Date : May 03, 2022

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 22D19-NSO02
Customer identification : Balsam Fir - Canada - D45-1134
Type : Essential oil
Source : *Abies balsamea* ct. Eastern / Low thymol
Customer : Natural Sourcing LLC

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 : Pamela Lavoie, M.Sc., Chimiste
Analysis date : May 03, 2022

Checked and approved by :

Alexis St-Gelais, Ph. D., Chimiste 2013-174

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Méthode certifiée ISO 17025:2017 Certified method

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4740 ± 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
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Toluene	0.02	Simple phenolic
Unknown	0.01	Unknown
Octane	0.01	Alkane
Unknown	tr	Alkene
(3*Z*)-Hexenol	0.05	Aliphatic alcohol
Santene	1.82	Normonoterpene
Styrene	0.01	Simple phenolic
Unknown	0.02	Normonoterpene
Bornylene	0.01	Monoterpene
Hashishene	0.01	Monoterpene
Tricyclene	0.84	Monoterpene
α-Thujene	0.18	Monoterpene
α-Pinene	17.10	Monoterpene
Camphene	5.67	Monoterpene
α-Fenchene	0.09	Monoterpene
Thuja-2,4(10)-diene	0.07	Monoterpene
3,7,7-Trimethylcyclohepta-1,3,5-triene	0.06	Monoterpene
β-Pinene	29.38	Monoterpene
Sabinene	0.02	Monoterpene
Unknown	0.02	Monoterpene
Myrcene	1.68	Monoterpene
2-Pentylfuran	0.01	Furan
2-Carene	0.02	Monoterpene
α-Phellandrene	0.15	Monoterpene
Pseudolimonene	0.02	Monoterpene
Δ3-Carene	16.65	Monoterpene
(3*Z*)-Hexenyl acetate	0.03	Aliphatic ester
α-Terpinene	0.13	Monoterpene
Carvomenthene	0.05	Aliphatic alcohol
para-Cymene	0.31	Monoterpene
Limonene	8.83	Monoterpene
β-Phellandrene	4.41	Monoterpene
(*Z*)-β-Ocimene	0.02	Monoterpene
(*E*)-β-Ocimene	0.01	Monoterpene
γ-Terpinene	0.22	Monoterpene
Unknown	0.02	Oxygenated monoterpene
meta-Cymenene	0.02	Monoterpene
Fenchone	0.08	Monoterpenic ketone
Terpinolene	0.98	Monoterpene
γ-Campholenal	0.05	Aliphatic alcohol
para-Cymenene	0.10	Monoterpene
α-Pinene oxide	0.01	Monoterpenic ether
α-Thujone	0.03	Monoterpenic ketone

Linalool	0.04	Monoterpenic alcohol
Nonanal	0.02	Aliphatic aldehyde
endo-Fenchol	0.06	Monoterpenic alcohol
β-Thujone	0.02	Monoterpenic ketone
cis-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
α-Campholenal	0.02	Monoterpenic aldehyde
Nopinone	0.03	Normonoterpenic ketone
trans-Pinocarveol	0.14	Monoterpenic alcohol
cis-para-Mentha-2,8-dien-1-ol	0.02	Monoterpenic alcohol
Camphor	0.14	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
Camphene hydrate	0.06	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.02	Monoterpenic alcohol
Isoborneol	0.03	Monoterpenic alcohol
Hexyl isobutyrate	0.01	Aliphatic ester
Pinocarvone	0.04	Monoterpenic ketone
Borneol	0.39	Monoterpenic alcohol
Isopinocamphone	0.07	Monoterpenic ketone
Terpinen-4-ol	0.21	Monoterpenic alcohol
meta-Cymen-8-ol	0.02	Monoterpenic alcohol
Cryptone	0.04	Normonoterpenic ketone
para-Cymen-8-ol	0.03	Monoterpenic alcohol
α-Terpineol	0.67	Monoterpenic alcohol
Myrtenal	0.07	Monoterpenic aldehyde
Myrtenol	0.08	Monoterpenic alcohol
cis-Piperitol	0.07	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Unknown	0.01	Unknown
Verbenone	0.03	Monoterpenic ketone
trans-Piperitol	0.03	Monoterpenic alcohol
endo-Fenchyl acetate	0.04	Monoterpenic ester
trans-Carveol	0.02	Monoterpenic alcohol
Citronellol	0.03	Monoterpenic alcohol
Thymol methyl ether	0.01	Monoterpenic ether
Carvone	0.01	Monoterpenic ketone
Piperitone	0.09	Monoterpenic ketone
Unknown	0.03	Unknown
Phellandral	0.03	Monoterpenic aldehyde
Isobornyl acetate	0.03	Monoterpenic ester
Bornyl acetate	5.11	Monoterpenic ester
2-Undecanone	0.02	Aliphatic ketone
Thymol	0.02	Monoterpenic alcohol
Carvacrol	0.04	Monoterpenic alcohol
Isohexyl isocaproate	0.01	Aliphatic ester
Myrtenyl acetate	0.01	Monoterpenic ester
α-Longipinene	0.07	Sesquiterpene
α-Terpinyl acetate	0.04	Monoterpenic ester
Citronellyl acetate	0.02	Monoterpenic ester
Longicyclene	0.01	Sesquiterpene
Neryl acetate	0.01	Monoterpenic ester
α-Copaene	0.01	Sesquiterpene
Unknown	0.05	Unknown

