

Date : July 03, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 20G02-PTH01


**Customer identification :** Tea Tree Organic - Australia - T30113201R

**Type :** Essential oil

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

**Customer :** Plant Therapy

ANALYSIS

**Method:** PC-MAT-014  - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID (in French); identifications validated by GC-MS.

**Analyst :** Fanny Charlier, B. Sc., chimiste à l'entraînement

**Analysis date :** July 02, 2020

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4770 \pm 0.0003$  (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-Methylbutyral	0.01	Aliphatic aldehyde
Isobutyric acid	0.01	Aliphatic acid
(3Z)-Hexenol	0.01	Aliphatic alcohol
$\alpha$ -Thujene	0.97	Monoterpene
$\alpha$ -Pinene	2.45	Monoterpene
$\alpha$ -Fenchene	tr	Monoterpene
Camphene	0.01	Monoterpene
Sabinene	0.62	Monoterpene
$\beta$ -Pinene	0.80	Monoterpene
3-Methyl-3-cyclohexenone	0.01	Aliphatic ketone
Myrcene	0.95	Monoterpene
$\alpha$ -Phellandrene	0.40	Monoterpene
Pseudolimonene	0.01	Monoterpene
(3Z)-Hexenyl acetate	0.01	Aliphatic ester
$\alpha$ -Terpinene	10.94	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	1.32	Monoterpene
Limonene	1.04	Monoterpene
1,8-Cineole	4.10	Monoterpenic ether
$\beta$ -Phellandrene	0.76	Monoterpene
(Z)- $\beta$ -Ocimene	tr	Monoterpene
(E)- $\beta$ -Ocimene	0.02	Monoterpene
$\gamma$ -Terpinene	21.53	Monoterpene
cis-Sabinene hydrate	0.16	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Terpinolene	3.62	Monoterpene
para-Cymenene	0.02	Monoterpene
trans-Sabinene hydrate	0.27	Monoterpenic alcohol
Linalool	0.07	Monoterpenic alcohol
Unknown	0.01	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	Monoterpene
endo-Fenchol	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.44	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.01	Aliphatic alcohol
Cosmene isomer I	0.02	Monoterpene
trans-Pinocarveol	0.02	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.32	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
$\delta$ -Terpineol	0.02	Monoterpenic alcohol
Terpinen-4-ol	38.26	Monoterpenic alcohol
Dill ether	tr	Monoterpenic ether

para-Cymen-8-ol	0.04	Monoterpenic alcohol
$\alpha$ -Terpineol	2.65	Monoterpenic alcohol
cis-Piperitol	0.12	Monoterpenic alcohol
trans-Piperitol	0.18	Monoterpenic alcohol
exo-2-Hydroxycineole	0.02	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Piperitone	0.03	Monoterpenic ketone
cis-Carvenone oxide?	0.01	Monoterpenic ketone
trans-Ascaridole glycol	0.04	Monoterpenic alcohol
cis-Ascaridole glycol	0.02	Monoterpenic alcohol
Thymol	0.02	Monoterpenic alcohol
Carvacrol	0.01	Monoterpenic alcohol
Unknown	0.04	Monoterpenic alcohol
Bicycloelemene	0.02	Sesquiterpene
$\alpha$ -Cubebene	0.04	Sesquiterpene
Unknown	0.02	Unknown
Cyclosativene II	0.01	Sesquiterpene
Isoledene	0.04	Sesquiterpene
$\alpha$ -Copaene	0.07	Sesquiterpene
7-Cubebene	0.04	Sesquiterpene
7-Cubebene epimer?	0.02	Aliphatic alcohol
$\beta$ -Cubebene	0.01	Sesquiterpene
$\beta$ -Elemene	0.02	Sesquiterpene
Unknown	0.02	Sesquiterpene
$\alpha$ -Gurjunene	0.23	Sesquiterpene
Methyleugenol	0.02	Phenylpropanoid
$\beta$ -Maaliene	0.02	Sesquiterpene
$\beta$ -Caryophyllene	0.32	Sesquiterpene
$\gamma$ -Maaliene	0.04	Sesquiterpene
$\beta$ -Gurjunene	0.01	Sesquiterpene
$\alpha$ -Maaliene	0.04	Sesquiterpene
Aromadendrene	0.60	Sesquiterpene
Selina-5,11-diene	0.09	Sesquiterpene
trans-Muurolo-3,5-diene	0.10	Sesquiterpene
$\alpha$ -Humulene	0.09	Sesquiterpene
allo-Aromadendrene	0.33	Sesquiterpene
Valerena-4,7(11)-diene	0.03	Sesquiterpene
$\gamma$ -Gurjunene	0.03	Sesquiterpene
trans-Cadina-1(6),4-diene	0.15	Sesquiterpene
Selina-4,11-diene	0.06	Sesquiterpene
$\gamma$ -Muurolole	0.03	Sesquiterpene
$\beta$ -Selinene	0.06	Sesquiterpene
allo-Aromadendr-9-ene	0.02	Sesquiterpene
trans-Muurolo-4(15),5-diene	0.02	Sesquiterpene
$\delta$ -Selinene	0.07	Sesquiterpene
Bicyclogermacrene	0.85	Sesquiterpene
Viridiflorene	0.56	Sesquiterpene
$\alpha$ -Muurolole	0.11	Sesquiterpene
$\gamma$ -Cadinene	0.04	Sesquiterpene
$\delta$ -Cadinene	0.59	Sesquiterpene
trans-Calamenene	0.05	Sesquiterpene

