

**Date :** June 09, 2023

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 23E26-NPA03


**Customer identification :** Tea Tree - South Africa - NPS00053 - Lot # NP0005

**Type :** Essential oil

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

**Customer :** Nature Packaged

**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 :** Amélie Simard, Analyste

**Analysis date :** June 07, 2023

Checked and approved by :



Alexis St-Gelais, Ph. D., Chimiste 2013-174

*Notes: This report is digitally signed, it is only considered valid if the digital signature is intact. The results only describe the samples that were submitted to the assays.*

*This report is an update from the first version issued on June 9, 2023, to format it for online publication.*

*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4774 \pm 0.0003$  (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
Isobutyral	0.02	Aliphatic aldehyde
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
(3Z)-Hexenol	0.07	Aliphatic alcohol
Hexanol	0.02	Aliphatic alcohol
$\alpha$ -Thujene	0.82	Monoterpene
$\alpha$ -Pinene	2.42	Monoterpene
$\alpha$ -Fenchene	tr	Monoterpene
Camphene	0.02	Monoterpene
Sabinene	0.14	Monoterpene
$\beta$ -Pinene	0.71	Monoterpene
3-Methyl-3-cyclohexenone	0.01	Aliphatic ketone
Myrcene	0.87	Monoterpene
$\alpha$ -Phellandrene	0.40	Monoterpene
Pseudolimonene	0.01	Monoterpene
(3Z)-Hexenyl acetate	0.03	Aliphatic ester
$\alpha$ -Terpinene	9.86	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	1.95	Monoterpene
Limonene	1.00	Monoterpene
1,8-Cineole	3.89	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.01	Monoterpene
(E)- $\beta$ -Ocimene	0.03	Monoterpene
$\gamma$ -Terpinene	20.76	Monoterpene
cis-Sabinene hydrate	0.05	Monoterpenic alcohol
Terpinolene	3.49	Monoterpene
para-Cymenene	0.05	Monoterpene
trans-Sabinene hydrate	0.06	Monoterpenic alcohol
Linalool	0.07	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	Monoterpene
endo-Fenchol	0.02	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.23	Monoterpenic alcohol
Cosmene isomer I	0.03	Monoterpene
trans-Pinocarveol	0.03	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.06	Monoterpenic alcohol
Unknown	0.12	Oxygenated monoterpene
Unknown	0.01	Unknown
Borneol	0.01	Monoterpenic alcohol
$\delta$ -Terpineol	0.02	Monoterpenic alcohol
Terpinen-4-ol	42.19	Monoterpenic alcohol
Dill ether	0.04	Monoterpenic ether
para-Cymen-8-ol	0.05	Monoterpenic alcohol
$\alpha$ -Terpineol	2.75	Monoterpenic alcohol
cis-Piperitol	0.08	Monoterpenic alcohol
trans-Piperitol	0.12	Monoterpenic alcohol