β-Bourbonene	0.01	Sesquiterpene
Geranyl acetate	0.01	Monoterpenic ester
Sativene	0.01	Sesquiterpene
β-Longipinene	0.01	Sesquiterpene
Longifolene	0.17	Sesquiterpene
β-Caryophyllene	0.21	Sesquiterpene
β-Copaene	0.01	Sesquiterpene
trans-α-Bergamotene	0.02	Sesquiterpene
α-Himachalene	0.01	Sesquiterpene
α-Humulene	0.10	Sesquiterpene
(*E*)-β-Farnesene	0.03	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
γ-Humulene?	0.02	Sesquiterpene
β-Selinene	0.02	Sesquiterpene
β-Himachalene	0.03	Sesquiterpene
α-Muurolene	0.02	Sesquiterpene
(*Z*)-α-Bisabolene	0.03	Sesquiterpene
β-Bisabolene	0.20	Sesquiterpene
γ-Cadinene	0.01	Sesquiterpene
β-Curcumene	0.01	Sesquiterpene
δ-Cadinene	0.02	Sesquiterpene
trans-Calamenene	0.01	Sesquiterpene
(*E*)-γ-Bisabolene	0.01	Sesquiterpene
Citronellyl butyrate	0.01	Monoterpenic ester
α-Calacorene	0.01	Sesquiterpene
(*E*)-α-Bisabolene	0.05	Sesquiterpene
(*E*)-Nerolidol	0.05	Sesquiterpenic alcohol
Caryophyllene oxide	0.03	Sesquiterpenic ether
Humulene epoxide II	0.01	Sesquiterpenic ether
τ-Cadinol	0.02	Sesquiterpenic alcohol
Dihydroconiferol	0.02	Phenylpropanoid
α-Cadinol	0.01	Sesquiterpenic alcohol
α-Bisabolol	0.16	Sesquiterpenic alcohol
Manoyl oxide	0.01	Diterpenic ether
18-Norabieta-8,11,13-triene?	0.01	Norditerpene
(*Z*)-Abienol	0.01	Diterpenic alcohol
Consolidated total	**98.67%**	

