

Date : March 16, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21B23-FEP30

Customer identification : Tea Tree - Australia - 51264-01

Type : Essential oil

Source : *Melaleuca alternifolia* ct. Terpinen-4-ol

Customer : Fern & Petal

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

Analysis date : March 16, 2021

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4786 ± 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	0.02	Aliphatic alcohol
Isobutyral	0.02	Aliphatic aldehyde
2-Methylfuran	tr	Furan
Isobutanol	tr	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
Isoamyl alcohol	tr	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
Toluene	0.02	Simple phenolic
(3Z)-Hexenol	0.03	Aliphatic alcohol
Hexanol	tr	Aliphatic alcohol
α -Thujene	0.87	Monoterpene
α -Pinene	2.47	Monoterpene
α -Fenchene	0.02	Monoterpene
Camphene	0.02	Monoterpene
Sabinene	0.17	Monoterpene
β -Pinene	0.71	Monoterpene
Octen-3-ol	0.02	Aliphatic alcohol
3-Methyl-3-cyclohexenone	0.02	Aliphatic ketone
<i>cis</i> -Carane	0.01	Monoterpene
Myrcene	0.74	Monoterpene
2,7-Dimethyl-2,6-octadiene	0.02	Monoterpene
α -Phellandrene	0.38	Monoterpene
Pseudolimonene	0.01	Monoterpene
α -Terpinene	8.19	Monoterpene
Carvomenthene	0.08	Aliphatic alcohol
para-Cymene	3.79	Monoterpene
1,8-Cineole	3.07	Monoterpenic ether
Limonene	0.86	Monoterpene
(<i>E</i>)- β -Ocimene	0.01	Monoterpene
γ -Terpinene	18.70	Monoterpene
<i>cis</i> -Sabinene hydrate	0.05	Monoterpenic alcohol
Terpinolene	3.09	Monoterpene
para-Cymenene	0.05	Monoterpene
<i>trans</i> -Sabinene hydrate	0.08	Monoterpenic alcohol
Linalool	0.07	Monoterpenic alcohol
Unknown	0.05	Monoterpenic alcohol
endo-Fenchol	0.02	Monoterpenic alcohol
<i>cis</i> -para-Menth-2-en-1-ol	0.23	Monoterpenic alcohol
1-Terpineol	0.03	Monoterpenic alcohol
<i>cis</i> -para-Mentha-2,8-dien-1-ol	0.02	Monoterpenic alcohol
<i>trans</i> -para-Menth-2-en-1-ol	0.13	Monoterpenic alcohol
Unknown	0.11	Unknown
Unknown	0.03	Oxygenated monoterpene
Terpinen-4-ol	41.14	Monoterpenic alcohol

