

Date : November 06, 2018

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 18J30-PTH02-1-CC

Customer identification : Tea Tree Organic - Australia - T3011282R

Type : Essential oil

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

Customer : Plant Therapy

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 : Lindsay Girard, B. Sc.

Analysis date : November 01, 2018

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4768 ± 0.0003 (20 °C)

ISO 4730:2017 - TEA TREE OIL

Compound	Min. %	Max. %	Observed %	Complies?
Viridiflorol	tr	1.0	0.2	Yes
Globulol	tr	1.0	0.4	Yes
δ-Cadinene	0.2	3.0	0.9	Yes
Viridiflorene	0.1	3.0	0.7	Yes
Aromadendrene	0.2	3.0	1.0	Yes
α-Terpineol	2.0	5.0	2.9	Yes
Terpinen-4-ol	35.0	48.0	39.6	Yes
Terpinolene	1.5	5.0	3.3	Yes
γ-Terpinene	14.0	28.0	20.9	Yes
1,8-Cineole	tr	10.0	3.9	Yes
para-Cymene	0.5	8.0	3.9	Yes
Limonene	0.5	1.5	1.1	Yes
α-Terpinene	6.0	12.0	8.6	Yes
Sabinene	tr	3.5	0.2	Yes
α-Pinene	1.0	4.0	2.7	Yes
Refractive index	1.4750	1.4820	1.4768	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for tea tree oil.

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Isobutanol	tr	0.70*	Aliphatic alcohol
Isovaleral	tr	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	0.01	Aliphatic aldehyde
(3Z)-Hexenol	0.02	0.02	Aliphatic alcohol
α -Thujene	0.84	0.82	Monoterpene
α -Pinene	2.72	2.68	Monoterpene
Camphene	0.03*	0.02	Monoterpene
α -Fenchene	[0.03]*	0.01	Monoterpene
β -Pinene	0.90*	[0.70]*	Monoterpene
Sabinene	[0.90]*	0.19	Monoterpene
3-Methyl-3-cyclohexenone	0.01	0.03*	Aliphatic ketone
Myrcene	0.86	0.84	Monoterpene
α -Phellandrene	0.40	0.38	Monoterpene
(3Z)-Hexenyl acetate	8.69*	0.01	Aliphatic ester
α -Terpinene	[8.69]*	8.57	Monoterpene
para-Cymene	3.90	3.91	Monoterpene
Limonene	4.88	1.05	Monoterpene
1,8-Cineole	[4.88]*	3.86*	Monoterpenic ether
β -Phellandrene	[4.88]*	[3.86]*	Monoterpene
(Z)- β -Ocimene	0.01	20.62*	Monoterpene
(E)- β -Ocimene	0.01	0.02	Monoterpene
γ -Terpinene	20.87	[20.62]*	Monoterpene
cis-Sabinene hydrate	0.03	0.03	Monoterpenic alcohol
Terpinolene	3.25	3.12	Monoterpene
trans-Sabinene hydrate	0.02	0.04	Monoterpenic alcohol
Linalool	0.07	0.09	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	[0.03]*	Monoterpene
endo-Fenchol	0.01	0.03	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.16	0.16	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.02	0.01	Aliphatic alcohol
Cosmene isomer I	0.02	0.01	Monoterpene
trans-para-Menth-2-en-1-ol	0.12	0.12	Monoterpenic alcohol
Unknown	0.01	0.02	Unknown
δ -Terpineol	0.02	0.03	Monoterpenic alcohol
Terpinen-4-ol	39.66*	39.94*	Monoterpenic alcohol
Dill ether	[39.66]*	0.02*	Monoterpenic ether
para-Cymen-8-ol	0.08	0.07	Monoterpenic alcohol
α -Terpineol	2.93	3.05	Monoterpenic alcohol
cis-Piperitol	0.04	0.03	Monoterpenic alcohol
trans-Piperitol	0.06	0.28*	Monoterpenic alcohol
exo-2-Hydroxycineole	0.02	0.02	Monoterpenic alcohol
Nerol	0.03	0.04	Monoterpenic alcohol
Piperitone	0.03	0.02*	Monoterpenic ketone
cis-Carvenone oxide?	0.01		Monoterpenic ketone
trans-Ascaridole glycol	0.03	0.03	Monoterpenic alcohol
cis-Ascaridole glycol?	0.02	0.03	Monoterpenic alcohol
Thymol	0.02	0.03	Monoterpenic alcohol

