

Date : October 20, 2022

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 22J13-PTH02

Customer identification : Douglas Fir - Canada - DC0104R

Type : Essential oil

Source : *Pseudotsuga menziesii*

Customer : Plant Therapy

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 : Amélie Simard, Analyste

Analysis date : October 17, 2022

Checked and approved by :

Alexis St-Gelais, Ph. D., Chimiste 2013-174

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4753 ± 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
3-Methylcyclopentene	0.02	Alkene
Toluene	tr	Simple phenolic
Ethyl 2-methylbutyrate	0.02	Aliphatic ester
Unknown	0.01	Unknown
Santene	0.05	Normonoterpene
Styrene	0.01	Simple phenolic
Hashishene	0.01	Monoterpene
Tricyclene	0.16	Monoterpene
α -Thujene	0.74	Monoterpene
α -Pinene	11.13	Monoterpene
Camphene	1.37	Monoterpene
α -Fenchene	0.02	Monoterpene
Thuja-2,4(10)-diene	0.02	Monoterpene
β -Pinene	32.62	Monoterpene
Sabinene	10.75	Monoterpene
3-Methyl-3-cyclohexenone	0.03	Aliphatic ketone
Dehydro-1,8-cineole	0.01	Monoterpenic ether
Myrcene	1.77	Monoterpene
α -Phellandrene	0.24	Monoterpene
Pseudolimonene	0.03	Monoterpene
Ethyl hexanoate	0.01	Aliphatic ester
Δ^3 -Carene	4.21	Monoterpene
(3Z)-Hexenyl acetate	0.01	Aliphatic ester
α -Terpinene	2.03	Monoterpene
Carvomenthene	0.02	Aliphatic alcohol
para-Cymene	0.60	Monoterpene
β -Phellandrene	1.18*	Monoterpene
1,8-Cineole	1.18*	Monoterpenic ether
Limonene	2.49	Monoterpene
(Z)- β -Ocimene	0.23	Monoterpene
(E)- β -Ocimene	0.19	Monoterpene
Unknown	0.03	Unknown
γ -Terpinene	3.66	Monoterpene
cis-Sabinene hydrate	0.03	Monoterpenic alcohol
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Terpinolene isomer	0.15	Monoterpene
Terpinolene	13.06	Monoterpene
para-Cymenene	0.17	Monoterpene
α -Pinene oxide	0.01	Monoterpenic ether
trans-Sabinene hydrate	0.02	Monoterpenic alcohol
Linalool	0.09	Monoterpenic alcohol
Unknown	0.01	Monoterpenic alcohol
cis-Rose oxide	0.03	Monoterpenic ether
endo-Fenchol	0.05	Monoterpenic alcohol

(E)-4,8-Dimethylnona-1,3,7-triene	0.02	Terpene derivative
cis-para-Menth-2-en-1-ol	0.10	Monoterpenic alcohol
Methyl octanoate	0.05	Aliphatic ester
Cosmene	0.04	Monoterpene
1-Terpineol	0.03	Monoterpenic alcohol
trans-Pinocarveol	0.05	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.08	Monoterpenic alcohol
Epoxyterpinolene	0.16	Monoterpenic ether
Camphene hydrate	0.06	Monoterpenic alcohol
Citronellal	0.14	Monoterpenic aldehyde
Pinocamphone	0.01	Monoterpenic ketone
Pinocarvone	0.02	Monoterpenic ketone
Borneol	0.04	Monoterpenic alcohol
Terpinen-4-ol	2.88	Monoterpenic alcohol
Unknown	0.03	Oxygenated monoterpene
Unknown	0.01	Oxygenated monoterpene
para-Cymen-8-ol	0.12	Monoterpenic alcohol
α-Terpineol	0.44	Monoterpenic alcohol
Methyl salicylate	0.02	Phenolic ester
Myrtenol	0.03	Monoterpenic alcohol
γ-Terpineol	0.03	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Ethyl octanoate	0.09	Aliphatic ester
Verbenone	0.02	Monoterpenic ketone
trans-Piperitol	0.04	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Citronellol	0.84	Monoterpenic alcohol
Unknown	0.07	Oxygenated monoterpene
Thymol methyl ether	0.06	Monoterpenic ether
Neral	0.02	Monoterpenic aldehyde
Piperitone	0.04	Monoterpenic ketone
Geraniol	0.02	Monoterpenic alcohol
trans-Ascaridole glycol	0.02	Monoterpenic alcohol
Unknown	0.02	Unknown
Unknown	0.05	Oxygenated monoterpene
Bornyl acetate	0.68	Monoterpenic ester
cis-Ascaridole glycol	0.02	Monoterpenic alcohol
trans-Pinocarvyl acetate	0.04	Monoterpenic ester
Unknown	0.01	Unknown
Unknown	0.02	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Methyl geranate	0.05	Monoterpenic ester
Methyl decanoate	0.11	Aliphatic ester
Citronellic acid	0.05	Monoterpenic acid
δ-Elemene	0.03	Sesquiterpene
α-Longipinene	0.01	Sesquiterpene
Citronellyl acetate	1.72	Monoterpenic ester
Unknown	0.04	Unknown
Unknown	0.01	Unknown
Ethyl (4E)-decenoate	0.02	Aliphatic ester
Geranyl acetate	1.17	Monoterpenic ester
β-Elemene	0.05	Sesquiterpene