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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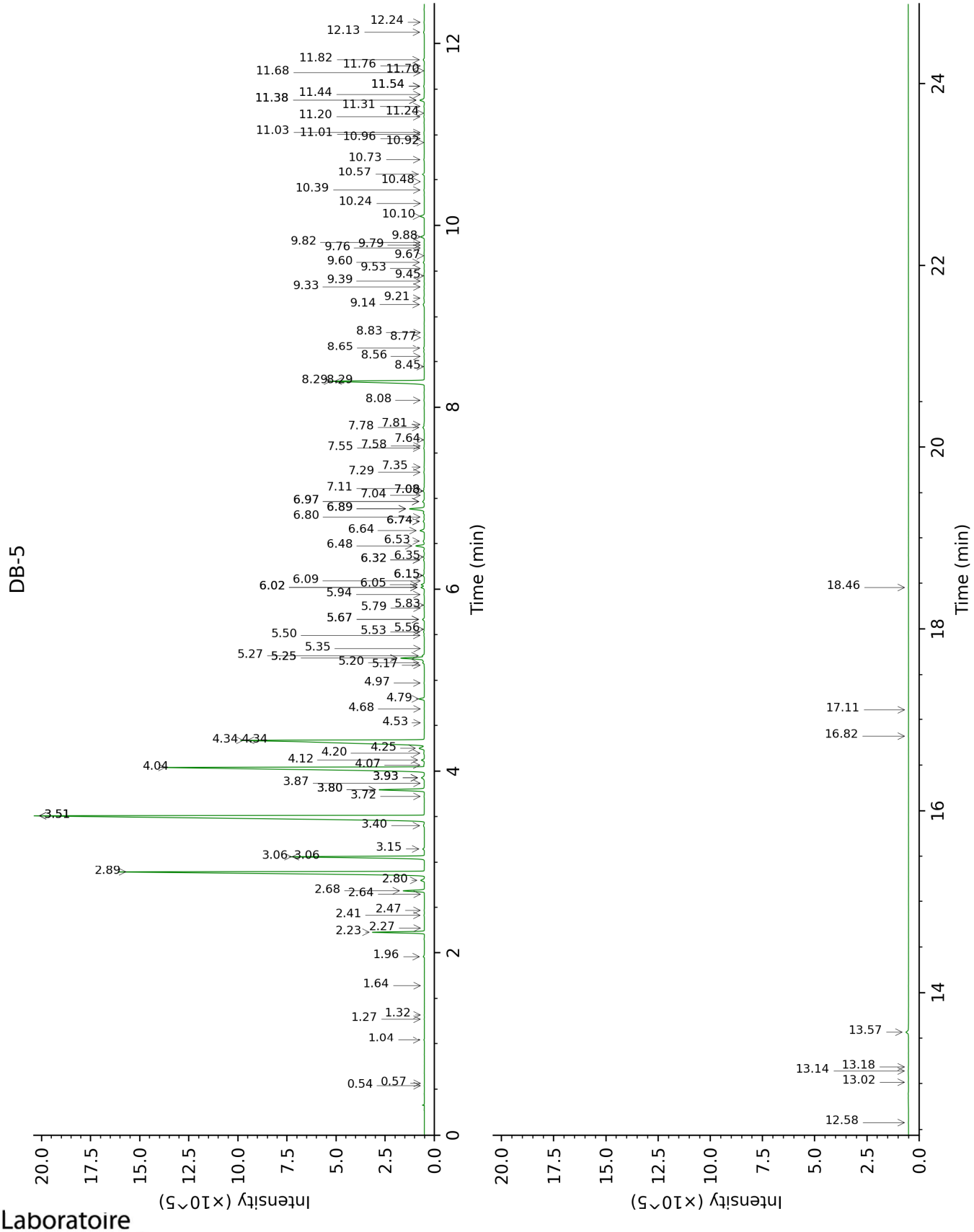
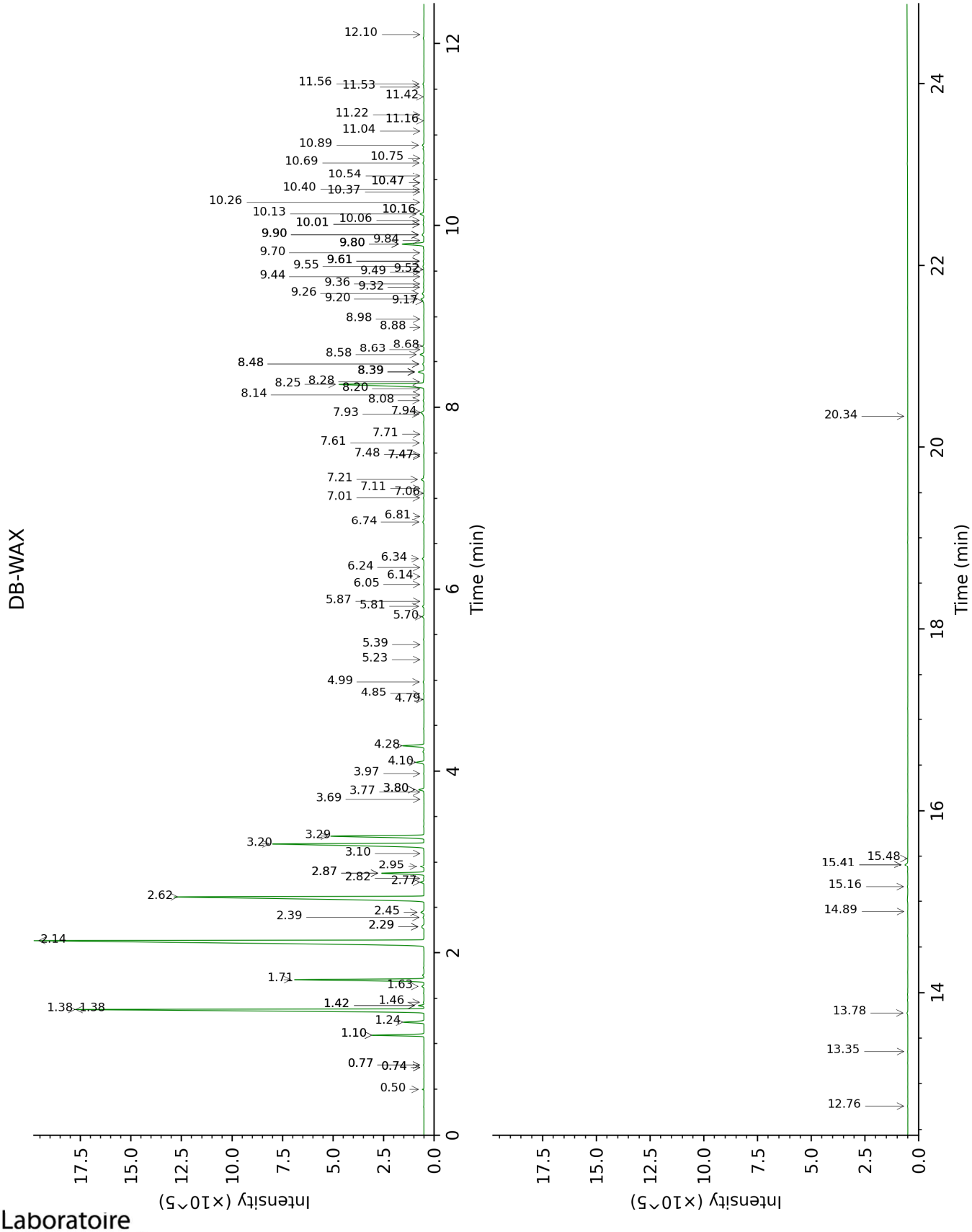