Carvacrol	0.02	0.03	Monoterpenic alcohol
Unknown	0.02	0.03	Monoterpenic alcohol
Bicycloelemene	0.01	0.01*	Sesquiterpene
α -Cubebene	0.04	0.04	Sesquiterpene
Cyclosativene II	0.02	[0.01]*	Sesquiterpene
Isoledene	0.01	0.07	Sesquiterpene
α -Copaene	0.06	0.09*	Sesquiterpene
7-Cubebene	0.10	[0.09]*	Sesquiterpene
7-Cubebene epimer?	0.02	[0.02]*	Aliphatic alcohol
β -Cubebene	0.01	0.04*	Sesquiterpene
β -Elemene	0.01	0.08	Sesquiterpene
Methyleugenol	0.30*	0.09	Phenylpropanoid
α -Gurjunene	[0.30]*	0.27	Sesquiterpene
β -Maaliene	0.01	[0.04]*	Sesquiterpene
β -Caryophyllene	0.31	0.32*	Sesquiterpene
γ -Maaliene	0.07*	0.10	Sesquiterpene
β -Gurjunene	[0.07]*	[0.32]*	Sesquiterpene
Aromadendrene	0.07	1.00	Sesquiterpene
Selina-5,11-diene	1.22	[39.94]*	Sesquiterpene
<i>trans</i> -Muuroala-3,5-diene	0.14	0.07	Sesquiterpene
α -Humulene	0.18	0.19	Sesquiterpene
allo-Aromadendrene	0.50	0.49	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.06	0.07	Sesquiterpene
γ -Muuroolene	0.24	0.95*	Sesquiterpene
β -Selinene	0.03	[0.02]*	Sesquiterpene
allo-Aromadendr-9-ene	0.11	0.14	Sesquiterpene
δ -Selinene	0.10	[0.95]*	Sesquiterpene
α -Selinene	1.38*	0.12	Sesquiterpene
Bicyclogermacrene	[1.38]*	0.37	Sesquiterpene
α -Muuroolene	[1.38]*	0.10	Sesquiterpene
Viridiflorene	[1.38]*	[0.95]*	Sesquiterpene
Epizonarene	[1.38]*	0.12	Sesquiterpene
γ -Cadinene	0.04	[0.28]*	Sesquiterpene
Zonarene	0.11	[0.28]*	Sesquiterpene
<i>trans</i> -Calamenene	1.08*	0.14	Sesquiterpene
δ -Cadinene	[1.08]*	0.88	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.15	0.16	Sesquiterpene
α -Calacorene	0.02	0.04	Sesquiterpene
Eudesma-5,7(11)-diene	0.09	0.02	Sesquiterpene
Unknown	0.02	0.03	Oxygenated sesquiterpene
Palustrol	0.10	0.05	Sesquiterpenic alcohol
Spathulenol	0.10	0.09	Sesquiterpenic alcohol
Globulol	0.36	0.35*	Sesquiterpenic alcohol
Viridiflorol	0.17	0.19	Sesquiterpenic alcohol
Cubeban-11-ol	0.14	0.22*	Sesquiterpenic alcohol
Eudesm-5-en-11-ol	0.13*	0.14*	Sesquiterpenic alcohol
Ledol	[0.13]*	0.05	Sesquiterpenic alcohol
10-epi-Cubenol	0.01	[0.35]*	Sesquiterpenic alcohol
Rosifoliol	0.13	[0.14]*	Sesquiterpenic alcohol
1-epi-Cubenol	0.17	0.17	Sesquiterpenic alcohol
Isospathulenol	0.04	0.04	Sesquiterpenic alcohol
Cubenol	0.10	[0.22]*	Sesquiterpenic alcohol