Sibirene	0.01	Sesquiterpene
Longifolene	0.02	Sesquiterpene
Ethyl decanoate	0.07	Aliphatic ester
<i>cis</i> - α -Bergamotene	0.01	Sesquiterpene
β -Caryophyllene	0.02	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.01	Sesquiterpene
6,9-Guaiadiene	0.01	Sesquiterpene
Unknown	0.01	Sesquiterpene
α -Humulene	0.07	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.02	Sesquiterpene
γ -Muurolene	0.02	Sesquiterpene
Germacrene D	0.07	Sesquiterpene
Unknown	0.02	Sesquiterpene
δ -Selinene	0.04	Sesquiterpene
α -Muurolene	0.03	Sesquiterpene
Methyl (<i>E</i>)-isoeugenol	0.01	Phenylpropanoid
(<i>Z</i>)- α -Bisabolene	0.01	Sesquiterpene
γ -Cadinene	0.05	Sesquiterpene
δ -Cadinene	0.09	Sesquiterpene
Methyl laurate?	0.01	Aliphatic ester
(<i>E</i>)- α -Bisabolene	0.02	Sesquiterpene
α -Elemol	0.02	Sesquiterpenic alcohol
(<i>E</i>)-Nerolidol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.02	Sesquiterpenic ether
Humulene epoxide II	0.03	Sesquiterpenic ether
Selin-6-en-4 α -ol isomer	0.12	Sesquiterpenic alcohol
Alismol	0.10	Sesquiterpenic alcohol
τ -Cadinol	0.02	Sesquiterpenic alcohol
Cubenol	0.02	Sesquiterpenic alcohol
β -Eudesmol	0.02	Sesquiterpenic alcohol
α -Eudesmol	0.01	Sesquiterpenic alcohol
α -Cadinol	0.04	Sesquiterpenic alcohol
Unknown	0.02	Oxygenated sesquiterpene
(<i>E</i>)-Isoelemicin	0.01	Phenylpropanoid
(2 <i>E</i> ,6 <i>Z</i>)-Farnesal	0.01	Sesquiterpenic aldehyde
(2 <i>E</i> ,6 <i>E</i>)-Farnesol	0.05	Sesquiterpenic alcohol
Unknown	0.01	Unknown
(2 <i>E</i> ,6 <i>E</i>)-Farnesyl acetate	0.01	Sesquiterpenic ester
Cembrene?	0.01	Diterpene
(<i>Z</i>)-Abienol	0.03	Diterpenic alcohol
Consolidated total	98.19%	