Zonarene	0.03	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.13	Sesquiterpene
$\alpha$ -Calacorene	0.04	Sesquiterpene
Epiglobulol	0.06	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.03	Sesquiterpene
Maaliol	0.03	Sesquiterpenic alcohol
Unknown	0.02	Oxygenated sesquiterpene
Spathulenol	0.05	Sesquiterpenic alcohol
Globulol	0.26	Sesquiterpenic alcohol
Gleenol	0.02	Sesquiterpenic alcohol
Viridiflorol	0.12	Sesquiterpenic alcohol
Cubeban-11-ol	0.10	Sesquiterpenic alcohol
Ledol	0.02	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.01	Sesquiterpenic alcohol
10-epi-Cubenol	tr	Sesquiterpenic alcohol
Rosifoliol	0.11	Sesquiterpenic alcohol
1-epi-Cubenol	0.15	Sesquiterpenic alcohol
Isospathulenol	0.04	Sesquiterpenic alcohol
Cubenol	0.09	Sesquiterpenic alcohol
$\alpha$ -Muurolol	0.04	Sesquiterpenic alcohol
<b>Consolidated total</b>	<b>98.68%</b>	

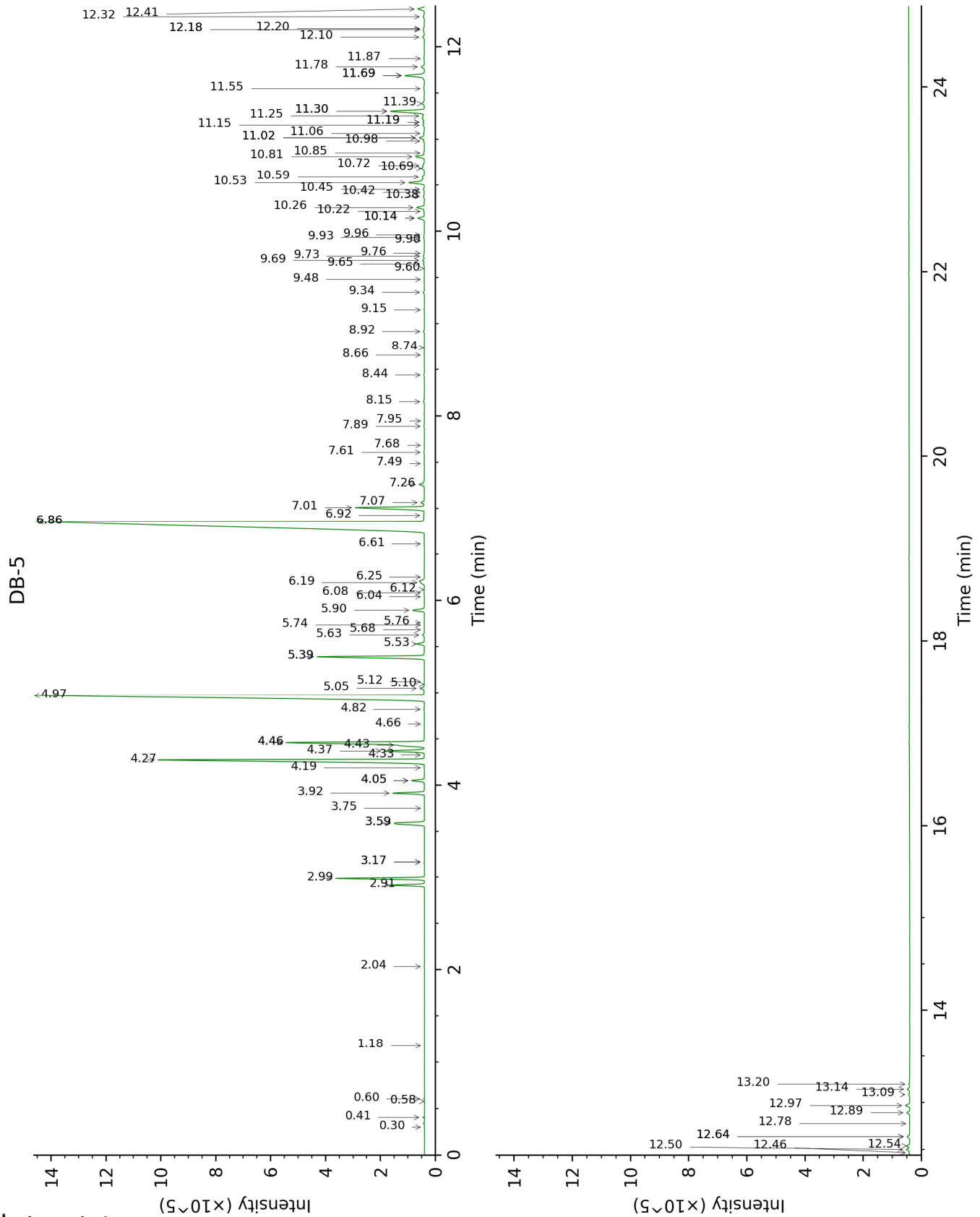
tr: The compound has been detected below 0.005% of total signal.

