Date : April 29, 2021

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 21D15-ZAA01
Customer identification : Balsam Fir - Canada - EAB224225 - CA55521A
Type : Essential oil
Source : *Abies balsamea* ct. Eastern / Low thymol
Customer : ZAYAT AROMA

Analysis

Method: PC-MAT-014 ISO - 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 29, 2021

Checked and approved by :

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

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4741 ± 0.0003 (20 °C; method PC-MAT-016)

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	%	Class
Isopropanol	0.01	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
Toluene	0.01	Simple phenolic
Hexanal	tr	Aliphatic aldehyde
Octane	tr	Alkane
Ethyl isovalerate	tr	Aliphatic ester
(3*Z*)-Hexenol	tr	Aliphatic alcohol
Unknown	tr	Unknown
Santene	1.22	Normonoterpene
Styrene	0.01	Simple phenolic
Bornylene	0.01	Monoterpene
Hashishene	tr	Monoterpene
Tricyclene	0.68	Monoterpene
α-Thujene	0.14	Monoterpene
α-Pinene	17.22	Monoterpene
α-Fenchene	0.09	Monoterpene
Camphene	4.55	Monoterpene
Thuja-2,4(10)-diene	0.05	Monoterpene
meta-Cymene	0.04	Monoterpene
Sabinene	0.04	Monoterpene
β-Pinene	32.14	Monoterpene
Unknown	0.02	Monoterpene
Myrcene	2.42	Monoterpene
2-Carene	tr	Monoterpene
Pseudolimonene	0.02	Monoterpene
α-Phellandrene	0.18	Monoterpene
Δ3-Carene	10.46	Monoterpene
α-Terpinene	0.17	Monoterpene
ortho-Cymene	0.01	Monoterpene
para-Cymene	0.17	Monoterpene
1,8-Cineole	5.27*	Monoterpenic ether
β-Phellandrene	[5.27]*	Monoterpene
Limonene	12.72	Monoterpene
(*Z*)-β-Ocimene	0.01	Monoterpene
(*E*)-β-Ocimene	0.01	Monoterpene
γ-Terpinene	0.26	Monoterpene
Fenchone	0.12	Monoterpenic ketone
Isoterpinolene	0.04	Monoterpene
Terpinolene	0.98	Monoterpene
para-Cymenene	0.07	Monoterpene
Linalool	0.04	Monoterpenic alcohol
α-Thujone	0.01	Monoterpenic ketone
endo-Fenchol	0.10	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
α-Campholenal	0.03	Monoterpenic aldehyde

cis-Limonene oxide	0.01	Monoterpenic ether
trans-Pinocarveol	0.11	Monoterpenic alcohol
Camphor	0.18	Monoterpenic ketone
Camphene hydrate	0.06	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.02	Monoterpenic alcohol
Isoborneol	0.02	Monoterpenic alcohol
Myrtenyl methyl ether	0.03	Monoterpenic ether
Pinocarvone	0.04	Monoterpenic ketone
Borneol	0.30	Monoterpenic alcohol
Isopinocamphone	0.04	Monoterpenic ketone
Terpinen-4-ol	0.20	Monoterpenic alcohol
meta-Cymen-8-ol	0.02	Monoterpenic alcohol
para-Cymen-8-ol	0.01	Monoterpenic alcohol
α-Terpineol	0.69	Monoterpenic alcohol
Myrtenal	tr	Monoterpenic aldehyde
Myrtenol	0.06	Monoterpenic alcohol
cis-Piperitol	0.03	Monoterpenic alcohol
Verbenone	0.05	Monoterpenic ketone
endo-Fenchyl acetate	0.04	Monoterpenic ester
Citronellol	0.02	Monoterpenic alcohol
Thymol methyl ether	0.06	Monoterpenic ether
Carvone	0.01	Monoterpenic ketone
Piperitone	0.08	Monoterpenic ketone
Phellandral	0.03	Monoterpenic aldehyde
Isobornyl acetate	0.01	Monoterpenic ester
Bornyl acetate	4.94	Monoterpenic ester
2-Undecanone	0.08	Aliphatic ketone
Thymol	0.08	Monoterpenic alcohol
Isohexyl isocaproate	0.01	Aliphatic ester
Myrtenyl acetate	0.01	Monoterpenic ester
Unknown	0.02	Unknown
α-Longipinene	0.08	Sesquiterpene
α-Terpinyl acetate	0.01	Monoterpenic ester
Citronellyl acetate	0.02	Monoterpenic ester
Geranyl acetate	0.03	Monoterpenic ester
β-Longipinene	0.02	Sesquiterpene
Longifolene	0.41	Sesquiterpene
Methyleugenol	0.01	Phenylpropanoid
β-Caryophyllene	0.16	Sesquiterpene
α-Humulene	0.07	Sesquiterpene
(*E*)-β-Farnesene	0.03	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
Germacrene D	0.04	Sesquiterpene
β-Selinene	0.03	Sesquiterpene
α-Selinene	tr	Sesquiterpene
β-Himachalene	0.02	Sesquiterpene
(*Z*)-α-Bisabolene	0.04	Sesquiterpene
β-Bisabolene	0.37	Sesquiterpene
δ-Cadinene	0.06	Sesquiterpene
(*E*)-α-Bisabolene	0.06	Sesquiterpene
(*E*)-Nerolidol	0.06	Sesquiterpenic alcohol
Caryophyllene oxide	0.02	Sesquiterpenic ether

