Date : October 25, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19J18-PTH16-1-CC
Customer identification : Frankincense Frereana Organic - Somaliland - FE010393R
Type : Essential oil
Source : *Boswellia frereana*
Customer : Plant Therapy

Analysis

Method: PC-PA-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 : Benoit Roger, Ph. D.
Analysis date : October 23, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow liquid
Refractive index: 1.4673 ± 0.0003 (20 °C)

CONCLUSION

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

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Analysis summary – Consolidated contents

New readers of similar reports are encouraged to read table footnotes at least once.

Identification	%	Classe
2-Methyl-3-buten-2-ol	0.01	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
3-Methyl-2-butanone	0.03	Aliphatic ketone
Unknown	0.01	Unknown
4-Methyl-2-pentanone	tr	Aliphatic ketone
Toluene	0.05	Simple phenolic
Unknown	0.03	Alkene
(*Z*)-Salvene	0.02	Normonoterpene
(*E*)-Salvene	0.01	Normonoterpene
Unknown	0.03	Unknown
Unknown	0.02	Monoterpene
Unknown	0.04	Unknown
Hashishene	0.42	Monoterpene
Tricyclene	0.09	Monoterpene
α-Thujene	27.20	Monoterpene
α-Pinene	34.80	Monoterpene
Thujadiene isomer	1.67	Monoterpene
Camphene	0.68	Monoterpene
Thuja-2,4(10)-diene	0.41	Monoterpene
Sabinene	4.95	Monoterpene
β-Pinene	1.59	Monoterpene
6-Methyl-5-hepten-2-one	0.04	Aliphatic ketone
Dehydro-1,8-cineole	0.06	Monoterpenic ether
Myrcene	0.67	Monoterpene
6-Methyl-5-hepten-2-ol	0.06	Aliphatic alcohol
Pseudolimonene	0.02	Monoterpene
α-Phellandrene	0.65	Monoterpene
Octanal	0.02	Aliphatic aldehyde
Δ3-Carene	0.04	Monoterpene
α-Terpinene	0.28	Monoterpene
Carvomenthene	0.05	Aliphatic alcohol
ortho-Cymene	0.15	Monoterpene
para-Cymene	6.90	Monoterpene
Unknown	0.54	Unknown
Limonene	0.92	Monoterpene
β-Phellandrene	1.76*	Monoterpene
1,8-Cineole	[1.76]*	Monoterpenic ether
(*Z*)-β-Ocimene	0.02	Monoterpene
Unknown	0.02	Unknown
Unknown	0.26	Unknown
(*E*)-β-Ocimene	0.01	Monoterpene
Unknown	0.01	Unknown
γ-Terpinene	0.42	Monoterpene
cis-Sabinene hydrate	0.09	Monoterpenic alcohol
Unknown	0.05	Oxygenated monoterpene
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Unknown	0.07	Oxygenated monoterpene

para-Cymenene	0.16	Monoterpene
Terpinolene	0.10	Monoterpene
α-Pinene oxide	0.03	Monoterpenic ether
trans-Sabinene hydrate	0.07	Monoterpenic alcohol
Linalool	0.31	Monoterpenic alcohol
α-Thujone	0.07	Monoterpenic ketone
β-Thujone	0.68	Monoterpenic ketone
trans-para-Mentha-2,8-dien-1-ol	0.09	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.12	Monoterpenic alcohol
Dehydrosabinaketone	0.12	Normonoterpenic ketone
Unknown	0.07	Unknown
α-Campholenal	0.17	Monoterpenic aldehyde
trans-Pinocarveol	0.51	Monoterpenic alcohol
cis-Verbenol	0.17	Monoterpenic alcohol
trans-Sabinol	0.24	Monoterpenic alcohol
trans-Verbenol	0.77	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.17	Monoterpenic alcohol
Sabinaketone	0.07	Normonoterpenic ketone
Unknown	0.06	Oxygenated monoterpene
Pinocarvone	0.19	Monoterpenic ketone
Unknown	0.11	Oxygenated monoterpene
α-Phellandren-8-ol	0.29	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Umbellulone	0.20	Monoterpenic ketone
cis-Sabinol	0.23	Monoterpenic alcohol
Terpinen-4-ol	3.65	Monoterpenic alcohol
Cryptone	0.14	Normonoterpenic ketone
para-Cymen-8-ol	0.33	Monoterpenic alcohol
Myrtenal	0.25	Monoterpenic aldehyde
α-Terpineol	0.62	Monoterpenic alcohol
cis-Piperitol	0.03	Monoterpenic alcohol
Myrtenol	0.15	Monoterpenic alcohol
α-Phellandrene epoxide	0.10	Monoterpenic ether
Verbenone	0.46	Monoterpenic ketone
trans-Piperitol	0.08	Monoterpenic alcohol
trans-Carveol	0.13	Monoterpenic alcohol
Citronellol	0.04	Monoterpenic alcohol
Cuminal	0.13	Monoterpenic aldehyde
Carvone	0.04	Monoterpenic ketone
Carvotanacetone	0.05	Monoterpenic ketone
Piperitone	0.05	Monoterpenic ketone
Unknown	0.01	Unknown
Bornyl acetate	0.76	Monoterpenic ester
Thymol	0.08	Monoterpenic alcohol
Carvacrol	0.07	Monoterpenic alcohol
exo-2-Hydroxycineole acetate	0.02	Monoterpenic ester
Citronellyl acetate	0.05	Monoterpenic ester
β-Bourbonene	0.45	Sesquiterpene
β-Elemene	0.08	Sesquiterpene
β-Caryophyllene	0.02	Sesquiterpene
β-Ylangene	0.04	Sesquiterpene
β-Copaene	0.07	Sesquiterpene

