			
meta-Cymene	3.73	965	0.03	2.96*	1136	4.96
β -Pinene	3.83*	971	9.91	2.18	1069	9.77
Sabinene	3.83*	971	[9.91]	2.38	1088	0.01
Unknown [m/z 93, 79 (73), 67 (49), 95 (42), 91 (41), 121 (38)...]	3.95	979	0.11	2.55	1103	0.07
<i>cis</i> -Carane	4.02	984	0.01	1.82	1035	tr
Myrcene	4.14	992	4.97	2.96*	1136	[4.96]
2-Carene	4.19	995	0.07	2.49*	1098	0.09
<i>trans</i> -Carane?	4.22	997	0.02	2.35*	1086	[0.05]
α -Phellandrene	4.26	1000	0.37	2.91	1131	0.29
Δ 3-Carene	4.38	1007	11.01	2.68	1114	10.97
α -Terpinene	4.47*	1013	0.33	3.04*	1142	0.33
1,4-Cineole	4.47*	1013	[0.33]	3.04*	1142	[0.33]
Carvomenthene	4.55	1018	0.03	2.49*	1098	[0.09]
para-Cymene	4.59	1021	1.25	4.19*	1232	1.25
Limonene	4.68	1026	9.38	3.29	1162	8.31
(<i>Z</i>)- β -Ocimene	4.88	1038	0.01	3.87	1207	0.01
Unknown [m/z 93, 136 (45), 79 (41), 91 (33), 77 (25)...]	4.99	1046	0.01			
(<i>E</i>)- β -Ocimene	5.03	1048	0.02	4.07	1223	0.02
γ -Terpinene	5.15	1056	0.04	3.90	1210	0.05
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.33	1067	0.02	4.86	1284	0.02
Isoterpinolene	5.55*	1081	0.01	4.19*	1232	[1.25]
Unknown [m/z 43, 94 (63), 109	5.55*	1081	[0.01]	7.32	1455	0.01

(61), 59 (55), 79 (51)...152 (2)]						
Terpinolene	5.61*	1085	0.44	4.38	1246	0.42
para-Cymenene	5.61*	1085	[0.44]	6.41	1387	0.02
α-Pinene oxide	5.72	1091	0.04	5.49	1320	0.03
Unknown [m/z 109, 43 (65), 95 (54), 119 (50), 91 (47)... 149 (8)...]	5.81	1097	0.01			
Verbenol analog?	5.85	1100	0.05	8.33*	1532	0.85
endo-Fenchol	5.99	1109	0.06	8.45*	1542	0.07
α-Campholenal	6.11*	1116	0.02	7.08	1437	0.02
exo-Fenchol	6.11*	1116	[0.02]			
cis-Limonene oxide	6.29*	1128	0.01	6.51	1395	0.01
4-Hydroxy-4-methylcyclohex-2-enone	6.29*	1128	[0.01]	14.12*	2031	0.04
1-Terpineol	6.36*	1132	0.10	8.45*	1542	[0.07]
trans-Pinocarveol	6.36*	1132	[0.10]	9.24	1604	0.10
cis-Verbenol	6.43	1137	0.02	9.33	1611	0.02
Epoxyterpinolene	6.48*	1141	0.16	6.81	1417	0.02
trans-Verbenol	6.48*	1141	[0.16]	9.60*	1632	0.13
Camphene hydrate	6.54*	1144	0.01	8.60	1553	0.02
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.54*	1144	[0.01]	6.89*	1423	0.13
Phellandrenol analog I	6.71	1156	0.02			
Pinocarvone	6.73	1156	0.02	7.99	1505	0.03
Borneol	6.80	1161	0.08	9.85*	1654	0.64
trans-2-Caren-4-ol?	6.87	1166	0.01			
Terpinen-4-ol	6.98	1173	0.05	8.65	1557	0.04
meta-Cymen-8-ol	7.08*	1179	0.03	11.56	1797	0.01
Cryptone	7.08*	1179	[0.03]	9.18	1598	0.01
para-Cymen-8-ol	7.12	1182	0.07	11.59	1800	0.08
α-Terpineol	7.21	1188	0.59	9.85*	1654	[0.64]
Myrtenal	7.29	1193	0.05	8.74	1564	0.04
Myrtenol	7.32	1195	0.03	10.89*	1740	0.05
Verbenone	7.43*	1202	0.07	9.65	1637	0.05
Unknown [m/z 109, 91 (100), 81 (88), 94 (75), 119 (74), 96 (73), 41 (63)... 150 (2)]	7.43*	1202	[0.07]	10.89*	1740	[0.05]
Car-2-en-4-one?	7.65*	1217	0.03	9.53	1627	0.01
trans-Carveol	7.65*	1217	[0.03]	11.39	1783	0.02
Unknown [m/z 43, 97 (72), 41	7.65*	1217	[0.03]			

