

**Date :** April 07, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 21C29-PTH04

**Customer identification :** Frank Frereana Organic - Somalia - FE0105204R

**Type :** Essential oil

**Source :** *Boswellia frereana*

**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 :** Alexis St-Gelais, M. Sc., chimiste

**Analysis date :** April 06, 2021

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Yellow liquid

**Refractive index:**  $1.4672 \pm 0.0003$  (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
2-Methyl-3-buten-2-ol	tr	Aliphatic alcohol
(E)-2-Methyl-1,3-pentadiene	tr	Alkene
Isovaleral	tr	Aliphatic aldehyde
3-Methyl-2-butanone	0.09	Aliphatic ketone
Unknown	tr	Unknown
4-Methyl-2-pentanone	0.03	Aliphatic ketone
Toluene	0.05	Simple phenolic
Hexadiene isomer?	0.03	Alkene
Unknown	tr	Alkene
Unknown	tr	Alkene
(Z)-Salvene	0.05	Normonoterpene
Unknown	0.03	Unknown
(E)-Salvene	0.02	Normonoterpene
Unknown	0.02	Unknown
Unknown	0.09	Monoterpene
Unknown	0.15	Unknown
Hashishene	0.46	Monoterpene
Tricyclene	0.02	Monoterpene
$\alpha$ -Thujene	43.89	Monoterpene
$\alpha$ -Pinene	4.40	Monoterpene
Unknown	3.93	Monoterpene
Camphene	0.14	Monoterpene
$\alpha$ -Fenchene	tr	Monoterpene
Thuja-2,4(10)-diene	0.11	Monoterpene
meta-Cymene	0.01	Monoterpene
$\beta$ -Pinene	0.32	Monoterpene
Sabinene	5.04	Monoterpene
Pseudolimonene isomer	0.03	Monoterpene
cis-Carane	0.03	Monoterpene
Dehydro-1,8-cineole	0.02	Monoterpenic ether
6-Methyl-5-hepten-2-one	0.09	Aliphatic ketone
Myrcene	0.15	Monoterpene
trans-Carane?	0.23	Monoterpene
$\alpha$ -Phellandrene	0.48	Monoterpene
Pseudolimonene	0.04	Monoterpene
Menthatriene isomer I	0.04	Monoterpene
$\Delta^3$ -Carene	0.04	Monoterpene
ortho-Methylanisole	0.02	Simple phenolic
Unknown	0.02	Monoterpene
$\alpha$ -Terpinene	0.61	Monoterpene
Carvomenthene	0.07	Aliphatic alcohol
ortho-Cymene	0.22	Monoterpene
para-Cymene	16.91	Monoterpene
Unknown	0.59	Unknown
$\beta$ -Phellandrene	2.46	Monoterpene