DB-5
Time (min)
Intensity (×10^5)
12.24
12.13
11.82
11.76
11.70
11.68
11.54
11.44
11.38
11.31
11.24
11.20
11.03
11.01
10.96
10.92
10.73
10.57
10.48
10.39
10.24
10.10
9.88
9.82
9.76
9.79
9.67
9.60
9.53
9.45
9.39
9.33
9.21
9.14
8.83
8.77
8.65
8.56
8.45
8.29
8.29
8.08
7.81
7.78
7.64
7.55
7.58
7.35
7.29
7.11
7.08
7.04
6.97
6.89
6.80
6.74
6.64
6.53
6.48
6.35
6.32
6.15
6.09
6.05
6.02
5.94
5.83
5.79
5.67
5.56
5.53
5.50
5.35
5.27
5.25
5.20
5.17
4.97
4.79
4.68
4.53
4.34
4.34
4.25
4.20
4.12
4.07
4.04
3.93
3.87
3.80
3.72
3.51
3.40
3.15
3.06
3.06
2.89
2.80
2.68
2.64
2.47
2.41
2.27
2.23
1.96
1.64
1.32
1.27
1.04
0.57
0.54
18.46
17.11
16.82
13.57
13.18
13.14
13.02
12.58


DB-WAX
Time (min)
Intensity (×10^5)
12.10
11.56
11.53
11.42
11.22
11.16
11.04
10.89
10.75
10.69
10.54
10.47
10.40
10.37
10.26
10.16
10.13
10.06
10.01
9.90
9.84
9.80
9.70
9.61
9.55
9.52
9.49
9.44
9.36
9.32
9.26
9.20
9.17
8.98
8.88
8.68
8.63
8.58
8.48
8.39
8.28
8.25
8.20
8.14
8.08
7.94
7.93
7.71
7.61
7.48
7.47
7.21
7.11
7.06
7.01
6.81
6.74
6.34
6.24
6.14
6.05
5.87
5.81
5.70
5.39
5.23
4.99
4.85
4.79
4.28
4.10
3.97
3.80
3.77
3.69
3.29
3.20
3.10
2.95
2.87
2.82
2.77
2.62
2.45
2.39
2.29
2.14
1.71
1.63
1.46
1.42
1.38
1.38
1.24
1.10
0.77
0.74
0.50
20.34
15.48
15.41
15.16
14.89
13.78
13.35
12.76

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.54	642	tr	0.77*	890	0.01
2-Methylbutyral	0.57	653	tr	0.74*	879	tr
Toluene	1.04	758	0.02	1.46	1002	0.02
Unknown [m/z 56, 45 (99), 41 (24), 84 (24), 69 (19), 43 (17)...]	1.27	795	0.01	0.77*	890	[0.01]
Octane	1.32	803	0.01	0.50	784	0.03
Unknown [m/z 109, 67 (32), 81 (14), 41 (12), 124 (10)]	1.64	831	tr	0.74*	879	[tr]
(3*Z*)-Hexenol	1.96	859	0.05	5.81	1353	0.07
Santene	2.23	882	1.82	1.10*	947	1.83
Styrene	2.27	886	0.01	3.80*	1207	0.24
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]	2.41	899	0.02	1.42*	998	0.19
Bornylene	2.47	903	0.01	1.10*	947	[1.83]
Hashishene	2.64	915	0.01	1.38*	994	17.14
Tricyclene	2.68	918	0.84	1.24	971	0.84
α-Thujene	2.80	926	0.18	1.42*	998	[0.19]
α-Pinene	2.89	932	17.10	1.38*	994	[17.14]
Camphene	3.06*	944	5.75	1.71	1027	5.67
α-Fenchene	3.06*	944	[5.75]	1.63	1020	0.09
Thuja-2,4(10)-diene	3.15	950	0.07	2.29*	1086	0.16
3,7,7-Trimethylcyclohepta-1,3,5-triene	3.40	967	0.06	2.87*	1134	1.74
β-Pinene	3.51*	974	29.40	2.14	1070	29.38
Sabinene	3.51*	974	[29.40]	2.29*	1086	[0.16]
Unknown [m/z 91, 119 (65), 109 (51), 134 (47)]	3.72	989	0.02	3.10	1152	0.01
Myrcene	3.80*	994	1.85	2.87*	1134	[1.74]
2-Pentylfuran	3.80*	994	[1.85]	3.69	1200	0.01
2-Carene	3.87	998	0.02	2.39	1096	0.04
α-Phellandrene	3.93*	1002	0.18	2.78	1126	0.15
Pseudolimonene	3.93*	1002	[0.18]	2.82	1130	0.02
Δ3-Carene	4.04	1010	16.65	2.62	1114	16.59
(3*Z*)-Hexenyl acetate	4.07	1011	0.03	4.85	1286	0.02
α-Terpinene	4.12	1015	0.13	2.95	1140	0.15
Carvomenthene	4.20	1019	0.05	2.45	1100	0.16
para-Cymene	4.25	1023	0.31	4.10	1230	0.37
Limonene	4.34*	1028	13.51	3.20	1161	8.83
β-Phellandrene	4.34*	1028	[13.51]	3.29	1168	4.41
(*Z*)-β-Ocimene	4.53	1040	0.02	3.77	1206	0.01
(*E*)-β-Ocimene	4.68	1050	0.01	3.97	1220	0.02
γ-Terpinene	4.79	1057	0.22	3.80*	1207	[0.24]

Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	4.97	1068	0.02	4.78	1281	0.02
meta-Cymenene	5.17	1081	0.02	6.14	1377	0.01
Fenchone	5.20	1082	0.08	5.70	1345	0.08
Terpinolene	5.25*	1086	1.08	4.28	1243	0.98
γ-Campholenal	5.25*	1086	[1.08]	4.98	1296	0.05
para-Cymenene	5.27	1087	0.10	6.34	1390	0.09
α-Pinene oxide	5.35	1092	0.01	5.39	1324	0.01
α-Thujone	5.50	1101	0.03	6.05	1370	0.02
Linalool	5.53	1104	0.04	8.08	1519	0.04
Nonanal	5.56	1106	0.02	5.87	1357	0.01
endo-Fenchol	5.67*	1113	0.08	8.39*	1542	0.30
β-Thujone	5.67*	1113	[0.08]	6.24	1384	0.02
cis-para-Menth-2-en-1-ol	5.79	1120	0.01	8.14	1523	0.03
α-Campholenal	5.83	1123	0.02	7.01	1440	0.03
Nopinone	5.94	1130	0.03	8.20	1528	0.01
trans-Pinocarveol	6.02*	1135	0.15	9.20†	1605	[0.21]
cis-para-Mentha-2,8-dien-1-ol	6.02*	1135	[0.15]	9.49	1628	0.02
Camphor	6.05	1137	0.14	7.21	1454	0.14
trans-para-Menth-2-en-1-ol	6.09	1140	0.01	8.98	1587	0.02
Camphene hydrate	6.15*	1144	0.08	8.48*	1549	0.07
meta-Mentha-4,6-dien-8-ol	6.15*	1144	[0.08]	9.32	1615	0.02
Isoborneol	6.32*	1154	0.04	9.36	1618	0.03
Hexyl isobutyrate	6.32*	1154	[0.04]	5.23	1312	0.01
Pinocarvone	6.35	1156	0.04	7.93†	1507	0.22
Borneol	6.48	1164	0.39	9.80*	1653	1.09
Isopinocamphone	6.53	1168	0.07	7.61	1484	0.04
Terpinen-4-ol	6.64	1175	0.21	8.58	1557	0.20
meta-Cymen-8-ol	6.74*	1181	0.06	11.53	1797	0.02
Cryptone	6.74*	1181	[0.06]	9.17†	1603	0.21
para-Cymen-8-ol	6.80	1185	0.03	11.56	1800	0.06
α-Terpineol	6.89*	1191	0.76	9.80*	1653	[1.09]
Myrtenal	6.89*	1191	[0.76]	8.68	1565	0.07
Myrtenol	6.97*	1196	0.10	10.89	1743	0.08
cis-Piperitol	6.97*	1196	[0.10]	9.55	1633	0.07
Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	7.04	1200	0.01			
Unknown [m/z 93, 121 (98), 79 (64), 91 (41), 77 (35), 124 (24)...]	7.08*	1203	0.05	11.04	1756	0.01
Verbenone	7.08*	1203	[0.05]	9.61*	1638	0.05
trans-Piperitol	7.11	1205	0.03	10.40	1702	0.03

