

Date : April 26, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code** : 21D13-PTH19

**Customer identification** : Balsam Fir - 2101048

**Type** : Essential oil

**Source** : *Abies balsamea* ct. *low thymol*

**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** : April 16, 2021

Checked and approved by :

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

*Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia. 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 of the version first issued on April 20, 2021 to correct a mistake in the customer identification.*

*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4742 \pm 0.0003$  (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
Isovaleral	tr	Aliphatic aldehyde
Toluene	0.01	Simple phenolic
(3Z)-Hexenol	0.02	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
Santene	1.66	Normonoterpene
Unknown	0.02	Normonoterpene
Bornylene	0.01	Monoterpene
Tricyclene	0.82	Monoterpene
$\alpha$ -Thujene	0.16	Monoterpene
$\alpha$ -Pinene	15.23	Monoterpene
Camphene	5.60	Monoterpene
$\alpha$ -Fenchene	0.09	Monoterpene
Thuja-2,4(10)-diene	0.05	Monoterpene
meta-Cymene	0.05	Monoterpene
Sabinene	0.06	Monoterpene
$\beta$ -Pinene	29.42	Monoterpene
Unknown	0.01	Monoterpene
Unknown	0.02	Unknown
Myrcene	1.84	Monoterpene
2-Carene	0.01	Monoterpene
$\alpha$ -Phellandrene	0.20	Monoterpene
Pseudolimonene	0.02	Monoterpene
$\Delta^3$ -Carene	14.72	Monoterpene
$\alpha$ -Terpinene	0.19	Monoterpene
ortho-Cymene	0.03	Monoterpene
para-Cymene	0.22	Monoterpene
1,8-Cineole	5.46*	Monoterpenic ether
Limonene	9.77	Monoterpene
$\beta$ -Phellandrene	[5.46]*	Monoterpene
(Z)- $\beta$ -Ocimene	tr	Monoterpene
(E)- $\beta$ -Ocimene	tr	Monoterpene
$\gamma$ -Terpinene	0.30	Monoterpene
Fenchone	0.10	Monoterpenic ketone
Isoterpinolene	0.08	Monoterpene
para-Cymenene	0.08	Monoterpene
Terpinolene	1.17	Monoterpene
Linalool	0.07	Monoterpenic alcohol
$\alpha$ -Thujone	0.01	Monoterpenic ketone
endo-Fenchol	0.10	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
$\alpha$ -Campholenal	0.02	Monoterpenic aldehyde
cis-Limonene oxide	0.01	Monoterpenic ether
trans-Pinocarveol	0.13	Monoterpenic alcohol
Camphor	0.27	Monoterpenic ketone
Camphene hydrate	0.08	Monoterpenic alcohol

meta-Mentha-4,6-dien-8-ol	0.01	Monoterpenic alcohol
Isoborneol	0.02	Monoterpenic alcohol
Myrtenyl methyl ether	0.03	Monoterpenic ether
Pinocarvone	0.03	Monoterpenic ketone
Borneol	0.48	Monoterpenic alcohol
Isopinocampone	0.05	Monoterpenic ketone
Terpinen-4-ol	0.29	Monoterpenic alcohol
meta-Cymen-8-ol	0.05	Monoterpenic alcohol
para-Cymen-8-ol	0.05	Monoterpenic alcohol
Myrtenal	0.06	Monoterpenic aldehyde
$\alpha$ -Terpineol	0.80	Monoterpenic alcohol
Myrtenol	0.10	Monoterpenic alcohol
cis-Piperitol	0.03	Monoterpenic alcohol
Verbenone	0.07	Monoterpenic ketone
endo-Fenchyl acetate	0.03	Monoterpenic ester
cis-Carveol	0.01	Monoterpenic alcohol
Citronellol	0.02	Monoterpenic alcohol
Thymol methyl ether	0.04	Monoterpenic ether
Carvone	0.01	Monoterpenic ketone
Piperitone	0.13	Monoterpenic ketone
Phellandral	0.03	Monoterpenic aldehyde
Isopulegyl acetate	0.02	Monoterpenic ester
Bornyl acetate	6.19	Monoterpenic ester
Isobornyl acetate	0.02	Monoterpenic ester
2-Undecanone	0.06	Aliphatic ketone
Thymol	0.02	Monoterpenic alcohol
Isohexyl isocaproate	0.01	Aliphatic ester
Myrtenyl acetate	0.01	Monoterpenic ester
$\alpha$ -Longipinene	0.02	Sesquiterpene
$\alpha$ -Terpinyl acetate	0.06	Monoterpenic ester
Citronellyl acetate	0.02	Monoterpenic ester
Geranyl acetate	0.02	Monoterpenic ester
$\beta$ -Longipinene	0.01	Sesquiterpene
Longifolene	0.24	Sesquiterpene
Methyleugenol	0.01	Phenylpropanoid
$\beta$ -Caryophyllene	0.24	Sesquiterpene
$\alpha$ -Humulene	0.11	Sesquiterpene
(E)- $\beta$ -Farnesene	0.04	Sesquiterpene
$\gamma$ -Muurolene	0.01	Sesquiterpene
Germacrene D	0.02	Sesquiterpene
$\beta$ -Selinene	0.02	Sesquiterpene
$\beta$ -Himachalene	0.02	Sesquiterpene
$\alpha$ -Selinene	0.02	Sesquiterpene
(Z)- $\alpha$ -Bisabolene	0.03	Sesquiterpene
$\beta$ -Bisabolene	0.39	Sesquiterpene
$\delta$ -Cadinene	0.04	Sesquiterpene
(E)-Nerolidol	0.03	Sesquiterpenic alcohol
Caryophyllene oxide	0.02	Sesquiterpenic ether
Humulene epoxide II	0.02	Sesquiterpenic ether
Manool	0.01	Diterpenic alcohol
(Z)-Abienol	0.03	Diterpenic alcohol
<b>Consolidated total</b>	<b>98.28%</b>	