*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered

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

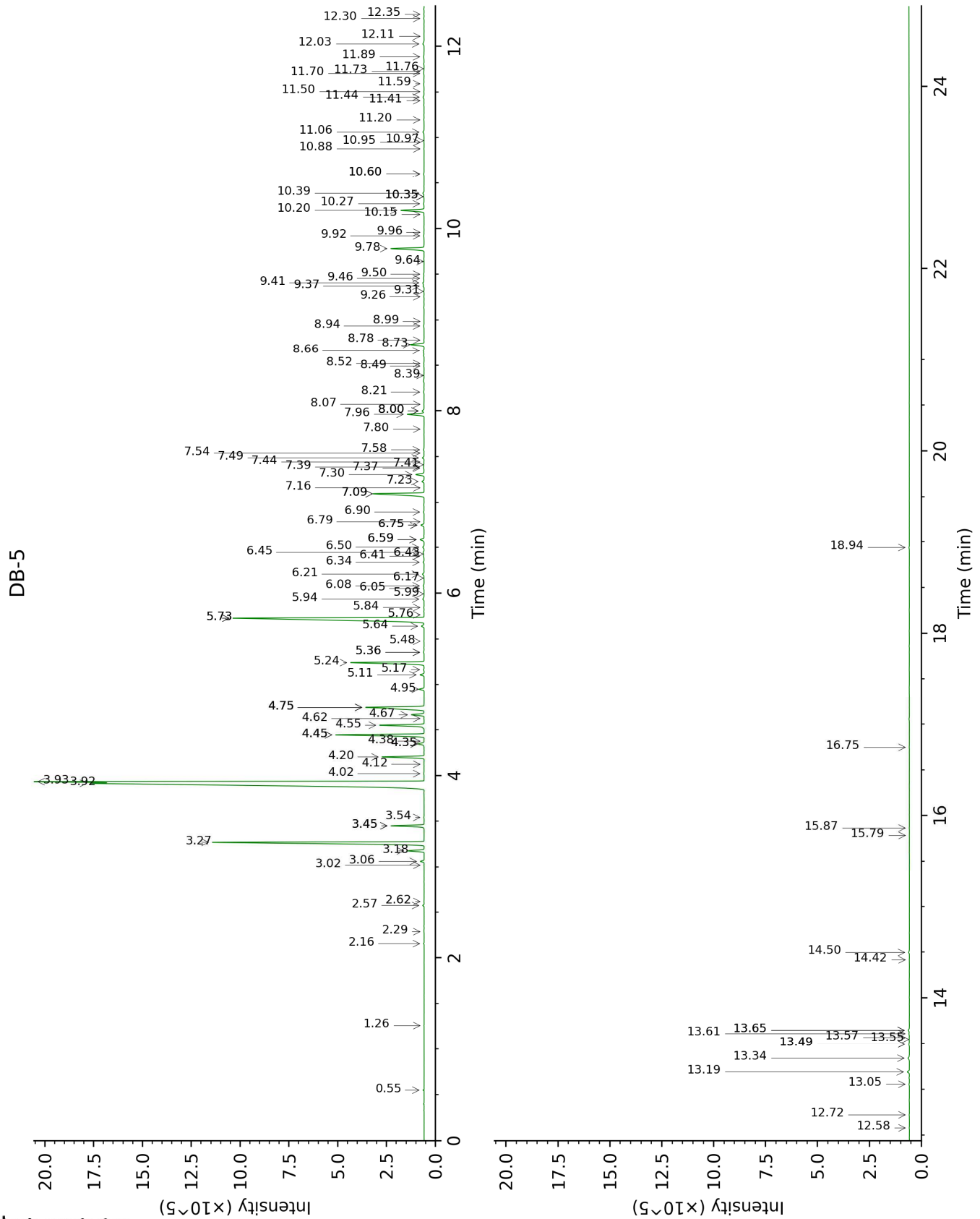
tr: The compound has been detected below 0.005% of total signal.