Dill ether	0.01	Monoterpenic ether
para-Cymen-8-ol	0.07	Monoterpenic alcohol
α -Terpineol	2.88	Monoterpenic alcohol
<i>cis</i> -Piperitol	0.11	Monoterpenic alcohol
<i>trans</i> -Piperitol	0.12	Monoterpenic alcohol
exo-2-Hydroxycineole	0.04	Monoterpenic alcohol
Nerol	0.03	Monoterpenic alcohol
Unknown	0.06	Oxygenated monoterpene
Unknown	0.10	Unknown
<i>cis</i> -Carvenone oxide?	0.02	Monoterpenic ketone
<i>trans</i> -Ascaridole glycol	0.17	Monoterpenic alcohol
<i>cis</i> -Ascaridole glycol	0.09	Monoterpenic alcohol
Thymol	0.04	Monoterpenic alcohol
Unknown	0.05	Unknown
Carvacrol	0.04	Monoterpenic alcohol
Unknown	0.10	Monoterpenic alcohol
Bicycloelemene	0.02	Sesquiterpene
α -Cubebene	0.03	Sesquiterpene
Unknown	0.07	Unknown
Cyclosativene I	0.01	Sesquiterpene
Cyclosativene II	0.02	Sesquiterpene
Isoledene	0.05	Sesquiterpene
α -Copaene	0.08	Sesquiterpene
7-Cubebene	0.05	Sesquiterpene
7-Cubebene epimer?	0.02	Aliphatic alcohol
β -Cubebene	0.01	Sesquiterpene
Unknown	0.04	Unknown
β -Elemene	0.03	Sesquiterpene
Unknown	0.02	Sesquiterpene
α -Gurjunene	0.32	Sesquiterpene
Methyleugenol	0.01	Phenylpropanoid
β -Maaliene	0.03	Sesquiterpene
β -Caryophyllene	0.37	Sesquiterpene
γ -Maaliene	0.07	Sesquiterpene
β -Gurjunene	0.02	Sesquiterpene
α -Maaliene	0.07	Sesquiterpene
Aromadendrene	1.04	Sesquiterpene
Selina-5,11-diene	0.22	Sesquiterpene
<i>trans</i> -Muurolo-3,5-diene	0.09	Sesquiterpene
α -Humulene	0.12	Sesquiterpene
allo-Aromadendrene	0.47	Sesquiterpene
Valerena-4,7(11)-diene	0.05	Sesquiterpene
γ -Gurjunene	0.04	Sesquiterpene
γ -Muurolole	0.07	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.24	Sesquiterpene
Selina-4,11-diene	0.03	Sesquiterpene
(1S,2S,4S)-para-Menthane-1,2,4-triol	0.02	Monoterpenic alcohol
β -Selinene	0.05	Sesquiterpene
allo-Aromadendr-9-ene	0.10	Sesquiterpene
α -Selinene	0.16	Sesquiterpene
Bicyclogermacrene	0.44	Sesquiterpene
Viridiflorene	0.99	Sesquiterpene

α-Muurolene	0.20	Sesquiterpene
γ-Cadinene	0.03	Sesquiterpene
δ-Cadinene	1.20	Sesquiterpene
Zonarene	0.09	Sesquiterpene
<i>trans</i> -Calamenene	0.14	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.20	Sesquiterpene
α-Calacorene	0.02	Sesquiterpene
Epiglobulol	0.07	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.05	Sesquiterpene
Maaliol	0.04	Sesquiterpenic alcohol
Unknown	0.02	Oxygenated sesquiterpene
Spathulenol	0.12	Sesquiterpenic alcohol
Globulol	0.32	Sesquiterpenic alcohol
Gleenol	0.04	Sesquiterpenic alcohol
Viridiflorol	0.15	Sesquiterpenic alcohol
Cubeban-11-ol	0.15	Sesquiterpenic alcohol
Ledol	0.05	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.02	Sesquiterpenic alcohol
Rosifoliol	0.12	Sesquiterpenic alcohol
1-epi-Cubenol	0.19	Sesquiterpenic alcohol
Isospathulenol	0.06	Sesquiterpenic alcohol
Cubenol	0.10	Sesquiterpenic alcohol
α-Muurolol	0.06	Sesquiterpenic alcohol
Consolidated total	98.22%	