Limonene	1.39	Monoterpene
Cymene analog	0.01	Monoterpene
Unknown	0.09	Unknown
Unknown	0.29	Unknown
γ-Terpinene	0.79	Monoterpene
cis-Sabinene hydrate	0.03	Monoterpenic alcohol
Unknown	0.09	Oxygenated monoterpene
cis-Linalool oxide (fur.)	0.03	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Terpinolene	0.16	Monoterpene
para-Cymenene	0.18	Monoterpene
Unknown	0.04	Unknown
trans-Sabinene hydrate	0.04	Monoterpenic alcohol
Linalool	0.09	Monoterpenic alcohol
α-Thujone	0.22	Monoterpenic ketone
Perillene	0.04	Monoterpenic ether
β-Thujone	1.54	Monoterpenic ketone
Unknown	0.09	Oxygenated monoterpene
Unknown	0.34	Oxygenated monoterpene
α-Campholenal	0.04	Monoterpenic aldehyde
Unknown	0.06	Unknown
Unknown	0.01	Unknown
trans-Pinocarveol	0.11	Monoterpenic alcohol
trans-Chrysanthenol	0.11	Monoterpenic alcohol
trans-Sabinol	0.41	Monoterpenic alcohol
Camphor	0.02	Monoterpenic ketone
cis-Verbenol	0.02	Monoterpenic alcohol
trans-Verbenol	0.08	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.05	Monoterpenic alcohol
Sabinaketone	0.11	Normonoterpenic ketone
Unknown	0.02	Oxygenated monoterpene
Pinocamphone	0.01	Monoterpenic ketone
Pinocarvone	0.07	Monoterpenic ketone
α-Phellandren-8-ol	0.14	Monoterpenic alcohol
Umbellulone	0.47	Monoterpenic ketone
cis-Sabinol	0.43	Monoterpenic alcohol
Terpinen-4-ol	3.50	Monoterpenic alcohol
Unknown	0.07	Unknown
Cryptone	0.06	Normonoterpenic ketone
Thuj-3-en-10-al	0.23	Monoterpenic aldehyde
para-Cymen-8-ol	0.54	Monoterpenic alcohol
Myrtenal	0.20	Monoterpenic aldehyde
α-Terpineol	0.12	Monoterpenic alcohol
Myrtenol	0.13	Monoterpenic alcohol
trans-Isopiperitenol	0.03	Monoterpenic alcohol
cis-α-Phellandrene epoxide (IPP vs Me)	0.13	Monoterpenic ether
Verbenone	0.10	Monoterpenic ketone
trans-Piperitol	0.11	Monoterpenic alcohol
trans-Carveol	0.06	Monoterpenic alcohol
Citronellol	0.03	Monoterpenic alcohol
Cuminal	0.29	Monoterpenic aldehyde
Carvone	0.04	Monoterpenic ketone

Carvotanacetone	0.04	Monoterpenic ketone
<i>trans</i> -Sabinene hydrate acetate	0.05	Monoterpenic ester
Unknown	0.13	Oxygenated monoterpene
Piperitone	0.06	Monoterpenic ketone
Unknown	0.03	Unknown
Unknown	0.05	Unknown
Bornyl acetate	0.16	Monoterpenic ester
Cuminol	0.06	Monoterpenic alcohol
Thymol	0.13	Monoterpenic alcohol
Carvacrol	0.18	Monoterpenic alcohol
exo-2-Hydroxycineole acetate	0.01	Monoterpenic ester
α-Cubebene	0.03	Sesquiterpene
Eugenol	0.01	Phenylpropanoid
Citronellyl acetate	0.04	Monoterpenic ester
α-Copaene	0.03	Sesquiterpene
β-Bourbonene	1.26	Sesquiterpene
1,5-diepi-β-Bourbonene	0.08	Sesquiterpene
β-Elemene	0.09	Sesquiterpene
β-Ylangene	0.16	Sesquiterpene
β-Caryophyllene	0.06	Sesquiterpene
β-Copaene	0.13	Sesquiterpene
Isogermacrene D	0.09	Sesquiterpene
α-Humulene	0.01	Sesquiterpene
allo-Aromadendrene	0.01	Sesquiterpene
Unknown	0.03	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
β-Selinene	0.01	Sesquiterpene
γ-Cadinene	0.03	Sesquiterpene
δ-Cadinene	0.02	Sesquiterpene
Caryophyllene oxide	0.03	Sesquiterpenic ether
Viridiflorol	0.02	Sesquiterpenic alcohol
τ-Cadinol	0.05	Sesquiterpenic alcohol
α-Phellandrene dimer I	0.04	Diterpene
α-Phellandrene dimer II	0.68	Diterpene
α-Phellandrene dimer III	0.06	Diterpene
α-Phellandrene dimer IV	0.10	Diterpene
<b>Consolidated total</b>	<b>98.18%</b>	

