

## GC/MS BATCH NUMBER: F40106

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**ESSENTIAL OIL:** FRANKINCENSE SERRATA  
**BOTANICAL NAME:** BOSWELLIA SERRATA  
**ORIGIN:** INDIA

KEY CONSTITUENTS PRESENT IN THIS BATCH OF FRANKINCENSE SERRATA OIL	%
$\alpha$ -THUJENE	68.4
SABINENE	5.6
$\alpha$ -PINENE	5.2
$\Delta$ 3-CARENE	3.9
$\alpha$ -PHELLANDRENE	2.2
LIMONENE	1.9
METHYLCHAVICOL	1.8
p-CYMENE	1.4
MYRCENE	1.1

Comments from Robert Tisserand: Fresh, woody-balsamic odor quality. Constituents are in expected amounts.

**Date :** June 29, 2018

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 18F21-PTH2-1-CC

**Customer identification :** Frankincense Serrata - India - F4010684R

**Type :** Essential oil

**Source :** *Boswellia serrata*

**Customer :** Plant Therapy

**ANALYSIS**

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID (in French); identifications validated by GC-MS.

**Analyst :** Sarah-Eve Tremblay, M. Sc. A., Chimiste

**Analysis date :** June 22, 2018

Checked and approved by :

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

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*This report is digitally signed, it is only considered valid if the digital signature is intact.*

*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4590 \pm 0.0003$  (20 °C)

*CONCLUSION*

No adulterant, contaminant or diluent has been detected using this method.

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Ethanol	0.08	0.08*	Aliphatic alcohol
3-Methyl-2-butanone	tr	[0.08]*	Aliphatic ketone
Toluene	0.01	68.44*	Simple phenolic
Unknown	tr	tr	Monoterpene
Unknown	0.02		Monoterpene
Hashishene	0.11	5.26*	Monoterpene
Tricyclene	tr	0.01	Monoterpene
$\alpha$ -Thujene	68.40	[68.44]*	Monoterpene
$\alpha$ -Pinene	5.19	[5.26]*	Monoterpene
Unknown	0.45	3.87*	Monoterpene
Camphene	0.06*	0.06	Monoterpene
$\alpha$ -Fenchene	[0.06]*	0.01	Monoterpene
Thuja-2,4(10)-diene	0.01	5.60*	Monoterpene
$\beta$ -Pinene	5.93*	0.34	Monoterpene
Sabinene	[5.93]*	[5.60]*	Monoterpene
6-Methyl-5-hepten-2-one	0.01		Aliphatic ketone
Myrcene	1.07	1.10	Monoterpene
$\alpha$ -Phellandrene	2.22*	2.21	Monoterpene
Pseudolimonene	[2.22]*	tr	Monoterpene
$\Delta^3$ -Carene	3.89	[3.87]*	Monoterpene
$\alpha$ -Terpinene	0.38	0.37	Monoterpene
ortho-Cymene	0.07*	1.42*	Simple phenolic
Carvomenthene	[0.07]*	0.02	Aliphatic alcohol
para-Cymene	1.38	[1.42]*	Monoterpene
Unknown	0.12	0.18*	Unknown
1,8-Cineole	2.37*	0.48*	Monoterpenic ether
Limonene	[2.37]*	1.87	Monoterpene
$\beta$ -Phellandrene	[2.37]*	[0.48]*	Monoterpene
(Z)- $\beta$ -Ocimene	0.52	0.52	Monoterpene
Unknown	0.06		Unknown
(E)- $\beta$ -Ocimene	0.26	0.26	Monoterpene
Unknown	0.01		Unknown
$\gamma$ -Terpinene	0.73	0.72	Monoterpene
cis-Sabinene hydrate	0.05	0.05	Monoterpenic alcohol
Unknown	0.01	0.01	Oxygenated monoterpene
para-Cymenene	0.29*	[0.18]*	Monoterpene
Terpinolene	[0.29]*	0.27	Monoterpene
trans-Sabinene hydrate	0.05	0.04	Monoterpenic alcohol
Unknown	0.01	0.02	Unknown
Linalool	0.10*	0.09	Monoterpenic alcohol
Perillene	[0.10]*	0.01	Monoterpenic ether
$\beta$ -Thujone	0.20*	[0.18]*	Monoterpenic ketone
Unknown	[0.20]*	0.16	Oxygenated monoterpene
Unknown	0.01		Oxygenated monoterpene
cis-para-Menth-2-en-1-ol	0.06	0.05	Monoterpenic alcohol
$\alpha$ -Campholenal	0.01	tr	Monoterpenic aldehyde
Unknown	0.01		Unknown
4-Hydroxy-4-methylcyclohex-2-	0.02*	0.01*	Aliphatic alcohol