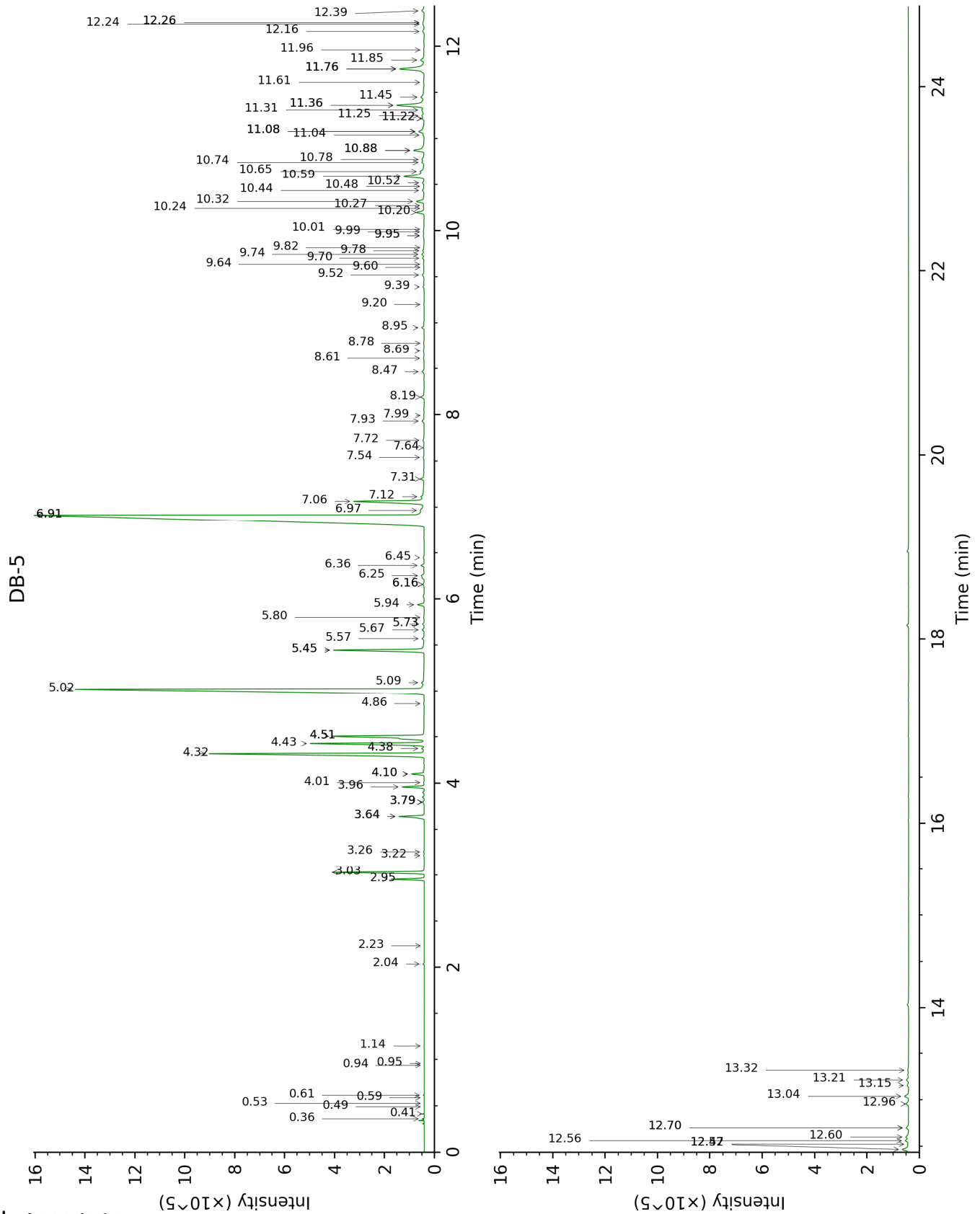
tr: The compound has been detected below 0.005% of total signal.

