

Date : July 02, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19F18-PTH03-1-SCC

Customer identification : Tea Tree - T2010895R

Type : Essential oil

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

Customer : Plant Therapy

ANALYSIS

Method: PC-PA-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 : Benoit Roger, Ph. D.

Analysis date : June 28, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4785 ± 0.0003 (20 °C)

ISO 4730:2017 - TEA TREE OIL

Compound	Min. %	Max. %	Observed %	Complies?
Viridiflorol	tr	1.0	0.1	Yes
Globulol	tr	1.0	0.3	Yes
δ-Cadinene	0.2	3.0	1.2	Yes
Viridiflorene	0.1	3.0	0.9	Yes
Aromadendrene	0.2	3.0	0.9	Yes
α-Terpineol	2.0	5.0	3.0	Yes
Terpinen-4-ol	35.0	48.0	42.0	Yes
Terpinolene	1.5	5.0	3.3	Yes
γ-Terpinene	14.0	28.0	19.0	Yes
1,8-Cineole	tr	10.0	2.2	Yes
para-Cymene	0.5	8.0	2.5	Yes
Limonene	0.5	1.5	0.7	Yes
α-Terpinene	6.0	12.0	9.3	Yes
Sabinene	tr	3.5	0.4	Yes
α-Pinene	1.0	4.0	2.2	Yes
Refractive index	1.4750	1.4820	1.4785	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 – CONSOLIDATED CONTENTS

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

Identification	%	Classe
Ethanol	0.08	Aliphatic alcohol
Isobutyral	0.02	Aliphatic aldehyde
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	0.02	Aliphatic aldehyde
(3Z)-Hexenol	0.08	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
α -Thujene	0.87	Monoterpene
α -Pinene	2.22	Monoterpene
α -Fenchene	tr	Monoterpene
Camphene	0.01	Monoterpene
β -Pinene	0.66	Monoterpene
Sabinene	0.39	Monoterpene
3-Methyl-3-cyclohexenone	0.01	Aliphatic ketone
Myrcene	0.77	Monoterpene
α -Phellandrene	0.46	Monoterpene
Pseudolimonene	0.01	Monoterpene
(3Z)-Hexenyl acetate	0.01	Aliphatic ester
α -Terpinene	9.30	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	2.52	Monoterpene
1,8-Cineole	2.23	Monoterpenic ether
Limonene	0.69	Monoterpene
(Z)- β -Ocimene	tr	Monoterpene
(E)- β -Ocimene	0.02	Monoterpene
γ -Terpinene	19.00	Monoterpene
cis-Sabinene hydrate	0.12	Monoterpenic alcohol
para-Cymenene	0.01	Monoterpene
Terpinolene	3.31	Monoterpene
trans-Sabinene hydrate	0.17	Monoterpenic alcohol
Linalool	0.06	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	Monoterpene
endo-Fenchol	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.37	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.03	Aliphatic alcohol
Cosmene isomer I	0.02	Monoterpene
trans-Pinocarveol	0.02	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.29	Monoterpenic alcohol
δ -Terpineol	0.02	Monoterpenic alcohol
Terpinen-4-ol	42.00	Monoterpenic alcohol
Dill ether	0.02	Monoterpenic ether
para-Cymen-8-ol	0.08	Monoterpenic alcohol
α -Terpineol	3.02	Monoterpenic alcohol
Unknown	tr	Oxygenated monoterpene
cis-Piperitol	0.09	Monoterpenic alcohol
trans-Piperitol	0.19	Monoterpenic alcohol
exo-2-Hydroxycineole	0.03	Monoterpenic alcohol
Nerol	0.03	Monoterpenic alcohol