Selin-6-en-4α-ol isomer	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
Dihydroconiferol	0.02	Phenylpropanoid
Allohimachalol	0.01	Sesquiterpenic alcohol
Citronellyl caproate	0.16	Monoterpenic ester
Manool	0.01	Diterpenic alcohol
7,13-Abietadiene	0.01	Diterpene
(*Z*)-Abienol	0.05	Diterpenic alcohol
Pimaral?	tr	Diterpenic aldehyde
Ethyl α-linolenate	0.01	Aliphatic ester
Palustral	0.01	Diterpenic aldehyde
Consolidated total	**98.46%**	

*: 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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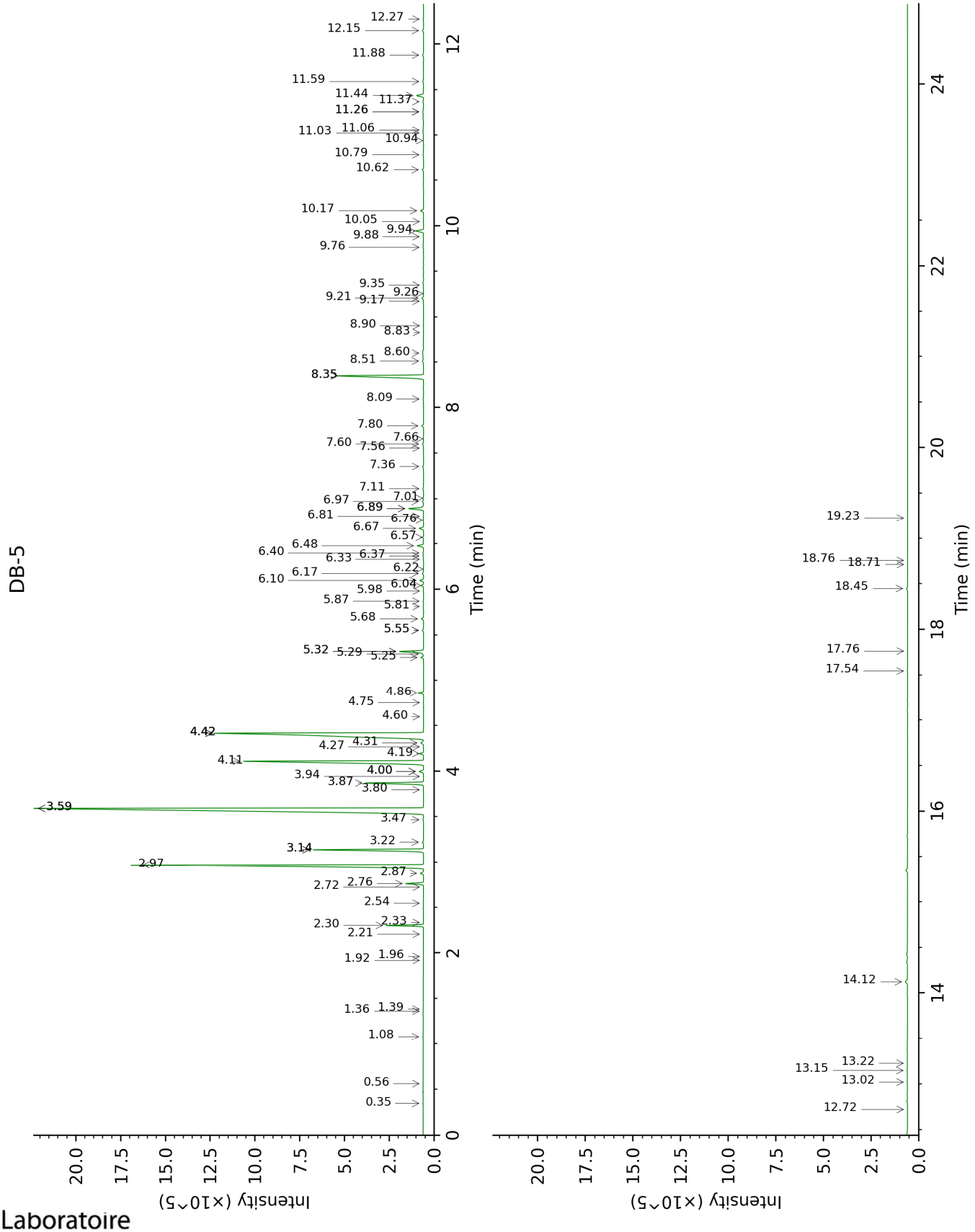
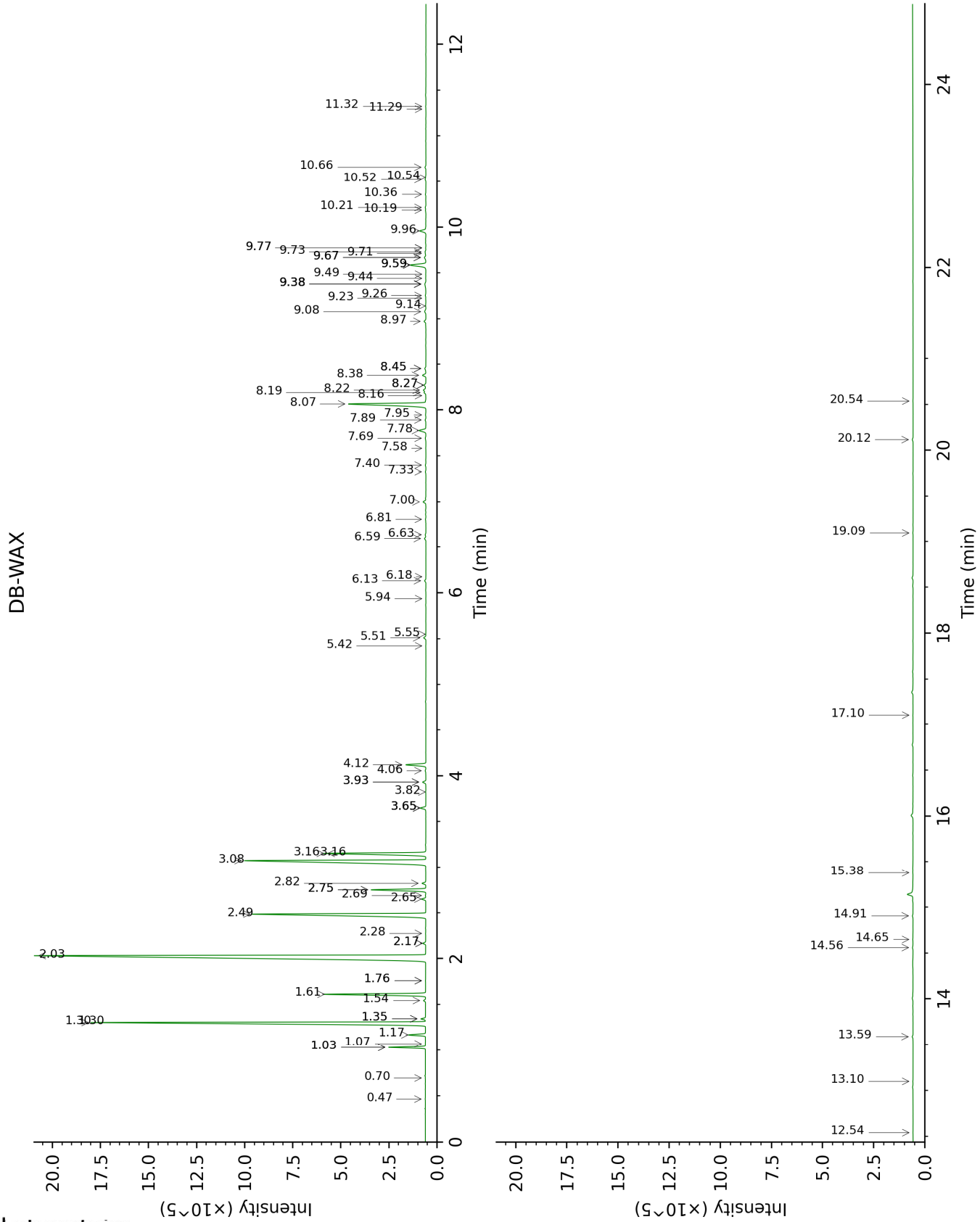