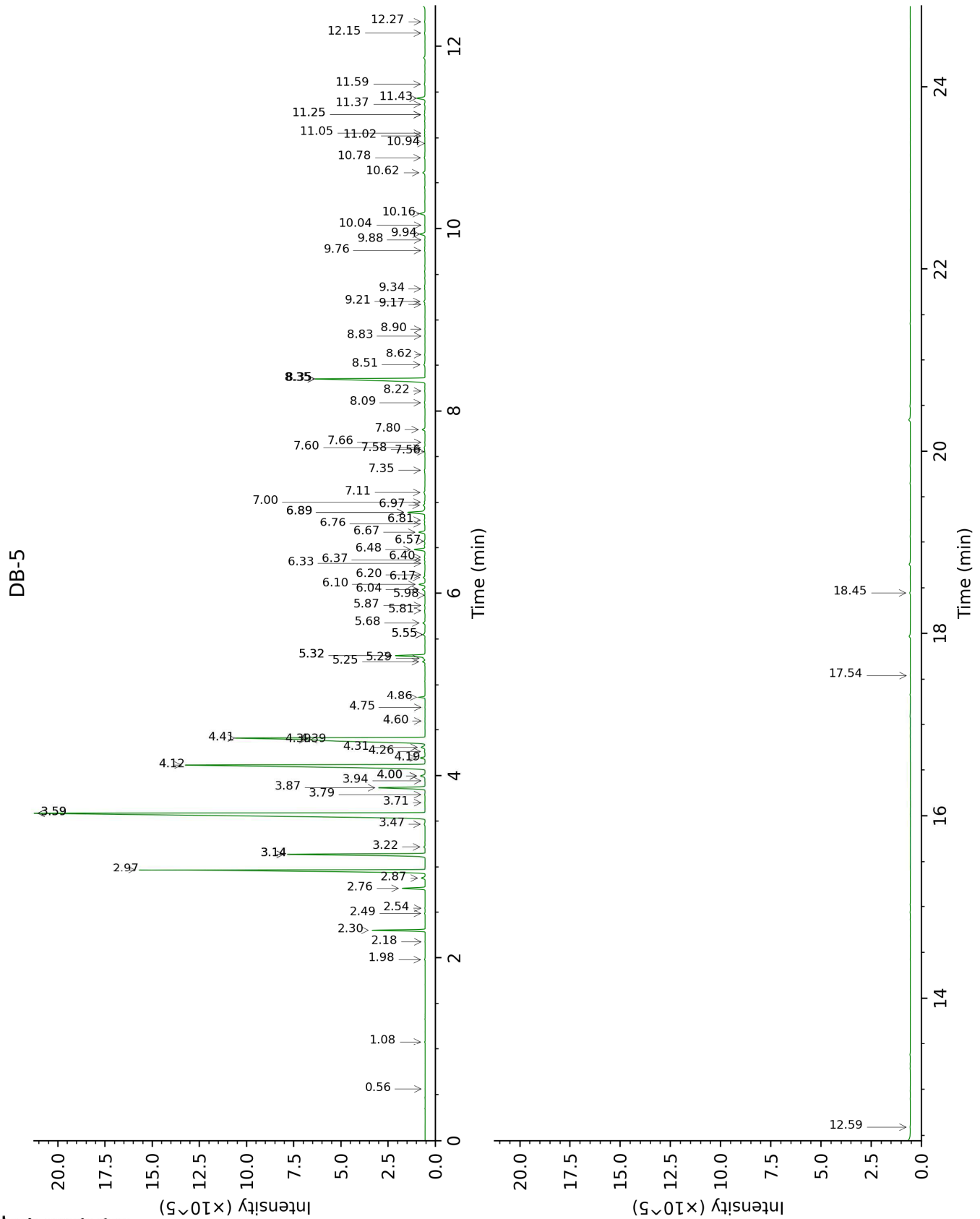
\*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered  
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total  
tr: The compound has been detected below 0.005% of total signal.