enone			
allo-Ocimene	[0.02]*	0.01	Monoterpene
cis-para-Mentha-2,8-dien-1-ol	0.01	0.09*	Monoterpenic alcohol
trans-Pinocarveol	0.01	0.01*	Monoterpenic alcohol
trans-Sabinol	0.06	0.05	Monoterpenic alcohol
trans-Verbenol	0.02*	0.02	Monoterpenic alcohol
Epoxyterpinolene	[0.02]*	tr	Monoterpenic ether
Unknown	0.01	0.02	Unknown
Unknown	0.01		Oxygenated monoterpene
Unknown	0.03		Oxygenated monoterpene
Borneol	0.03	0.27*	Monoterpenic alcohol
α-Phellandren-8-ol	0.01	0.02	Monoterpenic alcohol
Unknown	0.06*	tr	Oxygenated monoterpene
cis-Sabinol	[0.06]*	0.06*	Monoterpenic alcohol
Umbellulone	0.01	0.02	Monoterpenic ketone
Terpinen-4-ol	0.52	0.54	Monoterpenic alcohol
meta-Cymen-8-ol	0.01	0.02	Monoterpenic alcohol
Cryptone	0.01	[0.01]*	Normoterpenic ketone
para-Cymen-8-ol	0.01	0.02	Monoterpenic alcohol
α-Terpineol	0.05	[0.27]*	Monoterpenic alcohol
Methylchavicol	1.79	1.81	Phenylpropanoid
α-Phellandrene epoxide	0.02	0.02	Monoterpenic ether
Unknown	0.02*	[0.06]*	Oxygenated monoterpene
Verbenone	[0.02]*	0.01	Monoterpenic ketone
trans-Piperitol	0.01	0.01	Monoterpenic alcohol
trans-Carveol	0.01	0.01	Monoterpenic alcohol
Carvone	0.10*	0.30	Monoterpenic ketone
cis-Carveol	[0.10]*		Monoterpenic alcohol
Cuminal	[0.10]*	0.01	Monoterpenic aldehyde
Carvotanacetone	0.03	[0.09]*	Monoterpenic ketone
Piperitone	0.03*	0.17*	Monoterpenic ketone
Unknown	[0.03]*	tr	Unknown
Linalyl acetate	0.03	0.03	Monoterpenic ester
Bornyl acetate	0.02	0.01	Monoterpenic ester
Thymol	0.02	0.01	Monoterpenic alcohol
Unknown	0.01	0.01	Unknown
α-Terpinyl acetate	0.05	0.02	Monoterpenic ester
α-Copaene	0.10	0.10	Sesquiterpene
β-Bourbonene	0.57*	0.52	Sesquiterpene
1,5-diepi-β-Bourbonene	[0.57]*	0.04	Sesquiterpene
β-Elemene	0.01	0.05*	Sesquiterpene
Sibirene	0.07	0.07	Sesquiterpene
Methyleugenol	0.14	0.12	Phenylpropanoid
β-Caryophyllene	0.09*	[0.05]*	Sesquiterpene
β-Ylangene	[0.09]*	0.03	Sesquiterpene
β-Copaene	0.07	0.06	Sesquiterpene
trans-α-Bergamotene	0.05	0.02	Sesquiterpene
Isogermacrene D	0.04	0.05	Sesquiterpene
cis-Muurolo-4(15),5-diene	0.04	0.02	Sesquiterpene
γ-Muurolole	0.04	0.06	Sesquiterpene
Germacrene D	0.24	[0.27]*	Sesquiterpene
Unknown	0.15	[0.17]*	Sesquiterpene