α -Muurolol	0.07	0.05	Sesquiterpenic alcohol
Total identified	98.88%	98.34%	

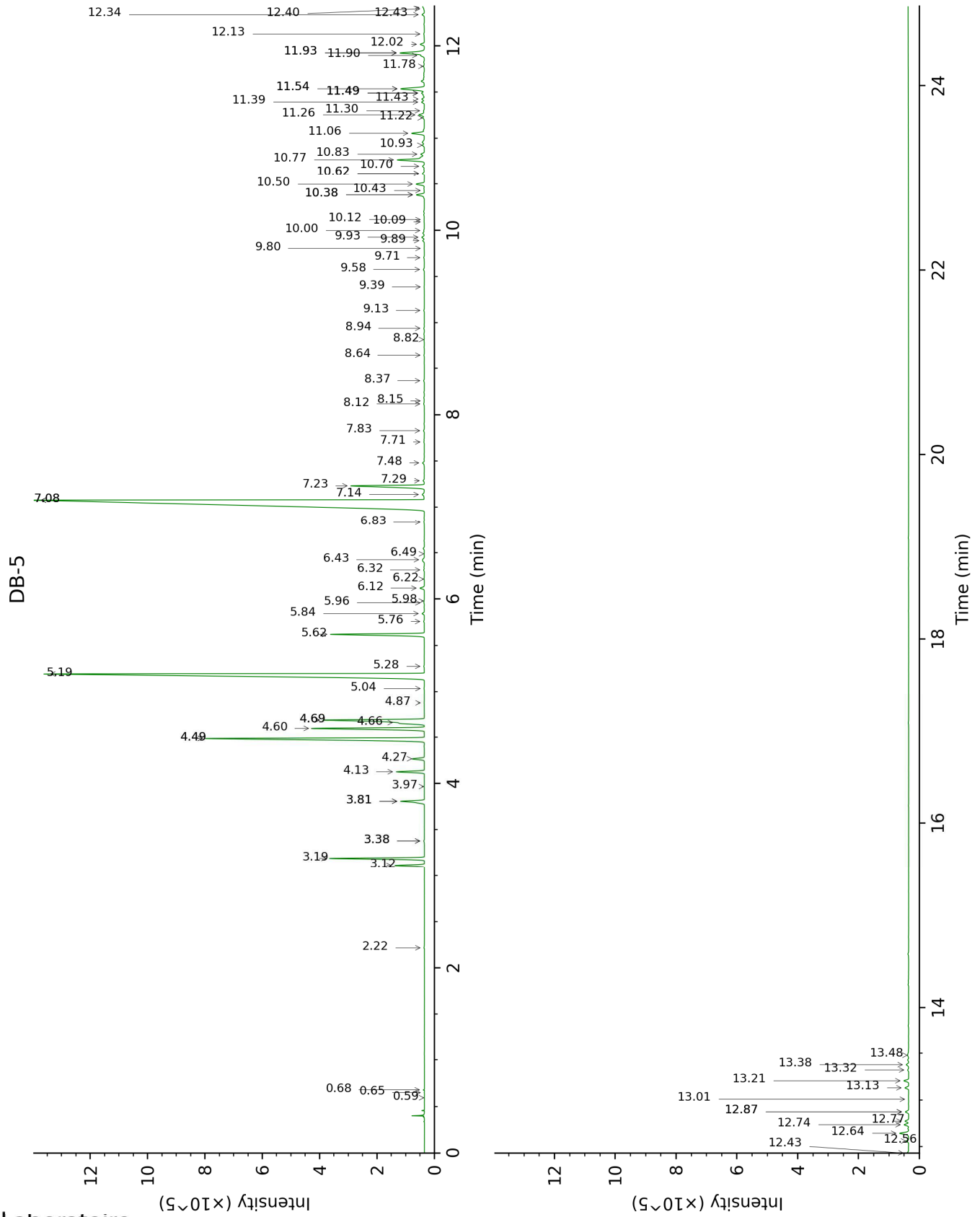
*: Two or more compounds are coeluting on this column