Piperitone	0.07	Monoterpenic ketone
<i>cis</i> -Carvenone oxide?	0.02	Monoterpenic ketone
<i>trans</i> -Ascaridole glycol	0.08	Monoterpenic alcohol
<i>cis</i> -Ascaridole glycol	0.06	Monoterpenic alcohol
Thymol	0.04	Monoterpenic alcohol
Carvacrol	0.01	Monoterpenic alcohol
Unknown	0.09	Monoterpenic alcohol
Bicycloelemene	0.03	Sesquiterpene
α -Cubebene	0.06	Sesquiterpene
Isoledene	0.06	Sesquiterpene
α -Copaene	0.11	Sesquiterpene
7-Cubebene	0.05	Sesquiterpene
7-Cubebene epimer?	0.02	Aliphatic alcohol
β -Cubebene	0.02	Sesquiterpene
β -Elemene	0.04	Sesquiterpene
Methyleugenol	0.11	Phenylpropanoid
α -Gurjunene	0.33	Sesquiterpene
β -Maaliene	0.01	Sesquiterpene
β -Caryophyllene	0.38	Sesquiterpene
γ -Maaliene	0.06	Sesquiterpene
β -Gurjunene	0.02	Sesquiterpene
α -Maaliene	0.07	Sesquiterpene
Aromadendrene	0.85	Sesquiterpene
Selina-5,11-diene	0.12	Sesquiterpene
Cadina-3,5-diene isomer I?	0.12	Sesquiterpene
<i>trans</i> -Muurolo-3,5-diene	0.14	Sesquiterpene
α -Humulene	0.11	Sesquiterpene
Valerena-4,7(11)-diene	0.05	Sesquiterpene
allo-Aromadendrene	0.43	Sesquiterpene
γ -Gurjunene	0.04	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.32	Sesquiterpene
γ -Muurolole	0.04	Sesquiterpene
Selina-4,11-diene	0.04	Sesquiterpene
β -Selinene	0.09	Sesquiterpene
allo-Aromadendr-9-ene	0.09	Sesquiterpene
δ -Selinene	0.10	Sesquiterpene
α -Selinene	0.09	Sesquiterpene
Viridiflorene	0.89	Sesquiterpene
Epizonarene	0.12	Sesquiterpene
Bicyclogermacrene	0.84	Sesquiterpene
α -Muurolole	0.18	Sesquiterpene
γ -Cadinene	0.05	Sesquiterpene
Zonarene	0.27	Sesquiterpene
<i>trans</i> -Calamenene	0.12	Sesquiterpene
δ -Cadinene	1.25	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.20	Sesquiterpene
α -Calacorene	0.01	Sesquiterpene
Maaliol	0.04	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.02	Sesquiterpene
Unknown	0.04	Oxygenated sesquiterpene
Spathulenol	0.08	Sesquiterpenic alcohol
Globulol	0.27	Sesquiterpenic alcohol

Gleenol	0.03	Sesquiterpenic alcohol
Viridiflorol	0.14	Sesquiterpenic alcohol
Cubeban-11-ol	0.15	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.05	Sesquiterpenic alcohol
Ledol	0.06	Sesquiterpenic alcohol
Eudesm-5-en-11-ol	0.01	Sesquiterpenic alcohol
Rosifoliol	0.11	Sesquiterpenic alcohol
1-epi-Cubenol	0.19	Sesquiterpenic alcohol
Isospathulenol	0.09	Sesquiterpenic alcohol
Cubenol	0.11	Sesquiterpenic alcohol
α -Muurolol	0.04	Sesquiterpenic alcohol
α -Cadinol	0.02	Sesquiterpenic alcohol
Consolidated total	99.07%	