endo-Fenchyl acetate	7.29	1217	0.04	6.81	1425	0.02
trans-Carveol	7.35	1221	0.02	11.42	1787	0.02
Citronellol	7.55	1235	0.03	10.75	1731	0.01
Thymol methyl ether	7.58	1236	0.01	8.48*	1549	[0.07]
Carvone	7.64	1241	0.01	10.01*	1670	0.04
Piperitone	7.78	1250	0.09	9.90*	1661	0.11
Unknown [m/z 43, 97 (55), 107 (44), 41 (38), 109 (32), 55 (27)...]	7.81	1252	0.03			
Phellandral	8.08	1270	0.03	10.01*	1670	[0.04]
Isobornyl acetate	8.29*	1284	5.13	8.28	1534	0.03
Bornyl acetate	8.29*	1284	[5.13]	8.25	1532	5.11
2-Undecanone	8.45	1294	0.02	8.63	1561	0.01
Thymol	8.56	1302	0.02	15.16	2134	0.03
Carvacrol	8.65	1308	0.04	15.41*	2159	0.19
Isohexyl isocaproate	8.77	1317	0.01	7.48	1474	0.02
Myrtenyl acetate	8.83	1321	0.01	9.61*	1638	[0.05]
α-Longipinene	9.14	1342	0.07	6.74	1420	0.07
α-Terpinyl acetate	9.20	1347	0.04	9.70	1645	0.03
Citronellyl acetate	9.33	1356	0.02	9.44	1624	0.03
Longicyclene	9.39	1361	0.01	7.06	1443	0.01
Neryl acetate	9.45	1365	0.01	10.16*	1682	0.04
α-Copaene	9.53	1370	0.01	7.11	1447	0.01
Unknown [m/z 93, 43 (59), 41 (40), 91 (40), 69 (33), 77 (22)...]	9.60	1375	0.05			
β-Bourbonene	9.67	1380	0.01	7.47*	1473	0.01
Geranyl acetate	9.76	1386	0.01	10.54	1714	0.02
Sativene	9.79	1388	0.01	7.47*	1473	[0.01]
β-Longipinene	9.82	1390	0.01	7.71	1491	0.02
Longifolene	9.88	1395	0.17	7.94†	1509	[0.22]
β-Caryophyllene	10.10	1411	0.21	8.39*	1542	[0.30]
β-Copaene	10.24	1422	0.01	8.39*	1542	[0.30]
trans-α-Bergamotene	10.39	1432	0.02	8.39*	1542	[0.30]
α-Himachalene	10.48	1439	0.01	8.88	1580	0.01
α-Humulene	10.57	1446	0.10	9.26	1610	0.10
(*E*)-β-Farnesene	10.73	1458	0.03	9.52	1631	0.02
γ-Muurolene	10.92	1472	0.01	9.61*	1638	[0.05]
Germacrene D	10.96	1475	0.01	9.84	1656	0.02
γ-Humulene?	11.01	1478	0.02	9.90*	1661	[0.11]
β-Selinene	11.03	1480	0.02	9.90*	1661	[0.11]
β-Himachalene	11.20	1493	0.03	9.80*	1653	[1.09]
α-Muurolene	11.24	1496	0.02	10.06	1674	0.04
(*Z*)-α-Bisabolene	11.31	1501	0.03	10.16*	1682	[0.04]
β-Bisabolene	11.38*	1507	0.23	10.13	1680	0.20
γ-Cadinene	11.38*	1507	[0.23]	10.37	1699	0.01
β-Curcumene	11.44	1511	0.01	10.26	1690	0.02
δ-Cadinene	11.54*	1518	0.05	10.47*	1708	0.02
trans-Calamenene	11.54*	1518	[0.05]	11.22	1771	0.01
(*E*)-γ-Bisabolene	11.68	1530	0.01	10.47*	1708	[0.02]

Citronellyl butyrate	11.70	1532	0.01	11.16	1765	0.01
α-Calacorene	11.76	1536	0.01	12.10	1847	0.01
(*E*)-α-Bisabolene	11.82	1541	0.05	10.69	1726	0.05
(*E*)-Nerolidol	12.13	1565	0.05	13.78	2000	0.05
Caryophyllene oxide	12.24	1574	0.03	12.76	1905	0.02
Humulene epoxide II	12.58	1600	0.01	13.35	1960	0.01
τ-Cadinol	13.02	1636	0.02	14.89	2107	0.01
Dihydroconiferol	13.14	1646	0.02			
α-Cadinol	13.18	1650	0.01	15.48	2166	0.02
α-Bisabolol	13.57	1682	0.16	15.41*	2159	[0.19]
Manoyl oxide	16.82	1974	0.01			
18-Norabieta-8,11,13-triene?	17.11	2002	0.01			
(*Z*)-Abienol	18.46	2137	0.01	20.34	2710	0.01
Total identified		**99.03%**			**98.77%**	
Total reported		**99.20%**			**98.81%**	

*: 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