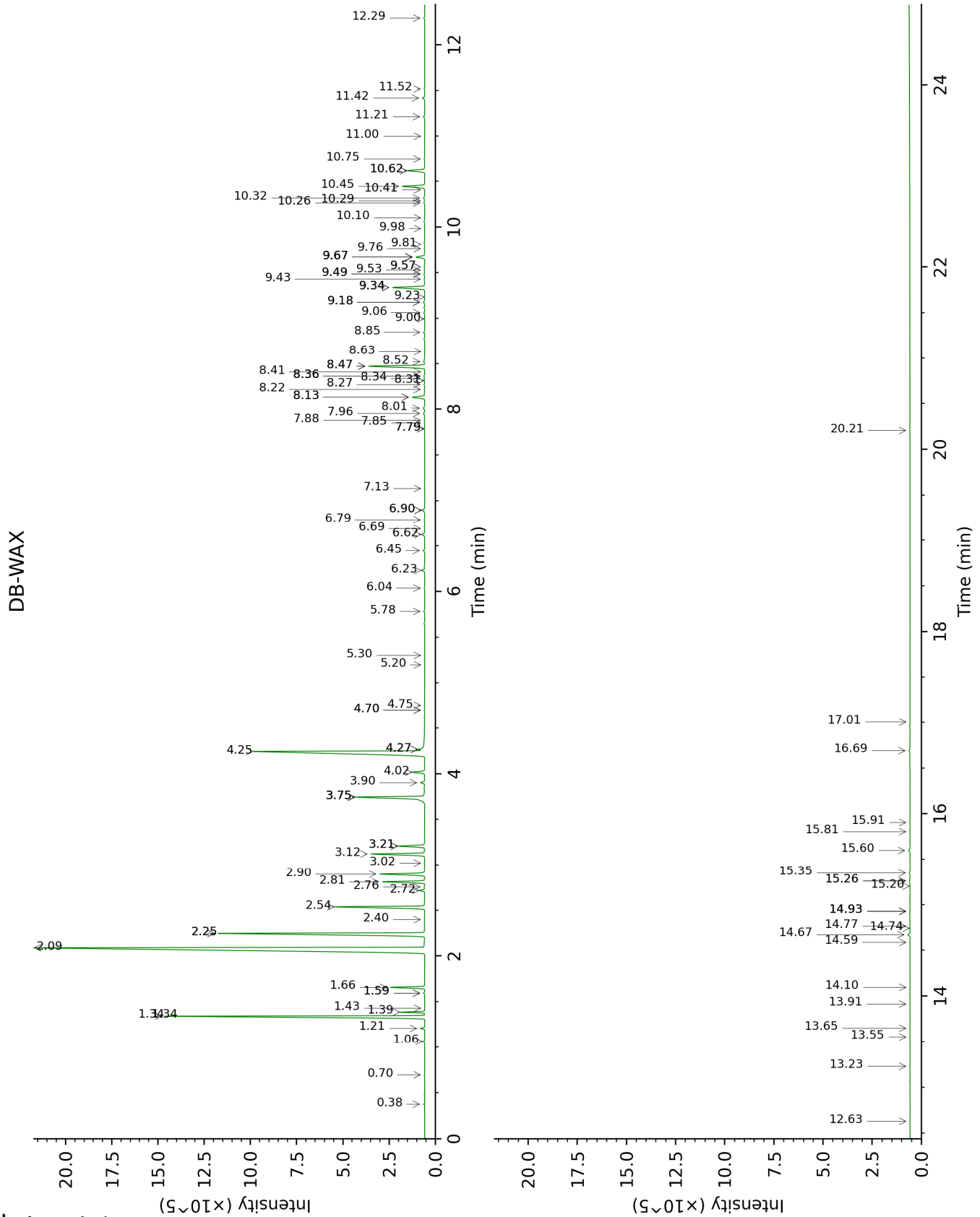
Note: no correction factor was applied

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	%
3-Methylcyclopentene	0.55	609	0.02	0.38	665	0.01
Toluene	1.26	758	tr	1.43	1004	tr
Ethyl 2-methylbutyrate	2.16	848	0.02	1.60*	1020	0.05
Unknown [m/z 55, 83 (89), 82 (70), 67 (66), 41 (55), 69 (46), 111 (37)... 126 (2)]	2.29	859	0.01	0.70	871	0.01
Santene	2.57	882	0.05	1.06	947	0.05
Styrene	2.62	886	0.01	3.75*	1205	3.89
Hashishene	3.02	916	0.01	1.34*	995	11.24
Tricyclene	3.06	919	0.16	1.21	972	0.15
α -Thujene	3.18	926	0.74	1.39	999	0.75
α -Pinene	3.27	932	11.13	1.34*	995	[11.24]
Camphene	3.45*	944	1.39	1.66	1027	1.37
α -Fenchene	3.45*	944	[1.39]	1.60*	1020	[0.05]
Thuja-2,4(10)-diene	3.54	950	0.02	2.25*	1086	11.02
β -Pinene	3.92†	975	43.37	2.09	1070	32.62
Sabinene	3.93†	976	[43.37]	2.25*	1086	[11.02]
3-Methyl-3-cyclohexenone	4.02	982	0.03	6.04	1371	0.03
Dehydro-1,8-cineole	4.12	988	0.01	3.02	1149	0.01
Myrcene	4.20	994	1.77	2.81	1133	1.80
α -Phellandrene	4.35*	1003	0.32	2.72	1125	0.24
Pseudolimonene	4.35*	1003	[0.32]	2.76	1128	0.03
Ethyl hexanoate	4.38	1005	0.01	3.75*	1205	[3.89]
Δ 3-Carene	4.45*	1009	4.20	2.54	1111	4.21
(3Z)-Hexenyl acetate	4.45*	1009	[4.20]	4.75	1278	0.01
α -Terpinene	4.55	1016	2.03	2.90	1139	2.04
Carvomenthene	4.62	1020	0.02	2.40	1100	0.04
para-Cymene	4.66	1023	0.60	4.02	1225	0.61
β -Phellandrene	4.75*	1028	3.67	3.21*	1164	1.20
1,8-Cineole	4.75*	1028	[3.67]	3.21*	1164	[1.20]
Limonene	4.75*	1028	[3.67]	3.12	1157	2.49
(Z)- β -Ocimene	4.95	1041	0.23	3.75*	1205	[3.89]
(E)- β -Ocimene	5.11	1051	0.19	3.90	1217	0.21
Unknown [m/z 115, 97 (84), 155 (69), 55 (51), 69 (50), 43 (46)...]	5.17	1054	0.03	4.27*	1243	0.49
γ -Terpinene	5.24	1059	3.66	3.75*	1205	[3.89]
