Date : March 16, 2021

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 21B23-FEP24
Customer identification : Pine Needle - Hungary - 672821-19
Type : Essential oil
Source : *Pinus sylvestris*
Customer : Fern & Petal

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 : March 15, 2021

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4742 ± 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
Acetone	0.01	Aliphatic ketone
Toluene	0.02	Simple phenolic
Santene	0.06	Normonoterpene
Tricyclene	0.13	Monoterpene
α-Thujene	0.03	Monoterpene
α-Pinene	53.22	Monoterpene
Camphene	1.35	Monoterpene
α-Fenchene	0.07	Monoterpene
Thuja-2,4(10)-diene	0.04	Monoterpene
Benzaldehyde	0.02	Simple phenolic
Unknown	0.05	Monoterpene
β-Pinene	10.08	Monoterpene
Sabinene	0.03	Monoterpene
Unknown	0.15	Monoterpene
Myrcene	2.78	Monoterpene
2,7-Dimethyl-2,6-octadiene	0.10	Monoterpene
Octan-3-ol	0.04	Aliphatic alcohol
α-Phellandrene	0.32	Monoterpene
Pseudolimonene	0.01	Monoterpene
Δ3-Carene	8.65	Monoterpene
α-Terpinene	0.11	Monoterpene
Unknown	0.02	Monoterpene
Carvomenthene	0.08	Aliphatic alcohol
para-Cymene	1.46	Monoterpene
β-Phellandrene	0.05	Monoterpene
1,8-Cineole	0.29	Monoterpenic ether
Limonene	7.82	Monoterpene
(*Z*)-β-Ocimene	0.02	Monoterpene
(*E*)-β-Ocimene	0.01	Monoterpene
γ-Terpinene	0.01	Monoterpene
Unknown	0.01	Oxygenated monoterpene
Octanol	0.01	Aliphatic alcohol
Fenchone	0.01	Monoterpenic ketone
Terpinolene	0.07	Monoterpene
para-Cymenene	0.02	Monoterpene
α-Pinene oxide	0.46	Monoterpenic ether
Verbenol analog?	0.47	Monoterpenic alcohol
endo-Fenchol	0.14	Monoterpenic alcohol
trans-para-Mentha-2,8-dien-1-ol	0.04	Monoterpenic alcohol
α-Campholenal	0.04	Monoterpenic aldehyde
trans-Pinocarveol	0.41	Monoterpenic alcohol
Camphor	0.03	Monoterpenic ketone
trans-Verbenol	0.35	Monoterpenic alcohol
Camphene hydrate	0.07	Monoterpenic alcohol
Isoborneol	0.02	Monoterpenic alcohol

Pinocamphone	0.03	Monoterpenic ketone
Pinocarvone	0.08	Monoterpenic ketone
Borneol	0.10	Monoterpenic alcohol
Isopinocamphone	0.03	Monoterpenic ketone
Terpinen-4-ol	0.02	Monoterpenic alcohol
trans-2-Caren-4-ol	0.14	Monoterpenic alcohol
Cryptone	0.01	Normonoterpenic ketone
meta-Cymen-8-ol	0.02	Monoterpenic alcohol
para-Cymen-8-ol	0.17	Monoterpenic alcohol
α-Terpineol	0.81	Monoterpenic alcohol
Myrtenol	0.26	Monoterpenic alcohol
Methylchavicol	0.03	Phenylpropanoid
cis-α-Phellandrene epoxide (IPP vs Me)	0.03	Monoterpenic ether
Verbenone	0.09	Monoterpenic ketone
Unknown	0.49	Oxygenated monoterpene
trans-Carveol	0.12	Monoterpenic alcohol
Thymol methyl ether	0.03	Monoterpenic ether
Carvone	0.03	Monoterpenic ketone
Piperitone	0.01	Monoterpenic ketone
(7*Z*)-Undecen-2-one	0.04	Aliphatic ketone
Bornyl acetate	0.88	Monoterpenic ester
2-Undecanone	0.03	Aliphatic ketone
Unknown	0.15	Oxygenated monoterpene
Unknown	0.29	Unknown
Bicycloelemene	0.01	Sesquiterpene
α-Longipinene	0.07	Sesquiterpene
Unknown	0.02	Unknown
Unknown	0.03	Unknown
α-Terpinyl acetate	0.01	Monoterpenic ester
Longicyclene	0.04	Sesquiterpene
Unknown	0.03	Unknown
α-Copaene	0.09	Sesquiterpene
β-Bourbonene	0.01	Sesquiterpene
Geranyl acetate	0.03	Monoterpenic ester
β-Elemene	0.01	Sesquiterpene
β-Longipinene	0.01	Sesquiterpene
Longifolene	0.88	Sesquiterpene
Methyleugenol	0.02	Phenylpropanoid
β-Caryophyllene	0.74	Sesquiterpene
β-Copaene	0.03	Sesquiterpene
Aromadendrene	0.04	Sesquiterpene
cis-Muurola-3,5-diene	0.02	Sesquiterpene
trans-Muurola-3,5-diene	0.02	Sesquiterpene
α-Humulene	0.12	Sesquiterpene
cis-Muurola-4(15),5-diene	0.02	Sesquiterpene
γ-Humulene?	0.03	Sesquiterpene
β-Selinene	0.03	Sesquiterpene
trans-Muurola-4(15),5-diene	0.01	Sesquiterpene
γ-Amorphene	0.02	Sesquiterpene
α-Muurolene	0.03	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
δ-Cadinene	0.06	Sesquiterpene