DB-5
Intensity (×10^5)
Time (min)
12.27
12.15
11.88
11.59
11.44
11.37
11.26
11.03
11.06
10.94
10.79
10.62
10.17
10.05
9.94
9.88
9.76
9.35
9.21
9.26
9.17
8.90
8.83
8.60
8.51
8.35
8.09
7.80
7.66
7.60
7.56
7.36
7.11
7.01
6.97
6.89
6.81
6.76
6.67
6.57
6.48
6.40
6.37
6.33
6.22
6.17
6.10
6.04
5.98
5.87
5.81
5.68
5.55
5.32
5.29
5.25
4.86
4.75
4.60
4.42
4.31
4.27
4.19
4.11
4.00
3.94
3.87
3.80
3.59
3.47
3.22
3.14
2.97
2.87
2.76
2.72
2.54
2.33
2.30
2.21
1.96
1.92
1.39
1.36
1.08
0.56
0.35
19.23
18.76
18.71
18.45
17.76
17.54
14.12
13.22
13.15
13.02
12.72


DB-WAX
Time (min)
Intensity (×10^5)
11.32
11.29
10.66
10.52
10.54
10.36
10.21
10.19
9.96
9.77
9.73
9.67
9.71
9.59
9.49
9.44
9.38
9.23
9.26
9.14
9.08
8.97
8.38
8.45
8.19
8.22
8.27
8.16
8.07
7.89
7.95
7.69
7.78
7.58
7.40
7.33
7.00
6.81
6.59
6.63
6.13
6.18
5.94
5.51
5.55
5.42
4.12
4.06
3.93
3.82
3.65
3.16
3.08
2.82
2.75
2.69
2.65
2.49
2.28
2.17
2.03
1.76
1.61
1.54
1.35
1.30
1.17
1.03
1.07
0.70
0.47
20.54
20.12
19.09
17.10
15.38
14.91
14.65
14.56
13.59
13.10
12.54