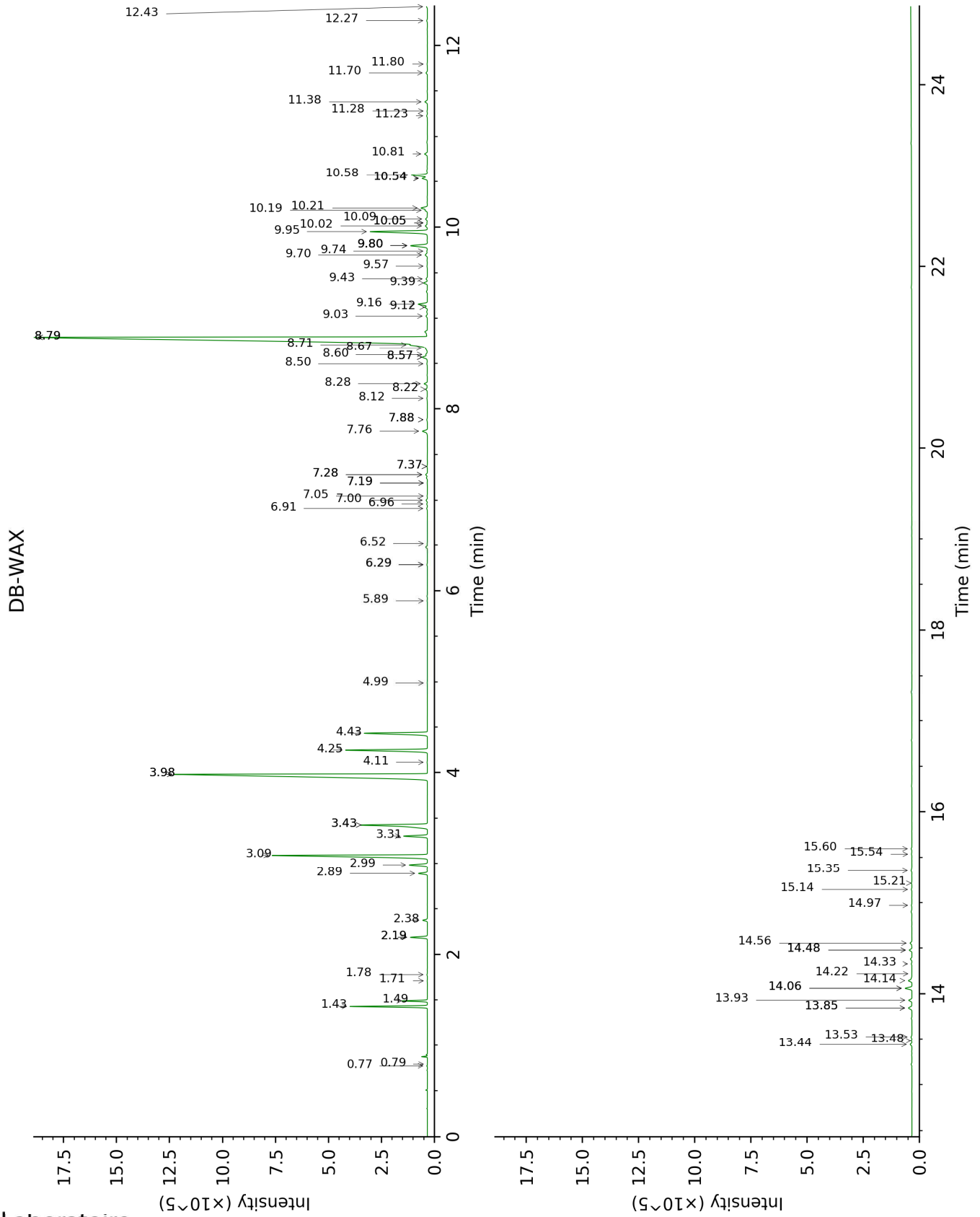
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Isobutanol	0.60	624	tr	2.19*	1067	0.70
Isovaleral	0.65	640	tr	0.79	890	tr
2-Methylbutyral	0.68	649	0.01	0.77	884	0.01
(3Z)-Hexenol	2.22	856	0.02	5.89	1347	0.02
α-Thujene	3.12	924	0.84	1.49	1001	0.82
α-Pinene	3.19	929	2.72	1.43	993	2.68
Camphene	3.38*	942	0.03	1.78	1028	0.02
α-Fenchene	3.38*	942	[0.03]	1.71	1022	0.01
β-Pinene	3.81*	970	0.90	2.19*	1067	[0.70]
Sabinene	3.81*	970	[0.90]	2.38	1085	0.19
3-Methyl-3-cyclohexenone	3.97	981	0.01	6.29*	1376	0.03
Myrcene	4.13	991	0.86	2.99	1134	0.84
α-Phellandrene	4.27	1000	0.40	2.89	1127	0.38
(3Z)-Hexenyl acetate	4.49*	1014	8.69	4.99	1288	0.01
α-Terpinene	4.49*	1014	[8.69]	3.09	1142	8.57
para-Cymene	4.60	1021	3.90	4.25	1232	3.91
Limonene	4.66†	1025	4.88	3.31	1159	1.05
1,8-Cineole	4.69*†	1027	[4.88]	3.43*	1169	3.86
β-Phellandrene	4.69*†	1027	[4.88]	3.43*	1169	[3.86]
(Z)-β-Ocimene	4.87	1039	0.01	3.98*	1212	20.62
(E)-β-Ocimene	5.04	1049	0.01	4.11	1222	0.02
γ-Terpinene	5.19	1059	20.87	3.98*	1212	[20.62]
cis-Sabinene hydrate	5.28	1064	0.03	6.96	1425	0.03
Terpinolene	5.62	1086	3.25	4.43	1246	3.12
trans-Sabinene hydrate	5.76	1095	0.02	8.12	1511	0.04
Linalool	5.84	1101	0.07	8.22	1519	0.09
para-Mentha-1,3,8-triene	5.96	1108	0.01	6.29*	1376	[0.03]
endo-Fenchol	5.98	1109	0.01	8.50	1540	0.03
cis-para-Menth-2-en-1-ol	6.12	1118	0.16	8.28	1524	0.16
4-Hydroxy-4-methylcyclohex-2-enone	6.22	1125	0.02	14.22	2031	0.01
Cosmene isomer I	6.32	1131	0.02	6.52	1392	0.01
trans-para-Menth-2-en-1-ol	6.43	1138	0.12	9.12	1589	0.12
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.49	1142	0.01	7.05	1431	0.02
δ-Terpineol	6.83	1165	0.02	9.57	1625	0.03
Terpinen-4-ol	7.08*	1181	39.66	8.79*	1563	39.94
Dill ether	7.08*	1181	[39.66]	7.37*	1455	0.02