exo-2-Hydroxycineole	0.02	Monoterpenic alcohol
Nerol	0.03	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Piperitone	0.02	Monoterpenic ketone
cis-Carvenone oxide?	0.01	Monoterpenic ketone
trans-Ascaridole glycol	0.06	Monoterpenic alcohol
cis-Ascaridole glycol	0.04	Monoterpenic alcohol
Thymol	0.01	Monoterpenic alcohol
Carvacrol	0.01	Monoterpenic alcohol
Unknown	0.01	Monoterpenic alcohol
Bicycloelemene	0.02	Sesquiterpene
α-Cubebene	0.04	Sesquiterpene
Unknown	0.01	Unknown
Isoledene	0.05	Sesquiterpene
α-Copaene	0.08	Sesquiterpene
7-Cubebene	0.05	Sesquiterpene
7-Cubebene epimer?	0.02	Aliphatic alcohol
β-Elemene	0.02	Sesquiterpene
Unknown	0.03	Sesquiterpene
α-Gurjunene	0.26	Sesquiterpene
Methyleugenol	0.02	Phenylpropanoid
β-Maaliene	0.01	Sesquiterpene
β-Caryophyllene	0.27	Sesquiterpene
γ-Maaliene	0.06	Sesquiterpene
β-Gurjunene	0.02	Sesquiterpene
α-Maaliene	0.05	Sesquiterpene
Aromadendrene	0.70	Sesquiterpene
Selina-5,11-diene	0.11	Sesquiterpene
Cadina-3,5-diene isomer I?	0.11	Sesquiterpene
trans-Muurolo-3,5-diene	0.09	Sesquiterpene
α-Humulene	0.08	Sesquiterpene
allo-Aromadendrene	0.36	Sesquiterpene
Valerena-4,7(11)-diene	0.03	Sesquiterpene
γ-Gurjunene	0.04	Sesquiterpene
trans-Cadina-1(6),4-diene	0.23	Sesquiterpene
γ-Muurolole	0.03	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
β-Selinene	0.09	Sesquiterpene
allo-Aromadendr-9-ene	0.07	Sesquiterpene
trans-Muurolo-4(15),5-diene	0.05	Sesquiterpene
δ-Selinene	0.10	Sesquiterpene
Viridiflorene	0.59	Sesquiterpene
α-Selinene	0.07	Sesquiterpene
Bicyclogermacrene	0.41	Sesquiterpene
Epizonarene	0.01	Sesquiterpene
α-Muurolole	0.11	Sesquiterpene
γ-Cadinene	0.06	Sesquiterpene
trans-Calamenene	0.07	Sesquiterpene
δ-Cadinene	0.75	Sesquiterpene
Zonarene	0.14	Sesquiterpene
trans-Cadina-1,4-diene	0.13	Sesquiterpene
α-Calacorene	0.02	Sesquiterpene

Epiglobulol	0.06	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.02	Sesquiterpene
Unknown	0.02	Oxygenated sesquiterpene
Palustrol	0.04	Sesquiterpenic alcohol
Spathulenol	0.05	Sesquiterpenic alcohol
Globulol	0.22	Sesquiterpenic alcohol
Gleenol	0.04	Sesquiterpenic alcohol
Viridiflorol	0.11	Sesquiterpenic alcohol
Cubeban-11-ol	0.12	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.07	Sesquiterpenic alcohol
Ledol	0.04	Sesquiterpenic alcohol
Eudesm-5-en-11-ol	0.01	Sesquiterpenic alcohol
10-epi-Cubenol	0.01	Sesquiterpenic alcohol
Rosifoliol	0.10	Sesquiterpenic alcohol
1-epi-Cubenol	0.14	Sesquiterpenic alcohol
Isospathulenol	0.05	Sesquiterpenic alcohol
Cubenol	0.08	Sesquiterpenic alcohol
$\alpha$ -Muurolol	0.03	Sesquiterpenic alcohol
<b>Consolidated total</b>	<b>99.41%</b>	

