

Date : May 17, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code** : 21E03-PTH05


**Customer identification** : Organic Tea Tree - Australia - T30115207R

**Type** : Essential oil

**Source** : *Melaleuca alternifolia* ct. Terpinen-4-ol (Tea Tree)

**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** : Seydou Ka, M. Sc.

**Analysis date** : May 13, 2021

Checked and approved by :

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Sylvain Mercier, M. Sc., chimiste 2014-005

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## PHYSICOCHEMICAL DATA

**Physical aspect:** Clear liquid

**Refractive index:** 1.4768 ± 0.0003 (20 °C; method PC-MAT-016)

## ISO 4730:2017 - TEA TREE OIL

Compound	Min. %	Max. %	Observed %	Complies?
α-Pinene	1.0	4.0	2.1	Yes
Sabinene	tr	3.5	0.2	Yes
α-Terpinene	6.0	12.0	9.9	Yes
Limonene	0.5	1.5	0.9	Yes
para-Cymene	0.5	8.0	1.6	Yes
1,8-Cineole	tr	10.0	3.9	Yes
γ-Terpinene	14.0	28.0	20.3	Yes
Terpinolene	1.5	5.0	3.4	Yes
Terpinen-4-ol	35.0	48.0	44.8	Yes
α-Terpineol	2.0	5.0	3.1	Yes
Aromadendrene	0.2	3.0	0.4	Yes
Viridiflorene	0.1	3.0	0.4	Yes
δ-Cadinene	0.2	3.0	0.3	Yes
Globulol	tr	1.0	0.2	Yes
Viridiflorol	tr	1.0	0.1	Yes
<b>Refractive index</b>	1.4750	1.4820	1.4768	Yes

## 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
Isobutyral	0.02	Aliphatic aldehyde
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Methylbutyric acid	0.02	Aliphatic acid
(3Z)-Hexenol	0.08	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
$\alpha$ -Thujene	0.84	Monoterpene
$\alpha$ -Pinene	2.12	Monoterpene
Camphene	0.01	Monoterpene
Sabinene	0.18	Monoterpene
$\beta$ -Pinene	0.69	Monoterpene
Myrcene	0.90	Monoterpene
Pseudolimonene	0.01	Monoterpene
$\alpha$ -Phellandrene	0.35	Monoterpene
Menthatriene isomer I	tr	Monoterpene
(3Z)-Hexenyl acetate	0.03	Aliphatic ester
$\alpha$ -Terpinene	9.93	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
ortho-Cymene	0.01	Monoterpene
para-Cymene	1.57	Monoterpene
Limonene	0.89	Monoterpene
1,8-Cineole	3.94	Monoterpenic ether
(Z)- $\beta$ -Ocimene	tr	Monoterpene
(E)- $\beta$ -Ocimene	0.02	Monoterpene
$\gamma$ -Terpinene	20.28	Monoterpene
cis-Sabinene hydrate	0.04	Monoterpenic alcohol
Terpinolene	3.38	Monoterpene
para-Cymenene	0.01	Monoterpene
trans-Sabinene hydrate	0.06	Monoterpenic alcohol
Linalool	0.07	Monoterpenic alcohol
para-Mentha-1,3,8-triene	tr	Monoterpene
endo-Fenchol	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.36	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.01	Aliphatic alcohol
Cosmene isomer I	0.01	Monoterpene
Unknown	0.09	Oxygenated monoterpene
trans-para-Menth-2-en-1-ol	0.18	Monoterpenic alcohol
Unknown	0.01	Unknown
$\delta$ -Terpineol	0.02	Monoterpenic alcohol
Dill ether	0.01	Monoterpenic ether
Terpinen-4-ol	44.79	Monoterpenic alcohol
para-Cymen-8-ol	0.04	Monoterpenic alcohol
$\alpha$ -Terpineol	3.14	Monoterpenic alcohol
cis-Piperitol	0.09	Monoterpenic alcohol
trans-Piperitol	0.17	Monoterpenic alcohol