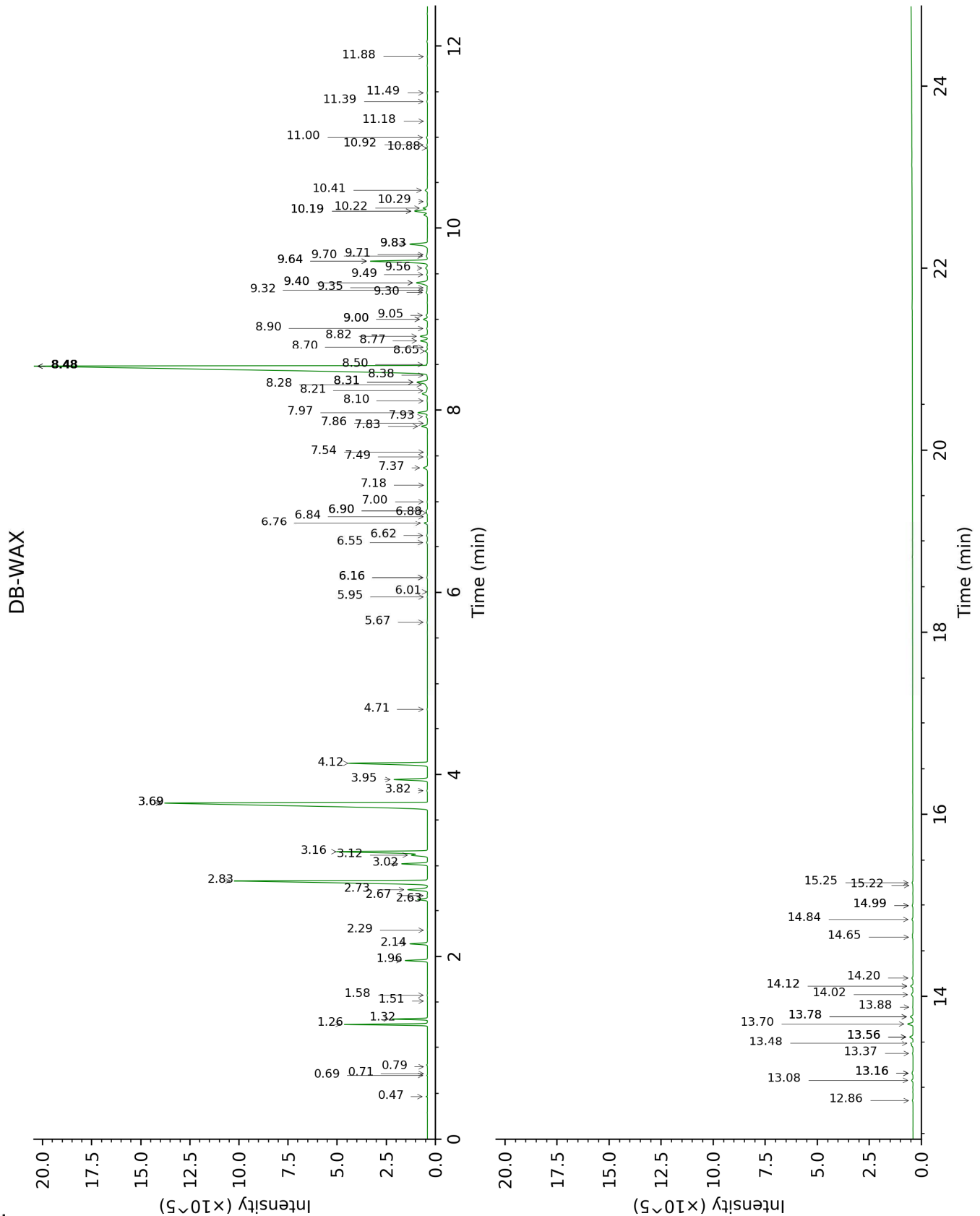
Note: no correction factor was applied

**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	0.30	524	tr	0.79	905	tr
Isobutyral	0.41	524	0.02	0.46	776	0.02
Isovaleral	0.58	639	tr	0.72	889	tr
2-Methylbutyral	0.60	651	0.01	0.70	880	0.01
Isobutyric acid	1.18	774	0.01	7.86	1514	0.01
(3Z)-Hexenol	2.04	859	0.01	5.67	1351	0.02
$\alpha$ -Thujene	2.91	926	0.97	1.32	998	0.96
$\alpha$ -Pinene	2.99	931	2.45	1.26	990	2.44
$\alpha$ -Fenchene	3.17*	943	0.02	1.51	1018	tr
Camphene	3.17*	943	[0.02]	1.58	1025	0.01
Sabinene	3.59*	970	1.42	2.14	1084	0.62
$\beta$ -Pinene	3.59*	970	[1.42]	1.96	1065	0.80
3-Methyl-3-cyclohexenone	3.75	981	0.01	5.95	1372	0.01
Myrcene	3.92	992	0.95	2.73	1135	0.96
$\alpha$ -Phellandrene	4.05*	1001	0.41	2.63	1126	0.40
Pseudolimonene	4.05*	1001	[0.41]	2.67	1130	0.01
(3Z)-Hexenyl acetate	4.19	1010	0.01	4.71	1287	0.02