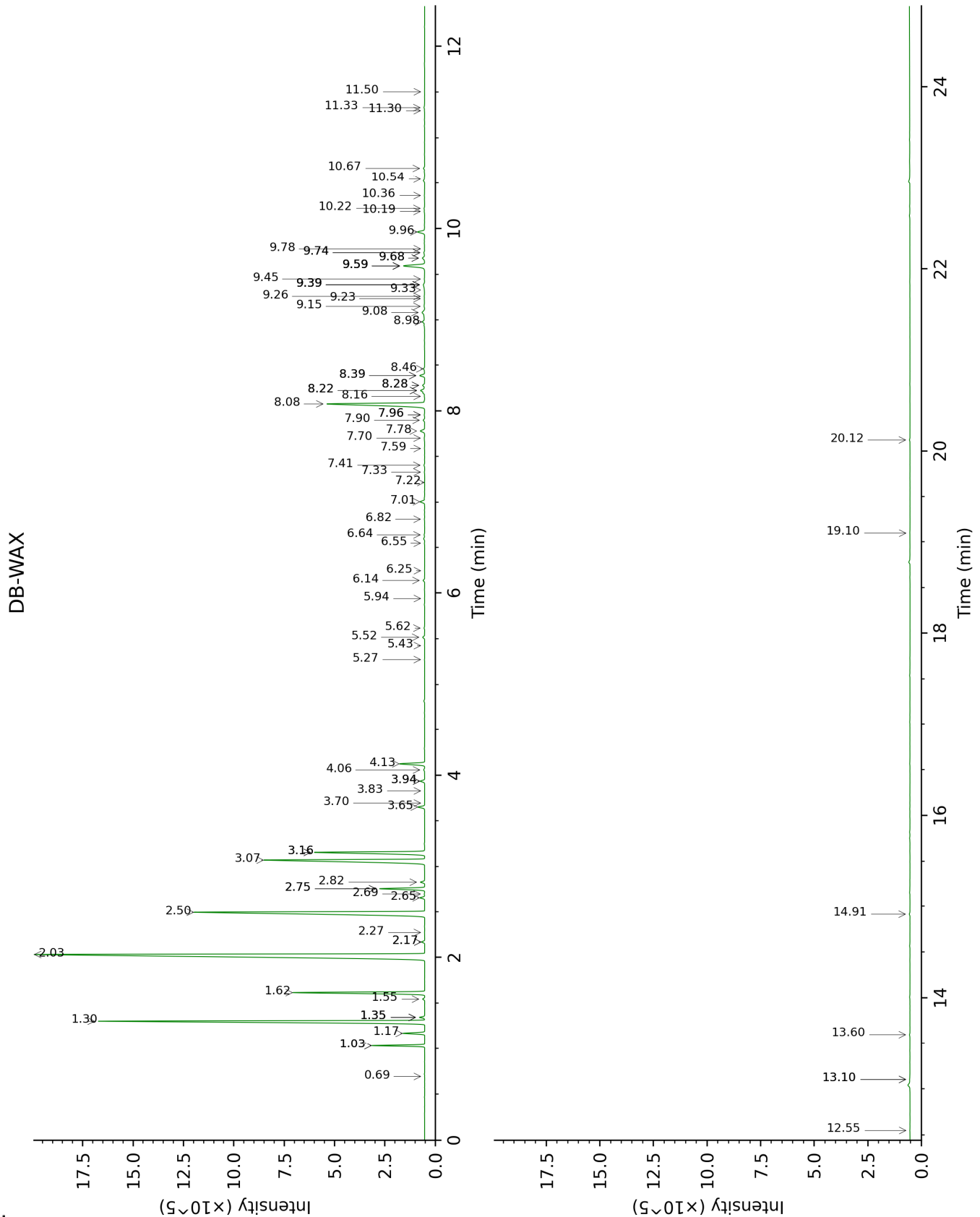
Note: no correction factor was applied

**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	%
Isovaleral	0.56	639	tr	0.70	882	tr
Toluene	1.08	758	0.01	1.35*	1001	0.19
(3Z)-Hexenol	1.98	856	0.02	5.62	1348	0.03
Hexanol	2.18	873	0.01	5.27	1323	0.01
Santene	2.30	884	1.66	1.03*	949	1.67
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]	2.49	900	0.02	1.35*	1001	[0.19]
Bornylene	2.54	905	0.01	1.03*	949	[1.67]
Tricyclene	2.76	920	0.82	1.17	973	0.82
α-Thujene	2.87	927	0.16	1.35*	1001	[0.19]
α-Pinene	2.97	934	15.23	1.30	996	15.28
Camphene	3.14*	945	5.69	1.62	1029	5.60
α-Fenchene	3.14*	945	[5.69]	1.55	1022	0.09
Thuja-2,4(10)- diene	3.22	951	0.05	2.17*	1085	0.13
meta-Cymene	3.47	968	0.05	2.75*	1134	1.88
Sabinene	3.59*	976	29.47	2.17*	1085	[0.13]
β-Pinene	3.59*	976	[29.47]	2.03	1071	29.42
Unknown [m/z 91, 119 (65), 109 (51), 134 (47)]	3.70	984	0.01			
Unknown [m/z 108, 79 (86), 80 (41), 52 (38), 51 (21), 77 (20)...]	3.79	990	0.02	7.22	1466	0.01