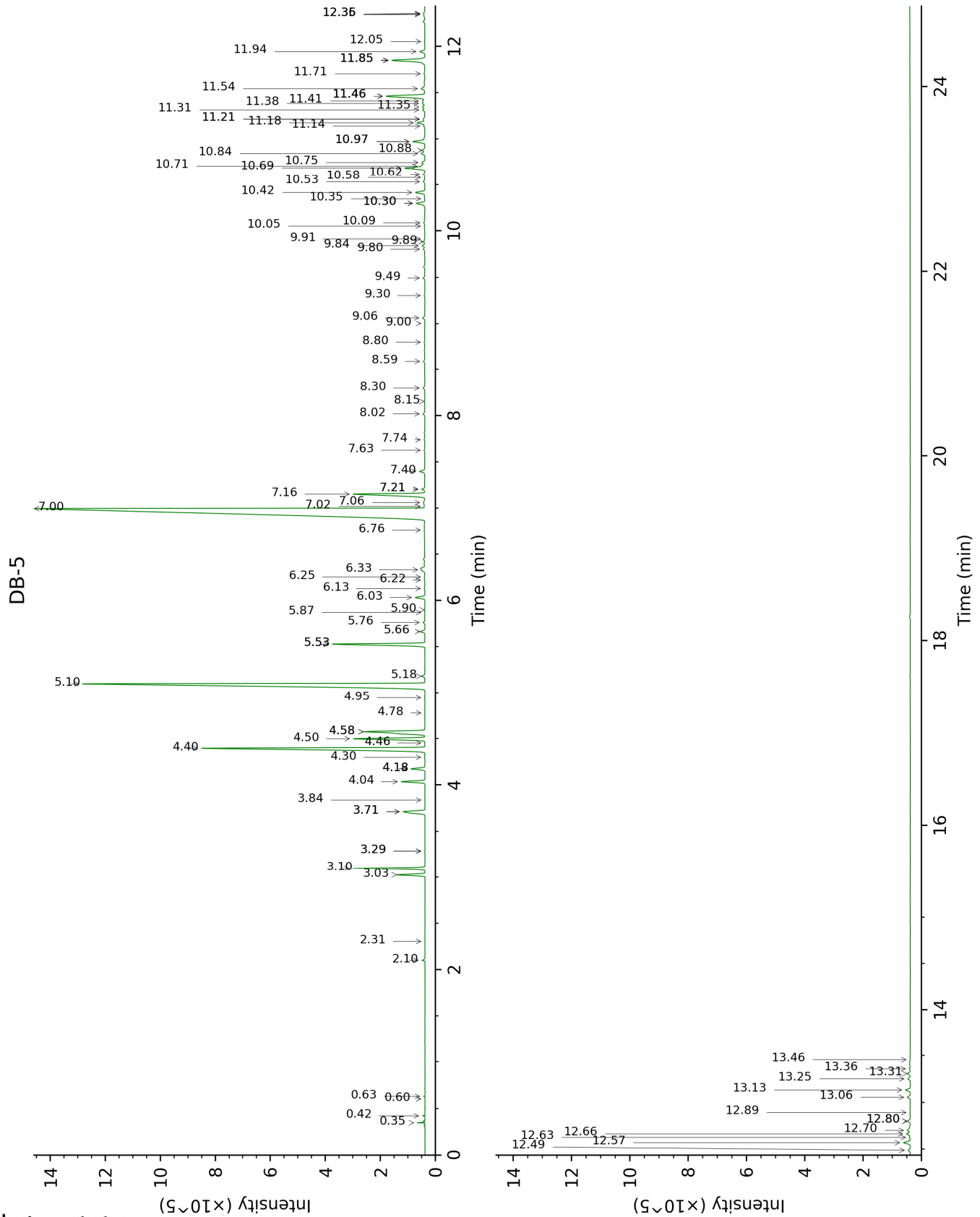
tr: The compound has been detected below 0.005% of total signal.