trans-Cadina-1,4-diene	0.01	Sesquiterpene
Isocaryophyllene epoxide B	0.06	Sesquiterpenic ether
Caryophyllene oxide	0.98	Sesquiterpenic ether
Caryophyllene oxide isomer	0.28	Sesquiterpenic ether
Humulene epoxide II	0.08	Sesquiterpenic ether
1-epi-Cubenol	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
α-Muurolol	0.22	Sesquiterpenic alcohol
α-Cadinol	0.02	Sesquiterpenic alcohol
Bulnesol	0.04	Sesquiterpenic alcohol
meta-Camphorene	0.04	Diterpene
Unknown	0.01	Norditerpene
para-Camphorene	0.02	Diterpene
Unknown	0.01	Unknown
Dehydroabietal	0.01	Diterpenic aldehyde
Consolidated total	**97.32%**	

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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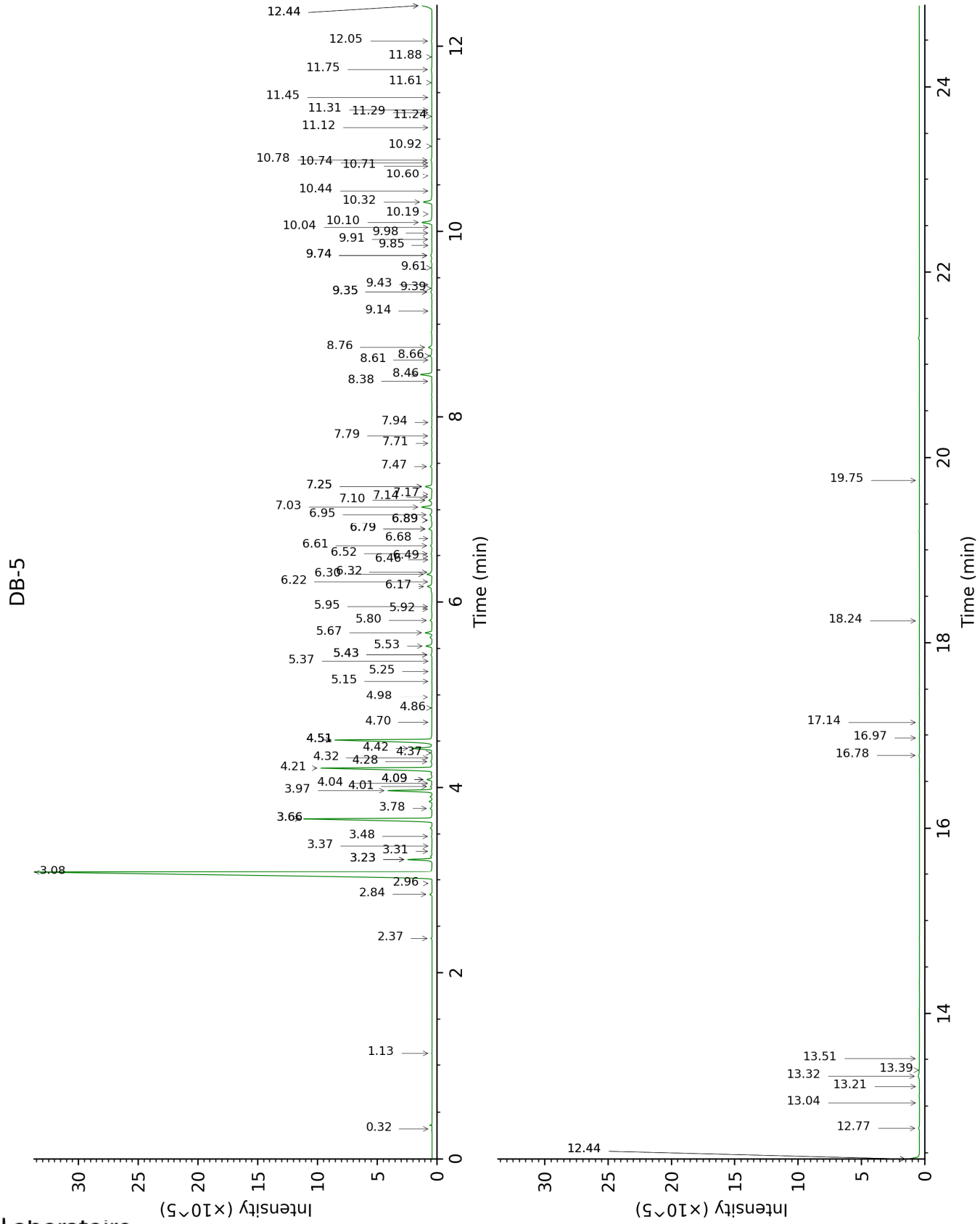
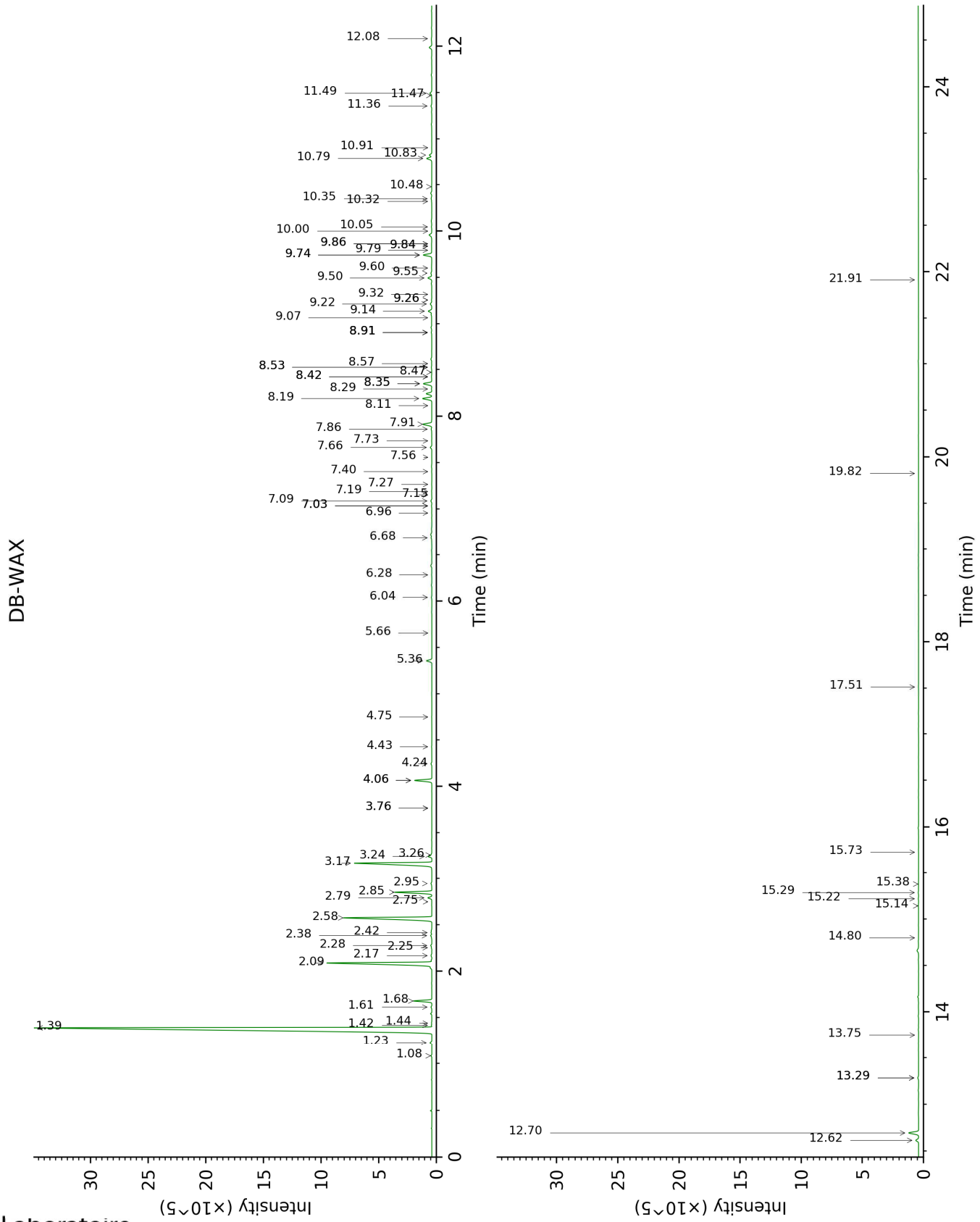