α-Muurolene	0.02	0.16	Sesquiterpene
γ-Cadinene	0.03	0.17*	Sesquiterpene
δ-Cadinene	0.19*	[0.17]*	Sesquiterpene
Zonarene	[0.19]*	[0.17]*	Sesquiterpene
Kessane	[0.19]*	0.01	Sesquiterpenic ether
Isocaryophyllene epoxide B	0.02		Sesquiterpenic ether
Elemicin	0.03	0.04	Phenylpropanoid
Guaiol	0.01	[0.01]*	Sesquiterpenic alcohol
10-epi-γ-Eudesmol	0.02		Sesquiterpenic alcohol
Unknown	0.02	0.01	Oxygenated sesquiterpene
α-Phellandrene dimer I	0.01		Diterpene
α-Phellandrene dimer II	0.06	0.05	Diterpene
α-Phellandrene dimer IV	0.02	tr	Diterpene
(3E)-Cembrene A	0.04	0.04	Diterpene
Verticilla-4(20),7,11-triene	0.03		Diterpene
Cembrenol	0.03	0.02	Diterpenic alcohol
Serratol	0.17	0.16	Diterpenic alcohol
<b>Total identified</b>	<b>98.53%</b>	<b>98.68%</b>	

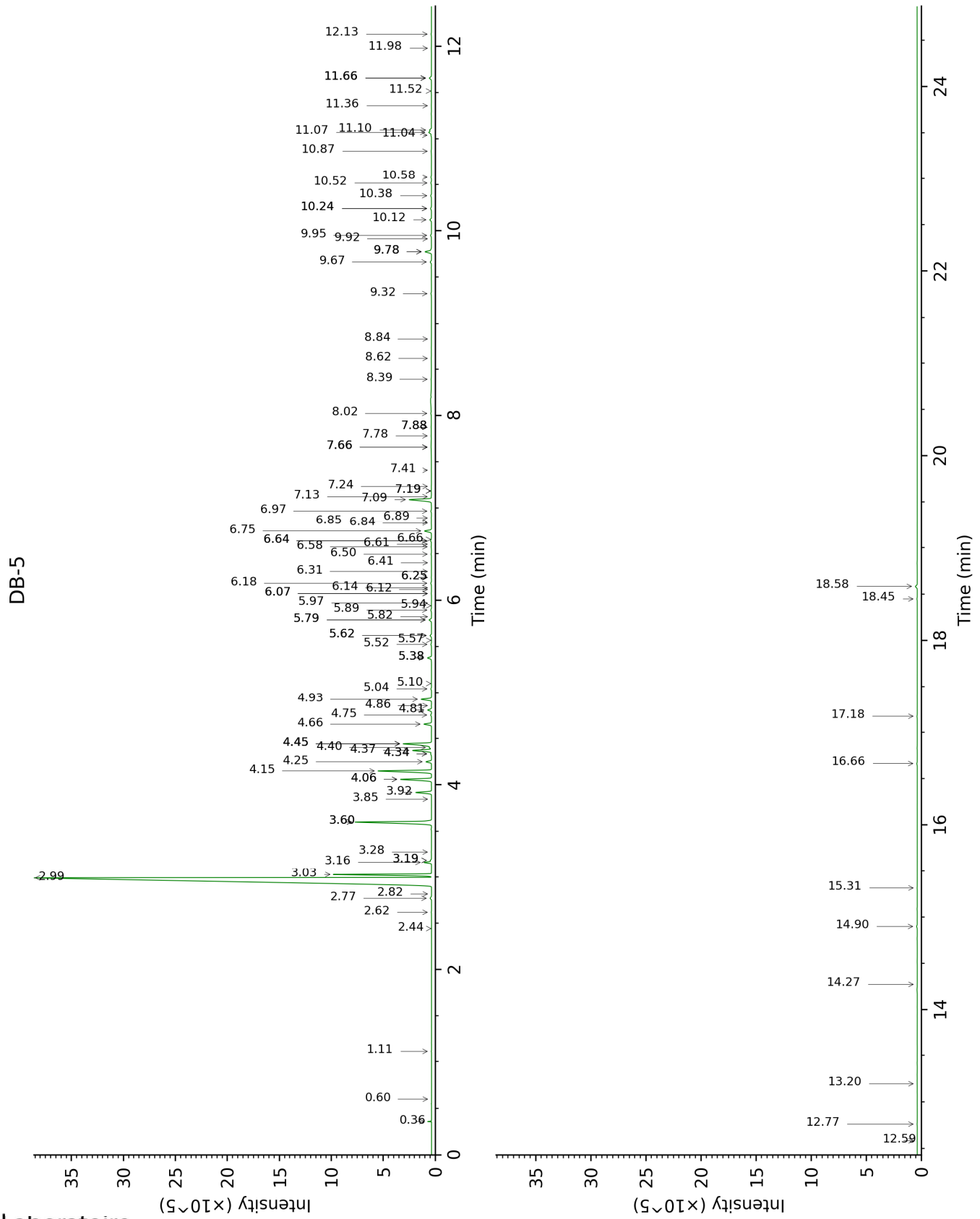
\*: Two or more compounds are coeluting on this column

