

**Date :** September 29, 2020

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 20I21-PTH08


**Customer identification :** Fir Needle - Russia - F20107205R

**Type :** Essential oil

**Source :** *Abies sibirica*

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

**Analysis date :** September 23, 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:** 1.4700 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 10869:2011 - OIL OF FIR NEEDLE, SIBERIAN

Compound	Min. %	Max. %	Observed %	Complies?
α-Humulene	0.3	0.9	0.6	Yes
Borneol	1.0	3.0	1.6	Yes
Isobornyl acetate		0.1	0.1	Yes
β-Caryophyllene	0.5	2.0	1.2	Yes
Bornyl acetate	20.0	35.0	27.4	Yes
β-Phellandrene	1.5	5.0	3.4	Yes
Limonene	4.0	10.0	4.5	Yes
Δ3-Carene	9.0	15.0	12.6	Yes
β-Pinene	1.0	3.5	2.0	Yes
Camphene	15.0	26.0	22.8	Yes
α-Pinene	10.0	22.0	12.0	Yes
Tricyclene	1.5	3.5	2.3	Yes
Santene	1.5	3.5	2.8	Yes
<b>Refractive index</b>	1.4680	1.4730	1.4700	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
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Toluene	0.01	Simple phenolic
Santene	2.81	Normonoterpene
Unknown	0.03	Normonoterpene
Tricyclene	2.31	Monoterpene
$\alpha$ -Thujene	0.09	Monoterpene
$\alpha$ -Pinene	12.03	Monoterpene
$\beta$ -Fenchene?	0.21	Monoterpene
$\alpha$ -Fenchene	0.03	Monoterpene
Camphene	22.81	Monoterpene
Thuja-2,4(10)-diene	0.02	Monoterpene
meta-Cymene	0.04	Monoterpene
$\beta$ -Pinene	2.04	Monoterpene
Sabinene	0.01	Monoterpene
Unknown	0.01	Monoterpene
Myrcene	0.64	Monoterpene
2-Carene	0.01	Monoterpene
$\alpha$ -Phellandrene	0.20	Monoterpene
Pseudolimonene	0.01	Monoterpene
$\Delta^3$ -Carene	12.60	Monoterpene
$\alpha$ -Terpinene	0.13	Monoterpene
Carvomenthene	0.02	Aliphatic alcohol
para-Cymene	0.08	Monoterpene
Limonene	4.51	Monoterpene
$\beta$ -Phellandrene	3.41	Monoterpene
(Z)- $\beta$ -Ocimene	0.02	Monoterpene
$\gamma$ -Terpinene	0.17	Monoterpene
cis-Sabinene hydrate	0.01	Monoterpenic alcohol
meta-Cymenene	0.02	Monoterpene
Isoterpinolene	0.03	Monoterpene
Terpinolene	1.19	Monoterpene
para-Cymenene	0.03	Monoterpene
$\alpha$ -Pinene oxide	0.01	Monoterpenic ether
Linalool	0.04	Monoterpenic alcohol
endo-Fenchol	0.02	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
$\alpha$ -Campholenal	0.02	Monoterpenic aldehyde
Cosmene?	0.01	Monoterpene
trans-Pinocarveol	0.02	Monoterpenic alcohol
Camphor	0.19	Monoterpenic ketone
Camphene hydrate	0.09	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.02	Monoterpenic alcohol
Isoborneol	0.03	Monoterpenic alcohol
Pinocarvone	0.01	Monoterpenic ketone