$\alpha$ -Terpinene	4.27	1015	10.94	2.83	1142	10.92
Carvomenthene	4.33	1018	0.01	2.29	1099	0.01
para-Cymene	4.37	1021	1.32	3.95	1230	1.34
Limonene	4.43†	1025	5.85	3.02	1158	1.04
1,8-Cineole	4.46*†	1027	[5.85]	3.16	1169	4.10
$\beta$ -Phellandrene	4.46*†	1027	[5.85]	3.12	1166	0.76
(Z)- $\beta$ -Ocimene	4.66	1039	tr	3.69*	1211	21.49
(E)- $\beta$ -Ocimene	4.82	1049	0.02	3.82	1221	0.02
$\gamma$ -Terpinene	4.97	1059	21.53	3.69*	1211	[21.49]
cis-Sabinene hydrate	5.05	1064	0.16	6.76	1431	0.13
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.10	1066	0.01			
cis-Linalool oxide (fur.)	5.12	1068	0.01			
Terpinolene	5.39*	1085	3.66	4.12	1243	3.62
para-Cymenene	5.39*	1085	[3.66]	6.16*	1387	0.03
trans-Sabinene hydrate	5.53	1094	0.27	7.82	1511	0.27
Linalool	5.63	1100	0.07	7.93	1519	0.06
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.68	1104	0.01	8.38	1555	0.01

