

Date : May 25, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 20E21-PTH02

Customer identification : Balsam Fir - Canada - BN0105199R

Type : Essential oil

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

Customer : Plant Therapy

ANALYSIS

Method: PC-MAT-007 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID (in French); identifications validated by GC-MS.

Analyst : Sylvain Mercier, M. Sc., Chimiste

Analysis date : May 22, 2020

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4742 ± 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
Ethanol	tr	Aliphatic alcohol
Isobutyral	0.02	Aliphatic aldehyde
Isovaleral	tr	Aliphatic aldehyde
2-Ethylfuran	0.01	Furan
Toluene	0.01	Simple phenolic
Hexanal	0.01	Aliphatic aldehyde
Octane	tr	Alkane
Ethyl 2-methylbutyrate	0.01	Aliphatic ester
Ethyl isovalerate	0.01	Aliphatic ester
(3Z)-Hexenol	0.05	Aliphatic alcohol
Hexanol	0.02	Aliphatic alcohol
Santene	2.07	Normonoterpene
Styrene	0.01	Simple phenolic
Unknown	0.02	Normonoterpene
Bornylene	0.01	Monoterpene
Tricyclene	0.91	Monoterpene
α -Thujene	0.16	Monoterpene
α -Pinene	15.61	Monoterpene
Camphene	6.32	Monoterpene
α -Fenchene	0.06	Monoterpene
Thuja-2,4(10)-diene	0.04	Monoterpene
Benzaldehyde	0.01	Simple phenolic
meta-Cymene	0.06	Monoterpene
Sabinene	0.10	Monoterpene
β -Pinene	26.96	Monoterpene
Unknown	0.01	Monoterpene
Myrcene	1.68	Monoterpene
2-Carene	0.01	Monoterpene
α -Phellandrene	0.12	Monoterpene
Pseudolimonene	0.02	Monoterpene
Δ^3 -Carene	17.58	Monoterpene
(3Z)-Hexenyl acetate	0.01	Aliphatic ester
α -Terpinene	0.09	Monoterpene
ortho-Cymene	0.01	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
Hexyl acetate	0.05	Aliphatic ester
para-Cymene	0.29	Monoterpene
Limonene	7.91	Monoterpene
β -Phellandrene	5.42	Monoterpene
(Z)- β -Ocimene	0.01	Monoterpene
(E)- β -Ocimene	tr	Monoterpene
γ -Terpinene	0.22	Monoterpene
Unknown	0.01	Oxygenated monoterpene
Fenchone	0.13	Monoterpenic ketone
γ -Campholenal	0.06	Aliphatic alcohol

Isoterpinolene	0.01	Monoterpene
Terpinolene	0.89	Monoterpene
para-Cymenene	0.07	Monoterpene
α -Pinene oxide	0.02	Monoterpenic ether
Unknown	0.01	Unknown
Linalool	0.10	Monoterpenic alcohol
α -Thujone	0.02	Monoterpenic ketone
Nonanal	0.01	Aliphatic aldehyde
endo-Fenchol	0.07	Monoterpenic alcohol
<i>cis</i> -para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
α -Campholenal	0.01	Monoterpenic aldehyde
Nopinone	0.02	Normonoterpenic ketone
<i>cis</i> -Limonene oxide	0.02	Monoterpenic ether
<i>trans</i> -Pinocarveol	0.13	Monoterpenic alcohol
<i>trans</i> -para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
Camphor	0.35	Monoterpenic ketone
Camphene hydrate	0.04	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.02	Monoterpenic alcohol
Isoborneol	0.02	Monoterpenic alcohol
Pinocarvone	0.03	Monoterpenic ketone
Myrtenyl methyl ether	0.01	Monoterpenic ether
Borneol	0.52	Monoterpenic alcohol
α -Phellandren-8-ol	0.02	Monoterpenic alcohol
Isopinocampone	0.05	Monoterpenic ketone
Terpinen-4-ol	0.23	Monoterpenic alcohol
Cryptone	0.06	Normonoterpenic ketone
para-Cymen-8-ol	0.06	Monoterpenic alcohol
α -Terpineol	0.36	Monoterpenic alcohol
Myrtenal	0.07	Monoterpenic aldehyde
Myrtenol	0.08	Monoterpenic alcohol
Methylchavicol	0.03	Phenylpropanoid
Unknown	0.02	Oxygenated monoterpene
Verbenone	0.06	Monoterpenic ketone
Unknown	0.02	Unknown
<i>trans</i> -Piperitol	0.01	Monoterpenic alcohol
endo-Fenchyl acetate	0.05	Monoterpenic ester
3-Methyl-3-butenyl 4-methylvalerate	0.02	Aliphatic ester
Thymol methyl ether	tr	Monoterpenic ether
Citronellol	0.04	Monoterpenic alcohol
Carvone	0.01	Monoterpenic ketone
Piperitone	0.21	Monoterpenic ketone
Geraniol	0.01	Monoterpenic alcohol
Phellandral	0.03	Monoterpenic aldehyde
Isopulegyl acetate	0.02	Monoterpenic ester
Bornyl acetate	7.00	Monoterpenic ester
Isobornyl acetate	0.02	Monoterpenic ester
Thymol	0.03	Monoterpenic alcohol
Isohexyl isocaproate	0.03	Aliphatic ester
Myrtenyl acetate	0.02	Monoterpenic ester
Unknown	0.06	Unknown
α -Longipinene	0.10	Sesquiterpene
α -Terpinyl acetate	0.01	Monoterpenic ester