para-Cymen-8-ol	7.14	1185	0.08	11.70	1801	0.07
α-Terpineol	7.23	1191	2.93	9.95	1655	3.05
cis-Piperitol	7.29	1195	0.04	9.74	1638	0.03
trans-Piperitol	7.48	1207	0.06	10.54*	1703	0.28
exo-2-Hydroxycineole	7.71	1223	0.02	11.80	1810	0.02
Nerol	7.83	1232	0.03	11.23	1761	0.04
Piperitone	8.12	1252	0.03	10.05*	1663	0.02
cis-Carvenone oxide?	8.15	1254	0.01			
trans-Ascaridole glycol	8.37	1269	0.03	14.33	2041	0.03
cis-Ascaridole glycol?	8.64	1288	0.02	14.97	2103	0.03
Thymol	8.82	1300	0.02	15.21	2128	0.03
Carvacrol	8.94	1309	0.02	15.54	2160	0.03
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.13	1316	0.02	15.14	2121	0.03
Bicycloelemene	9.39	1334	0.01	7.19*	1442	0.01
α-Cubebene	9.58	1348	0.04	6.91	1421	0.04
Cyclosativene II	9.70	1357	0.02	7.19*	1442	[0.01]
Isoledene	9.80	1364	0.01	7.00	1428	0.07
α-Copaene	9.89	1370	0.06	7.28*	1449	0.09
7-Cubebene	9.93	1372	0.10	7.28*	1449	[0.09]
7-Cubebene epimer?	10.00	1378	0.02	7.37*	1455	[0.02]
β-Cubebene	10.09	1384	0.01	7.88*	1493	0.04
β-Elemene	10.12	1386	0.01	8.60	1548	0.08
Methyleugenol	10.38*	1405	0.30	13.44	1957	0.09
α-Gurjunene	10.38*	1405	[0.30]	7.76	1484	0.27
β-Maaliene	10.43	1409	0.01	7.88*	1493	[0.04]
β-Caryophyllene	10.50	1414	0.31	8.57*	1546	0.32
γ-Maaliene	10.62*	1423	0.07	8.67	1554	0.10
β-Gurjunene	10.62*	1423	[0.07]	8.57*	1546	[0.32]
Aromadendrene	10.70	1429	0.07	8.71	1557	1.00
Selina-5,11-diene	10.77	1434	1.22	8.79*	1563	[39.94]
trans-Muurolo-3,5-diene	10.83	1439	0.14	9.03	1581	0.07
α-Humulene	10.93	1446	0.18	9.39	1610	0.19
allo-Aromadendrene	11.06	1456	0.50	9.16	1591	0.49
trans-Cadina-1(6),4-diene	11.22	1468	0.06	9.43	1613	0.07
γ-Muurolole	11.26	1470	0.24	9.80*	1643	0.95
β-Selinene	11.30	1474	0.03	10.05*	1663	[0.02]
allo-Aromadendr-9-ene	11.39	1481	0.11	9.70	1635	0.14
δ-Selinene	11.43	1483	0.10	9.80*	1643	[0.95]
α-Selinene	11.49*†	1488	1.38	10.09	1666	0.12
Bicyclogermacrene	11.49*†	1488	[1.38]	10.21	1676	0.37

