

Date : August 20, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21H17-ORA04

Customer identification : Pine - Hungary - 3 years - OIL-SINGLE-4

Type : Essential oil

Source : *Pinus sylvestris*

Customer : Organic Aromas Inc.

ANALYSIS

Method: PC-MAT-014  - 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 2014-005

Analysis date : August 19, 2021

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid

Refractive index: 1.4752 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

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

ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

New readers of similar reports are encouraged to read table footnotes at least once.

Identification	%	Class
Toluene	0.01	Simple phenolic
Unknown	tr	Alkene
Cyclofenchene	tr	Monoterpene
Santene	0.13	Normonoterpene
Unknown	0.01	Unknown
Tricyclene	0.18	Monoterpene
α -Thujene	0.02	Monoterpene
α -Pinene	33.47	Monoterpene
α -Fenchene	0.04	Monoterpene
Camphene	1.90	Monoterpene
Thuja-2,4(10)-diene	0.05	Monoterpene
Unknown	0.01	Monoterpene
Unknown	0.08	Unknown
β -Pinene	19.44	Monoterpene
Sabinene	0.03	Monoterpene
Unknown	0.03	Monoterpene
<i>cis</i> -Carane	0.03	Monoterpene
Myrcene	1.17	Monoterpene
<i>trans</i> -Carane?	0.07	Monoterpene
α -Phellandrene	0.03	Monoterpene
Pseudolimonene	0.09	Monoterpene
Δ^3 -Carene	16.99	Monoterpene
α -Terpinene	0.24	Monoterpene
ortho-Cymene	0.02	Monoterpene
Carvomenthene	0.04	Aliphatic alcohol
para-Cymene	1.76	Monoterpene
β -Phellandrene	0.24	Monoterpene
Limonene	10.26	Monoterpene
1,8-Cineole	0.11	Monoterpenic ether
Cymene analog	0.01	Monoterpene
(<i>Z</i>)- β -Ocimene	0.01	Monoterpene
(<i>E</i>)- β -Ocimene	0.01	Monoterpene
γ -Terpinene	0.01	Monoterpene
Unknown	0.05	Oxygenated monoterpene
Unknown	0.01	Monoterpene
2,6-Dimethylstyrene?	0.01	Simple phenolic
Isoterpinolene	0.01	Monoterpene
Terpinolene	0.10	Monoterpene
para-Cymenene	0.02	Monoterpene
α -Pinene oxide	0.15	Monoterpenic ether
Unknown	0.07	Unknown
Verbenol analog?	0.08	Monoterpenic alcohol
Linalool	0.01	Monoterpenic alcohol
endo-Fenchol	0.11	Monoterpenic alcohol
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.04	Monoterpenic alcohol