Myrcene	3.87	995	1.84	2.75*	1134	[1.88]
2-Carene	3.94	1000	0.01	2.27	1095	0.01
α-Phellandrene	4.00*	1003	0.24	2.65	1126	0.20
Pseudolimonene	4.00*	1003	[0.24]	2.70	1130	0.02
Δ3-Carene	4.12	1011	14.72	2.50	1114	14.72
α-Terpinene	4.19	1016	0.19	2.82	1140	0.18
ortho-Cymene	4.26	1020	0.03	3.94*	1227	0.21
para-Cymene	4.31	1023	0.22	3.94*	1227	[0.21]
1,8-Cineole	4.39*†	1028	15.22	3.16*	1167	5.49
Limonene	4.39*†	1028	[15.22]	3.07	1160	9.77
β-Phellandrene	4.41†	1030	[15.22]	3.16*	1167	[5.49]
(Z)-β-Ocimene	4.60	1041	tr	3.70	1209	tr
(E)-β-Ocimene	4.75	1051	tr	3.83	1219	0.01
γ-Terpinene	4.86	1058	0.30	3.65	1206	0.31
Fenchone	5.25	1083	0.10	5.52	1341	0.10
Isoterpinolene	5.29	1085	0.08	4.06	1236	0.05
para-Cymenene	5.32*	1087	1.26	6.14	1386	0.08
Terpinolene	5.32*	1087	[1.26]	4.13	1241	1.17
Linalool	5.55*	1102	0.10	7.90	1518	0.07
α-Thujone	5.55*	1102	[0.10]	5.94	1372	0.01
endo-Fenchol	5.68	1110	0.10	8.22*	1543	0.25