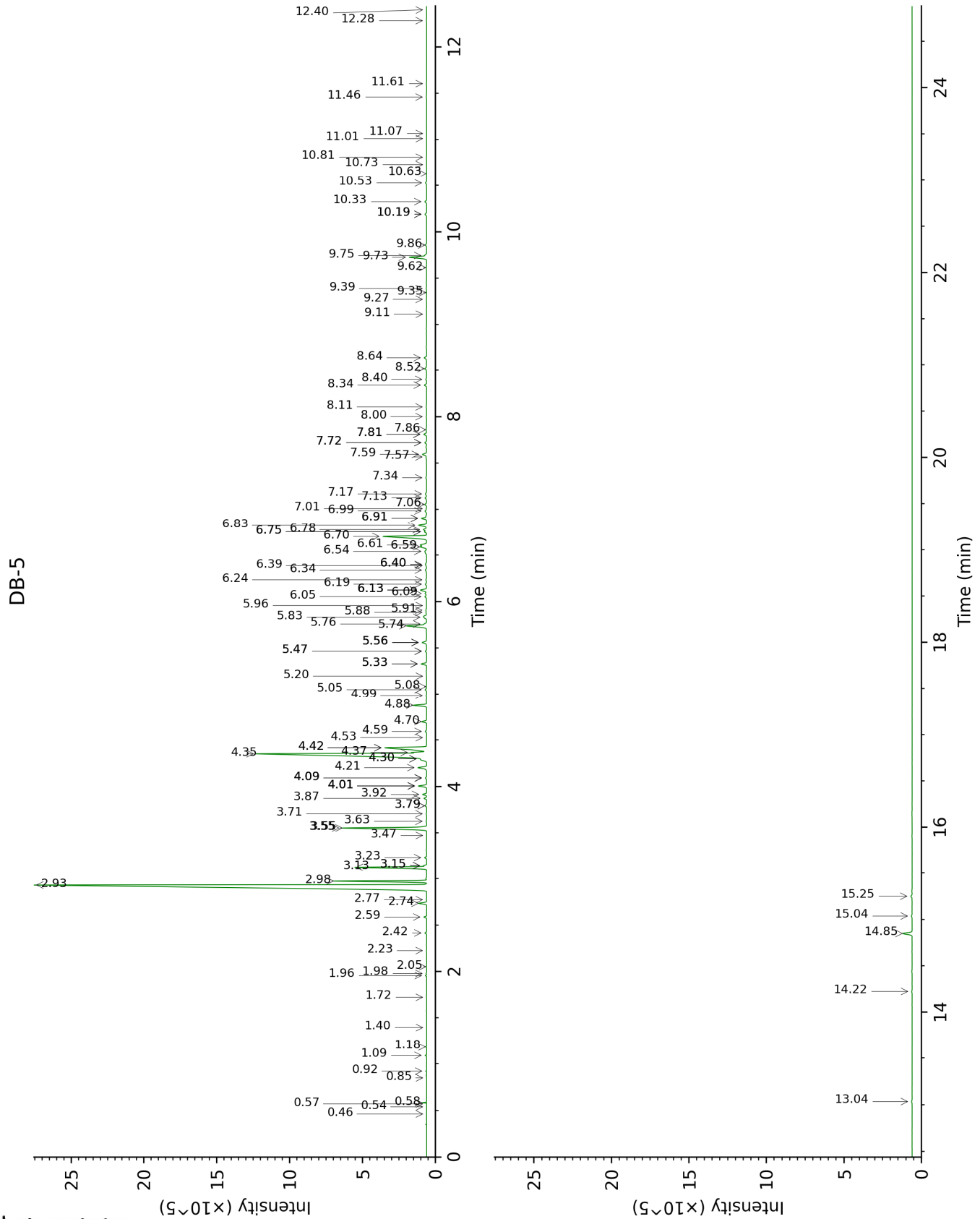
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