exo-2-Hydroxycineole	0.02	Monoterpenic alcohol
Nerol	0.03	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Piperitone	0.02	Monoterpenic ketone
Unknown	0.01	Unknown
<i>cis</i> -Carvenone oxide?	0.03	Monoterpenic ketone
<i>trans</i> -Ascaridole glycol	0.03	Monoterpenic alcohol
<i>cis</i> -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	0.01	Unknown
Isoledene	0.01	Sesquiterpene
$\alpha$ -Copaene	0.03	Sesquiterpene
7-Cubebene	0.04	Sesquiterpene
7-Cubebene epimer?	0.03	Aliphatic alcohol
$\beta$ -Elemene	0.01	Sesquiterpene
$\alpha$ -Gurjunene	0.17	Sesquiterpene
$\beta$ -Maaliene	0.01	Sesquiterpene
$\beta$ -Caryophyllene	0.17	Sesquiterpene
$\beta$ -Gurjunene	0.03	Sesquiterpene
$\alpha$ -Maaliene	0.01	Sesquiterpene
Aromadendrene	0.37	Sesquiterpene
Selina-5,11-diene	0.07	Sesquiterpene
Cadina-3,5-diene isomer I?	0.06	Sesquiterpene
<i>trans</i> -Muurolo-3,5-diene	0.05	Sesquiterpene
$\alpha$ -Humulene	0.05	Sesquiterpene
Valerena-4,7(11)-diene	0.21	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.02	Sesquiterpene
$\gamma$ -Muurolole	0.14	Sesquiterpene
Selina-4,11-diene	0.01	Sesquiterpene
$\beta$ -Selinene	0.01	Sesquiterpene
allo-Aromadendr-9-ene	0.05	Sesquiterpene
$\delta$ -Selinene	0.05	Sesquiterpene
$\alpha$ -Selinene	0.03	Sesquiterpene
Bicyclogermacrene	0.47	Sesquiterpene
Viridiflorene	0.41	Sesquiterpene
$\alpha$ -Muurolole	0.08	Sesquiterpene
$\gamma$ -Cadinene	0.03	Sesquiterpene
<i>trans</i> -Calamenene	0.03	Sesquiterpene
Zonarene	0.26	Sesquiterpene
$\delta$ -Cadinene	0.29	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.08	Sesquiterpene
$\alpha$ -Calacorene	0.01	Sesquiterpene
Unknown	0.05	Oxygenated sesquiterpene
Palustrol	0.03	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
Eudesma-5,7(11)-diene	0.01	Sesquiterpene
Maaliol	0.02	Sesquiterpenic alcohol
Spathulenol	0.05	Sesquiterpenic alcohol

Globulol	0.21	Sesquiterpenic alcohol
Gleenol	0.02	Sesquiterpenic alcohol
Viridiflorol	0.13	Sesquiterpenic alcohol
Cubeban-11-ol	0.08	Sesquiterpenic alcohol
Ledol	0.10	Sesquiterpenic alcohol
Rosifoliol	0.10	Sesquiterpenic alcohol
1-epi-Cubenol	0.12	Sesquiterpenic alcohol
Isospathulenol	0.04	Sesquiterpenic alcohol
Cubenol	0.07	Sesquiterpenic alcohol
$\alpha$ -Muurolol	0.02	Sesquiterpenic alcohol
$\alpha$ -Cadinol	0.01	Sesquiterpenic alcohol
<b>Consolidated total</b>	<b>99.10%</b>	