α -Campholenal	0.01	Monoterpenic aldehyde
<i>cis</i> -Limonene oxide	0.06	Monoterpenic ether
<i>trans</i> -Limonene oxide	0.05	Monoterpenic ether
<i>trans</i> -Pinocarveol	0.35	Monoterpenic alcohol
<i>cis</i> -Verbenol	0.02	Monoterpenic alcohol
<i>trans</i> -Verbenol	0.04	Monoterpenic alcohol
Camphene hydrate	0.04	Monoterpenic alcohol
Epoxyterpinolene	0.13	Monoterpenic ether
β -Pinene oxide	0.03	Monoterpenic ether
Pinocarvone	0.03	Monoterpenic ketone
Borneol	0.19	Monoterpenic alcohol
Unknown	0.11	Unknown
Terpinen-4-ol	0.04	Monoterpenic alcohol
meta-Cymen-8-ol	0.04	Monoterpenic alcohol
para-Cymen-8-ol	0.16	Monoterpenic alcohol
Myrtenal	0.08	Monoterpenic aldehyde
α -Terpineol	0.81	Monoterpenic alcohol
Myrtenol	0.19	Monoterpenic alcohol
Methylchavicol	0.03	Phenylpropanoid
<i>cis</i> - α -Phellandrene epoxide (IPP vs Me)	0.02	Monoterpenic ether
Unknown	0.01	Unknown
Unknown	0.10	Oxygenated monoterpene
Verbenone	0.02	Monoterpenic ketone
<i>trans</i> -Carveol	0.06	Monoterpenic alcohol
<i>cis</i> -Carveol	0.04	Monoterpenic alcohol
Citronellol	0.01	Monoterpenic alcohol
Carvone	0.03	Monoterpenic ketone
Car-3-en-2-one	0.03	Monoterpenic ketone
Piperitone	0.02	Monoterpenic ketone
Bornyl acetate	1.92	Monoterpenic ester
Unknown	0.05	Oxygenated monoterpene
Unknown	0.04	Unknown
Car-3-en-5-one	0.10	Monoterpenic ketone
para-Menth-5-en-1,2-diol isomer III	0.04	Monoterpenic alcohol
para-Mentha-1,8-diene-4-hydroperoxide	0.01	Monoterpenic peroxide
α -Longipinene	0.13	Sesquiterpene
α -Cubebene	0.05	Sesquiterpene
α -Terpinyl acetate	0.01	Monoterpenic ester
Longicyclene	0.05	Sesquiterpene
α -Ylangene	0.03	Sesquiterpene
α -Copaene	0.10	Sesquiterpene
Unknown	0.10	Unknown
β -Bourbonene	0.01	Sesquiterpene
Geranyl acetate	0.02	Monoterpenic ester
Sativene	0.03	Sesquiterpene
β -Cubebene	0.03	Sesquiterpene
β -Elemene	0.01	Sesquiterpene
allo-Isolongifolene	0.02	Sesquiterpene
Longifolene	1.59	Sesquiterpene
Methyleugenol	0.03	Phenylpropanoid
β -Caryophyllene	1.19	Sesquiterpene
β -Copaene	0.03	Sesquiterpene

6,9-Guaiadiene	0.01	Sesquiterpene
Cadina-3,5-diene?	0.01	Sesquiterpene
α-Humulene	0.14	Sesquiterpene
γ-Muurolene	0.04	Sesquiterpene
β-Selinene	0.03	Sesquiterpene
α-Muurolene	0.07	Sesquiterpene
γ-Cadinene	0.04	Sesquiterpene
β-Bisabolene	0.07	Sesquiterpene
<i>trans</i> -Calamenene	0.15	Sesquiterpene
δ-Cadinene	0.27	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.03	Sesquiterpene
α-Cadinene	0.01	Sesquiterpene
α-Calacorene	0.03	Sesquiterpene
Isocaryophyllene epoxide B	0.11	Sesquiterpenic ether
Unknown	0.08	Oxygenated sesquiterpene
Caryophyllenyl alcohol	0.04	Sesquiterpenic alcohol
Germacrene D-4-ol	0.03	Sesquiterpenic alcohol
Caryophyllene oxide	1.29	Sesquiterpenic ether
Caryophyllene oxide isomer	0.27	Sesquiterpenic ether
Longiborneol	0.01	Sesquiterpenic alcohol
Humulene epoxide I	0.03	Sesquiterpenic ether
Guaiol	0.01	Sesquiterpenic alcohol
Humulene epoxide II	0.13	Sesquiterpenic ether
10-epi-γ-Eudesmol	0.04	Sesquiterpenic alcohol
1-epi-Cubenol	0.01	Sesquiterpenic alcohol
Humulene 9,10-epoxide	0.02	Sesquiterpenic ether
Caryophylladienol II	0.04	Sesquiterpenic alcohol
τ-Muurolol	0.02	Sesquiterpenic alcohol
β-Eudesmol	0.01	Sesquiterpenic alcohol
Unknown	0.03	Oxygenated sesquiterpene
meta-Camphorene	0.02	Diterpene
Unknown	0.01	Norditerpene
para-Camphorene	0.01	Diterpene
Unknown	0.01	Unknown
Consolidated total	98.58%	