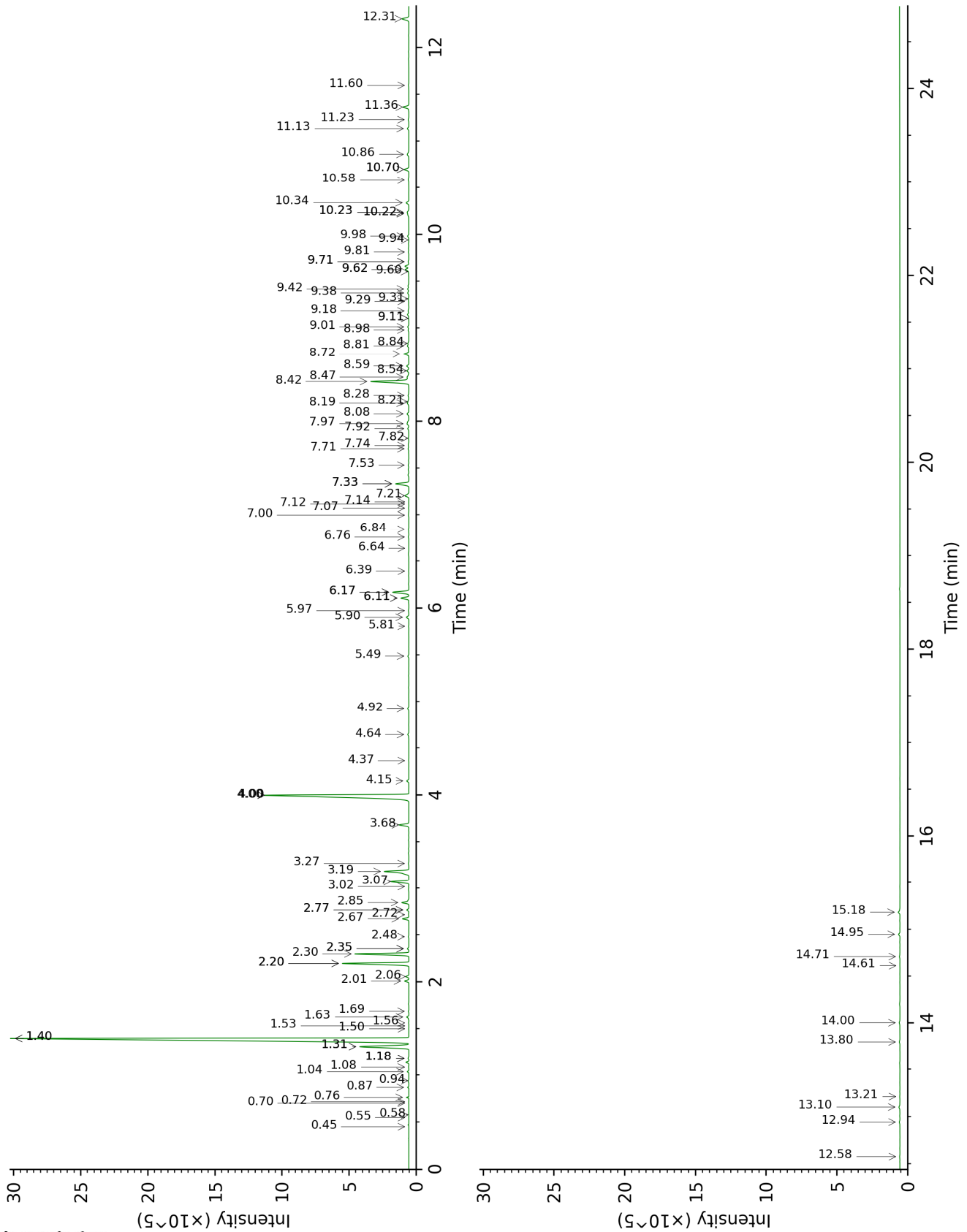
**About "consolidated" data:** The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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.



DB-WAX





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
2-Methyl-3-buten-2-ol	0.46	595	tr	1.50	1016	0.01
(E)-2-Methyl-1,3-pentadiene	0.54	630	tr	0.45	767	tr
Isovaleral	0.57	642	tr	0.72	886	tr
3-Methyl-2-butanone	0.58	647	0.09	0.76	901	0.09
Unknown [m/z 93, 91 (70), 77 (48), 108 (42)]	0.85	722	tr	0.55	822	tr
4-Methyl-2-pentanone	0.92	733	0.03	1.18*	972	0.06
Toluene	1.09	759	0.05	1.40*	1006	43.95
Hexadiene isomer?	1.18	772	0.03			
Unknown [m/z 109, 67 (33), 41 (16), 81 (13)... 124 (8)]	1.40	805	tr	0.58	834	tr
Unknown [m/z 109, 67 (32), 81 (14), 41 (12), 124 (10)]	1.72	833	tr	0.70	881	tr
(Z)-Salvene	1.96	853	0.05	0.87	919	0.06
Unknown [m/z 109, 43 (28), 124 (28), 41 (14), 55 (11), 79 (9), 81 (8)...]	1.98	855	0.03	1.56	1022	0.02
(E)-Salvene	2.05	861	0.02	0.94	931	0.02
Unknown [m/z 79, 78 (45), 91 (28), 77 (28), 41 (13), 80 (12), 107 (11)... 122 (1)]	2.23	876	0.02	1.08	956	0.02
Unknown [m/z 93, 91 (75), 121 (61), 77 (58), 79 (38), 92 (26), 43 (24), 41 (23), 105 (22), 107 (19), 136 (16)]	2.42	893	0.09	1.04	948	0.09
Unknown [m/z 93, 91 (72), 121 (58), 77 (49), 79 (41), 43 (22), 105 (20), 107 (20), 41	2.59	907	0.15			