Borneol	1.61	Monoterpenic alcohol
Isopinocampone	0.01	Monoterpenic ketone
Terpinen-4-ol	0.12	Monoterpenic alcohol
Cryptone	0.03	Normonoterpenic ketone
para-Cymen-8-ol	0.03	Monoterpenic alcohol
$\alpha$ -Terpineol	0.16	Monoterpenic alcohol
Myrtenal	0.02	Monoterpenic aldehyde
Myrtenol	0.02	Monoterpenic alcohol
Unknown	0.04	Oxygenated monoterpene
Verbenone	0.01	Monoterpenic ketone
endo-Fenchyl acetate	0.02	Monoterpenic ester
Citronellol	0.04	Monoterpenic alcohol
Thymol methyl ether	0.02	Monoterpenic ether
Carvone	0.03	Monoterpenic ketone
Piperitone	0.01	Monoterpenic ketone
Geraniol	0.01	Monoterpenic alcohol
Phellandral	0.03	Monoterpenic aldehyde
iso-Isopulegyl acetate	0.01	Monoterpenic ester
Bornyl acetate	27.42	Monoterpenic ester
Isobornyl acetate	0.08	Monoterpenic ester
2-Undecanone	0.06	Aliphatic ketone
Thymol	0.01	Monoterpenic alcohol
Isohexyl isocaproate	0.03	Aliphatic ester
Unknown	0.02	Unknown
Unknown	0.02	Unknown
$\alpha$ -Longipinene	0.02	Sesquiterpene
$\alpha$ -Terpinyl acetate	0.01	Monoterpenic ester
Citronellyl acetate	0.01	Monoterpenic ester
Neryl acetate	0.06	Monoterpenic ester
$\alpha$ -Copaene	0.01	Sesquiterpene
Geranyl acetate	0.20	Monoterpenic ester
Longifolene	0.09	Sesquiterpene
$\beta$ -Longipinene	0.02	Sesquiterpene
Methyleugenol	0.02	Phenylpropanoid
Dodecanal	0.17	Aliphatic aldehyde
$\beta$ -Caryophyllene	1.15	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.01	Sesquiterpene
$\alpha$ -Himachalene	0.04	Sesquiterpene
$\alpha$ -Humulene	0.64	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.02	Sesquiterpene
$\gamma$ -Himachalene	0.03	Sesquiterpene
Unknown	0.04	Sesquiterpene
Unknown	0.02	Unknown
$\beta$ -Himachalene	0.03	Sesquiterpene
$\alpha$ -Muurolene	0.02	Sesquiterpene
( <i>Z</i> )- $\alpha$ -Bisabolene	0.02	Sesquiterpene
$\beta$ -Bisabolene	0.14	Sesquiterpene
$\delta$ -Cadinene	0.02	Sesquiterpene
( <i>E</i> )- $\gamma$ -Bisabolene	0.08	Sesquiterpene
( <i>E</i> )-Nerolidol	0.03	Sesquiterpenic alcohol
Caryophyllene oxide	0.03	Sesquiterpenic ether
Humulene epoxide II	0.02	Sesquiterpenic ether

Selin-6-en-4 $\alpha$ -ol isomer	0.05	Sesquiterpenic alcohol
$\alpha$ -Bisabolol analog	0.02	Sesquiterpenic alcohol
$\alpha$ -Bisabolol	0.22	Sesquiterpenic alcohol
Manoyl oxide	0.04	Diterpenic ether
13-epi-Manoyl oxide	0.03	Diterpenic ether
Manool	0.04	Diterpenic alcohol
<b>Consolidated total</b>	<b>99.21%</b>	