Citronellyl acetate	0.02	Monoterpenic ester
Longicyclene	0.03	Sesquiterpene
α -Copaene	0.02	Sesquiterpene
Geranyl acetate	0.04	Monoterpenic ester
Sativene	0.01	Sesquiterpene
β -Longipinene	0.02	Sesquiterpene
Longifolene	0.32	Sesquiterpene
Methyleugenol	0.01	Phenylpropanoid
β -Caryophyllene	0.26	Sesquiterpene
Aromadendrene	0.02	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.03	Sesquiterpene
α -Himachalene	0.02	Sesquiterpene
α -Humulene	0.11	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.04	Sesquiterpene
γ -Murolene	0.01	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
γ -Curcumene	0.02	Sesquiterpene
β -Selinene	0.02	Sesquiterpene
<i>trans</i> - β -Bergamotene	0.03	Sesquiterpene
α -Selinene	0.01	Sesquiterpene
β -Himachalene	0.01	Sesquiterpene
α -Murolene	0.03	Sesquiterpene
Methyl (<i>E</i>)-isoeugenol	0.01	Phenylpropanoid
δ -Amorphene	0.01	Sesquiterpene
(<i>Z</i>)- α -Bisabolene	0.01	Sesquiterpene
β -Bisabolene	0.39	Sesquiterpene
δ -Cadinene	0.03	Sesquiterpene
(<i>E</i>)- γ -Bisabolene	0.01	Sesquiterpene
α -Calacorene	0.01	Sesquiterpene
(<i>E</i>)- α -Bisabolene	0.05	Sesquiterpene
(<i>E</i>)-Nerolidol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.05	Sesquiterpenic ether
Humulene epoxide II	0.02	Sesquiterpenic ether
Manoyl oxide	0.01	Diterpenic ether
Abieta-8,12-diene	0.01	Diterpene
(<i>Z</i>)-Abienol	0.01	Diterpenic alcohol
Consolidated total	98.96%	