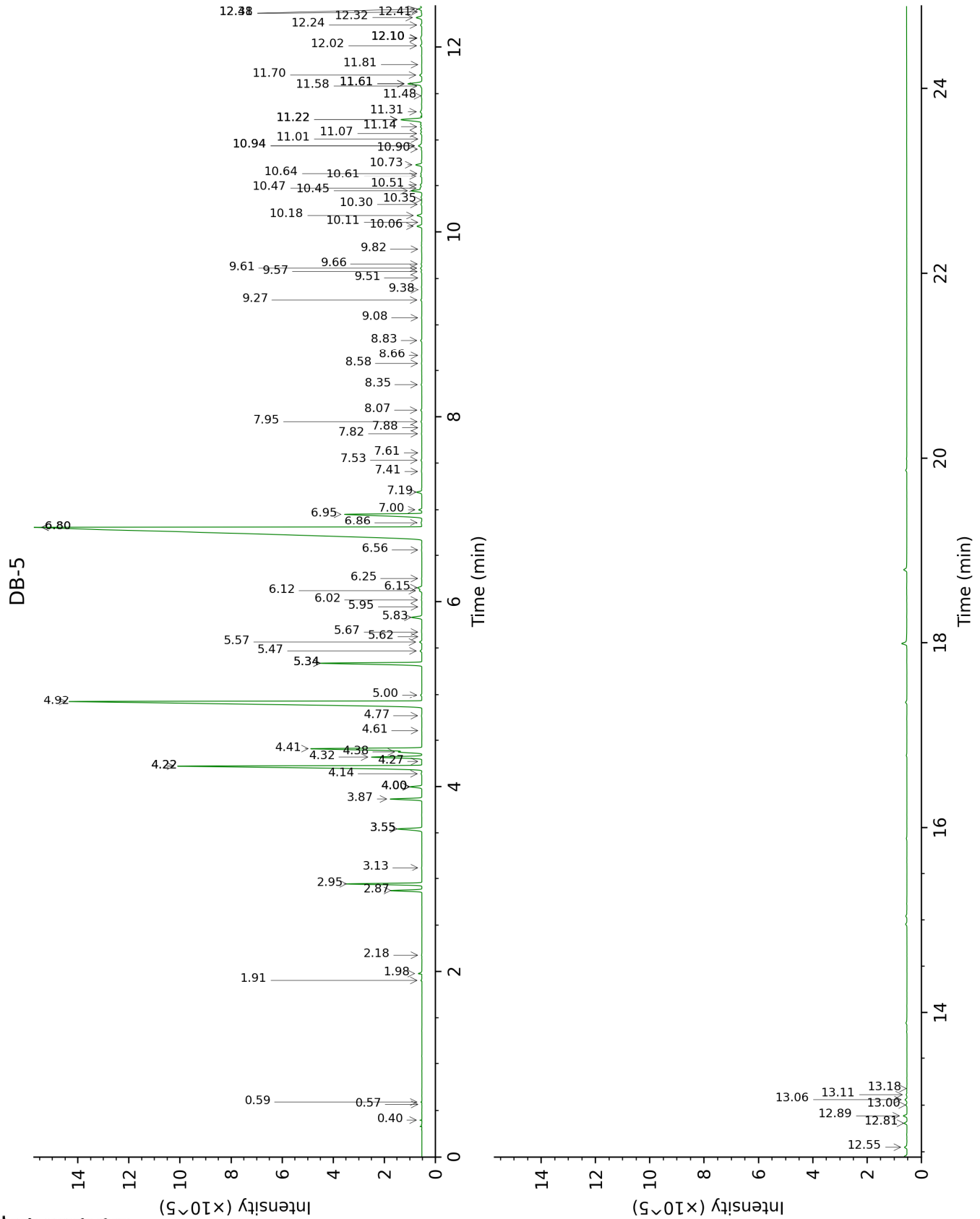
tr: The compound has been detected below 0.005% of total signal.