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isopropanol	0.35	500	0.01			
Isovaleral	0.56	639	tr	0.70	882	tr
Toluene	1.08	758	0.01	1.35*	1001	0.18
Hexanal	1.36	801	tr	1.76*	1043	0.01
Octane	1.38	804	tr	0.47	784	0.01
Ethyl isovalerate	1.92	851	tr	1.76*	1043	[0.01]
(3*Z*)-Hexenol	1.96	855	tr	5.55	1343	tr
Unknown [m/z 79, 78 (45), 91 (28), 77 (28), 41 (13), 80 (12), 107 (11)... 122 (1)]	2.21	876	tr	1.07	956	tr
Santene	2.30	884	1.22	1.03*	949	1.24
Styrene	2.33	887	0.01	3.65*	1206	0.27
Bornylene	2.54	905	0.01	1.03*	949	[1.24]
Hashishene	2.72	917	tr	1.30*	996	17.28
Tricyclene	2.76	920	0.68	1.17	973	0.68
α-Thujene	2.87	927	0.14	1.35*	1001	[0.18]
α-Pinene	2.97	934	17.22	1.30*	996	[17.28]
α-Fenchene	3.14*	945	4.64	1.54	1021	0.09
Camphene	3.14*	945	[4.64]	1.61	1028	4.55
Thuja-2,4(10)-diene	3.22	951	0.05	2.17*	1084	0.13
meta-Cymene	3.47	968	0.04	2.75*	1134	2.46
Sabinene	3.59*	976	32.18	2.17*	1084	[0.13]
β-Pinene	3.59*	976	[32.18]	2.03	1071	32.14
Unknown [m/z 91, 119 (65), 109 (51), 134 (47)]	3.80	990	0.02			
Myrcene	3.87	995	2.42	2.75*	1134	[2.46]
2-Carene	3.94	1000	tr	2.28	1096	0.01
Pseudolimonene	4.00*	1003	0.21	2.69	1129	0.02
α-Phellandrene	4.00*	1003	[0.21]	2.65	1126	0.18
Δ3-Carene	4.11	1010	10.46	2.49	1113	10.47
α-Terpinene	4.19	1016	0.17	2.82	1140	0.17
ortho-Cymene	4.27	1020	0.01	3.93*	1227	0.16
para-Cymene	4.31	1023	0.17	3.93*	1227	[0.16]
1,8-Cineole	4.42*	1030	17.99	3.16*	1167	5.29
β-Phellandrene	4.42*	1030	[17.99]	3.16*	1167	[5.29]
Limonene	4.42*	1030	[17.99]	3.08	1160	12.72
(*Z*)-β-Ocimene	4.60	1041	0.01	3.65*	1206	[0.27]
(*E*)-β-Ocimene	4.75	1051	0.01	3.82	1219	0.01
γ-Terpinene	4.86	1058	0.26	3.65*	1206	[0.27]
Fenchone	5.25	1083	0.12	5.51	1340	0.12
Isoterpinolene	5.29	1085	0.04	4.06	1236	0.04
Terpinolene	5.32*	1087	1.06	4.12	1241	0.98
para-Cymenene	5.32*	1087	[1.06]	6.13	1386	0.07
Linalool	5.55*	1102	0.07	7.89	1517	0.04