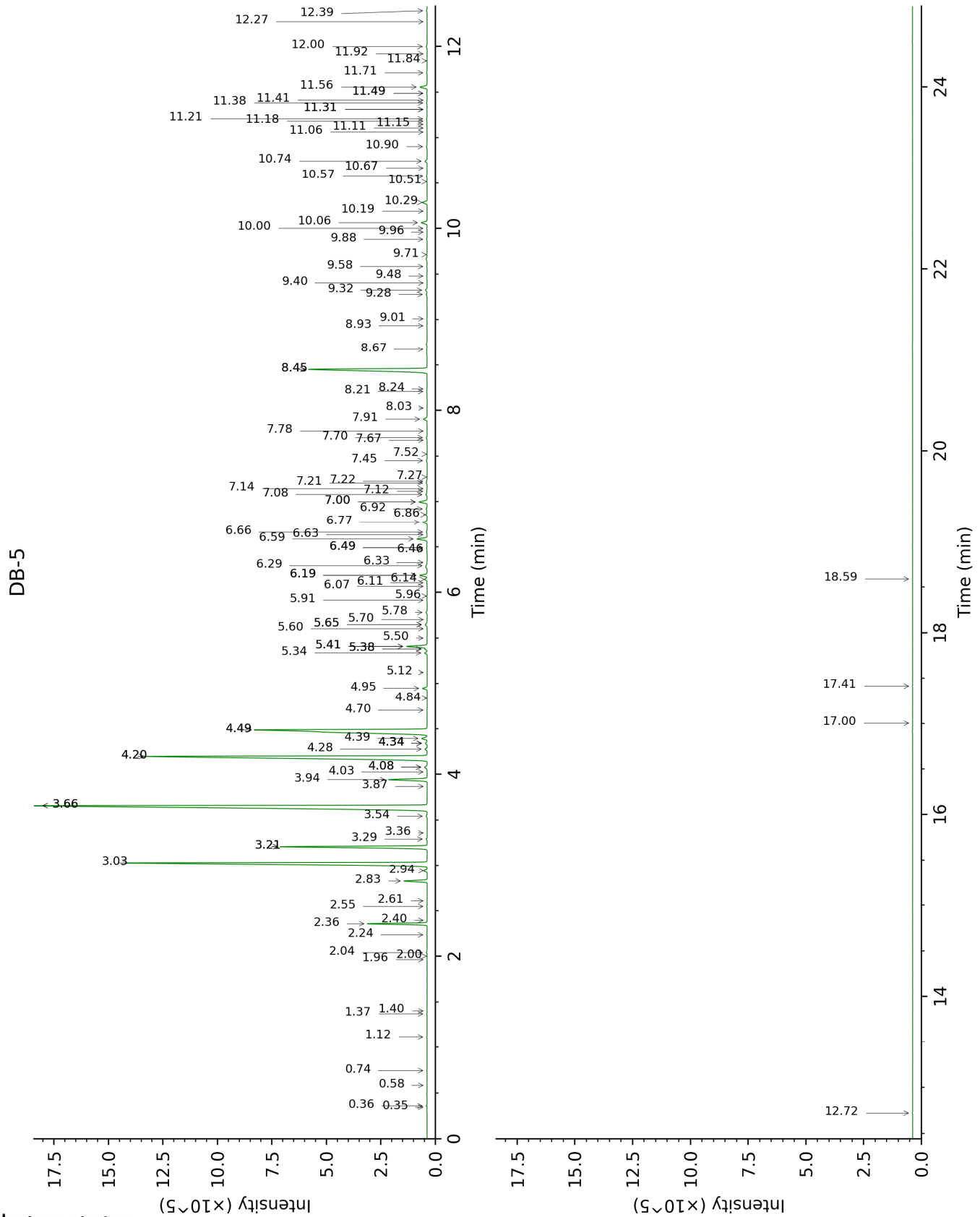
tr: The compound has been detected below 0.005% of total signal.