DB-5
Time (min)
Intensity (×10^5)
12.44
12.05
11.88
11.75
11.61
11.45
11.31
11.29
11.24
11.12
10.92
10.78
10.74
10.71
10.60
10.44
10.32
10.19
10.04
10.10
9.98
9.91
9.85
9.74
9.61
9.43
9.39
9.35
9.14
8.76
8.66
8.61
8.46
8.38
7.94
7.79
7.71
7.47
7.25
7.17
7.14
7.10
7.03
6.95
6.89
6.79
6.68
6.61
6.52
6.49
6.46
6.32
6.30
6.22
6.17
5.95
5.92
5.80
5.67
5.53
5.43
5.37
5.25
5.15
4.98
4.86
4.70
4.51
4.42
4.37
4.32
4.28
4.21
4.09
4.04
4.01
3.97
3.78
3.66
3.48
3.37
3.31
3.23
3.08
2.96
2.84
2.37
1.13
0.32
19.75
18.24
17.14
16.97
16.78
13.51
13.39
13.32
13.21
13.04
12.77
12.44


DB-WAX
Intensity (×10^5)
Time (min)
12.08
11.49
11.47
11.36
10.91
10.83
10.79
10.48
10.35
10.32
10.05
10.00
9.86
9.84
9.79
9.74
9.60
9.55
9.50
9.32
9.26
9.22
9.14
9.07
8.91
8.57
8.53
8.47
8.42
8.35
8.29
8.19
8.11
7.91
7.86
7.73
7.66
7.56
7.40
7.27
7.19
7.15
7.09
7.03
6.96
6.68
6.28
6.04
5.66
5.36
4.75
4.43
4.24
4.06
3.76
3.26
3.24
3.17
2.95
2.85
2.79
2.75
2.58
2.42
2.38
2.28
2.25
2.17
2.09
1.68
1.61
1.44
1.42
1.39
1.23
1.08
21.91
19.82
17.51
15.73
15.38
15.29
15.22
15.14
14.80
13.75
13.29
12.70
12.62