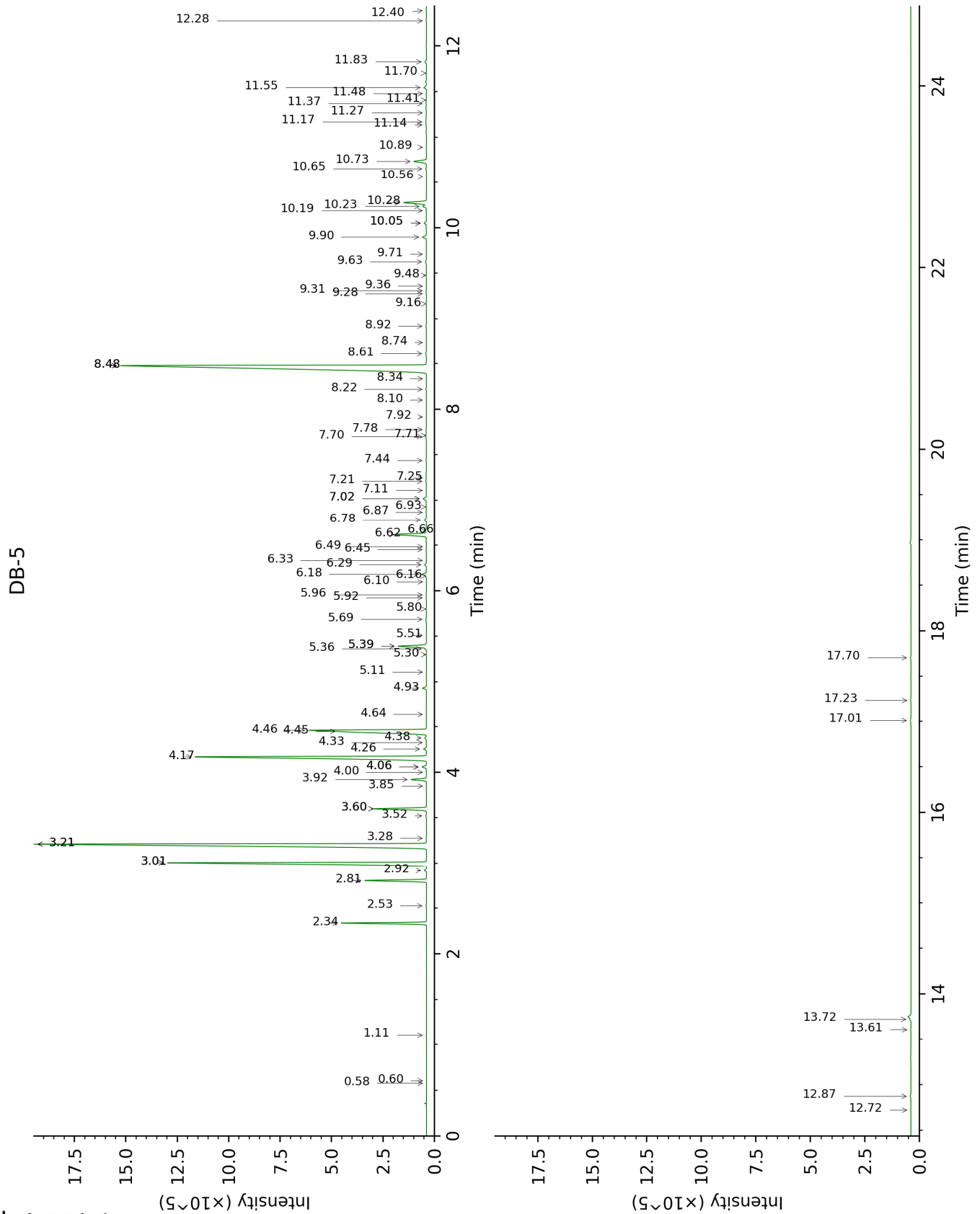
tr: The compound has been detected below 0.005% of total signal.