para-Mentha-1,3,8-triene	5.74	1107	0.01	6.01	1376	tr
endo-Fenchol	5.76	1109	0.01	8.22	1542	0.03
cis-para-Menth-2-en-1-ol	5.90	1117	0.44	7.97	1523	0.46
4-Hydroxy-4-methylcyclohex-2-enone	6.04	1127	0.01	13.88	2029	0.01
Cosmene isomer I	6.08	1129	0.02	6.16*	1387	[0.03]
trans-Pinocarveol	6.12	1132	0.02	9.00*	1603	0.19
trans-para-Menth-2-en-1-ol	6.19	1136	0.32	8.82	1588	0.32
Unknown [m/z 109, 43 (73), 71 (54), 124 (51), 69 (37), 41 (35)...152 (5)]	6.25	1140	0.01			
δ-Terpineol	6.61	1164	0.02	9.35	1631	0.02
Terpinen-4-ol	6.86*†	1180	38.77	8.48*	1562	38.95
Dill ether	6.86*†	1180	[38.77]	7.18	1462	tr
para-Cymen-8-ol	6.92	1184	0.04	11.39	1802	0.03
α-Terpineol	7.01	1190	2.65	9.64*	1655	2.74
cis-Piperitol	7.06	1193	0.12	9.40*	1636	0.68
trans-Piperitol	7.26	1206	0.18	10.22	1702	0.20
exo-2-Hydroxycineole	7.49	1222	0.02	11.49	1811	0.02
Nerol	7.61	1230	0.02	10.88	1759	0.02
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.68	1235	0.01	11.18	1784	0.01
Piperitone	7.89	1249	0.03	9.70	1659	0.06
cis-Carvenone oxide?	7.95	1253	0.01			
trans-Ascaridole glycol	8.15	1267	0.04	14.02	2042	0.09
cis-Ascaridole glycol	8.44	1287	0.02	14.65	2103	0.03
Thymol	8.66	1302	0.02	15.00*	2138	0.04
Carvacrol	8.74	1303	0.01	15.22	2160	0.01
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)...170? (4)]	8.92	1316	0.04	14.84	2123	0.05
Bicycloelemene	9.15	1332	0.02	6.88	1440	0.04
α-Cubebene	9.34	1346	0.04	6.55	1415	0.04
Unknown [m/z 43, 95 (62), 107 (45), 110 (41), 55 (28), 67 (25)...]	9.48	1356	0.02	13.78*	2019	0.13
Cyclosativene II	9.60	1364	0.01	6.84	1437	0.01
Isoledene	9.65	1368	0.04	6.62	1421	0.04