Isogermacrene D	0.03	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
δ-Cadinene	0.01	Sesquiterpene
τ-Cadinol	0.02	Sesquiterpenic alcohol
α-Phellandrene dimer I	0.01	Diterpene
α-Phellandrene dimer II	0.32	Diterpene
α-Phellandrene dimer III	0.03	Diterpene
α-Phellandrene dimer IV	0.04	Diterpene
Consolidated total	**98.58%**	

*: 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.

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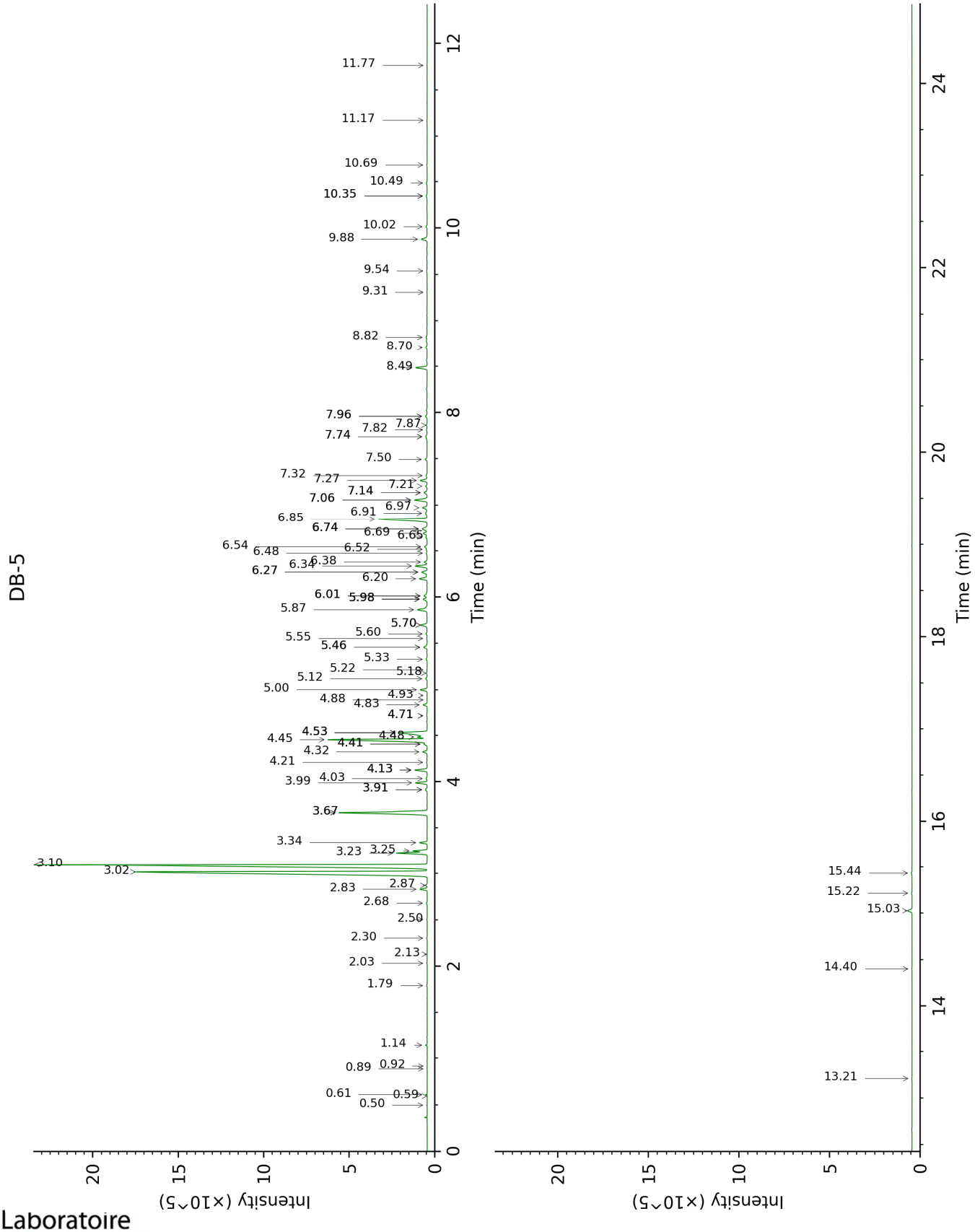
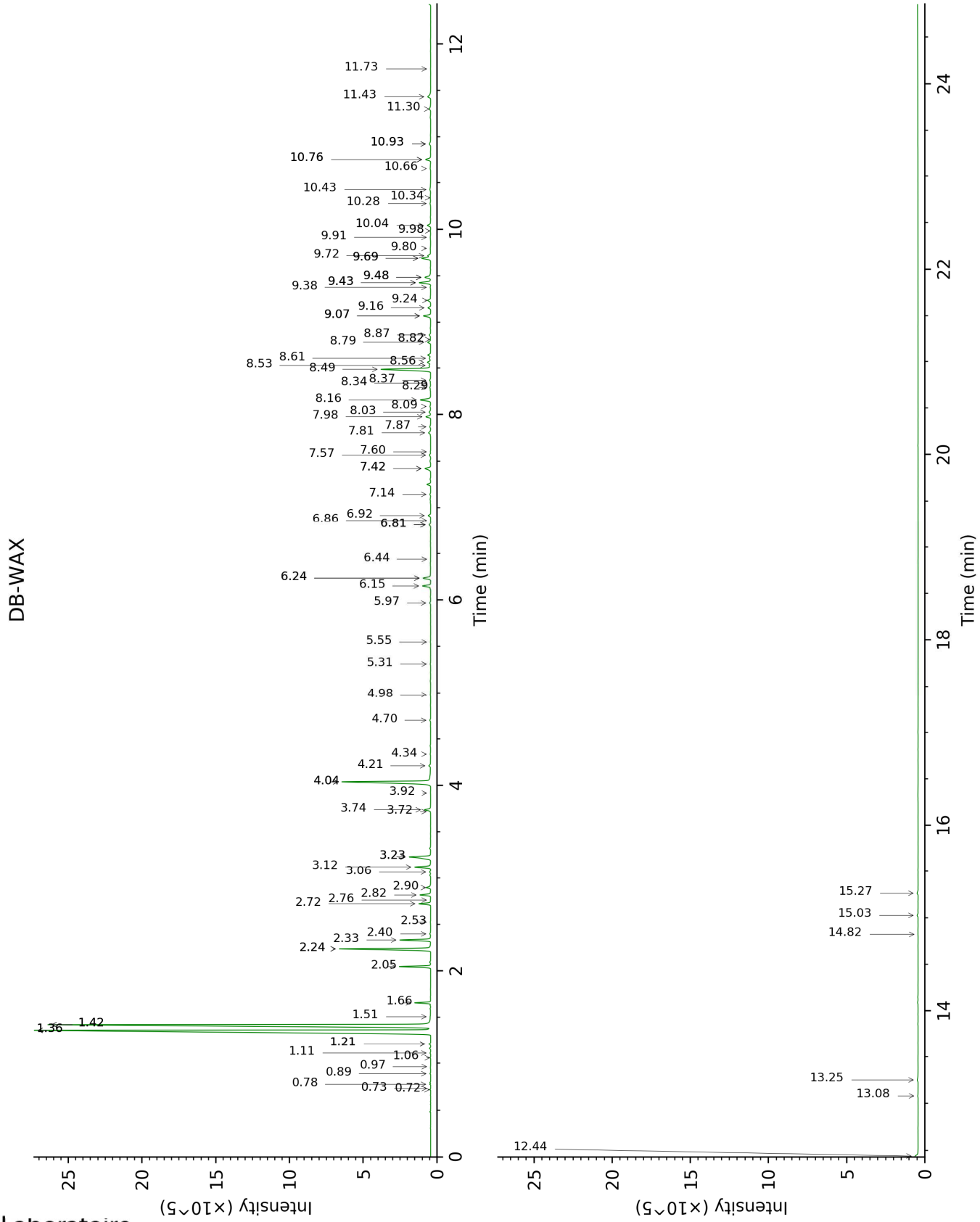