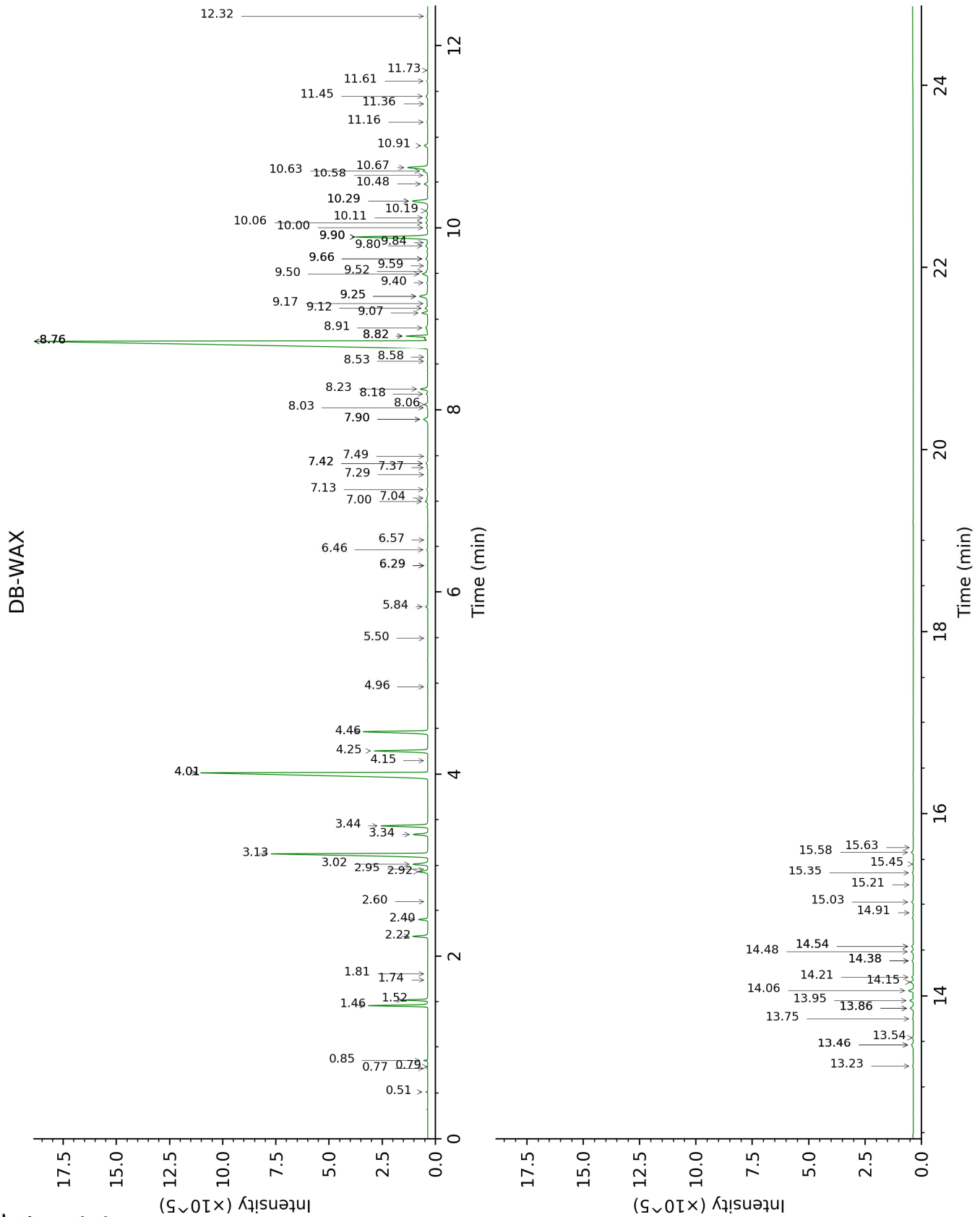
Note: no correction factor was applied

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	513	0.08	0.85	903	0.09
Isobutyral	0.42	528	0.02	0.51	782	0.03
Isovaleral	0.60	639	tr	0.79	886	tr
2-Methylbutyral	0.63	649	0.02	0.77	879	0.02
(3Z)-Hexenol	2.10	854	0.08	5.84	1338	0.09
Hexanol	2.31	871	0.01	5.50	1314	0.01
α -Thujene	3.03	924	0.87	1.52	1002	0.87
α -Pinene	3.10	929	2.22	1.46	996	2.17
α -Fenchene	3.29*	941	0.01	1.74	1023	tr
Camphene	3.29*	941	[0.01]	1.81	1029	0.01
β -Pinene	3.71*	969	1.07	2.22	1069	0.66
Sabinene	3.71*	969	[1.07]	2.40	1087	0.39
3-Methyl-3-cyclohexenone	3.84	978	0.01	6.29*	1371	0.01
Myrcene	4.04	991	0.77	3.02	1136	0.76
α -Phellandrene	4.18*	1000	0.47	2.92	1129	0.46
Pseudolimonene	4.18*	1000	[0.47]	2.95	1132	0.01
(3Z)-Hexenyl acetate	4.30	1008	0.01	4.96	1285	0.02
α -Terpinene	4.40	1014	9.30	3.13	1145	9.18
Carvomenthene	4.46	1017	0.01	2.60	1104	0.01
para-Cymene	4.50	1020	2.52	4.26	1232	2.51
1,8-Cineole	4.58*	1025	2.95	3.44	1169	2.23
Limonene	4.58*	1025	[2.95]	3.34	1162	0.69
(Z)- β -Ocimene	4.78	1038	tr	4.01*	1214	18.81
(E)- β -Ocimene	4.94	1048	0.02	4.15	1224	0.02
γ -Terpinene	5.10	1058	19.00	4.01*	1214	[18.81]
cis-Sabinene hydrate	5.18	1063	0.12	7.00	1424	0.12
para-Cymenene	5.53*	1084	3.38	6.57	1392	0.01
Terpinolene	5.53*	1084	[3.38]	4.46	1247	3.31
trans-Sabinene hydrate	5.66	1093	0.17	8.06	1503	0.18
Linalool	5.76	1099	0.06	8.18	1512	0.09
para-Mentha-1,3,8-triene	5.87	1106	0.01	6.29*	1371	[0.01]
endo-Fenchol	5.90	1108	0.01	8.53	1540	0.02
cis-para-Menth-2-en-1-ol	6.03	1116	0.37	8.23	1517	0.42
4-Hydroxy-4-methylcyclohex-2-enone	6.13	1123	0.03	14.20	2029	0.08
Cosmene isomer I	6.22	1129	0.02	6.46	1384	0.05
trans-Pinocarveol	6.25	1131	0.02	9.25*	1596	0.67
trans-para-Menth-2-en-1-ol	6.33	1136	0.29	9.07	1582	0.28
δ -Terpineol	6.76	1163	0.02	9.59	1624	0.03