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

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

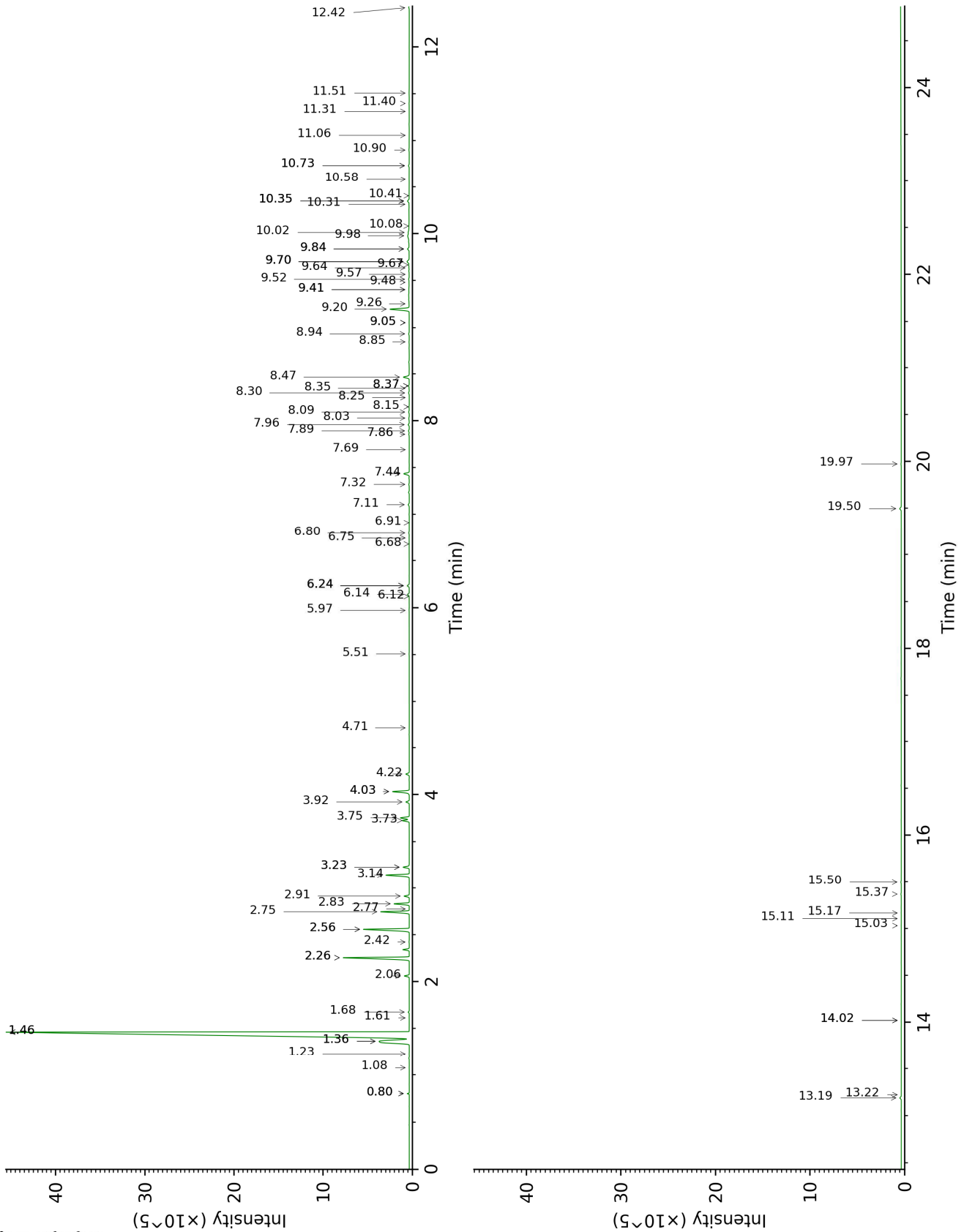
Note: no correction factor was applied

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DB-WAX



FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.36	498	0.08	0.80*	905	0.08
3-Methyl-2-butanone	0.60	646	tr	0.80*	905	[0.08]
Toluene	1.11	755	0.01	1.46*	1009	68.44
Unknown [m/z 93, 91 (75), 121 (61), 77 (58), 79 (38), 92 (26), 43 (24), 41 (23), 105 (22), 107 (19), 136 (16)]	2.44	890	tr	1.08	949	tr
Unknown [m/z 93, 91 (72), 121 (58), 77 (49), 79 (41), 43 (22), 105 (20), 107 (20), 41 (18), 136 (17), 92 (17)]	2.62	905	0.02			
Hashishene	2.77	915	0.11	1.36*	996	5.26
Tricyclene	2.82	918	tr	1.23	974	0.01
$\alpha$ -Thujene	2.99	930	68.40	1.46*	1009	[68.44]
$\alpha$ -Pinene	3.03	932	5.19	1.36*	996	[5.26]
Unknown [m/z 91, 92 (47), 65 (11)... 134 (1)]	3.16	942	0.45	2.56*	1114	3.87