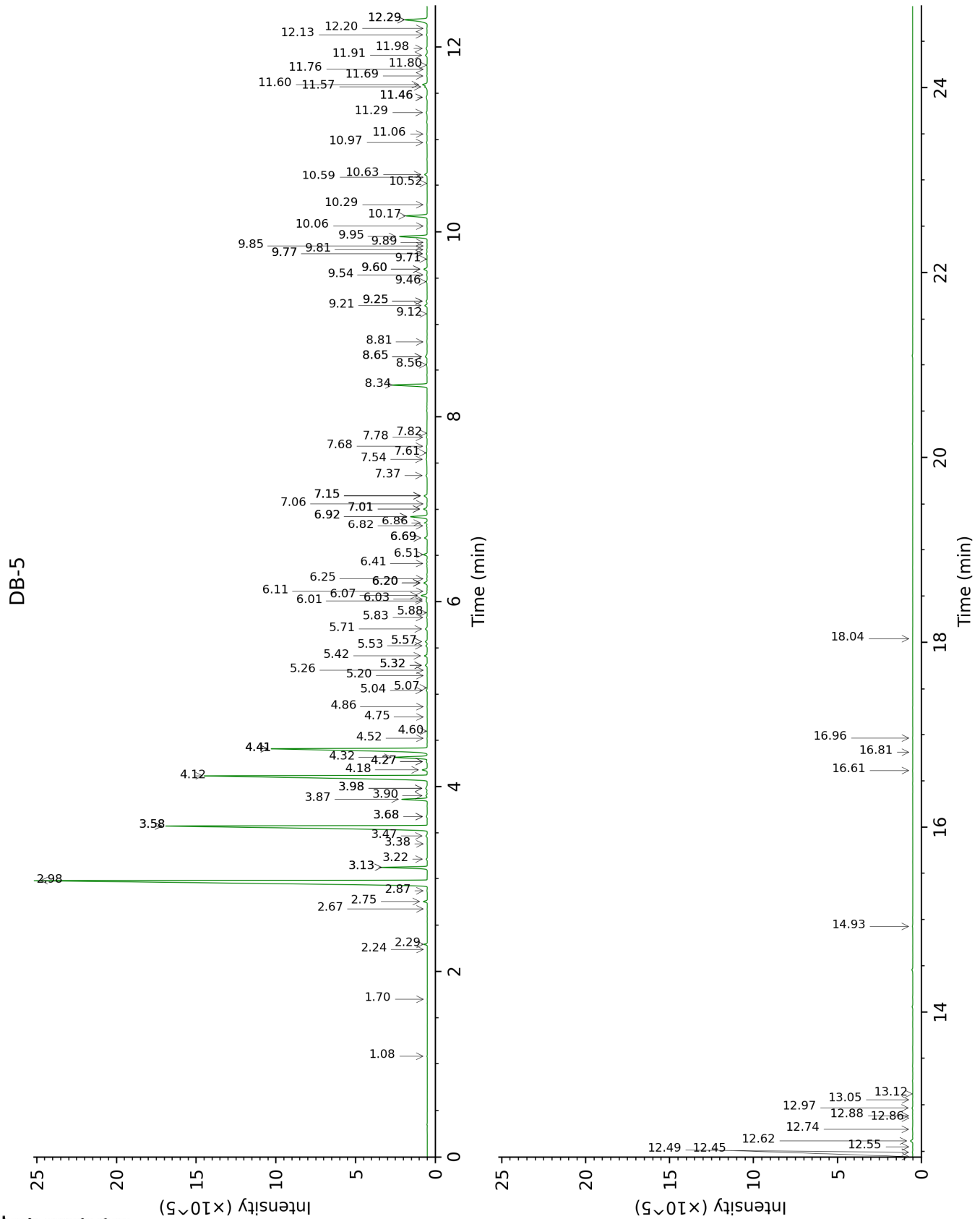
tr: The compound has been detected below 0.005% of total signal.