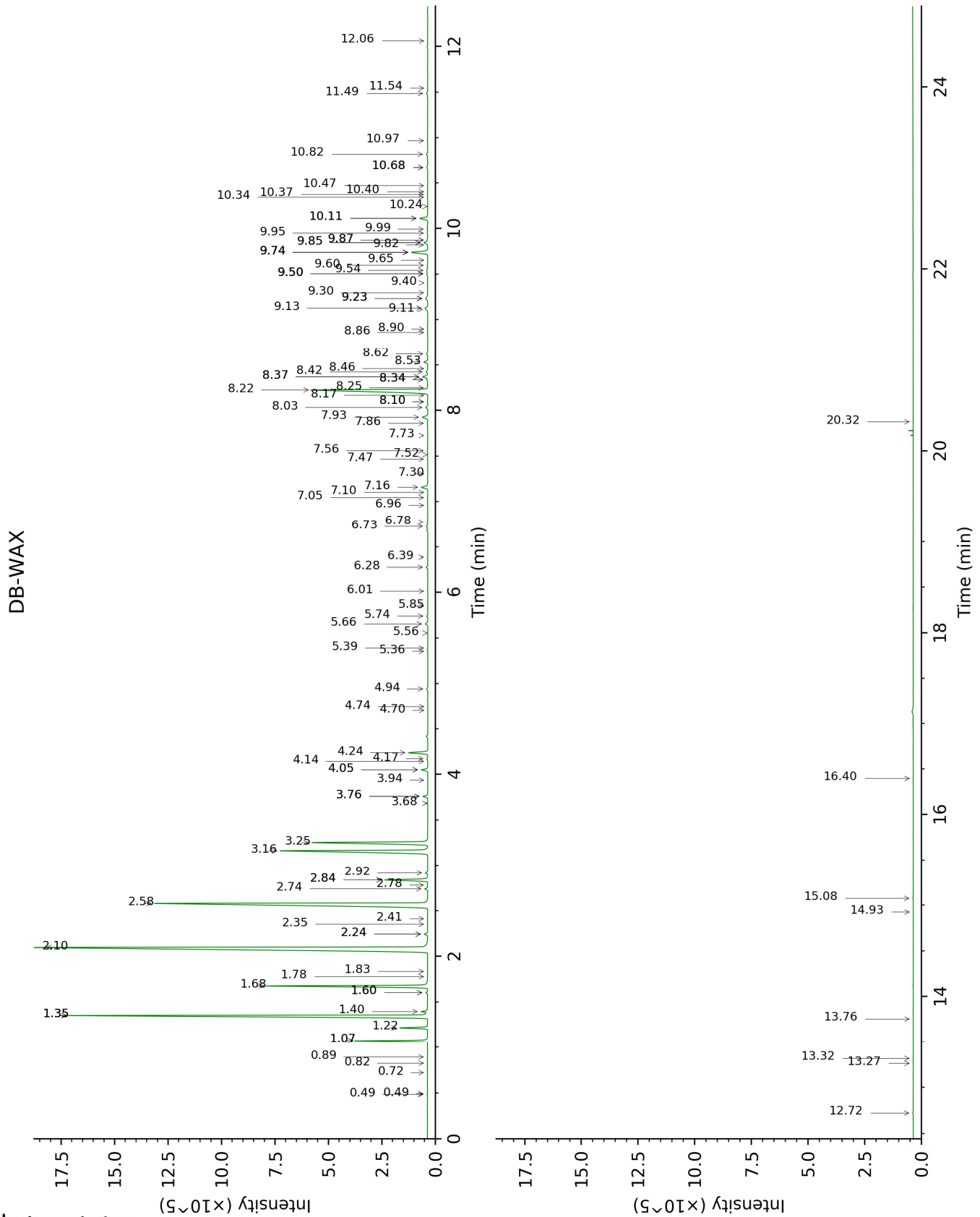
Note: no correction factor was applied

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	%
Ethanol	0.35	522	tr	0.82	910	tr
Isobutyral	0.36	522	0.02	0.49	786	0.01
Isovaleral	0.58	639	tr	0.72	882	tr
2-Ethylfuran	0.74	706	0.01	0.89	921	0.01
Toluene	1.12	762	0.01	1.35*†	996	15.72
Hexanal	1.37	797	0.01	1.84	1045	0.01
Octane	1.40	802	tr	0.49	791	tr
Ethyl 2-methylbutyrate	1.96	850	0.01	1.60*	1022	0.07
Ethyl isovalerate	2.00	853	0.01	1.78	1040	0.01
(3Z)-Hexenol	2.04	856	0.05	5.74	1348	0.04
Hexanol	2.24	873	0.02	5.39	1323	0.02
Santene	2.36	883	2.07	1.07*	950	2.06
Styrene	2.40	886	0.01	3.76*	1208	0.23
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]	2.55	898	0.02	1.35*†	996	[15.72]
Bornylene	2.61	903	0.01	1.07*	950	[2.06]
Tricyclene	2.83	918	0.91	1.22	974	0.91
α-Thujene	2.94	925	0.16	1.40†	1002	[15.72]
α-Pinene	3.03	931	15.61	1.35*†	996	[15.72]
Camphene	3.21*	943	6.40	1.68	1029	6.32
α-Fenchene	3.21*	943	[6.40]	1.60*	1022	[0.07]
Thuja-2,4(10)-diene	3.29	948	0.04	2.24*	1086	0.14
Benzaldehyde	3.36	953	0.01	7.30	1464	0.01
meta-Cymene	3.54	965	0.06	2.84*	1135	1.74
Sabinene	3.66*	973	27.18	2.24*	1086	[0.14]
β-Pinene	3.66*	973	[27.18]	2.10	1071	26.96
Unknown [m/z 91, 119 (65), 109 (51), 134 (47)]	3.87	986	0.01			
Myrcene	3.94	992	1.68	2.84*	1135	[1.74]
2-Carene	4.03	997	0.01	2.35	1096	0.01
α-Phellandrene	4.08*	1000	0.15	2.74	1128	0.12
Pseudolimonene	4.08*	1000	[0.15]	2.78	1131	0.02
Δ3-Carene	4.20*	1008	17.63	2.58	1115	17.58
(3Z)-Hexenyl acetate	4.20*	1008	[17.63]	4.74	1281	0.01
α-Terpinene	4.28	1013	0.09	2.92	1142	0.10
ortho-Cymene	4.34*	1017	0.09	4.05*	1230	0.30
Carvomenthene	4.34*	1017	[0.09]	2.41	1102	0.01
Hexyl acetate	4.34*	1017	[0.09]	4.17	1238	0.05
para-Cymene	4.39	1020	0.29	4.05*	1230	[0.30]
Limonene	4.49*	1026	13.35	3.16	1161	7.91
β-Phellandrene	4.49*	1026	[13.35]	3.25	1168	5.42
(Z)-β-Ocimene	4.70	1040	0.01	3.68	1202	0.01