(44), 71 (27), 55 (26), 82 (25)...						
<i>cis</i> -Carveol	7.82*	1229	0.02	11.79	1818	0.01
Thymol methyl ether	7.82*	1229	[0.02]	8.53*	1548	2.05
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.91*	1235	0.03	11.33	1778	0.04
Carvone	7.91*	1235	[0.03]	10.06	1670	0.03
<i>trans</i> -Ascaridole glycol	8.38	1267	0.02	14.21*	2040	0.06
Unknown [m/z 83, 43 (68), 69 (67), 41 (39), 82 (38), 98 (37)...	8.43	1270	0.01			
<i>cis</i> -Ascaridole glycol?	8.65*	1285	0.77	14.84	2102	0.03
Bornyl acetate	8.65*	1285	[0.77]	8.33*	1532	[0.85]
Car-3-en-5-one	8.88	1301	0.02	12.23*	1856	0.02
Unknown [m/z 112, 97 (93), 83 (60), 43 (46), 41 (20), 69 (19)...	8.94*	1306	0.04			
Unknown [m/z 69, 41 (79), 91 (56), 92 (54), 79 (50), 77 (35)...	8.94*	1306	[0.04]			
α -Longipinene	9.54	1345	0.08	6.89*	1423	[0.13]
α -Cubebene	9.58	1347	0.04	6.89*	1423	[0.13]
Longicyclene	9.81	1363	0.03	7.21	1447	0.02
α -Ylangene	9.87	1368	0.01	7.16	1443	0.01
α -Copaene	9.93	1372	0.11	7.26	1451	0.11
Sativene	10.11	1385	0.03	7.63	1478	0.02
Longifolene	10.29	1398	0.66	8.09	1514	0.70
Methyleugenol	10.35	1402	0.02			
β -Ylangene	10.51*	1414	1.97	8.19	1522	0.01
β -Caryophyllene	10.51*	1414	[1.97]	8.53*	1548	[2.05]
α -Humulene	10.97	1448	0.16	9.39	1616	0.19
(<i>E</i>)- β -Farnesene	11.11	1458	0.02	9.60*	1632	[0.13]
γ -Muuroleone	11.31	1473	0.02	9.70	1641	0.03
Germacrene D	11.35	1476	0.01	9.91	1658	0.02
α -Muuroleone	11.63	1497	0.04	10.14	1677	0.03
β -Bisabolene	11.79*	1510	0.03	10.26	1687	0.01
γ -Cadinene	11.79*	1510	[0.03]	10.50	1707	0.03
δ -Cadinene	11.93	1521	0.15	10.53	1709	0.13
<i>trans</i> -Cadina-1,4-diene	12.03	1529	0.02	10.77	1730	0.02
Isocaryophyllene epoxide B	12.25*	1546	0.06	12.23*	1856	[0.02]
α -Elemol	12.25*	1546	[0.06]	14.12*	2031	[0.04]
Caryophyllene	12.62*	1575	0.29	12.85	1913	0.25

oxide						
Caryophyllene oxide isomer	12.62*	1575	[0.29]	12.78	1906	0.06
Humulene epoxide I	12.78	1588	0.01	13.25	1950	0.01
Humulene epoxide II	12.86	1594	0.03	13.45	1968	0.03
10-epi- γ -Eudesmol	13.08	1612	0.01	14.21*	2040	[0.06]
Caryophylladienol I	13.22	1623	0.01	16.05	2224	0.01
τ -Cadinol	13.39	1638	0.02	14.94	2112	0.01
β -Eudesmol	13.46	1643	0.02	15.48	2166	0.05
α -Eudesmol	13.50	1647	0.02	15.36*	2154	0.05
Bulnesol	13.69	1663	0.04	15.36*	2154	[0.05]
Unknown [m/z 91, 93 (81), 79 (81), 41 (79), 69 (76), 105 (66)...]	13.74	1666	0.01			
Beyerene	16.53	1912	0.02	15.02	2119	0.05
meta-Camphorene	16.96	1953	0.03			
para-Camphorene	17.31	1986	0.02	15.90	2208	0.02
Unknown [m/z 191, 81 (47), 95 (41), 69 (39), 109 (32), 93 (32)...]	18.32	2086	0.05			
Total identified		99.29%			97.66%	
Total reported		99.52%			97.80%	

*: 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