DB-5
Time (min)
Intensity (×10^5)
11.77
11.17
10.69
10.49
10.35
10.02
9.88
9.54
9.31
8.82
8.70
8.49
7.96
7.87
7.82
7.74
7.50
7.32
7.27
7.21
7.14
7.06
6.97
6.91
6.85
6.74
6.69
6.65
6.54
6.52
6.48
6.38
6.34
6.27
6.20
6.01
5.98
5.87
5.70
5.60
5.55
5.46
5.33
5.22
5.18
5.12
5.00
4.93
4.88
4.83
4.71
4.53
4.48
4.45
4.41
4.32
4.21
4.13
4.03
3.99
3.91
3.67
3.34
3.25
3.23
3.10
3.02
2.87
2.83
2.68
2.50
2.30
2.13
2.03
1.79
1.14
0.92
0.89
0.61
0.59
0.50
15.44
15.22
15.03
14.40
13.21


DB-WAX
Intensity (×10^5)
Time (min)
11.73
11.43
11.30
10.93
10.76
10.66
10.43
10.28
10.34
10.04
9.91
9.98
9.80
9.72
9.69
9.48
9.38
9.43
9.24
9.16
9.07
8.87
8.79
8.82
8.61
8.53
8.56
8.49
8.37
8.34
8.29
8.16
8.09
8.03
7.98
7.87
7.81
7.60
7.57
7.42
7.14
6.92
6.86
6.81
6.44
6.24
6.15
5.97
5.55
5.31
4.98
4.70
4.34
4.21
4.04
3.92
3.74
3.72
3.23
3.12
3.06
2.90
2.82
2.76
2.72
2.53
2.40
2.33
2.24
2.05
1.66
1.51
1.42
1.36
1.21
1.11
1.06
0.97
0.89
0.78
0.73
0.72
15.27
15.03
14.82
13.25
13.08
12.44

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
2-Methyl-3-buten-2-ol	0.50	592	0.01	1.51	1015	tr
Isovaleral	0.60	641	tr	0.73	889	0.01
3-Methyl-2-butanone	0.61	647	0.03	0.78	905	0.03
Unknown [m/z 93, 91 (70), 77 (48), 108 (42)]	0.89	726	0.01			
4-Methyl-2-pentanone	0.92	730	tr	1.21*	975	0.10
Toluene	1.14	760	0.05	1.42*	1007	27.59
Unknown [m/z 109, 67 (32), 81 (14), 41 (12), 124 (10)]	1.79	832	0.03	0.72	885	0.02
(*Z*)-Salvene	2.03	852	0.02	0.89	924	0.02
(*E*)-Salvene	2.13	860	0.01	0.97	936	0.01
Unknown [m/z 79, 78 (45), 91 (28), 77 (28), 41 (13), 80 (12), 107 (11)... 122 (1)]	2.30	874	0.03	1.11	959	0.03
Unknown [m/z 93, 91 (75), 121 (61), 77 (58), 79 (38), 92 (26), 43 (24), 41 (23), 105 (22),107 (19), 136 (16)]	2.50	891	0.02	1.06	951	0.02
Unknown [m/z 93, 91 (72), 121 (58), 77 (49), 79 (41), 43 (22), 105 (20),107 (20), 41 (18), 136 (17), 92 (17)]	2.68	905	0.04			
Hashishene	2.83	915	0.42	1.36*	999	35.19
Tricyclene	2.87	918	0.09	1.21*	975	[0.10]
α-Thujene	3.02	927	27.20	1.42*	1007	[27.59]
α-Pinene	3.10	933	34.80	1.36*	999	[35.19]
Thujadiene isomer	3.23	941	1.67	2.33	1096	1.61
Camphene	3.25	943	0.68	1.66	1030	0.70
Thuja-2,4(10)-diene	3.34	948	0.41	2.24*	1086	5.37
Sabinene	3.67*	970	6.57	2.24*	1086	[5.37]
β-Pinene	3.67*	970	[6.57]	2.05	1068	1.59
6-Methyl-5-hepten-2-one	3.91*	986	0.14	4.98	1301	0.04
Dehydro-1,8-cineole	3.91*	986	[0.14]	3.06	1155	0.06
Myrcene	3.99	991	0.67	2.82	1135	0.62
6-Methyl-5-hepten-2-ol	4.03	994	0.06	6.81*	1428	0.11
Pseudolimonene	4.13*	1000	0.75	2.76	1131	0.02
α-Phellandrene	4.13*	1000	[0.75]	2.72	1128	0.65
Octanal	4.13*	1000	[0.75]	4.34	1253	0.02
Δ3-Carene	4.21	1006	0.04	2.53	1113	0.02
α-Terpinene	4.32	1013	0.28	2.90	1142	0.29
Carvomenthene	4.41*	1018	0.20	2.40	1102	0.05