α-Copaene	9.69	1370	0.07	6.90*	1442	0.07
7-Cubebene	9.73	1374	0.04	6.90*	1442	[0.07]
7-Cubebene epimer?	9.76	1376	0.02	7.00	1449	0.02
β-Cubebene	9.90	1385	0.01	7.54	1490	tr
β-Elemene	9.93	1388	0.02	8.31*	1549	0.62
Unknown [m/z 93, 122 (98), 161 (98), 107 (86), 95 (46), 105 (72)... 204 (34)]	9.96	1390	0.02			
α-Gurjunene	10.14*	1402	0.25	7.37	1477	0.23
Methyleugenol	10.14*	1402	[0.25]	13.16*	1961	0.07
β-Maaliene	10.22	1408	0.02	7.49	1486	0.02
β-Caryophyllene	10.26	1411	0.32	8.31*	1549	[0.62]
γ-Maaliene	10.38	1420	0.04	8.28	1547	0.08
β-Gurjunene	10.42	1423	0.01	8.10	1533	0.03
α-Maaliene	10.45	1426	0.04	8.50	1564	0.03
Aromadendrene	10.53	1431	0.60	8.48*	1562	[38.95]
Selina-5,11-diene	10.59	1436	0.09	8.48*	1562	[38.95]
<i>trans</i> -Muurolo-3,5- diene	10.69	1443	0.10	8.65	1575	0.10
α-Humulene	10.72	1445	0.09	9.05	1607	0.06
allo- Aromadendrene	10.81	1453	0.33	8.77	1584	0.32
Valerena-4,7(11)- diene	10.85	1456	0.03	8.70	1579	0.02
γ-Gurjunene	10.98	1465	0.03	8.90	1595	0.03
<i>trans</i> -Cadina- 1(6),4-diene	11.02*	1468	0.21	9.00*	1603	[0.19]
Selina-4,11-diene	11.02*	1468	[0.21]	9.30	1627	0.06
γ-Muurolole	11.06	1471	0.03	9.49	1643	0.03
β-Selinene	11.15	1478	0.06	9.64*	1655	[2.74]
allo-Aromadendr- 9-ene	11.18*	1480	0.06	9.32	1629	0.02
<i>trans</i> -Muurolo- 4(15),5-diene	11.18*	1480	[0.06]	9.71	1661	0.02
δ-Selinene	11.25	1485	0.07	9.56	1649	0.11
Bicyclogermacrene	11.30*	1489	1.45	9.83*	1670	0.96
Viridiflorene	11.30*	1489	[1.45]	9.40*	1636	[0.68]
α-Muurolole	11.39	1496	0.11	9.83*	1670	[0.96]
γ-Cadinene	11.55	1508	0.04	10.19*	1700	0.64
δ-Cadinene	11.69*	1519	0.84	10.19*	1700	[0.64]
<i>trans</i> -Calamenene	11.69*	1519	[0.84]	11.00	1768	0.05
Zonarene	11.69*	1519	[0.84]	10.29	1708	0.03
<i>trans</i> -Cadina-1,4- diene	11.78	1526	0.13	10.42	1719	0.12
α-Calacorene	11.87	1533	0.04	11.88	1846	0.01
Epiglobulol	12.10	1552	0.06	13.08	1954	0.07
Eudesma-5,7(11)- diene	12.18*	1558	0.06	10.92	1762	0.03
Maaliol	12.18*	1558	[0.06]	12.86	1933	0.03
Unknown [m/z	12.20	1559	0.02	13.16*	1961	[0.07]

161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]						
Spathulenol	12.32	1569	0.05	14.20	2060	0.05
Globulol	12.41	1576	0.26	13.70	2012	0.25
Gleenol	12.46	1580	0.02	13.37	1980	0.03
Viridiflorol	12.50	1583	0.12	13.78*	2019	[0.13]
Cubeban-11-ol	12.54	1586	0.10	13.56*	1998	0.16
Ledol	12.64*	1594	0.09	13.16*	1961	[0.07]
Eudesm-5-en-11-ol analog	12.64*	1594	[0.09]	14.12*	2051	0.11
10-epi-Cubenol	12.78	1605	tr	13.48	1991	0.11
Rosifoliol	12.89	1614	0.11	14.12*	2051	[0.11]
1-epi-Cubenol	12.97	1621	0.15	13.56*	1998	[0.16]
Isospathulenol	13.09	1630	0.04	15.25	2162	0.05
Cubenol	13.14	1635	0.09	13.56*	1998	[0.16]
α-Muurolol	13.20	1640	0.04	15.00*	2138	[0.04]
<b>Total identified</b>		<b>99.32%</b>			<b>98.87%</b>	
<b>Total reported</b>		<b>99.46%</b>			<b>98.95%</b>	

\*: 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