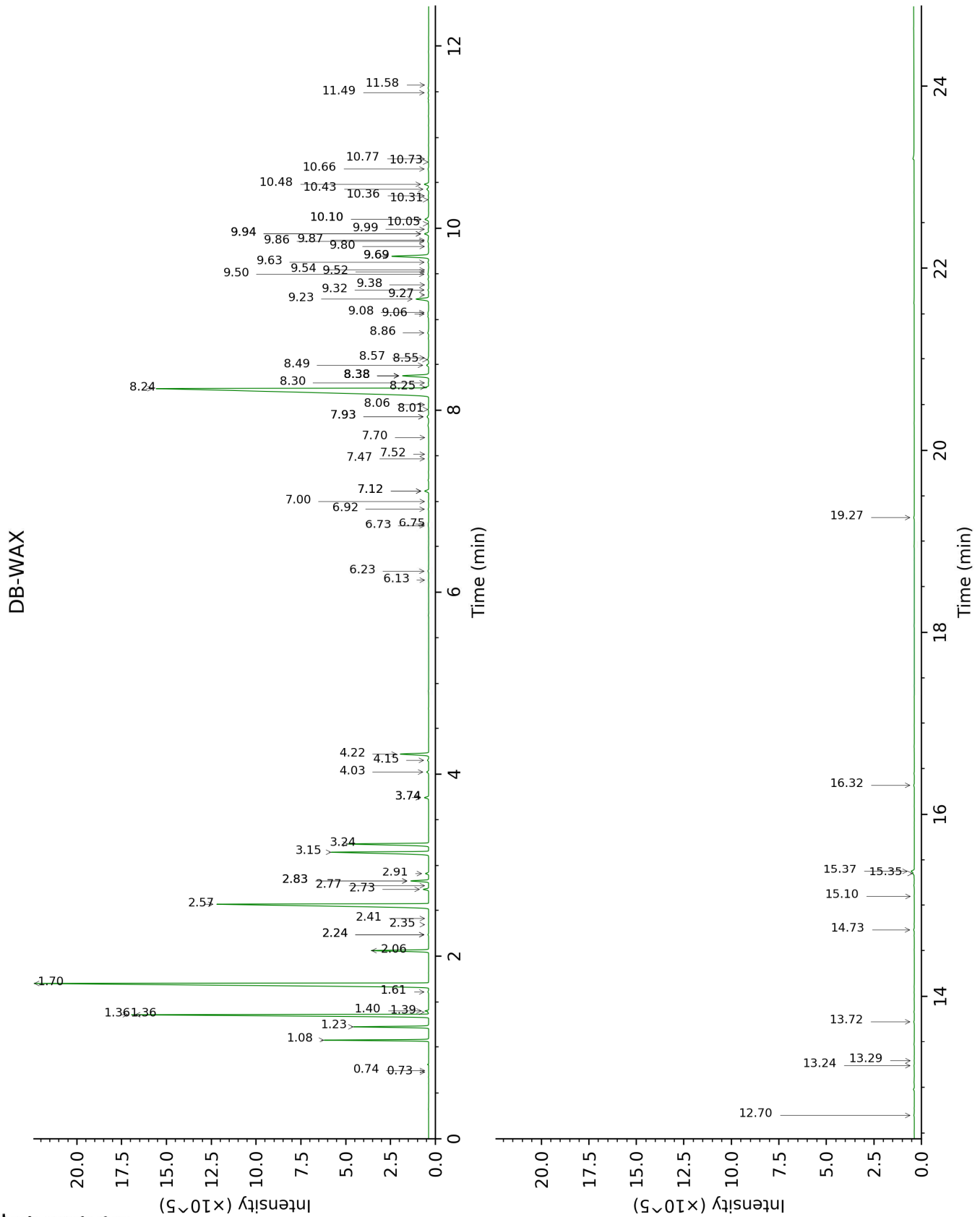
Note: no correction factor was applied

**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	%
Isovaleral	0.58	640	tr	0.74	881	tr
2-Methylbutyral	0.60	650	tr	0.73	875	tr
Toluene	1.11	758	0.01	1.39	997	0.02
Santene	2.34	882	2.81	1.08	946	2.78
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]	2.53	898	0.03	1.36*	992	12.06
Tricyclene	2.81	918	2.31	1.23	970	2.33
α-Thujene	2.92	925	0.09	1.40	998	0.10
α-Pinene	3.01*	931	12.23	1.36*	992	[12.06]
β-Fenchene?	3.01*	931	[12.23]			
α-Fenchene	3.21*	945	23.08	1.61	1019	0.03
Camphene	3.21*	945	[23.08]	1.70	1028	22.81
Thuja-2,4(10)- diene	3.28	949	0.02	2.24*	1081	0.02
meta-Cymene	3.52	966	0.04	2.82*	1130	0.65
β-Pinene	3.60*	971	2.09	2.06	1064	2.04
Sabinene	3.60*	971	[2.09]	2.24*	1081	[0.02]
Unknown [m/z 91, 119 (65), 109 (51), 134 (47)]	3.85	987	0.01			
Myrcene	3.92	992	0.64	2.82*	1130	[0.65]
2-Carene	4.00	998	0.01	2.35	1092	0.01
α-Phellandrene	4.06*	1001	0.21	2.73	1123	0.20
Pseudolimonene	4.06*	1001	[0.21]	2.77	1126	0.01
Δ <sup>3</sup> -Carene	4.17	1008	12.60	2.57	1111	12.44
α-Terpinene	4.26	1014	0.13	2.91	1137	0.12
Carvomenthene	4.33	1018	0.02	2.41	1098	0.01
para-Cymene	4.38	1021	0.08	4.02	1222	0.09
Limonene	4.45†	1026	8.01	3.15	1156	4.51
β-Phellandrene	4.46†	1027	[8.01]	3.24	1163	3.41
(Z)-β-Ocimene	4.64	1038	0.02	3.74*†	1202	0.18
γ-Terpinene	4.93	1056	0.17	3.74*†	1202	[0.18]
cis-Sabinene hydrate	5.11	1067	0.01	6.92	1430	0.02
meta-Cymenene	5.30	1079	0.02	6.13	1372	0.01
Isoterpinolene	5.36	1083	0.03	4.15	1231	0.05
Terpinolene	5.39*	1085	1.28	4.22	1236	1.19
para-Cymenene	5.39*	1085	[1.28]	6.23	1379	0.03
α-Pinene oxide	5.51	1092	0.01			
Linalool	5.69	1104	0.04	8.01	1512	0.03
endo-Fenchol	5.80	1111	0.02	8.30	1535	0.02
cis-para-Menth-2- en-1-ol	5.92	1118	0.02	8.06	1516	0.02
α-Campholenal	5.96	1121	0.02	7.00	1436	0.01