α-Muurolene	11.49*†	1488	[1.38]	10.19	1674	0.10
Viridiflorene	11.54*†	1492	[1.38]	9.80*	1643	[0.95]
Epizonarene	11.54*†	1492	[1.38]	10.02	1660	0.12
γ-Cadinene	11.78	1510	0.04	10.54*	1703	[0.28]
Zonarene	11.90	1519	0.11	10.54*	1703	[0.28]
<i>trans</i> -Calamenene	11.92*	1521	1.08	11.38	1774	0.14
δ-Cadinene	11.92*	1521	[1.08]	10.58	1706	0.88
<i>trans</i> -Cadina-1,4-diene	12.02	1529	0.15	10.81	1726	0.16
α-Calacorene	12.13	1538	0.02	12.27	1852	0.04
Eudesma-5,7(11)-diene	12.34	1554	0.09	11.28	1766	0.02
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.40	1559	0.02	13.48	1961	0.03
Palustrol	12.43	1561	0.10	12.43	1865	0.05
Spathulenol	12.56	1572	0.10	14.56	2063	0.09
Globulol	12.64	1578	0.36	14.06*	2016	0.35
Viridiflorol	12.74	1586	0.17	14.14	2024	0.19
Cubeban-11-ol	12.77	1588	0.14	13.84*	1995	0.22
Eudesm-5-en-11-ol	12.87*	1596	0.13	14.48*	2056	0.14
Ledol	12.87*	1596	[0.13]	13.53	1965	0.05
10-epi-Cubenol	13.01	1607	0.01	14.06*	2016	[0.35]
Rosifoliol	13.13	1617	0.13	14.48*	2056	[0.14]
1-epi-Cubenol	13.21	1624	0.17	13.93	2003	0.17
Isospathulenol	13.32	1633	0.04	15.60	2166	0.04
Cubenol	13.38	1638	0.10	13.84*	1995	[0.22]
α-Muurolol	13.48	1646	0.07	15.35	2141	0.05
Total identified		98.88%			98.34%	
Total reported		98.93%			98.41%	

*: Two or more compounds are coeluting on this column

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