(E)-β-Ocimene	4.84	1048	tr	3.94	1221	tr
γ-Terpinene	4.95	1055	0.22	3.76*	1208	[0.23]
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.12	1066	0.01	4.70	1278	tr
Fenchone	5.34	1080	0.13	5.66	1342	0.14
γ-Campholenal	5.38*	1083	0.09	4.94	1296	0.06
Isoterpinolene	5.38*	1083	[0.09]	4.14	1236	0.01
Terpinolene	5.41*	1084	0.98	4.24	1243	0.89
para-Cymenene	5.41*	1084	[0.98]	6.28	1387	0.07
α-Pinene oxide	5.50	1090	0.02	5.36	1320	0.01
Unknown [m/z 79, 94 (87), 77 (25), 91 (21), 93 (16), 95 (12), 138 (8)]	5.60	1097	0.01			
Linalool	5.65*	1100	0.12	8.03	1519	0.10
α-Thujone	5.65*	1100	[0.12]	6.01	1368	0.02
Nonanal	5.70	1103	0.01	5.85	1356	0.02
endo-Fenchol	5.78	1108	0.07	8.34*†	1542	0.33
cis-para-Menth-2- en-1-ol	5.91	1117	0.02	8.10*	1524	0.03
α-Campholenal	5.96	1120	0.01	6.96	1438	0.02
Nopinone	6.07	1127	0.02	8.17	1529	0.01
cis-Limonene oxide	6.11	1129	0.02	6.39	1395	0.02
trans-Pinocarveol	6.14	1132	0.13	9.13	1604	0.16
trans-para- Menth-2-en-1-ol	6.19*	1134	0.37	8.90	1586	0.01
Camphor	6.19*	1134	[0.37]	7.16	1453	0.35
Camphene hydrate	6.29	1141	0.04	8.42	1549	0.10
meta-Mentha-4,6- dien-8-ol	6.33	1144	0.02	9.23*	1613	0.16
Isoborneol	6.46	1152	0.02	9.30	1618	0.03
Pinocarvone	6.49*	1154	0.03	7.86	1505	0.03
Myrtenyl methyl ether	6.49*	1154	[0.03]	5.56	1335	0.01
Borneol	6.59	1160	0.52	9.74*	1654	0.91
α-Phellandren-8- ol	6.63	1163	0.02	10.11*	1684	0.42
Isopinocampone	6.66	1165	0.05	7.56	1482	0.04
Terpinen-4-ol	6.77	1173	0.23	8.53	1558	0.19
Cryptone	6.86	1178	0.06	9.11	1603	0.05
para-Cymen-8-ol	6.92	1182	0.06	11.49	1800	0.06
α-Terpineol	7.00*	1187	0.43	9.74*	1654	[0.91]
Myrtenal	7.00*	1187	[0.43]	8.62	1564	0.07
Myrtenol	7.08	1193	0.08	10.82	1744	0.07
Methylchavicol	7.12	1195	0.03	9.23*	1613	[0.16]
Unknown [m/z	7.14	1197	0.02			