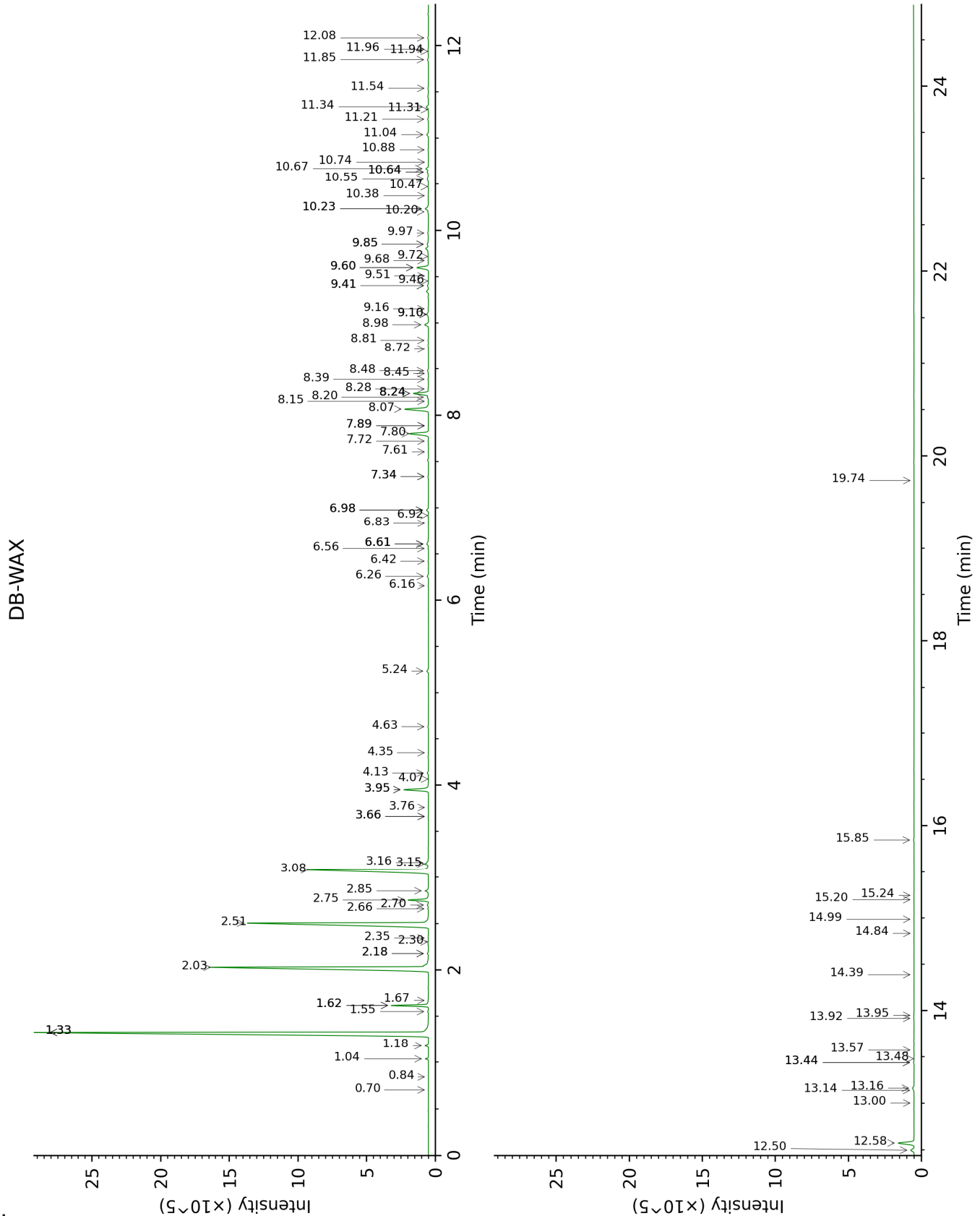
Note: no correction factor was applied

About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm is set to prioritize data from the most standard DB-5 column, and smallest values so as to avoid overestimating individual content. This process is semi-automatic. Advanced users are invited to consult the "Full analysis data" table after the chromatograms in this report to access the full untreated data and perform their own calculations if needed.

Unknowns: Unknown compounds' mass spectral data is presented in the "Full analysis data" table. The occurrence of unknown compounds is to be expected in many samples, and does not denote particular problems unless noted otherwise in the conclusion.