(18), 136 (17), 92 (17)]						
Hashishene	2.74	917	0.46	1.31*	994	4.82
Tricyclene	2.77	920	0.02	1.18*	972	[0.06]
$\alpha$ -Thujene	2.93	930	43.89	1.40*	1006	[43.95]
$\alpha$ -Pinene	2.98	933	4.40	1.31*	994	[4.82]
Unknown [m/z 91, 92 (47), 65 (11)... 134 (1)]	3.13†	944	4.09	2.30	1096	3.93
Camphene	3.15*†	945	[4.09]	1.63	1029	0.14
$\alpha$ -Fenchene	3.15*†	945	[4.09]	1.53	1019	tr
Thuja-2,4(10)-diene	3.24	951	0.11	2.20*	1086	5.16
meta-Cymene	3.47	967	0.01	2.77*	1134	0.15
$\beta$ -Pinene	3.55*	972	5.36	2.01	1067	0.32
Sabinene	3.55*	972	[5.36]	2.20*	1086	[5.16]
Pseudolimonene isomer	3.63	977	0.03	2.35*	1102	0.11
cis-Carane	3.71	982	0.03	1.69	1035	0.04
Dehydro-1,8-cineole	3.79*	988	0.11	3.02	1154	0.02
6-Methyl-5-hepten-2-one	3.79*	988	[0.11]	4.92	1295	0.09
Myrcene	3.87	994	0.15	2.77*	1134	[0.15]
trans-Carane?	3.92	996	0.23	2.06	1072	0.22
$\alpha$ -Phellandrene	4.01*	1003	0.51	2.67	1127	0.48
Pseudolimonene	4.01*	1003	[0.51]	2.72	1130	0.04
Menthatriene isomer I	4.01*	1003	[0.51]	3.27	1173	0.04
$\Delta$ 3-Carene	4.09*	1008	0.08	2.48	1112	0.04
ortho-Methylanisole	4.09*	1008	[0.08]	5.81	1360	0.02
Unknown [m/z 119, 91 (86), 41 (24), 79 (19), 77 (19), 134 (16)]	4.09*	1008	[0.08]			
$\alpha$ -Terpinene	4.20	1015	0.61	2.85	1140	0.55
Carvomenthene	4.30*	1021	0.47	2.35*	1102	[0.11]
ortho-Cymene	4.30*	1021	[0.47]	4.00*	1228	17.14
para-Cymene	4.35	1025	16.91	4.00*	1228	[17.14]
Unknown [m/z 109, 43 (58), 95 (26)... 137 (15)...]	4.37	1026	0.59	6.11*†	1382	2.12
$\beta$ -Phellandrene	4.42*	1029	3.86	3.18	1167	2.46
Limonene	4.42*	1029	[3.86]	3.07	1158	1.39
Cymene analog	4.53	1036	0.01	4.37	1255	0.02
Unknown [m/z 43, 55 (65), 41 (34), 67 (32), 107 (30), 122 (26)... 125 (10)]	4.60	1040	0.09	5.49	1337	0.08