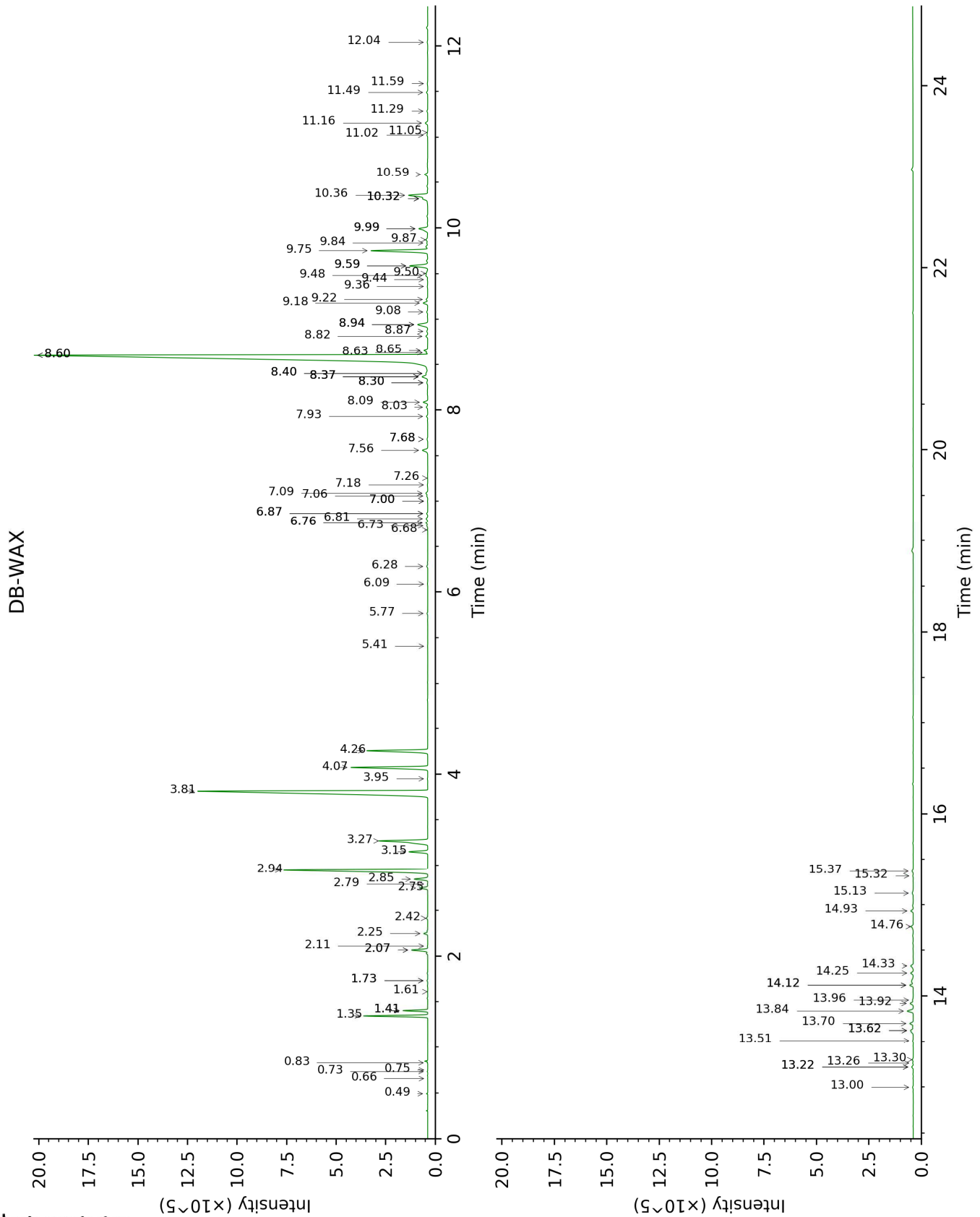
Note: no correction factor was applied

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	0.36	508	0.02	0.83	906	0.01
Isobutyral	0.41	537	0.02	0.49	781	0.02
2-Methylfuran	0.49	601	tr	0.66	852	tr
Isobutanol	0.53	619	tr	2.07*	1066	0.73
Isovaleral	0.59	642	tr	0.75	887	tr
2-Methylbutyral	0.62	652	0.01	0.73	880	0.01
Isoamyl alcohol	0.94	731	tr			
2-Methylbutanol	0.96	734	tr			
Toluene	1.14	761	0.02	1.40*	1000	0.86
(3Z)-Hexenol	2.04	854	0.03	5.77	1349	0.04
Hexanol	2.23	870	tr	5.41	1323	0.01
α -Thujene	2.95	925	0.87	1.40*	1000	[0.86]
α -Pinene	3.03	930	2.47	1.35	992	2.41
α -Fenchene	3.22	942	0.02	1.61	1021	0.01
Camphene	3.26	945	0.02	1.73*	1033	0.03
Sabinene	3.64*	971	0.88	2.25	1084	0.17
β -Pinene	3.64*	971	[0.88]	2.07*	1066	[0.73]
Octen-3-ol	3.80*	981	0.06	6.68	1416	0.02
3-Methyl-3-cyclohexenone	3.80*	981	[0.06]	6.09	1372	0.02
<i>cis</i> -Carane	3.80*	981	[0.06]	1.73*	1033	[0.03]
Myrcene	3.96	992	0.74	2.84	1133	0.64
2,7-Dimethyl-2,6-octadiene	4.01	995	0.02	2.11	1070	0.02
α -Phellandrene	4.10*	1001	0.39	2.75	1126	0.38
Pseudolimonene	4.10*	1001	[0.39]	2.79	1129	0.01
α -Terpinene	4.32	1015	8.19	2.94	1141	8.10
Carvomenthene	4.38	1019	0.08	2.42	1100	0.06
para-Cymene	4.43	1022	3.79	4.07	1227	3.79
1,8-Cineole	4.51*†	1027	4.04	3.27	1166	3.07
Limonene	4.51*†	1027	[4.04]	3.15	1157	0.86
(<i>E</i>)- β -Ocimene	4.86	1049	0.01	3.95	1218	0.02
γ -Terpinene	5.02	1059	18.70	3.82	1208	18.52
<i>cis</i> -Sabinene hydrate	5.10	1064	0.05	6.87*	1430	0.06
Terpinolene	5.45*	1086	3.15	4.26	1240	3.09
para-Cymenene	5.45*	1086	[3.15]	6.28	1386	0.05
<i>trans</i> -Sabinene hydrate	5.57	1094	0.08	7.93	1510	0.06
Linalool	5.67	1100	0.07	8.03	1517	0.08
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.73	1104	0.05	8.40*	1546	0.13
endo-Fenchol	5.80	1109	0.02	8.30*	1538	0.07