α-Thujone	5.55*	1102	[0.07]	5.94	1371	0.01
endo-Fenchol	5.68	1110	0.10	8.22	1543	0.16
cis-para-Menth-2-en-1-ol	5.81	1119	0.02	7.95	1522	0.02
α-Campholenal	5.87	1122	0.03	6.81	1436	0.03
cis-Limonene oxide	5.98	1130	0.01	6.18	1389	tr
trans-Pinocarveol	6.04	1133	0.11	8.97	1602	0.10
Camphor	6.10	1137	0.18	7.00	1450	0.16
Camphene hydrate	6.18	1142	0.06	8.27*	1547	0.11
meta-Mentha-4,6-dien-8-ol	6.22	1145	0.02	9.14	1616	0.02
Isoborneol	6.33	1152	0.02	9.23	1622	0.02
Myrtenyl methyl ether	6.37	1154	0.03	5.42	1334	0.01
Pinocarvone	6.40	1156	0.04	7.69	1502	0.05
Borneol	6.48	1161	0.30	9.59*	1652	1.02
Isopinocamphone	6.57	1167	0.04	7.40	1480	0.03
Terpinen-4-ol	6.67	1174	0.20	8.38	1555	0.19
meta-Cymen-8-ol	6.76	1180	0.02	11.32	1798	0.02
para-Cymen-8-ol	6.81	1183	0.01	11.29	1796	0.01
α-Terpineol	6.89*	1188	0.75	9.59*	1652	[1.02]
Myrtenal	6.89*	1188	[0.75]	8.45*	1561	0.08
Myrtenol	6.97	1193	0.06	10.66	1742	0.05
cis-Piperitol	7.01	1195	0.03	9.38*	1635	0.12
Verbenone	7.11	1202	0.05	9.44	1640	0.01
endo-Fenchyl acetate	7.36	1218	0.04	6.63	1422	0.04
Citronellol	7.56	1232	0.02	10.54	1732	0.02
Thymol methyl ether	7.60	1235	0.06	8.27*	1547	[0.11]
Carvone	7.66	1239	0.01	9.77*	1667	0.01
Piperitone	7.80	1248	0.08	9.67*	1659	0.11
Phellandral	8.09	1268	0.03	9.73	1664	0.05
Isobornyl acetate	8.35*	1285	4.96	8.16	1538	0.01
Bornyl acetate	8.35*	1285	[4.96]	8.07	1531	4.94
2-Undecanone	8.51	1296	0.08	8.45*	1561	[0.08]
Thymol	8.60	1302	0.08	14.91	2133	0.03
Isohexyl isocaproate	8.83	1318	0.01	7.33	1474	0.03
Myrtenyl acetate	8.90	1323	0.01	9.38*	1635	[0.12]
Unknown [m/z 121, 93 (84), 43 (81), 79 (48), 117 (40), 56 (37)...]	9.17	1342	0.02			
α-Longipinene	9.21	1345	0.08	6.59	1419	0.08
α-Terpinyl acetate	9.26	1348	0.01	9.49	1644	0.01
Citronellyl acetate	9.35	1355	0.02	9.26	1625	0.04
Geranyl acetate	9.76	1384	0.03	10.36	1716	0.02
β-Longipinene	9.88	1393	0.02	7.58	1494	0.01
Longifolene	9.94	1397	0.41	7.78	1508	0.41

Methyleugenol	10.05	1404	0.01	13.10	1959	0.01
β-Caryophyllene	10.17	1413	0.16	8.19	1541	0.09
α-Humulene	10.62	1447	0.07	9.08	1610	0.09
(*E*)-β-Farnesene	10.79	1460	0.03	9.38*	1635	[0.12]
γ-Muurolene	10.94	1471	0.02	9.38*	1635	[0.12]
Germacrene D	11.02	1477	0.04	9.59*	1652	[1.02]
β-Selinene	11.06	1480	0.03	9.71	1662	0.02
α-Selinene	11.26*	1495	0.06	9.77*	1667	[0.01]
β-Himachalene	11.26*	1495	[0.06]	9.67*	1659	[0.11]
(*Z*)-α-Bisabolene	11.37	1503	0.04	10.22	1703	0.04
β-Bisabolene	11.44	1508	0.37	9.96	1683	0.37
δ-Cadinene	11.59	1520	0.06	10.19	1701	0.02
(*E*)-α-Bisabolene	11.88	1543	0.06	10.52	1730	0.05
(*E*)-Nerolidol	12.15	1564	0.06	13.59	2004	0.05
Caryophyllene oxide	12.27	1574	0.02	12.54	1907	tr
Selin-6-en-4α-ol isomer	12.72	1610	0.01	14.56	2099	0.03
τ-Cadinol	13.02	1634	0.01	14.65	2107	0.01
Dihydroconiferol	13.15	1645	0.02			
Allohimachalol	13.22	1651	0.01	15.38	2181	0.01
Citronellyl caproate	14.12	1726	0.16			
Manool	17.54	2042	0.01	19.09	2588	0.01
7,13-Abietadiene	17.76	2064	0.01	17.10	2362	0.01
(*Z*)-Abienol	18.45	2133	0.05	20.12	2711	0.04
Pimaral?	18.71	2161	tr			
Ethyl α-linolenate	18.76	2165	0.01			
Palustral	19.23	2214	0.01	20.54	2763	0.01
Total identified		**98.54%**			**98.22%**	
Total reported		**98.58%**			**98.22%**	

*: 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