This page was intentionally left blank. The following pages present the complete data of the analysis.





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Toluene	1.08	758	0.01	1.33*	997	33.46
Unknown [m/z 109, 67 (32), 81 (14), 41 (12), 124 (10)]	1.70	831	tr	0.70	881	tr
Cyclofenchene	2.24	878	tr	0.84	915	tr
Santene	2.29	883	0.13	1.04	948	0.13
Unknown [m/z 69, 93 (91), 41 (88), 79 (22), 40 (20), 91 (17)...]	2.68	913	0.01	1.62*	1027	1.91
Tricyclene	2.76	918	0.18	1.18	972	0.18
α -Thujene	2.87	926	0.02	1.33*	997	[33.46]
α -Pinene	2.98	934	33.47	1.33*	997	[33.46]
α -Fenchene	3.13*	944	1.97	1.55	1020	0.04
Camphene	3.13*	944	[1.97]	1.62*	1027	[1.91]
Thuja-2,4(10)-diene	3.22	950	0.05	2.18*	1084	0.08
Unknown [m/z 121, 93 (86), 79 (71), 67 (62), 55 (49)... 136 (24)]	3.38	961	0.01			
Unknown [m/z 93, 79 (62), 121 (37), 67 (35), 107 (34), 91 (33)...]	3.47	967	0.08			
β -Pinene	3.58*	974	19.49	2.03	1069	19.44
Sabinene	3.58*	974	[19.49]	2.18*	1084	[0.08]
Unknown [m/z 93, 79 (73), 67 (49), 95 (42), 91 (41), 121 (38)...]	3.68*	981	0.06	2.30	1097	0.03
<i>cis</i> -Carane	3.68*	981	[0.06]	1.67	1032	0.03
Myrcene	3.86	993	1.17	2.76	1133	1.26
<i>trans</i> -Carane?	3.90	996	0.07			
α -Phellandrene	3.98*	1001	0.12	2.66	1126	0.03
Pseudolimonene	3.98*	1001	[0.12]	2.70	1129	0.09
Δ^3 -Carene	4.12	1010	16.99	2.51	1113	16.93
α -Terpinene	4.18	1014	0.24	2.85	1141	0.24
ortho-Cymene	4.27*	1020	0.06	3.95*	1228	1.79
Carvomenthene	4.27*	1020	[0.06]	2.35	1100	0.04
para-Cymene	4.32	1023	1.76	3.95*	1228	[1.79]
β -Phellandrene	4.41*	1028	10.66	3.15	1165	0.24
Limonene	4.41*	1028	[10.66]	3.08	1160	10.26
1,8-Cineole	4.41*	1028	[10.66]	3.16	1166	0.11
Cymene analog	4.52	1036	0.01	4.35	1258	0.02
(<i>Z</i>)- β -Ocimene	4.60	1040	0.01	3.66*	1206	0.02
(<i>E</i>)- β -Ocimene	4.75	1050	0.01	3.76	1214	0.01