<i>cis</i> -para-Menth-2-en-1-ol	5.81	1118	0.02	7.96*	1522	0.03
$\alpha$ -Campholenal	5.87	1122	0.02	6.82	1436	0.02
<i>cis</i> -Limonene oxide	5.98	1129	0.01	6.24	1394	tr
<i>trans</i> -Pinocarveol	6.04	1133	0.13	8.98	1602	0.14
Camphor	6.10	1137	0.27	7.01	1450	0.24
Camphene hydrate	6.17	1142	0.08	8.28*	1548	0.11
meta-Mentha-4,6-dien-8-ol	6.20	1144	0.01	9.15	1616	0.04
Isoborneol	6.33	1152	0.02	9.24	1623	0.02
Myrtenyl methyl ether	6.37	1154	0.03	5.43	1334	0.01
Pinocarvone	6.40	1156	0.03	7.70	1503	0.04
Borneol	6.48	1161	0.48	9.59*	1652	1.27
Isopinocampone	6.57	1167	0.05	7.41	1480	0.04
Terpinen-4-ol	6.67	1174	0.29	8.39*	1556	0.25
meta-Cymen-8-ol	6.76	1180	0.05	11.33	1799	0.04
para-Cymen-8-ol	6.81	1183	0.05	11.30	1796	0.01
Myrtenal	6.89*	1188	0.86	8.46	1562	0.06
$\alpha$ -Terpineol	6.89*	1188	[0.86]	9.59*	1652	[1.27]
Myrtenol	6.97	1193	0.10	10.67	1742	0.06
<i>cis</i> -Piperitol	7.00	1195	0.03	9.33	1631	0.01
Verbenone	7.11	1202	0.07	9.39*	1636	0.12
endo-Fenchyl acetate	7.35	1218	0.03	6.64	1423	0.03
<i>cis</i> -Carveol	7.56	1232	0.01	11.50	1814	0.01
Citronellol	7.58	1234	0.02	10.54	1732	0.02
Thymol methyl ether	7.60	1235	0.04	8.28*	1548	[0.11]
Carvone	7.66	1239	0.01	9.78	1668	0.01
Piperitone	7.80	1248	0.13	9.68*	1660	0.14
Phellandral	8.09	1268	0.03	9.74*	1664	0.05
Isopulegyl acetate	8.22	1276	0.02	7.96*	1522	[0.03]
Bornyl acetate	8.35*	1285	6.21	8.08	1532	6.19
Isobornyl acetate	8.35*	1285	[6.21]	8.16	1538	0.02
2-Undecanone	8.51	1296	0.06	8.39*	1556	[0.25]
Thymol	8.62	1303	0.02	14.92	2134	0.03
Isohexyl isocaproate	8.83	1318	0.01	7.33	1475	0.02
Myrtenyl acetate	8.90	1323	0.01	9.39*	1636	[0.12]
$\alpha$ -Longipinene	9.17	1342	0.02	6.55	1416	0.02
$\alpha$ -Terpinyl acetate	9.21	1345	0.06	9.45	1641	0.01
Citronellyl acetate	9.34	1354	0.02	9.26	1625	0.03
Geranyl acetate	9.76	1384	0.02	10.36	1716	0.02
$\beta$ -Longipinene	9.88	1392	0.01	7.59	1494	0.02
Longifolene	9.94	1397	0.24	7.78	1509	0.26
Methyleugenol	10.04	1404	0.01	13.10*	1959	0.05
$\beta$ -Caryophyllene	10.16	1413	0.24	8.22*	1543	[0.25]
$\alpha$ -Humulene	10.62	1447	0.11	9.08	1611	0.26

(E)-β-Farnesene	10.78	1459	0.04	9.39*	1636	[0.12]
γ-Murolene	10.94	1471	0.01	9.39*	1636	[0.12]
Germacrene D	11.02	1477	0.02	9.59*	1652	[1.27]
β-Selinene	11.05	1479	0.02	9.68*	1660	[0.14]
β-Himachalene	11.25*	1494	0.04	9.59*	1652	[1.27]
α-Selinene	11.25*	1494	[0.04]	9.74*	1664	[0.05]
(Z)-α-Bisabolene	11.37	1503	0.03	10.19	1701	0.03
β-Bisabolene	11.43	1508	0.39	9.96	1683	0.41
δ-Cadinene	11.59	1520	0.04	10.22	1704	0.03
(E)-Nerolidol	12.15	1564	0.03	13.60	2005	0.03
Caryophyllene oxide	12.27	1574	0.02	12.55	1908	0.01
Humulene epoxide II	12.59	1599	0.02	13.10*	1959	[0.05]
Manool	17.54	2042	0.01	19.10	2589	0.01
(Z)-Abienol	18.44	2133	0.03	20.12	2712	0.03
<b>Total identified</b>		<b>98.26%</b>			<b>98.04%</b>	
<b>Total reported</b>		<b>98.32%</b>			<b>98.05%</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