Terpinen-4-ol	7.00	1179	42.00	8.76*†	1558	42.60

Dill ether	7.02	1180	0.02	7.49	1461	0.03
para-Cymen-8-ol	7.06	1183	0.08	11.61	1793	0.04
α -Terpineol	7.16	1189	3.02	9.90*	1649	4.01
Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	7.21*	1192	0.09			
<i>cis</i> -Piperitol	7.21*	1192	[0.09]	9.66*	1630	0.13
<i>trans</i> -Piperitol	7.40	1205	0.19	10.48	1696	0.19
exo-2-Hydroxycineole	7.63	1221	0.03	11.73	1803	0.02
Nerol	7.74	1228	0.03	11.16	1755	0.04
Piperitone	8.02	1247	0.07	10.00	1658	0.08
<i>cis</i> -Carvenone oxide?	8.16	1257	0.02			
<i>trans</i> -Ascaridole glycol	8.30	1266	0.08	14.38*	2046	0.06
<i>cis</i> -Ascaridole glycol	8.59	1286	0.06	14.91	2096	0.04
Thymol	8.80	1301	0.04	15.22	2127	0.04
Carvacrol	9.00	1310	0.01	15.45	2150	0.02
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.06	1314	0.09	15.03	2108	0.10
Bicycloelemene	9.30	1331	0.03	7.29	1446	0.02
α -Cubebene	9.49	1345	0.06	7.04	1426	0.06
Isoledene	9.80	1366	0.06	7.13	1433	0.06
α -Copaene	9.84	1369	0.11	7.42*	1455	0.12
7-Cubebene	9.89	1372	0.05	7.37	1451	0.05
7-Cubebene epimer?	9.92	1374	0.02	7.42*	1455	[0.12]
β -Cubebene	10.05	1384	0.02	8.02	1501	0.04
β -Elemene	10.09	1386	0.04	8.76*†	1558	[42.60]
Methyleugenol	10.30*	1401	0.37	13.46*	1958	0.16
α -Gurjunene	10.30*	1401	[0.37]	7.90*	1491	0.34
β -Maaliene	10.35	1405	0.01	7.90*	1491	[0.34]
β -Caryophyllene	10.42	1410	0.38	8.76*†	1558	[42.60]
γ -Maaliene	10.53	1419	0.06	8.76*†	1558	[42.60]
β -Gurjunene	10.58	1422	0.02	8.58	1544	0.01
α -Maaliene	10.62	1425	0.07	8.82*	1562	0.83
Aromadendrene	10.69	1430	0.85	8.82*	1562	[0.83]
Selina-5,11-diene	10.71	1431	0.12	8.91	1569	0.14
Cadina-3,5-diene isomer I?	10.75	1434	0.12			
<i>trans</i> -Muuroala-3,5-diene	10.84	1442	0.14	9.12	1586	0.16
α -Humulene	10.88	1444	0.11	9.52	1618	0.08
Valerena-4,7(11)-diene	10.97*	1451	0.48	9.17	1590	0.05
allo-	10.97*	1451	[0.48]	9.25*	1596	[0.67]