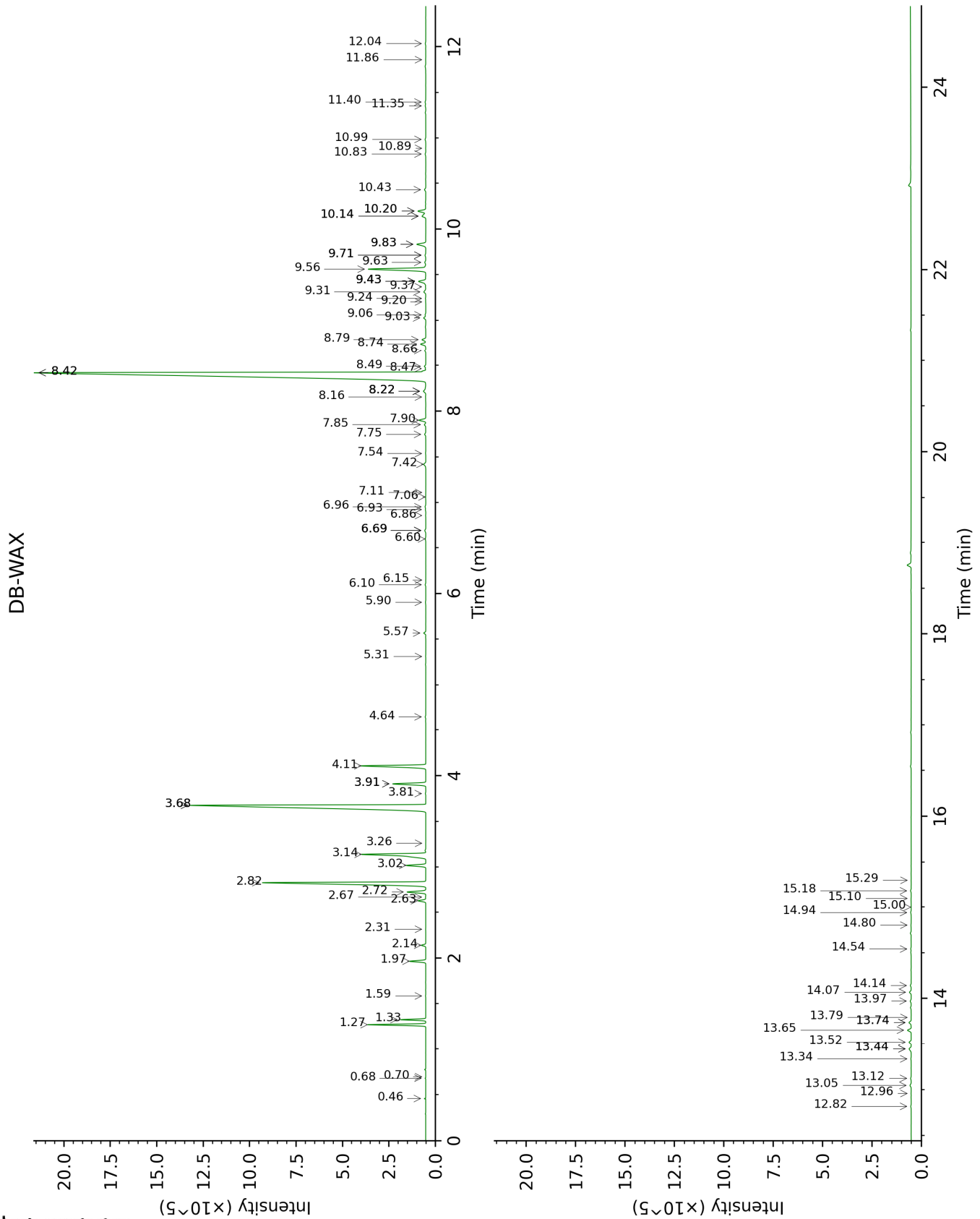
Note: no correction factor was applied

**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	%
Isobutylal	0.40	530	0.02	0.46	778	0.02
Isovaleral	0.57	640	tr	0.70	883	tr
2-Methylbutylal	0.59	650	0.01	0.68	877	0.01
2-Methylbutyric acid	1.90	850	0.02			
(3Z)-Hexenol	1.98	856	0.08	5.57	1344	0.09
Hexanol	2.18	873	0.01	5.31	1326	0.01
$\alpha$ -Thujene	2.87	927	0.84	1.33	1000	0.84
$\alpha$ -Pinene	2.95	932	2.12	1.27	990	2.11
Camphene	3.13	944	0.01	1.59	1026	0.01
Sabinene	3.55*	973	0.88	2.14	1082	0.18
$\beta$ -Pinene	3.55*	973	[0.88]	1.97	1064	0.69
Myrcene	3.87	995	0.90	2.72	1132	0.90
Pseudolimonene	4.00*	1003	0.36	2.67	1128	0.01
$\alpha$ -Phellandrene	4.00*	1003	[0.36]	2.63	1124	0.35
Menthatriene isomer I	4.00*	1003	[0.36]	3.26	1175	tr
(3Z)-Hexenyl acetate	4.14	1012	0.03	4.64	1280	0.03
$\alpha$ -Terpinene	4.22*	1018	9.95	2.82	1140	9.93
Carvomenthene	4.22*	1018	[9.95]	2.32	1099	0.01
ortho-Cymene	4.27	1021	0.01	3.91*	1225	1.57
para-Cymene	4.32	1024	1.57	3.91*	1225	[1.57]
Limonene	4.38†	1027	4.85	3.02	1156	0.89
1,8-Cineole	4.41†	1030	[4.85]	3.14	1165	3.94
(Z)- $\beta$ -Ocimene	4.60	1042	tr	3.68*	1208	20.28
(E)- $\beta$ -Ocimene	4.77	1052	0.02	3.81	1217	0.02
$\gamma$ -Terpinene	4.92	1062	20.28	3.68*	1208	[20.28]
cis-Sabinene hydrate	5.00	1066	0.04	6.69*	1427	0.06
Terpinolene	5.34*	1088	3.40	4.11	1240	3.38
para-Cymenene	5.34*	1088	[3.40]	6.15	1386	0.01
trans-Sabinene hydrate	5.47	1097	0.06	7.75	1506	0.06
Linalool	5.57	1103	0.07	7.85	1514	0.08
para-Mentha-1,3,8-triene	5.62	1106	tr	5.90	1369	0.03
endo-Fenchol	5.68	1110	0.01	8.22*	1543	0.20
cis-para-Menth-2-en-1-ol	5.83	1120	0.36	7.90	1518	0.36
4-Hydroxy-4-methylcyclohex-2-enone	5.95	1127	0.01	13.79	2024	tr