Unknown [m/z 109, 43 (57), 91 (28), 67 (25), 93 (24), 95 (22), 77 (21), 137 (21), 41 (17), 79 (14)...]	4.70	1047	0.29			
$\gamma$ -Terpinene	4.88	1058	0.79	3.68	1205	0.82
<i>cis</i> -Sabinene hydrate	4.99	1065	0.03	6.76	1430	0.05
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.05	1069	0.09	4.64	1275	0.09
<i>cis</i> -Linalool oxide (fur.)	5.08	1071	0.03	6.39	1403	0.02
Unknown [m/z 43, 94 (63), 109 (61), 59 (55), 79 (51)...152 (2)]	5.20	1078	0.01	7.12	1457	0.01
Terpinolene	5.33*	1087	0.34	4.15	1239	0.16
<i>para</i> -Cymenene	5.33*	1087	[0.34]	6.17*†	1387	[2.12]
Unknown [m/z 109, 43 (48), 91 (39), 81 (33), 95 (32), 93 (32), 67 (31)... 152 (9)]	5.47*	1095	0.08			
<i>trans</i> -Sabinene hydrate	5.47*	1095	[0.08]	7.82	1510	0.04
Linalool	5.56*	1101	0.32	7.92	1518	0.09
$\alpha$ -Thujone	5.56*	1101	[0.32]	5.90	1367	0.22
Perillene	5.56*	1101	[0.32]	5.97	1372	0.04
$\beta$ -Thujone	5.74	1113	1.54	6.17*†	1387	[2.12]
Unknown [m/z 109, 81 (54), 91 (32), 79 (22)...]	5.76	1114	0.09	6.11*†	1382	[2.12]
Unknown [m/z 109, 91 (57), 93 (47), 81 (44), 77 (40)... 154 (1)]	5.83	1119	0.34			
$\alpha$ -Campholenal	5.88	1122	0.04	6.84	1437	0.03
Unknown [m/z 111, 43 (22), 55 (14), 41 (12), 110 (11)...]	5.91	1124	0.06			
Unknown [m/z 95, 43 (41), 110 (36), 41 (19), 67 (18)... 150 (tr)]	5.96	1127	0.01			
<i>trans</i> -Pinocarveol	6.06	1133	0.11	9.01	1604	0.10

<i>trans</i> -Chrysanthenol	6.09	1135	0.11			
<i>trans</i> -Sabinol	6.13*	1137	0.45	9.62*†	1653	0.66
Camphor	6.13*	1137	[0.45]	7.07	1454	0.02
<i>cis</i> -Verbenol	6.13*	1137	[0.45]	9.10*	1611	0.03
<i>trans</i> -Verbenol	6.19	1142	0.08	9.38	1633	0.11
meta-Mentha-4,6-dien-8-ol	6.24	1144	0.05	9.18	1617	0.08
Sabinaketone	6.34	1151	0.11	8.54	1566	0.17
Unknown [m/z 97, 81 (96), 109 (80), 43 (53), 53 (40), 41 (36), 56 (29), 95 (25)... 152 (1)]	6.39	1154	0.02	7.33*	1473	1.25
Pinocamphone	6.40*	1155	0.10	7.14	1459	0.01
Pinocarvone	6.40*	1155	[0.10]	7.74	1504	0.07
α-Phellandren-8-ol	6.54	1164	0.14	9.98	1683	0.11
Umbellulone	6.59	1167	0.47	8.72	1581	0.47
<i>cis</i> -Sabinol	6.61	1169	0.43	10.70*	1743	0.40
Terpinen-4-ol	6.70	1175	3.50	8.42	1557	3.63
Unknown [m/z 69, 68 (65), 110 (51), 67 (39), 41 (27), 83 (26)...]	6.76*	1178	0.13	7.71	1501	0.07
Cryptone	6.76*	1178	[0.13]	8.98	1601	0.06
Thuj-3-en-10-al	6.78	1179	0.23	8.59	1570	0.18
para-Cymen-8-ol	6.82	1182	0.54	11.36	1800	0.52
Myrtenal	6.91*	1188	0.32	8.47	1561	0.20
α-Terpineol	6.91*	1188	[0.32]	9.62*†	1653	[0.66]
Myrtenol	6.98	1193	0.13	10.70*	1743	[0.40]
<i>trans</i> -Isopiperitenol	7.01	1194	0.03	10.22*	1702	0.11
<i>cis</i> -α-Phellandrene epoxide (IPP vs Me)	7.06	1197	0.13	10.86	1757	0.20
Verbenone	7.13	1202	0.10	9.42	1636	0.11
<i>trans</i> -Piperitol	7.17	1204	0.11	10.24*	1703	0.17
<i>trans</i> -Carveol	7.34	1216	0.06	11.23	1789	0.06
Citronellol	7.57	1231	0.03	10.58	1733	0.08
Cuminal	7.60	1233	0.29	10.34	1712	0.25
Carvone	7.72*	1242	0.12	9.81	1669	0.04
Carvotanacetone	7.72*	1242	[0.12]	9.31	1628	0.04
<i>trans</i> -Sabinene hydrate acetate	7.81*	1248	0.19	7.53	1488	0.05
Unknown [m/z 109, 119 (84), 91 (81), 134 (55)... 137 (27)...]	7.81*	1248	[0.19]	11.14	1780	0.13
Piperitone	7.86	1251	0.06	9.71*	1660	0.07