Camphene	3.19*	943	0.06	1.68	1030	0.06
$\alpha$ -Fenchene	3.19*	943	[0.06]	1.61	1024	0.01
Thuja-2,4(10)-diene	3.28	949	0.01	2.26*	1087	5.60
$\beta$ -Pinene	3.60*	971	5.93	2.06	1068	0.34
Sabinene	3.60*	971	[5.93]	2.26*	1087	[5.60]
6-Methyl-5-hepten-2-one	3.85	988	0.01			
Myrcene	3.92	993	1.07	2.83	1135	1.10
$\alpha$ -Phellandrene	4.06*	1002	2.22	2.75	1129	2.21
Pseudolimonene	4.06*	1002	[2.22]	2.78	1131	tr
$\Delta^3$ -Carene	4.15	1008	3.89	2.56*	1114	[3.87]
$\alpha$ -Terpinene	4.25	1014	0.38	2.91	1142	0.37
ortho-Cymene	4.34*	1020	0.07	4.03*	1227	1.42
Carvomenthene	4.34*	1020	[0.07]	2.42	1103	0.02
para-Cymene	4.37	1022	1.38	4.03*	1227	[1.42]
Unknown [m/z 109, 43 (58), 95 (26)... 137 (15)...]	4.40	1024	0.12	6.24*	1385	0.18
1,8-Cineole	4.44*	1026	2.37	3.23*	1166	0.48
Limonene	4.44*	1026	[2.37]	3.14	1160	1.87
$\beta$ -Phellandrene	4.44*	1026	[2.37]	3.23*	1166	[0.48]
(Z)- $\beta$ -Ocimene	4.66	1040	0.52	3.72	1205	0.52