<i>cis</i> -para-Menth-2-en-1-ol	5.94	1118	0.23	8.09	1522	0.23
1-Terpineol	6.16*	1132	0.05	8.30*	1538	[0.07]
<i>cis</i> -para-Mentha-2,8-dien-1-ol	6.16*	1132	[0.05]	9.44	1628	0.02
<i>trans</i> -para-Menth-2-en-1-ol	6.25	1138	0.13	8.94*	1588	0.71
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.36	1145	0.11	6.76*	1422	0.09
Unknown [m/z 109, 41 (49), 124 (41), 43 (31), 95 (28), 84 (22)... 152 (7)]	6.45	1150	0.03	6.76*	1422	[0.09]
Terpinen-4-ol	6.91*†	1180	41.84	8.60*	1562	42.18
Dill ether	6.91*†	1180	[41.84]	7.26	1459	0.01
para-Cymen-8-ol	6.97†	1184	[41.84]	11.49	1800	0.07
α-Terpineol	7.06	1190	2.88	9.75	1654	3.08
<i>cis</i> -Piperitol	7.12	1194	0.11	9.50	1633	0.11
<i>trans</i> -Piperitol	7.31	1206	0.12	10.32*	1700	0.31
exo-2-Hydroxycineole	7.54	1222	0.04	11.59	1808	0.03
Nerol	7.64	1229	0.03	11.05	1762	0.02
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.72	1234	0.06	11.29	1782	0.05
Unknown [m/z 43, 82 (79), 109 (69), 110 (65), 95 (38), 41 (36)...]	7.93	1249	0.10			
<i>cis</i> -Carvenone oxide?	7.99	1253	0.02			
<i>trans</i> -Ascaridole glycol	8.19	1266	0.17	14.12*	2041	0.19
<i>cis</i> -Ascaridole glycol	8.47	1285	0.09	14.76	2102	0.15
Thymol	8.61	1295	0.04			
Unknown [m/z 112, 97 (93), 83 (60), 43 (46), 41 (20), 69 (19)...]	8.69	1300	0.05			
Carvacrol	8.78	1306	0.04	15.32	2158	0.03
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.95	1319	0.10	14.93	2119	0.13
Bicycloelemene	9.20	1332	0.02	7.00*	1440	0.02
α-Cubebene	9.39	1345	0.03	6.73	1419	0.05