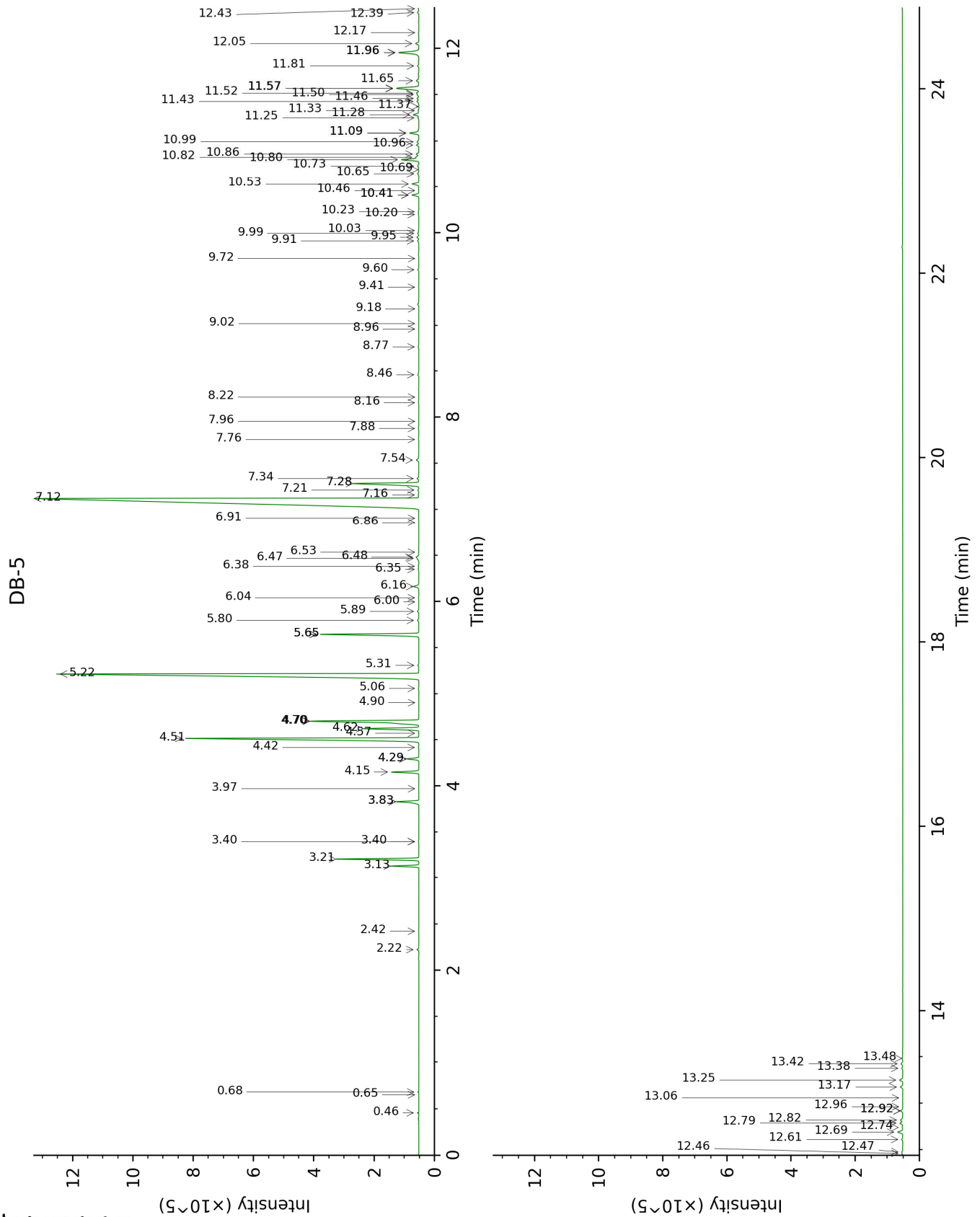
tr: The compound has been detected below 0.005% of total signal.