Cosmene isomer I	6.02	1132	0.01	6.10	1383	0.03
Unknown [m/z 109, 43 (73), 71 (54), 124 (51), 69	6.12	1138	0.09			

(37), 41 (35)...152 (5)]						
<i>trans</i> -para-Menth-2-en-1-ol	6.15	1140	0.18	8.79	1588	0.21
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.25	1147	0.01	6.69*	1427	[0.06]
δ-Terpineol	6.56	1167	0.02	9.24	1624	0.02
Dill ether	6.80*	1182	44.80	7.11	1458	0.01
Terpinen-4-ol	6.80*	1182	[44.80]	8.42*	1559	45.25
para-Cymen-8-ol	6.86	1186	0.04	11.35	1801	0.04
α-Terpineol	6.95	1192	3.14	9.56	1650	3.23
<i>cis</i> -Piperitol	7.00	1195	0.09	9.37	1634	0.02
<i>trans</i> -Piperitol	7.19	1207	0.17	10.20*	1702	0.46
exo-2-Hydroxycineole	7.41	1222	0.02	11.40	1804	0.04
Nerol	7.53	1230	0.03	10.83	1756	0.04
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.61	1236	0.01			
Piperitone	7.82	1250	0.02	9.71*	1662	0.05
Unknown [m/z 43, 82 (79), 109 (69), 110 (65), 95 (38), 41 (36)...]	7.88	1254	0.01			
<i>cis</i> -Carvenone oxide?	7.95	1258	0.03			
<i>trans</i> -Ascaridole glycol	8.07	1267	0.03	13.97	2042	0.06
<i>cis</i> -Ascaridole glycol	8.35	1285	0.02	14.54	2097	0.03
Thymol	8.58	1300	0.02	14.94	2137	0.04
Carvacrol	8.66	1306	0.01	15.10	2152	0.01
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.83	1318	0.04	14.80	2123	0.02
Bicycloelemene	9.08	1336	0.02	6.86	1440	0.01
α-Cubebene	9.27	1349	0.04	6.60	1420	0.04
Unknown [m/z 43, 95 (62), 107 (45), 110 (41), 55 (28), 67 (25)...]	9.38	1357	0.01	13.74*	2019	0.13
Isoledene	9.51	1366	0.01	6.69*	1427	[0.06]
α-Copaene	9.58	1371	0.03	6.93	1444	0.02
7-Cubebene	9.61	1374	0.04	6.96	1447	0.05
7-Cubebene epimer?	9.66	1377	0.03	7.06	1455	0.01
β-Elemene	9.82	1388	0.01	8.22*	1543	[0.20]
α-Gurjunene	10.06	1406	0.17	7.42	1482	0.14