Cosmene?	6.10	1130	0.01			
trans-Pinocarveol	6.16	1134	0.02	9.08	1595	0.04

Camphor	6.18	1135	0.19	7.12*	1445	0.19
Camphene hydrate	6.29	1142	0.09	8.38*	1541	1.25
meta-Mentha-4,6-dien-8-ol	6.33	1145	0.02	9.27	1611	0.02
Isoborneol	6.45	1152	0.03	9.32	1615	0.03
Pinocarvone	6.48	1154	0.01	7.93*	1506	0.10
Borneol	6.62†	1163	1.62	9.69*	1645	1.81
Isopinocampone	6.66†	1165	[1.62]	7.52	1475	0.01
Terpinen-4-ol	6.78	1173	0.12	8.49	1550	0.10
Cryptone	6.87	1179	0.03	9.06	1594	0.03
para-Cymen-8-ol	6.93	1182	0.03	11.49	1795	0.03
α-Terpineol	7.02*	1188	0.17	9.69*	1645	[1.81]
Myrtenal	7.02*	1188	[0.17]	8.57	1556	0.02
Myrtenol	7.11	1194	0.02	10.77	1734	0.01
Unknown [m/z 109, 91 (100), 81 (88), 94 (75), 119 (74), 96 (73), 41 (63)... 150 (2)]	7.21	1200	0.04	10.73	1731	0.01
Verbenone	7.25	1203	0.01	9.54	1633	0.01
endo-Fenchyl acetate	7.44	1215	0.02	6.73	1416	0.02
Citronellol	7.70	1233	0.04	10.66	1724	0.04
Thymol methyl ether	7.71	1234	0.02	8.38*	1541	[1.25]
Carvone	7.78	1238	0.03	9.99	1669	0.03
Piperitone	7.92	1247	0.01	9.87	1659	0.03
Geraniol	8.10	1260	0.01	11.58	1803	0.01
Phellandral	8.22	1268	0.03	9.94*	1665	0.21
iso-Isopulegyl acetate	8.34	1275	0.01			
Bornyl acetate	8.48*	1285	27.07	8.24	1530	27.42
Isobornyl acetate	8.48*	1285	[27.07]	8.25	1531	0.08
2-Undecanone	8.61	1294	0.06	8.55	1554	0.04
Thymol	8.74	1301	0.01	15.10	2130	0.01
Isohexyl isocaproate	8.92	1314	0.03	7.47	1471	0.02
Unknown [m/z 135, 91 (76), 43 (59), 77 (39), 93 (33)...]	9.16	1331	0.02			
Unknown [m/z 121, 93 (84), 43 (81), 79 (48), 117 (40), 56 (37)...]	9.28	1339	0.02			
α-Longipinene	9.31	1341	0.02	6.75	1417	0.02
α-Terpinyl acetate	9.36	1345	0.01	9.63	1640	0.04
Citronellyl acetate	9.48	1353	0.01	9.38	1620	0.01
Neryl acetate	9.63	1364	0.06	10.10*	1678	0.23
α-Copaene	9.71	1370	0.01	7.12*	1445	[0.19]
Geranyl acetate	9.90	1383	0.20	10.48	1710	0.20