ortho-Cymene	4.41*	1018	[0.20]	4.04*	1230	6.75
para-Cymene	4.45	1021	6.90	4.04*	1230	[6.75]
Unknown [m/z 109, 43 (58), 95 (26)... 137 (15)...]	4.48	1023	0.54	6.15	1379	0.54
Limonene	4.53*	1026	2.68	3.12	1160	0.92
β-Phellandrene	4.53*	1026	[2.68]	3.23*	1168	1.67
1,8-Cineole	4.53*	1026	[2.68]	3.23*	1168	[1.67]
(*Z*)-β-Ocimene	4.71*†	1038	0.04	3.72†	1207	0.41
Unknown [m/z 43, 55 (65), 41 (34), 67 (32), 107 (30), 122 (26)... 125 (10)]	4.71*†	1038	[0.04]	5.55	1335	0.02
Unknown [m/z 109, 43 (57), 91 (28), 67 (25), 93 (24), 95 (22), 77 (21), 137 (21), 41 (17), 79 (14)...]	4.83	1045	0.26			
(*E*)-β-Ocimene	4.88	1048	0.01	3.92	1222	0.01
Unknown [m/z 109 , 45 (67), 41 (40), 67 (39), 81 (33), 79 (27), 95 (24), 91 (23), 82 (21), 55 (21), 93 (20)...]	4.93	1052	0.01	6.86	1432	0.01
γ-Terpinene	5.00	1056	0.42	3.74†	1208	[0.41]
cis-Sabinene hydrate	5.12	1064	0.09	6.81*	1428	[0.11]
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.18	1067	0.05	4.70	1280	0.05
cis-Linalool oxide (fur.)	5.22	1070	0.01	6.44	1400	0.01
Unknown [m/z 43, 94 (63), 109 (61), 59 (55), 79 (51)...152 (2)]	5.33	1077	0.07	7.14	1453	0.05
para-Cymenene	5.46*	1085	0.26	6.24*	1385	0.58
Terpinolene	5.46*	1085	[0.26]	4.21	1243	0.10
α-Pinene oxide	5.56	1091	0.03	5.31	1318	0.03
trans-Sabinene hydrate	5.60	1094	0.07	7.87	1508	0.07
Linalool	5.70*	1100	0.46	7.98	1517	0.31
α-Thujone	5.70*	1100	[0.46]	5.97	1366	0.07
β-Thujone	5.86	1111	0.68	6.24*	1385	[0.58]
trans-para-Mentha-2,8-dien-1-ol	5.98*†	1119	0.57	8.86	1586	0.09
cis-para-Menth-2-en-1-ol	5.98*†	1119	[0.57]	8.03	1521	0.12
Dehydrosabinaketone	5.98*†	1119	[0.57]	8.53	1560	0.12
Unknown [m/z 111, 43 (22), 55 (14), 41 (12), 110 (11)...]	6.01*†	1121	[0.57]			
α-Campholenal	6.01*†	1121	[0.57]	6.92	1436	0.17