Aromadendrene						
γ-Gurjunene	11.14	1463	0.04	9.40	1608	0.06
<i>trans</i> -Cadina-1(6),4-diene	11.18	1466	0.32	9.50	1616	0.33
γ-Murolene	11.22*	1469	0.08	9.84	1644	0.04
Selina-4,11-diene	11.22*	1469	[0.08]	9.66*	1630	[0.13]
β-Selinene	11.32	1476	0.09	10.11	1666	0.11
allo-Aromadendr-9-ene	11.35	1479	0.09	9.80	1641	0.12
δ-Selinene	11.38	1482	0.10	9.90*	1649	[4.01]
α-Selinene	11.41	1483	0.09	10.19	1672	0.10
Viridiflorene	11.46*	1487	1.84	9.90*	1649	[4.01]
Epizonarene	11.46*	1487	[1.84]	10.06	1662	0.12
Bicyclogermacrene	11.46*	1487	[1.84]	10.29*	1681	1.02
α-Murolene	11.54	1493	0.18	10.29*	1681	[1.02]
γ-Cadinene	11.70	1506	0.05	10.58	1705	0.03
Zonarene	11.85*	1517	1.54	10.63	1709	0.27
<i>trans</i> -Calamenene	11.85*	1517	[1.54]	11.45	1779	0.12
δ-Cadinene	11.85*	1517	[1.54]	10.67	1712	1.25
<i>trans</i> -Cadina-1,4-diene	11.94	1524	0.20	10.91	1733	0.20
α-Calacorene	12.05	1533	0.01	12.32	1856	0.03
Maaliol	12.35*	1555	0.06	13.23	1937	0.04
Eudesma-5,7(11)-diene	12.35*	1555	[0.06]	11.36	1772	0.02
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.36	1556	0.04	13.46*	1958	[0.16]
Spathulenol	12.49	1566	0.08	14.54*	2061	0.09
Globulol	12.57	1573	0.27	14.06	2015	0.27
Gleenol	12.63	1577	0.03	13.75	1986	0.04
Viridiflorol	12.66	1580	0.14	14.15	2024	0.15
Cubeban-11-ol	12.70	1583	0.15	13.86*	1996	0.20
Eudesm-5-en-11-ol analog	12.80*	1591	0.11	14.38*	2046	[0.06]
Ledol	12.80*	1591	[0.11]	13.54	1966	0.06
Eudesm-5-en-11-ol	12.89	1598	0.01	14.54*	2061	[0.09]
Rosifoliol	13.06	1611	0.11	14.48	2056	0.11
1-epi-Cubenol	13.13	1618	0.19	13.95	2004	0.19
Isospathulenol	13.25	1628	0.09	15.58	2163	0.11
Cubenol	13.31	1632	0.11	13.86*	1996	[0.20]
α-Muurolol	13.36	1636	0.04	15.35	2140	0.06
α-Cadinol	13.46	1644	0.02	15.63	2169	0.01
Total identified		98.88%			98.85%	
Total reported		99.01%			98.95%	

*: 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