γ-Terpinene	4.86	1057	0.01	3.66*	1206	[0.02]
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.04	1069	0.05	4.63	1279	0.05
Unknown [m/z 93, 79 (79), 136 (53), 107 (44), 91 (43), 67 (43), 121 (34), 41 (28)]	5.07	1070	0.01			
2,6-Dimethylstyrene?	5.20	1079	0.01			
Isoterpinolene	5.26	1082	0.01	4.07	1237	0.01
Terpinolene	5.32*	1086	0.11	4.13	1241	0.10
para-Cymenene	5.32*	1086	[0.11]	6.16	1385	0.02
α-Pinene oxide	5.42	1092	0.15	5.24	1318	0.14
Unknown [m/z 109, 43 (65), 95 (54), 119 (50), 91 (47)... 149 (8)...]	5.53	1099	0.07			
Verbenol analog?	5.57*	1102	0.10	8.20	1538	0.08
Linalool	5.57*	1102	[0.10]	7.89*	1514	0.02
endo-Fenchol	5.71	1111	0.11	8.24*	1542	1.19
trans-para-Mentha-2,8-dien-1-ol	5.83	1119	0.04	8.82	1587	0.04
α-Campholenal	5.88	1122	0.01	6.83	1435	0.01
cis-Limonene oxide	6.01	1130	0.06	6.26	1392	0.11
trans-Limonene oxide	6.03	1131	0.05	6.42	1404	0.03
trans-Pinocarveol	6.07	1134	0.35	8.98	1600	0.31
cis-Verbenol	6.11	1137	0.02	9.10*	1609	0.17
trans-Verbenol	6.20*	1143	0.21	9.41*	1634	0.08
Camphene hydrate	6.20*	1143	[0.21]	8.28	1545	0.04
Epoxyterpinolene	6.20*	1143	[0.21]	6.61*	1418	0.17
β-Pinene oxide	6.25	1145	0.03	6.56	1414	0.03
Pinocarvone	6.41	1156	0.03	7.72	1502	0.05
Borneol	6.51	1162	0.19	9.60*	1650	1.00
Unknown [m/z 109, 71 (66), 43 (55), 93 (55), 69 (43), 91 (43)...]	6.69*	1174	0.15			
Terpinen-4-ol	6.69*	1174	[0.15]	8.39	1553	0.04
meta-Cymen-8-ol	6.82	1182	0.04	11.31	1793	0.02
para-Cymen-8-ol	6.86	1184	0.16	11.34	1796	0.17
Myrtenal	6.92*	1189	0.93	8.48	1561	0.08
α-Terpineol	6.92*	1189	[0.93]	9.60*	1650	[1.00]
Myrtenol	7.01*	1194	0.21	10.67	1739	0.19
Methylchavicol	7.01*	1194	[0.21]	9.16	1614	0.03

<i>cis</i> - α -Phellandrene epoxide (IPP vs Me)	7.06	1198	0.02	10.88	1756	0.03
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.15*	1203	0.20	10.74	1745	0.01
Unknown [m/z 109, 91 (100), 81 (88), 94 (75), 119 (74), 96 (73), 41 (63)... 150 (2)]	7.15*	1203	[0.20]	10.64*	1736	0.10
Verbenone	7.15*	1203	[0.20]	9.46	1638	0.02
<i>trans</i> -Carveol	7.37	1218	0.06	11.21	1784	0.06
<i>cis</i> -Carveol	7.54	1230	0.04	11.54	1813	0.04
Citronellol	7.61	1234	0.01	10.56	1729	0.14
Carvone	7.68	1239	0.03	9.85*	1670	0.11
Car-3-en-2-one	7.78	1246	0.03	10.23*	1702	0.29
Piperitone	7.82	1249	0.02	9.72	1660	0.04
Bornyl acetate	8.34	1284	1.92	8.07	1528	2.01
Unknown [m/z 43, 93 (66), 91 (44), 41 (38), 69 (35)... 152? (1)]	8.56	1298	0.05			
Unknown [m/z 69, 41 (79), 91 (59), 92 (55), 79 (52), 107 (40)...]	8.65*	1304	0.14			
Car-3-en-5-one	8.65*	1304	[0.14]	11.85	1841	0.10
para-Menth-5-en-1,2-diol isomer III	8.82	1316	0.04	14.99	2136	0.03
para-Mentha-1,8-diene-4-hydroperoxide	9.12	1337	0.01			
α -Longipinene	9.21	1344	0.13	6.61*	1418	[0.17]
α -Cubebene	9.25*	1347	0.06	6.61*	1418	[0.17]
α -Terpinyl acetate	9.25*	1347	[0.06]	9.51	1643	0.01
Longicyclene	9.46	1362	0.05	6.98*	1446	0.15
α -Ylangene	9.54	1367	0.03	6.92	1442	0.04
α -Copaene	9.60*	1371	0.19	6.98*	1446	[0.15]
Unknown [m/z 93, 43 (59), 41 (40), 91 (40), 69 (33), 77 (22)...]	9.60*	1371	[0.19]			
β -Bourbonene	9.71	1379	0.01	7.34*	1473	0.05
Geranyl acetate	9.76*	1383	0.05	10.38	1714	0.02
Sativene	9.76*	1383	[0.05]	7.34*	1473	[0.05]
β -Cubebene	9.81	1386	0.03	7.61	1493	0.02
β -Elemene	9.85	1389	0.01	8.24*	1542	[1.19]