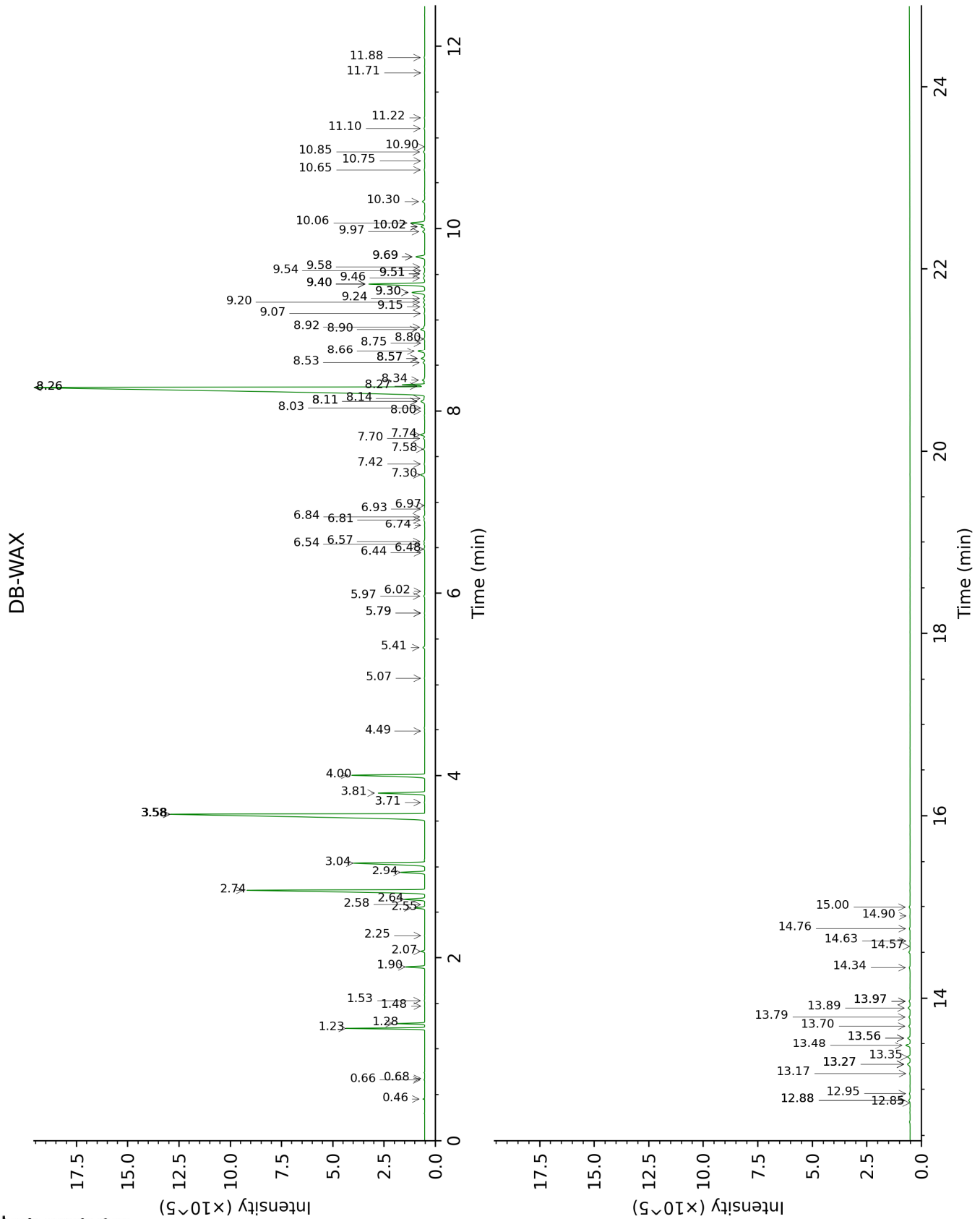
Note: no correction factor was applied

**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	%
Isobutyral	0.46	539	0.02	0.46	785	0.02
Isovaleral	0.65	641	tr	0.68	888	tr
2-Methylbutyral	0.68	651	0.01	0.66	881	0.01
(3Z)-Hexenol	2.22	857	0.07	5.41	1345	0.09
Hexanol	2.42	873	0.02	5.07	1320	0.02
$\alpha$ -Thujene	3.13	926	0.82	1.28	1003	0.82
$\alpha$ -Pinene	3.21	931	2.42	1.23	994	2.44
$\alpha$ -Fenchene	3.40*	944	0.03	1.48	1023	tr
Camphene	3.40*	944	[0.03]	1.53	1029	0.02
Sabinene	3.83*	972	0.84	2.07	1085	0.14
$\beta$ -Pinene	3.83*	972	[0.84]	1.90	1067	0.71
3-Methyl-3-cyclohexenone	3.97	981	0.01	5.78*	1372	0.02
Myrcene	4.15	993	0.87	2.64	1136	0.88
$\alpha$ -Phellandrene	4.29*	1002	0.42	2.55	1128	0.40
Pseudolimonene	4.29*	1002	[0.42]	2.58	1131	0.01
(3Z)-Hexenyl acetate	4.42	1010	0.03	4.49	1283	0.02
$\alpha$ -Terpinene	4.51	1016	9.86	2.74	1144	9.97
Carvomenthene	4.57	1020	0.01	2.24	1103	0.01
para-Cymene	4.62	1023	1.95	3.81	1230	1.97
Limonene	4.70*	1028	4.87	2.94	1160	1.00
1,8-Cineole	4.70*	1028	[4.87]	3.04	1169	3.89
(Z)- $\beta$ -Ocimene	4.90	1040	0.01	3.58*	1213	20.94
(E)- $\beta$ -Ocimene	5.06	1050	0.03	3.71	1223	0.02
$\gamma$ -Terpinene	5.22	1060	20.76	3.58*	1213	[20.94]
cis-Sabinene hydrate	5.31	1066	0.05	6.57	1430	0.05
Terpinolene	5.65*	1087	3.50	4.00	1246	3.49
para-Cymenene	5.65*	1087	[3.50]	5.97	1386	0.05
trans-Sabinene hydrate	5.80	1096	0.06	7.58	1507	0.07
Linalool	5.89	1102	0.07	7.70	1516	0.06
para-Mentha-1,3,8-triene	6.00	1109	0.01	5.78*	1372	[0.02]
endo-Fenchol	6.04	1112	0.02	8.00	1540	0.01
cis-para-Menth-2-en-1-ol	6.16	1120	0.23	7.74	1520	0.22
Cosmene isomer I	6.35	1131	0.03	6.02	1390	0.01
trans-Pinocarveol	6.38	1133	0.03	8.75	1599	0.01
trans-para-Menth-2-en-1-ol	6.47	1139	0.06	8.58*	1585	0.19
Unknown [m/z 109, 43 (73), 71 (54), 124 (51), 69 (37), 41 (35)...152 (5)]	6.48	1140	0.12			

Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.53	1143	0.01	6.44	1421	0.01
Borneol	6.86	1164	0.01	9.40*	1652	2.75
δ-Terpineol	6.91	1167	0.02	9.07	1626	0.04
Terpinen-4-ol	7.12	1180	42.19	8.26*	1560	42.19
Dill ether	7.16	1183	0.04	6.97	1461	0.01
para-Cymen-8-ol	7.21	1186	0.05	11.10	1797	0.04
α-Terpineol	7.28	1191	2.75	9.40*	1652	[2.75]
cis-Piperitol	7.34	1194	0.08	9.15	1632	0.06
trans-Piperitol	7.54	1207	0.12	9.97	1700	0.11
exo-2-Hydroxycineole	7.76	1222	0.02	11.22	1807	0.02
Nerol	7.88	1230	0.03	10.65	1758	0.04
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.96	1235	0.01	10.90	1780	0.01
Piperitone	8.16	1248	0.02	9.51*	1661	0.07
cis-Carvenone oxide?	8.22	1252	0.01			
trans-Ascaridole glycol	8.46	1268	0.06	13.70	2036	0.07
cis-Ascaridole glycol	8.77	1289	0.04	14.34	2098	0.04
Thymol	8.96	1302	0.01	14.63	2128	0.02
Carvacrol	9.02	1306	0.01	14.90	2155	0.02
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.18	1317	0.01	14.57	2122	0.01
Bicycloelemene	9.41	1334	0.02	6.74	1444	0.02
α-Cubebene	9.60	1347	0.04	6.48	1424	0.04
Unknown [m/z 43, 95 (62), 107 (45), 110 (41), 55 (28), 67 (25)...]	9.72	1356	0.01	13.56*	2023	0.13
Isoledene	9.91	1369	0.05	6.54	1428	0.04
α-Copaene	9.95	1372	0.08	6.84	1451	0.08
7-Cubebene	9.99	1375	0.05	6.81	1449	0.05
7-Cubebene epimer?	10.02	1377	0.02	6.93	1458	0.03
β-Elemene	10.20	1389	0.02	8.11*	1548	0.27
Unknown [m/z 93, 122 (98), 161 (98), 107 (86), 95 (46), 105 (72)... 204 (34)]	10.23	1391	0.03			
α-Gurjunene	10.41*	1404	0.28	7.30	1486	0.26
Methyleugenol	10.41*	1404	[0.28]	12.88*	1958	0.07
β-Maaliene	10.46	1408	0.01	7.42	1495	0.04
β-Caryophyllene	10.53	1413	0.27	8.11*	1548	[0.27]