121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]						
Verbenone	7.21	1201	0.06	9.54	1638	0.07
Unknown [m/z 93, 121 (98), 79 (64), 91 (41), 77 (35), 124 (24)...]	7.22	1202	0.02	10.97	1756	0.03
<i>trans</i> -Piperitol	7.27	1205	0.01	10.34	1703	0.01
endo-Fenchyl acetate	7.45	1218	0.05	6.78	1424	0.04
3-Methyl-3-butenyl 4-methylvalerate	7.52	1222	0.02			
Thymol methyl ether	7.67	1233	tr	8.34*†	1542	[0.33]
Citronellol	7.70	1235	0.04	10.68*	1732	0.06
Carvone	7.78	1240	0.01	9.95	1671	0.03
Piperitone	7.90	1249	0.21	9.84*	1663	0.22
Geraniol	8.03	1257	0.01	11.54	1806	0.01
Phellandral	8.21	1270	0.03	9.87*	1665	0.04
Isopulegyl acetate	8.24	1272	0.02	8.10*	1524	[0.03]
Bornyl acetate	8.45*	1287	6.99	8.22	1534	7.00
Isobornyl acetate	8.45*	1287	[6.99]	8.25	1536	0.02
Thymol	8.67	1302	0.03	15.08	2136	0.03
Isohexyl isocaproate	8.93	1316	0.03	7.47	1476	0.03
Myrtenyl acetate	9.01	1322	0.02	9.50*	1635	0.07
Unknown [m/z 121, 93 (84), 43 (81), 79 (48), 117 (40), 56 (37)...]	9.28	1340	0.06			
α -Longipinene	9.32	1344	0.10	6.73	1420	0.08
α -Terpinyl acetate	9.40	1349	0.01	9.65	1647	0.01
Citronellyl acetate	9.48	1355	0.02	9.40	1627	0.02
Longicyclene	9.58	1362	0.03	7.05	1444	0.02
α -Copaene	9.71	1371	0.02	7.10	1448	0.01
Geranyl acetate	9.88	1383	0.04	10.47	1714	0.02
Sativene	9.96	1388	0.01	7.52	1479	0.01
β -Longipinene	10.00	1391	0.02	7.73	1495	0.02
Longifolene	10.06	1396	0.32	7.93	1510	0.32
Methyleugenol	10.19	1405	0.01	13.26	1961	0.01
β -Caryophyllene	10.28	1412	0.26	8.37*†	1545	[0.33]
Aromadendrene	10.51	1429	0.02	8.46	1552	0.01
<i>trans</i> - α -Bergamotene	10.57	1433	0.03	8.37*†	1545	[0.33]
α -Himachalene	10.67	1440	0.02	8.86	1583	0.02
α -Humulene	10.74	1446	0.11	9.23*	1613	[0.16]
(<i>E</i>)- β -Farnesene	10.90	1458	0.04	9.50*	1635	[0.07]
γ -Muurolene	11.06	1470	0.01	9.50*	1635	[0.07]

Germacrene D	11.11	1473	0.01	9.74*	1654	[0.91]
γ-Curcumene	11.15	1476	0.02	9.60	1642	0.03
β-Selinene	11.18	1479	0.02	9.82	1661	0.01
<i>trans</i> -β-Bergamotene	11.21	1481	0.03	9.50*	1635	[0.07]
α-Selinene	11.31*	1488	0.02	9.87*	1665	[0.04]
β-Himachalene	11.31*	1488	[0.02]	9.74*	1654	[0.91]
α-Muurolene	11.38	1494	0.03	9.99	1675	0.04
Methyl (<i>E</i>)-isoeugenol	11.41	1496	0.01	14.93	2120	0.01
δ-Amorphene	11.49*	1501	0.02	9.84*	1663	[0.22]
(<i>Z</i>)-α-Bisabolene	11.49*	1501	[0.02]	10.24	1695	0.01
β-Bisabolene	11.56	1507	0.39	10.11*	1684	[0.42]
δ-Cadinene	11.71	1519	0.03	10.37	1706	0.03
(<i>E</i>)-γ-Bisabolene	11.84	1529	0.01	10.40	1708	0.01
α-Calacorene	11.92	1535	0.01	12.06	1852	0.01
(<i>E</i>)-α-Bisabolene	12.00	1541	0.05	10.68*	1732	[0.06]
(<i>E</i>)-Nerolidol	12.27	1563	0.01	13.76	2007	0.01
Caryophyllene oxide	12.39	1572	0.05	12.72	1911	0.04
Humulene epoxide II	12.72	1598	0.02	13.32	1966	0.02
Manoyl oxide	17.00	1976	0.01	16.40	2270	0.01
Abieta-8,12-diene	17.42	2015	0.01			
(<i>Z</i>)-Abienol	18.59	2134	0.01	20.32	2715	0.01
Total identified		99.06%			98.57%	
Total reported		99.20%			98.60%	

*: Two or more compounds are coeluting on this column

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