Unknown [m/z 43, 97 (78), 41 (45), 55 (35), 69 (28), 107 (24), 83 (23)...]	8.00	1260	0.03	13.21	1967	0.02
Unknown [m/z 109, 43 (83), 95 (70), 110 (70), 99 (53), 119 (48)...]	8.11	1268	0.05			
Bornyl acetate	8.34	1283	0.16	8.08	1530	0.17
Cuminol	8.40	1288	0.06	14.00	2043	0.08
Thymol	8.52	1295	0.13	14.95	2135	0.12
Carvacrol	8.64	1303	0.18	15.18	2159	0.18
exo-2- Hydroxycineole acetate	9.11	1337	0.01	9.94	1679	0.01
α-Cubebene	9.27	1348	0.03	6.64	1421	0.01
Eugenol	9.35	1353	0.01	14.61	2102	0.01
Citronellyl acetate	9.39	1356	0.04	9.29	1626	0.03
α-Copaene	9.62	1372	0.03	7.00	1448	0.06
β-Bourbonene	9.73	1380	1.26	7.33*	1473	[1.25]
1,5-diepi-β- Bourbonene	9.75	1382	0.08	7.21	1464	0.40
β-Elemene	9.86	1390	0.09	8.28	1546	0.07
β-Ylangene	10.19*	1414	0.13	7.97	1522	0.16
β-Caryophyllene	10.19*	1414	[0.13]	8.21	1540	0.06
β-Copaene	10.33	1424	0.13	8.19	1539	0.15
Isogermacrene D	10.53	1439	0.09	8.81	1588	0.13
α-Humulene	10.63	1447	0.01	9.10*	1611	[0.03]
allo- Aromadendrene	10.73	1454	0.01	8.84	1590	0.09
Unknown [m/z 161, 105 (56), 91 (50), 93 (36), 119 (33), 79 (31)...204 (5)]	10.81	1460	0.03			
Germacrene D	11.01	1475	0.01	9.60	1652	0.03
β-Selinene	11.07	1479	0.01	9.71*	1660	[0.07]
γ-Cadinene	11.46	1509	0.03	10.22*	1702	[0.11]
δ-Cadinene	11.60	1520	0.02	10.24*	1703	[0.17]
Caryophyllene oxide	12.28	1574	0.03	12.58	1908	0.03
Viridiflorol	12.40	1583	0.02	13.80	2023	0.07
τ-Cadinol	13.04	1634	0.05	14.71	2111	0.06
α-Phellandrene dimer I	14.22	1734	0.04	11.60	1820	0.03
α-Phellandrene dimer II	14.85	1788	0.68	12.31	1884	0.67
α-Phellandrene dimer III	15.04	1805	0.06	12.94	1942	0.07

$\alpha$ -Phellandrene dimer IV	15.25	1824	0.10	13.10	1957	0.12
<b>Total identified</b>	<b>92.18%</b>			<b>93.09%</b>		
<b>Total reported</b>	<b>98.26%</b>			<b>97.56%</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