allo-Isolongifolene	9.89	1392	0.02	7.89*	1514	[0.02]
Longifolene	9.95	1396	1.59	7.80	1508	1.59
Methyleugenol	10.06	1404	0.03	13.14	1958	0.02
β-Caryophyllene	10.17	1412	1.19	8.24*	1542	[1.19]
β-Copaene	10.29	1421	0.03	8.15	1535	0.02
6,9-Guaiadiene	10.52	1438	0.01	8.45	1558	0.01
Cadina-3,5-diene?	10.59	1443	0.01	8.72	1579	0.01
α-Humulene	10.63	1446	0.14	9.10*	1609	[0.17]
γ-Murolene	10.97	1472	0.04	9.41*	1634	[0.08]
β-Selinene	11.06	1479	0.03	9.68	1656	0.03
α-Murolene	11.29	1496	0.07	9.85*	1670	[0.11]
γ-Cadinene	11.46*	1508	0.09	10.20	1699	0.04
β-Bisabolene	11.46*	1508	[0.09]	9.97	1680	0.07
<i>trans</i> -Calamenene	11.57	1517	0.15	11.04	1770	0.15
δ-Cadinene	11.60	1519	0.27	10.23*	1702	[0.29]
<i>trans</i> -Cadina-1,4-diene	11.69	1526	0.03	10.47	1722	0.03
α-Cadinene	11.76	1532	0.01	10.64*	1736	[0.10]
α-Calacorene	11.80	1536	0.03	11.94	1849	0.05
Isocaryophyllene epoxide B	11.91	1544	0.11	11.96	1851	0.04
Unknown [m/z 79, 96 (89), 109 (76), 107 (71), 41 (66), 95 (63)... 220 (6)]	11.98	1550	0.08	12.08	1862	0.07
Caryophyllenyl alcohol	12.13	1561	0.04	13.44*	1985	0.04
Germacrene D-4-ol	12.20	1567	0.03	13.48	1989	0.01
Caryophyllene oxide	12.29*	1574	1.58	12.58	1906	1.29
Caryophyllene oxide isomer	12.29*	1574	[1.58]	12.50	1898	0.27
Longiborneol	12.44	1586	0.01	14.39	2077	0.01
Humulene epoxide I	12.49	1590	0.03	13.00	1945	0.02
Guaiol	12.55	1594	0.01	13.95	2034	0.01
Humulene epoxide II	12.62	1599	0.13	13.16	1960	0.14
10-epi-γ-Eudesmol	12.74	1610	0.04	13.92	2031	0.04
1-epi-Cubenol	12.86	1619	0.01	13.57	1998	0.02
Humulene 9,10-epoxide	12.88	1622	0.02	13.44*	1985	[0.04]
Caryophylladienol II	12.97	1628	0.04	15.85	2223	0.05
τ-Murolol	13.06	1636	0.02	14.84	2120	0.01
β-Eudesmol	13.12	1641	0.01	15.24	2162	0.02
Unknown [m/z 109, 123 (96), 127	14.93	1795	0.03			

(95), 55 (87), 81 (85), 41 (69)...220 (5)] meta- Camphorene	16.61	1950	0.02	15.20	2157	0.02
Unknown [m/z 159, 241 (59), 185 (24), 117 (23), 69 (23), 41 (22)... 256 (14)] para- Camphorene	16.81	1969	0.01			
Unknown [m/z 191, 81 (47), 95 (41), 69 (39), 109 (32), 93 (32)...]	16.96	1983	0.01			
	18.04	2090	0.01	19.74	2656	0.01
Total identified	98.36%			97.69%		
Total reported	98.78%			97.86%		

*: Two or more compounds are coeluting on this column

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