Unknown (m/z 109, 43 (57), 91 (28), 67 (25), 93 (24), 95 (22), 77 (21), 137 (21), 41 (17), 79 (14)...) (E)-β-Ocimene	4.76	1046	0.06			
Unknown [m/z 109, 45 (67), 41 (40), 67 (39), 81 (33), 79 (27), 95 (24), 91 (23), 82 (21), 55 (21), 93 (20)...] γ-Terpinene	4.81	1050	0.26	3.92	1219	0.26
cis-Sabinene hydrate	4.86	1053	0.01			
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)] para-Cymenene	4.93	1057	0.73	3.75	1207	0.72
Terpinolene	5.04	1064	0.05	6.80	1427	0.05
trans-Sabinene hydrate	5.10	1068	0.01	4.71	1276	0.01
Unknown [m/z 109, 43 (65), 95 (54), 119 (50), 91 (47)... 149 (8)...] Linalool	5.38*	1086	0.29	6.24*	1385	[0.18]
Perillene	5.38*	1086	[0.29]	4.22	1240	0.27
β-Thujone	5.52	1095	0.05	7.86	1506	0.04
Unknown [m/z 109, 81 (54), 91 (32), 79 (22)...] Linalool	5.57	1098	0.01	5.97	1366	0.02
Unknown [m/z 109, 91 (57), 93 (47), 81 (44), 77 (40)... 154 (1)] Perillene	5.62*	1101	0.10	7.96	1514	0.09
cis-para-Menth-2-en-1-ol	5.62*	1101	[0.10]	6.12	1377	0.01
α-Campholenal	5.79*	1112	0.20	6.24*	1385	[0.18]
Unknown [m/z 111, 43 (22), 55 (14), 41 (12), 110 (11)...] Unknown [m/z 109, 91 (57), 93 (47), 81 (44), 77 (40)... 154 (1)]	5.79*	1112	[0.20]	6.14	1379	0.16
4-Hydroxy-4-methylcyclohex-2-enone	5.82	1114	0.01			
allo-Ocimene	5.90	1119	0.06	8.09	1524	0.05
cis-para-Mentha-	5.94	1122	0.01	6.91	1435	tr
Unknown [m/z 111, 43 (22), 55 (14), 41 (12), 110 (11)...] 4-Hydroxy-4-methylcyclohex-2-enone	5.97	1123	0.01			
allo-Ocimene	6.07*	1130	0.02	14.02*	2034	0.01
cis-para-Mentha-	6.07*	1130	[0.02]	5.51	1333	0.01
	6.12	1133	0.01	9.41*	1627	0.09

2,8-dien-1-ol						
<i>trans</i> -Pinocarveol	6.14	1134	0.01	9.05*	1599	0.01
<i>trans</i> -Sabinol	6.18	1137	0.06	9.67	1649	0.05
<i>trans</i> -Verbenol	6.25*	1141	0.02	9.48	1634	0.02
Epoxyterpinolene	6.25*	1141	[0.02]	6.68	1418	tr
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.31	1145	0.01	6.74	1423	0.02
Unknown [m/z 109, 81 (39), 41 (38), 95 (24)... 152 (1)]	6.40	1151	0.01			
Unknown [m/z 109, 43 (75), 137 (46), 67 (31), 93 (25)... 152 (4)]	6.50	1157	0.03			
Borneol	6.58	1162	0.03	9.70*	1652	0.27
$\alpha$ -Phellandren-8- ol	6.61	1164	0.01	10.08	1683	0.02
Unknown [m/z 95, 110 (43), 81 (28), 41 (15)... 152 (8)]	6.64*	1167	0.06	7.69	1493	tr
<i>cis</i> -Sabinol	6.64*	1167	[0.06]	10.73*	1737	0.06
Umbellulone	6.66	1168	0.01	8.85	1583	0.02
Terpinen-4-ol	6.75	1174	0.52	8.47	1553	0.54
meta-Cymen-8-ol	6.84	1179	0.01	11.40	1794	0.02
Cryptone	6.85	1180	0.01	9.05*	1599	[0.01]
para-Cymen-8-ol	6.90	1183	0.01	11.51	1803	0.02
$\alpha$ -Terpineol	6.97	1188	0.05	9.70*	1652	[0.27]
Methylchavicol	7.09	1196	1.79	9.20	1610	1.81
$\alpha$ -Phellandrene epoxide	7.13	1198	0.02	10.90	1751	0.02
Unknown [m/z 109, 91 (100), 81 (88), 94 (75), 119 (74), 96 (73), 41 (63)... 150 (2)]	7.19*	1202	0.02	10.73*	1737	[0.06]
Verbenone	7.19*	1202	[0.02]	9.57	1641	0.01
<i>trans</i> -Piperitol	7.24	1205	0.01	10.32	1702	0.01
<i>trans</i> -Carveol	7.41	1217	0.01	11.31	1786	0.01
Carvone	7.66*	1233	0.10	9.98	1674	0.30
<i>cis</i> -Carveol	7.66*	1233	[0.10]			
Cuminal	7.66*	1233	[0.10]	10.58	1724	0.01
Carvotanacetone	7.78	1242	0.03	9.41*	1627	[0.09]
Piperitone	7.88*	1248	0.03	9.84*	1663	0.17
Unknown [m/z 43, 97 (69), 107 (46), 41 (28), 55 (21), 109 (20)...]	7.88*	1248	[0.03]	11.06	1765	tr
Linalyl acetate	8.02	1258	0.03	8.15	1528	0.03