cis-Sabinene hydrate	5.36*	1066	0.04	6.79	1427	0.03
Unknown [m/z 115, 43 (92), 97 (92), 69	5.36*	1066	[0.04]			

(70), 155 (70), 55 (69)...						
Unknown [m/z 101, 88 (98), 43 (54), 55 (44), 41 (40), 95 (40), 73 (36)...	5.48	1074	0.01	4.70*	1274	0.03
Terpinolene isomer	5.64	1084	0.15	4.27*	1243	[0.49]
Terpinolene	5.73*	1089	13.66	4.24	1242	13.06
para-Cymenene	5.73*	1089	[13.66]	6.23	1386	0.17
α-Pinene oxide	5.76	1092	0.01	5.30	1318	0.01
trans-Sabinene hydrate	5.84	1097	0.02	7.85	1506	0.01
Linalool	5.94	1102	0.09	7.96	1515	0.08
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.99	1106	0.01	8.41	1550	0.01
cis-Rose oxide	6.05	1110	0.03	5.20	1311	0.01
endo-Fenchol	6.08	1112	0.05	8.27	1539	0.04
(E)-4,8-Dimethylnona-1,3,7-triene	6.17	1117	0.02	4.70*	1274	[0.03]
cis-para-Menth-2-en-1-ol	6.21	1120	0.10	8.01	1519	0.10
Methyl octanoate	6.34	1128	0.05	5.78	1353	0.05
Cosmene	6.41	1132	0.04			
1-Terpineol	6.43	1134	0.03	8.22	1535	0.02
trans-Pinocarveol	6.45	1135	0.05	9.06	1601	0.04
trans-para-Menth-2-en-1-ol	6.50	1139	0.08	8.85	1584	0.06
Epoxyterpinolene	6.59*	1144	0.22	6.62	1414	0.16
Camphene hydrate	6.59*	1144	[0.22]	8.36*†	1546	[0.09]
Citronellal	6.74*	1154	0.17	6.90*	1435	0.17
Pinocamphone	6.74*	1154	[0.17]	7.14	1452	0.01
Pinocarvone	6.79	1157	0.02	7.79*	1502	0.02
Borneol	6.90	1164	0.04	9.67*	1650	0.47
Terpinen-4-ol	7.10*	1176	3.02	8.47*	1555	2.98
Unknown [m/z 69, 84 (62), 41 (30), 123 (26), 97 (24), 109 (23)...	7.10*	1176	[3.02]	9.53	1639	0.03
Unknown [m/z 96, 119 (99), 96 (86), 91 (81), 43 (65), 41 (49), 67 (45)...	7.16	1180	0.01			
para-Cymen-8-ol	7.23	1185	0.12	11.42	1797	0.13
α-Terpineol	7.30	1190	0.44	9.67*	1650	[0.47]
Methyl salicylate	7.37	1194	0.02	10.41	1711	0.02
Myrtenol	7.39	1195	0.03	10.75	1740	0.04
γ-Terpineol	7.41	1197	0.03	9.76	1658	0.03

Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	7.44	1198	0.02			
Ethyl octanoate	7.49	1201	0.09	6.45	1401	0.08
Verbenone	7.54	1205	0.02	9.49*	1635	0.06
<i>trans</i> -Piperitol	7.58	1207	0.04	10.26	1698	0.05
Unknown [m/z 122, 91 (56), 79 (33), 95 (33), 107 (31), 43 (30), 77 (30), 135 (27)... 150 (9)]	7.80	1222	0.01	9.24	1615	0.01
Citronellol	7.96	1233	0.84	10.62*	1729	0.92
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	8.00*	1236	0.13	11.21	1779	0.07
Thymol methyl ether	8.00*	1236	[0.13]	8.34†	1544	0.09
Neral	8.07	1240	0.02	9.34*	1623	1.73
Piperitone	8.21	1249	0.04	9.81	1662	0.02
Geraniol	8.39	1261	0.02	11.52	1806	0.03
<i>trans</i> -Ascaridole glycol	8.49	1268	0.02	14.10	2041	0.01
Unknown [m/z 88, 101 (61), 55 (39), 41 (34), 83 (30), 70 (24), 43 (24)...]	8.52	1270	0.02			
Unknown [m/z 95, 67 (45), 41 (42), 110 (42), 43 (41), 59 (36)]	8.66	1280	0.05	12.29	1874	0.05
Bornyl acetate	8.73	1284	0.68	8.13*	1528	0.67
<i>cis</i> -Ascaridole glycol	8.78	1288	0.02	14.74	2103	0.01
<i>trans</i> -Pinocarvyl acetate	8.94	1298	0.04	9.00	1596	0.01
Unknown [m/z 112, 97 (93), 83 (60), 43 (46), 41 (20), 69 (19)...]	8.99	1301	0.01			
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.26	1318	0.02	14.93*	2121	0.02
Unknown [m/z 91, 79 (94), 77 (72), 41 (37), 93 (31)... 152 (1)]	9.31	1322	0.02			
Methyl geranate	9.37	1326	0.05	9.67*	1650	[0.47]
Methyl decanoate	9.41	1329	0.11	8.47*	1555	[2.98]
Citronellic acid	9.46	1332	0.05	15.91	2220	0.03
δ-Elemene	9.50	1336	0.03	6.90*	1435	[0.17]
α-Longipinene	9.64	1345	0.01	6.69	1419	0.02