Unknown [m/z 43, 95 (62), 107 (45), 110 (41), 55 (28), 67 (25)...]	9.52	1354	0.07	13.96	2025	0.06
Cyclosativene I	9.60	1360	0.01	6.87*	1430	[0.06]
Cyclosativene II	9.64	1363	0.02	7.00*	1440	[0.02]
Isoledene	9.70	1367	0.05	6.81	1425	0.09
α-Copaene	9.74	1370	0.08	7.09	1446	0.11
7-Cubebene	9.78	1373	0.05	7.06	1444	0.05
7-Cubebene epimer?	9.82	1375	0.02	7.18	1453	0.03
β-Cubebene	9.94*	1384	0.05	7.68*	1490	0.04
Unknown [m/z 109, 43 (51), 84 (50), 81 (45), 71 (26), 41 (18)...]	9.94*	1384	[0.05]			
β-Elemene	9.99	1387	0.03	8.37*	1543	0.38
Unknown [m/z 93, 122 (98), 161 (98), 107 (86), 95 (46), 105 (72)... 204 (34)]	10.01	1389	0.02			
α-Gurjunene	10.20	1402	0.32	7.56	1482	0.34
Methyleugenol	10.24	1405	0.01	13.26	1961	0.03
β-Maaliene	10.27	1408	0.03	7.68*	1490	[0.04]
β-Caryophyllene	10.32	1411	0.37	8.37*	1543	[0.38]
γ-Maaliene	10.44	1420	0.07	8.40*	1546	[0.13]
β-Gurjunene	10.48	1423	0.02	8.37*	1543	[0.38]
α-Maaliene	10.52	1426	0.07	8.63	1564	0.06
Aromadendrene	10.59	1431	1.04	8.60*	1562	[42.18]
Selina-5,11-diene	10.65	1436	0.22	8.65	1566	0.16
trans-Muurolo-3,5-diene	10.74	1443	0.09	8.82	1578	0.09
α-Humulene	10.78	1445	0.12	9.22	1610	0.08
allo-Aromadendrene	10.88*	1453	0.52	8.94*	1588	[0.71]
Valerena-4,7(11)-diene	10.88*	1453	[0.52]	8.87	1583	0.05
γ-Gurjunene	11.04	1465	0.04	9.08	1599	0.06
γ-Muurolole	11.08*	1468	0.34	9.59*	1640	1.06
trans-Cadina-1(6),4-diene	11.08*	1468	[0.34]	9.18	1607	0.24
Selina-4,11-diene	11.08*	1468	[0.34]	9.36	1622	0.03
(1S,2S,4S)-para-Menthane-1,2,4-triol	11.22*	1478	0.08			
β-Selinene	11.22*	1478	[0.08]	9.84	1661	0.05
allo-Aromadendrene	11.25	1480	0.10	9.48	1632	0.11
α-Selinene	11.31	1485	0.16	9.87	1663	0.14
Bicyclogermacrene	11.36*	1489	1.45	9.99*	1673	0.64
Viridiflorene	11.36*	1489	[1.45]	9.59*	1640	[1.06]
α-Muurolole	11.45	1495	0.20	9.99*	1673	[0.64]

γ-Cadinene	11.61	1508	0.03	10.32*	1700	[0.31]
δ-Cadinene	11.76*	1519	1.44	10.36	1703	1.20
Zonarene	11.76*	1519	[1.44]	10.32*	1700	[0.31]
<i>trans</i> -Calamenene	11.76*	1519	[1.44]	11.16	1771	0.14
<i>trans</i> -Cadina-1,4-diene	11.85	1526	0.20	10.59	1723	0.19
α-Calacorene	11.96	1535	0.02	12.04	1848	0.03
Epiglobulol	12.16	1551	0.07	13.22*	1957	0.09
Eudesma-5,7(11)-diene	12.24	1557	0.05	11.02	1760	0.05
Maaliol	12.26*	1558	0.07	13.00	1937	0.04
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.26*	1558	[0.07]	13.22*	1957	[0.09]
Spathulenol	12.39	1568	0.12	14.33	2061	0.18
Globulol	12.47	1575	0.32	13.84	2014	0.35
Gleenol	12.52	1579	0.04	13.51	1984	0.04
Viridiflorol	12.56	1582	0.15	13.92	2022	0.18
Cubeban-11-ol	12.60	1585	0.15	13.62*	1994	0.24
Ledol	12.70*	1593	0.12	13.30	1964	0.05
Eudesm-5-en-11-ol analog	12.70*	1593	[0.12]	14.12*	2041	[0.19]
Rosifoliol	12.96	1614	0.12	14.25	2054	0.15
1-epi-Cubenol	13.04	1620	0.19	13.70	2001	0.20
Isospathulenol	13.16	1630	0.06	15.37	2163	0.07
Cubenol	13.21	1635	0.10	13.62*	1994	[0.24]
α-Muurolol	13.32	1643	0.06	15.13	2139	0.08
Total identified		98.46%			97.79%	
Total reported		99.05%			98.03%	

*: 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