β-Maaliene	10.11	1409	0.01	7.54	1490	0.02
β-Caryophyllene	10.18	1414	0.17	8.22*	1543	[0.20]
β-Gurjunene	10.30	1423	0.03	8.16	1538	0.02
α-Maaliene	10.35	1427	0.01	8.47	1562	0.02
Aromadendrene	10.45	1434	0.37	8.42*	1559	[45.25]
Selina-5,11-diene	10.47	1436	0.07	8.49	1564	0.07
Cadina-3,5-diene isomer I?	10.51	1439	0.06			
<i>trans</i> -Muurolo-3,5-diene	10.61	1446	0.05	8.66	1578	0.06
α-Humulene	10.64	1448	0.05	9.06	1609	0.04
Valerena-4,7(11)-diene	10.73	1456	0.21	8.74	1584	0.29
<i>trans</i> -Cadina-1(6),4-diene	10.90	1468	0.02	9.03	1606	0.12
γ-Muurolole	10.94*	1471	0.15	9.43*	1639	0.47
Selina-4,11-diene	10.94*	1471	[0.15]	9.20	1621	0.01
β-Selinene	11.01	1476	0.01	9.64	1656	0.06
allo-Aromadendrene	11.07	1481	0.05	9.31	1630	0.13
δ-Selinene	11.14	1486	0.05	9.43*	1639	[0.47]
α-Selinene	11.22*	1492	0.92	9.71*	1662	[0.05]
Bicyclogermacrene	11.22*	1492	[0.92]	9.83*	1672	0.55
Viridiflorene	11.22*	1492	[0.92]	9.43*	1639	[0.47]
α-Muurolole	11.31	1498	0.08	9.83*	1672	[0.55]
γ-Cadinene	11.48	1511	0.03	10.14*	1697	0.29
<i>trans</i> -Calamenene	11.58	1520	0.03	10.99	1770	0.04
Zonarene	11.61*	1522	0.55	10.14*	1697	[0.29]
δ-Cadinene	11.61*	1522	[0.55]	10.20*	1702	[0.46]
<i>trans</i> -Cadina-1,4-diene	11.70	1529	0.08	10.43	1722	0.07
α-Calacorene	11.81	1538	0.01	11.86	1846	0.01
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.02	1554	0.05	13.05	1954	0.08
Palustrol	12.10*	1560	0.08	12.04	1862	0.03
Unknown [m/z 107, 163 (88), 59 (60), 93 (49), 43 (47), 81 (46... 204 (5)...]	12.10*	1560	[0.08]	12.96	1946	0.01
Eudesma-5,7(11)-diene	12.10*	1560	[0.08]	10.89	1761	0.01
Maaliol	12.10*	1560	[0.08]	12.82	1933	0.02
Spathulenol	12.24	1571	0.05	14.14	2058	0.04
Globulol	12.32	1578	0.21	13.66	2011	0.21
Gleenol	12.38	1583	0.02	13.34	1981	0.02
Viridiflorol	12.41*†	1585	0.21	13.74*	2019	[0.13]
Cubeban-11-ol	12.41*†	1585	[0.21]	13.44*	1991	0.15

Ledol	12.55	1596	0.10	13.12	1961	0.04
Rosifoliol	12.81	1617	0.10	14.07	2051	0.10
1-epi-Cubenol	12.89	1623	0.12	13.52	1998	0.12
Isospathulenol	13.00	1633	0.04	15.18	2161	0.04
Cubenol	13.06	1638	0.07	13.44*	1991	[0.15]
$\alpha$ -Muurolol	13.11	1642	0.02	15.00	2143	tr
$\alpha$ -Cadinol	13.18	1647	0.01	15.29	2172	0.01
<b>Total identified</b>	<b>98.91%</b>			<b>99.06%</b>		
<b>Total reported</b>	<b>99.14%</b>			<b>99.16%</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