Bornyl acetate	8.39	1283	0.02	8.25	1536	0.01
Thymol	8.62	1298	0.02	15.03	2132	0.01
Unknown [m/z 111, 126 (93), 43 (90), 71 (60)...]	8.84	1313	0.01	15.17	2146	0.01
$\alpha$ -Terpinyl acetate	9.32	1348	0.05	9.64	1646	0.02
$\alpha$ -Copaene	9.67	1372	0.10	7.11	1450	0.10
$\beta$ -Bourbonene	9.78*	1380	0.57	7.44	1474	0.52
1,5-diepi- $\beta$ - Bourbonene	9.78*	1380	[0.57]	7.32	1466	0.04
$\beta$ -Elemene	9.92	1389	0.01	8.37*	1546	0.05
Sibirene	9.95	1392	0.07	7.89	1509	0.07
Methyleugenol	10.12	1404	0.14	13.19	1955	0.12
$\beta$ -Caryophyllene	10.24*	1413	0.09	8.37*	1546	[0.05]
$\beta$ -Ylangene	10.24*	1413	[0.09]	8.03	1519	0.03
$\beta$ -Copaene	10.38	1423	0.07	8.30	1540	0.06
<i>trans</i> - $\alpha$ - Bergamotene	10.52	1434	0.05	8.35	1544	0.02
Isogermacrene D	10.58	1438	0.04	8.94	1590	0.05
<i>cis</i> -Muuro- 4(15),5-diene	10.87	1460	0.04	9.26	1615	0.02
$\gamma$ -Muuro- lolen	11.04	1473	0.04	9.52	1636	0.06
Germacrene D	11.07	1475	0.24	9.70*	1652	[0.27]
Unknown [m/z 91, 93 (92), 105 (71), 77 (69), 79 (68), 133 (63)... 204 (32)]	11.10	1477	0.15	9.84*	1663	[0.17]
$\alpha$ -Muuro- lolen	11.36	1496	0.02	10.02	1677	0.16
$\gamma$ -Cadinene	11.52	1509	0.03	10.35*	1704	0.17
$\delta$ -Cadinene	11.66*	1520	0.19	10.35*	1704	[0.17]
Zonarene	11.66*	1520	[0.19]	10.35*	1704	[0.17]
Kessane	11.66*	1520	[0.19]	10.41	1709	0.01
Isocaryophyllene epoxide B	11.98	1545	0.02			
Elemicin	12.13	1557	0.03	15.37	2166	0.04
Guaiol	12.59	1593	0.01	14.02*	2034	[0.01]
10-epi- $\gamma$ - Eudesmol	12.76	1607	0.02			
Unknown [m/z 204, 161 (97), 59 (87), 189 (78), 105 (45)...]	13.20	1643	0.02	15.11	2140	0.01
$\alpha$ -Phellandrene dimer I	14.27	1734	0.01			
$\alpha$ -Phellandrene dimer II	14.90	1788	0.06	12.42	1884	0.05
$\alpha$ -Phellandrene dimer IV	15.32	1825	0.02	13.22	1958	tr
(3E)-Cembrene A	16.66	1950	0.04	15.50	2179	0.04
Verticilla-	17.18	1999	0.03			

4(20),7,11-triene						
Cembrenol	18.45	2126	0.03	19.97	2678	0.02
Serratol	18.58	2140	0.17	19.50	2621	0.16
<b>Total identified</b>		<b>98.53%</b>			<b>98.68%</b>	
<b>Total reported</b>		<b>99.45%</b>			<b>98.91%</b>	

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

[xx]: Duplicate percentage due to coelutions, not taken account in the identified 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