Longifolene	10.05*	1394	0.12	7.93*	1506	[0.10]
β-Longipinene	10.05*	1394	[0.12]	7.70	1488	0.02
Methyleugenol	10.19	1404	0.02	13.24	1952	0.02
Dodecanal	10.23	1407	0.17	9.94*	1665	[0.21]
β-Caryophyllene	10.28	1410	1.15	8.38*	1541	[1.25]
<i>trans</i> -α-Bergamotene	10.56	1431	0.01	8.38*	1541	[1.25]
α-Himachalene	10.65	1438	0.04	8.86	1578	0.05
α-Humulene	10.74	1444	0.64	9.23	1607	0.65
( <i>E</i> )-β-Farnesene	10.89	1456	0.02	9.52	1631	0.02
γ-Himachalene	11.14	1474	0.03	9.50	1629	0.04
Unknown [m/z 91, 93 (92), 105 (71), 77 (69), 79 (68), 133 (63)... 204 (32)]	11.17	1477	0.04	9.86	1658	0.05
Unknown [m/z 43, 58 (75), 57 (58), 71 (55), 41 (41), 59 (31)...]	11.27	1484	0.02			
β-Himachalene	11.37	1492	0.03	9.80	1654	0.03
α-Murolene	11.41	1494	0.02	10.05	1674	0.03
( <i>Z</i> )-α-Bisabolene	11.48	1500	0.02	10.31	1695	0.03
β-Bisabolene	11.55	1505	0.14	10.10*	1678	[0.23]
δ-Cadinene	11.70	1517	0.02	10.36	1699	0.02
( <i>E</i> )-γ-Bisabolene	11.83	1527	0.08	10.43	1705	0.10
( <i>E</i> )-Nerolidol	12.28	1562	0.03	13.72	1997	0.03
Caryophyllene oxide	12.40	1572	0.03	12.70	1902	0.03
Humulene epoxide II	12.72	1597	0.02	13.29	1957	0.01
Selin-6-en-4α-ol isomer	12.87	1610	0.05	14.73	2093	0.04
α-Bisabolol analog	13.61	1670	0.02	15.37†	2157	[0.23]
α-Bisabolol	13.72	1680	0.22	15.35†	2155	0.23
Manoyl oxide	17.01	1976	0.04			
13-epi-Manoyl oxide	17.23	1998	0.03	16.32	2254	0.03
Manool	17.70	2045	0.04	19.26	2578	0.03
<b>Total identified</b>		<b>99.06%</b>			<b>98.70%</b>	
<b>Total reported</b>		<b>99.24%</b>			<b>98.77%</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