trans-Pinocarveol	6.20	1133	0.51	9.07*	1602	0.53
cis-Verbenol	6.27*	1138	0.42	9.16	1609	0.17
trans-Sabinol	6.27*	1138	[0.42]	9.69*†	1653	0.87
trans-Verbenol	6.34	1142	0.77	9.43*	1632	0.77
meta-Mentha-4,6-dien-8-ol	6.38	1145	0.17	9.24	1616	0.22
Sabinaketone	6.48	1151	0.07	8.61	1566	0.11
Unknown [m/z 97, 81 (96), 109 (80), 43 (53), 53 (40), 41 (36), 56 (29), 95 (25)... 152 (1)]	6.52	1154	0.06	7.42*	1474	0.47
Pinocarvone	6.54	1156	0.19	7.81	1503	0.17
Unknown [m/z 95, 110 (38), 81 (21), 79 (16)... 152 (7)]	6.65	1163	0.11	7.57	1485	0.09
α-Phellandren-8-ol	6.69	1165	0.29	10.04	1682	0.25
Unknown [m/z 95, 110 (43), 81 (28), 41 (15)... 152 (8)]	6.74*	1168	0.46	7.60	1488	0.02
Umbellulone	6.74*	1168	[0.46]	8.79	1580	0.20
cis-Sabinol	6.74*	1168	[0.46]	10.76*	1742	0.38
Terpinen-4-ol	6.85	1176	3.65	8.49	1557	3.60
Cryptone	6.91	1180	0.14	9.07*	1602	[0.53]
para-Cymen-8-ol	6.97	1184	0.33	11.43	1800	0.31
Myrtenal	7.06*	1190	0.88	8.56	1563	0.25
α-Terpineol	7.06*	1190	[0.88]	9.69*†	1653	[0.87]
cis-Piperitol	7.14*	1195	0.22	9.48*	1636	0.49
Myrtenol	7.14*	1195	[0.22]	10.76*	1742	[0.38]
α-Phellandrene epoxide	7.21	1200	0.10	10.92*	1757	0.11
Verbenone	7.27	1204	0.46	9.48*	1636	[0.49]
trans-Piperitol	7.32	1207	0.08	10.28	1701	0.06
trans-Carveol	7.50	1219	0.13	11.30	1789	0.14
Citronellol	7.74*	1236	0.14	10.66	1734	0.04
Cuminal	7.74*	1236	[0.14]	10.43	1714	0.13
Carvone	7.82	1242	0.04	9.91	1672	0.05
Carvotanacetone	7.86	1245	0.05	9.38	1628	0.03
Piperitone	7.96*	1252	0.13	9.80	1662	0.05
Unknown [m/z 43, 97 (69), 107 (46), 41 (28), 55 (21), 109 (20)...]	7.96*	1252	[0.13]	10.92*	1757	[0.11]
Bornyl acetate	8.49	1282	0.76	8.16	1531	0.77
Thymol	8.70	1297	0.08	15.03	2136	0.08
Carvacrol	8.82	1305	0.07	15.26	2160	0.10
exo-2-Hydroxycineole acetate	9.31	1339	0.02	9.98	1677	0.02
Citronellyl acetate	9.54	1356	0.05	9.43*	1632	[0.77]
β-Bourbonene	9.88	1380	0.45	7.42*	1474	[0.47]
β-Elemene	10.02	1390	0.08	8.29	1542	0.06
β-Caryophyllene	10.35*	1414	0.09	8.34	1545	0.02
β-Ylangene	10.35*	1414	[0.09]	8.09	1525	0.04
β-Copaene	10.49	1424	0.07	8.37	1548	0.07

Isogermacrene D	10.69	1439	0.03	8.82	1583	0.02
Germacrene D	11.17	1475	0.01	9.72†	1655	[0.87]
δ-Cadinene	11.76	1520	0.01	10.34	1706	0.04
τ-Cadinol	13.21	1636	0.02	14.82	2115	0.02
α-Phellandrene dimer I	14.40	1736	0.01	11.73	1827	0.02
α-Phellandrene dimer II	15.03	1790	0.32	12.44	1890	0.32
α-Phellandrene dimer III	15.22	1807	0.03	13.08	1949	0.04
α-Phellandrene dimer IV	15.44	1826	0.04	13.25	1965	0.10
Total identified		**97.66%**			**96.62%**	
Total reported		**98.88%**			**97.49%**	

*: 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