γ-Maaliene	10.65	1422	0.06	8.14	1551	0.05
β-Gurjunene	10.69	1425	0.02	8.03	1543	0.02
α-Maaliene	10.73	1428	0.05	8.27	1562	0.06
Aromadendrene	10.80	1433	0.70	8.26*	1560	[42.19]
Selina-5,11-diene	10.82	1435	0.11	8.34	1567	0.12
Cadina-3,5-diene isomer I?	10.86	1437	0.11			
<i>trans</i> -Muuroala-3,5-diene	10.96	1445	0.09	8.53	1582	0.09
α-Humulene	10.99	1447	0.08	8.92	1613	0.05
allo-Aromadendrene	11.09*	1454	0.39	8.66	1592	0.36
Valerena-4,7(11)-diene	11.09*	1454	[0.39]	8.58*	1585	[0.19]
γ-Gurjunene	11.25	1466	0.04	8.80	1603	0.04
<i>trans</i> -Cadina-1(6),4-diene	11.28	1469	0.23	8.90	1611	0.22
γ-Muurolene	11.33	1472	0.03	9.24	1639	0.08
Germacrene D	11.37	1476	0.01	9.40*	1652	[2.75]
β-Selinene	11.43	1480	0.09	9.46	1658	0.09
allo-Aromadendr-9-ene	11.46	1482	0.07	9.20	1636	0.08
<i>trans</i> -Muuroala-4(15),5-diene	11.50	1485	0.05	9.51*	1661	[0.07]
δ-Selinene	11.52	1486	0.10	9.30*	1645	0.69
Viridiflorene	11.57*	1490	1.10	9.30*	1645	[0.69]
α-Selinene	11.57*	1490	[1.10]	9.58	1668	0.07
Bicyclogermacrene	11.57*	1490	[1.10]	9.69*	1677	0.52
Epizonarene	11.57*	1490	[1.10]	9.54	1664	0.01
α-Muurolene	11.65	1496	0.11	9.69*	1677	[0.52]
γ-Cadinene	11.81	1508	0.06	10.02*	1704	0.20
<i>trans</i> -Calamenene	11.96*	1520	0.98	10.85	1775	0.07
δ-Cadinene	11.96*	1520	[0.98]	10.06	1707	0.75
Zonarene	11.96*	1520	[0.98]	10.02*	1704	[0.20]
<i>trans</i> -Cadina-1,4-diene	12.05	1527	0.13	10.30	1727	0.12
α-Calacorene	12.17	1537	0.02	11.71	1851	0.02
Epiglobulol	12.39	1554	0.06	12.88*	1958	[0.07]
Eudesma-5,7(11)-diene	12.43	1557	0.02	10.75	1766	0.02
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.46	1559	0.02	12.85	1956	0.01
Palustrol	12.47	1560	0.04	11.88	1866	0.03
Spathulenol	12.61	1571	0.05	13.97*	2062	0.05
Globulol	12.69	1577	0.22	13.48	2015	0.24
Gleenol	12.74	1581	0.04	13.17	1986	0.02
Viridiflorol	12.79	1585	0.11	13.56*	2023	[0.13]
Cubeban-11-ol	12.82	1588	0.12	13.27*	1995	0.16

Eudesm-5-en-11-ol analog	12.92*	1595	0.09	13.80	2046	0.07
Ledol	12.92*	1595	[0.09]	12.95	1965	0.04
Eudesm-5-en-11-ol	12.96	1599	0.01	13.97*	2062	[0.05]
10-epi-Cubenol	13.06	1606	0.01	13.27*	1995	[0.16]
Rosifoliol	13.17	1616	0.10	13.89	2055	0.10
1-epi-Cubenol	13.25	1622	0.14	13.35	2003	0.13
Isospathulenol	13.38	1632	0.05	15.00	2165	0.05
Cubenol	13.42	1636	0.08	13.27*	1995	[0.16]
α-Muurolol	13.48	1641	0.03	14.76	2141	0.04
<b>Total identified</b>		<b>99.18%</b>			<b>98.65%</b>	
<b>Total reported</b>		<b>99.40%</b>			<b>98.68%</b>	

\*: Two or more compounds are coeluting on this column

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

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