Citronellyl acetate	9.78	1355	1.72	9.34*	1623	[1.73]
Unknown [m/z 43, 95 (53), 121 (47), 107 (38), 93 (36), 41 (35), 67 (31)...]	9.92	1365	0.04			
Unknown [m/z 69, 43 (79), 93 (68), 41 (66), 111 (43), 55 (41), 68 (37)...]	9.96	1368	0.01			
Ethyl (4E)-decenoate	10.16	1382	0.02	9.34*	1623	[1.73]
Geranyl acetate	10.20	1385	1.17	10.45	1714	1.19
β-Elemene	10.27	1390	0.05	8.36*†	1546	[0.09]
Sibirene	10.35*	1395	0.03	7.79*	1502	[0.02]
Longifolene	10.35*	1395	[0.03]	7.88	1509	0.02
Ethyl decanoate	10.39	1398	0.07	9.18*	1610	0.08
cis-α-Bergamotene	10.60*	1414	0.03	8.13*	1528	[0.67]
β-Caryophyllene	10.60*	1414	[0.03]	8.31	1542	0.02
trans-α-Bergamotene	10.88	1434	0.01	8.36*†	1546	[0.09]
6,9-Guaiadiene	10.95	1440	0.01	8.52	1559	0.07
Unknown [m/z 91, 161 (92), 105 (85), 119 (63), 133 (53), 79 (49), 204 (46)]	10.97	1441	0.01	8.63	1567	0.01
α-Humulene	11.06	1448	0.07	9.18*	1610	[0.08]
(E)-β-Farnesene	11.20	1458	0.02	9.43	1631	0.05
γ-Murolene	11.41	1474	0.02	9.49*	1635	[0.06]
Germacrene D	11.44	1476	0.07	9.67*	1650	[0.47]
Unknown [m/z 79, 107 (99), 91 (88), 93 (86), 81 (78), 105 (73), 41 (73)... 204? (12)]	11.50	1481	0.02	9.57*	1642	0.05
δ-Selinene	11.59	1487	0.04	9.57*	1642	[0.05]
α-Murolene	11.70	1496	0.03	9.98	1676	0.01
Methyl (E)-isoeugenol	11.73	1497	0.01	14.93*	2121	[0.02]
(Z)-α-Bisabolene	11.76	1500	0.01	10.10	1685	0.01
γ-Cadinene	11.89	1510	0.05	10.29	1700	0.02
δ-Cadinene	12.03	1521	0.09	10.32	1703	0.08
Methyl laurate?	12.11	1527	0.01	11.00	1761	0.01
(E)-α-Bisabolene	12.30	1542	0.02	10.62*	1729	[0.92]
α-Elemol	12.35	1546	0.02	13.91	2024	0.02
(E)-Nerolidol	12.58	1564	0.01	13.65	1999	0.03
Caryophyllene oxide	12.72	1575	0.02	12.63	1906	0.02
Humulene epoxide II	13.05	1601	0.03	13.23	1960	0.02
Selin-6-en-4α-ol isomer	13.19	1612	0.12	14.67	2096	0.12
Alismol	13.34	1624	0.10	15.60	2188	0.08
τ-Cadinol	13.49*	1637	0.05	14.76	2105	0.02

Cubenol	13.49*	1637	[0.05]	13.55	1990	0.02
β-Eudesmol	13.55	1642	0.02	15.26*	2154	0.05
α-Eudesmol	13.57	1643	0.01	15.20	2149	0.01
α-Cadinol	13.61	1647	0.04	15.35	2163	0.06
Unknown [m/z 161, 59 (67), 95 (45), 93 (40), 105 (40), 149 (39), 81 (39), 43 (38), 204 (37)... 220 (5)]	13.65*	1650	0.08	14.59	2088	0.02
(E)-Isoelemicin	13.65*	1650	[0.08]	17.01	2335	0.01
(2E,6Z)-Farnesal	14.42	1714	0.01	15.26*	2154	[0.05]
(2E,6E)-Farnesol	14.50	1721	0.05	16.69	2301	0.05
Unknown [m/z 107, 109 (64), 81 (61), 91 (51), 41 (49), 93 (47), 69 (41)...]	15.79	1833	0.01			
(2E,6E)-Farnesyl acetate	15.87	1841	0.01	15.81	2209	0.03
Cembrene?	16.75	1921	0.01	14.93*	2121	[0.02]
(Z)-Abienol	18.94	2135	0.03	20.21	2704	0.02
Total identified		98.56%			98.22%	
Total reported		98.87%			98.43%	

*: 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