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Acetone	0.32	507	0.01			
Toluene	1.13	759	0.02	1.44	1004	0.03
Santene	2.37	882	0.06	1.08	948	0.06
Tricyclene	2.84	918	0.13	1.23	972	0.14
α-Thujene	2.96	926	0.03	1.42	1002	0.03
α-Pinene	3.08	934	53.22	1.39	999	53.19
Camphene	3.23*	943	1.41	1.68	1028	1.35
α-Fenchene	3.23*	943	[1.41]	1.62	1021	0.07
Thuja-2,4(10)-diene	3.31	949	0.04	2.28	1086	0.09
Benzaldehyde	3.37	953	0.02	7.27	1460	0.02
Unknown [m/z 121, 93 (86), 79 (71), 67 (62), 55 (49)... 136 (24)]	3.48	960	0.05			
β-Pinene	3.66*	972	9.96	2.09	1068	10.08
Sabinene	3.66*	972	[9.96]	2.25	1084	0.03
Unknown [m/z 93, 79 (73), 67 (49), 95 (42), 91 (41), 121 (38)...]	3.78	980	0.15	2.38	1097	0.09
Myrcene	3.97	992	2.78	2.85	1134	2.92
2,7-Dimethyl-2,6-octadiene	4.01	995	0.10	2.17	1076	0.08
Octan-3-ol	4.04	998	0.04	6.04	1369	0.04
α-Phellandrene	4.09*	1000	0.35	2.79	1129	0.32
Pseudolimonene	4.09*	1000	[0.35]	2.75	1126	0.01
Δ3-Carene	4.21	1008	8.65	2.58	1112	8.68
α-Terpinene	4.28	1013	0.11	2.95	1141	0.07
Unknown [m/z 117, 132 (96), 115 (65), 91 (44), 131 (19), 116 (18)]	4.32	1015	0.02	4.43	1252	0.02
Carvomenthene	4.37	1018	0.08	2.42	1100	0.07
para-Cymene	4.42	1022	1.46	4.06*	1226	1.46
β-Phellandrene	4.51*	1027	8.11	3.26	1166	0.05
1,8-Cineole	4.51*	1027	[8.11]	3.24	1164	0.29
Limonene	4.51*	1027	[8.11]	3.17	1159	7.82
(*Z*)-β-Ocimene	4.70	1039	0.02	3.76*	1204	0.01
(*E*)-β-Ocimene	4.86	1049	0.01	4.06*	1226	[1.46]
γ-Terpinene	4.98	1056	0.01	3.76*	1204	[0.01]
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.15	1067	0.01	4.75	1275	0.02
Octanol	5.26	1074	0.01	8.11	1524	0.01
Fenchone	5.37	1081	0.01	5.66	1341	0.01

Terpinolene	5.43*	1085	0.09	4.24	1239	0.07
para-Cymenene	5.43*	1085	[0.09]	6.28	1386	0.02
α-Pinene oxide	5.53	1091	0.46	5.36	1320	0.49
Verbenol analog?	5.67	1100	0.47			
endo-Fenchol	5.80	1109	0.14	8.35*	1542	0.86
trans-para-Mentha-2,8-dien-1-ol	5.92	1117	0.04	8.91*	1586	0.04
α-Campholenal	5.95	1118	0.04	7.03*	1442	0.04
trans-Pinocarveol	6.17	1132	0.41	9.14	1604	0.33
Camphor	6.22	1136	0.03	7.19	1454	0.02
trans-Verbenol	6.30	1141	0.35	9.50	1633	0.38
Camphene hydrate	6.32	1142	0.07	8.47	1552	0.01
Isoborneol	6.46	1151	0.02	9.26*	1614	0.02
Pinocamphone	6.49	1153	0.03	7.15	1451	0.01
Pinocarvone	6.52	1155	0.08	7.86	1504	0.06
Borneol	6.61	1161	0.10	9.74*	1653	0.81
Isopinocamphone	6.68	1166	0.03	7.56	1481	0.01
Terpinen-4-ol	6.79*	1172	0.28	8.57	1559	0.02
trans-2-Caren-4-ol	6.79*	1172	[0.28]	7.66	1489	0.14
Cryptone	6.89*	1179	0.06	9.07	1598	0.01
meta-Cymen-8-ol	6.89*	1179	[0.06]	11.47	1798	0.02
para-Cymen-8-ol	6.95	1183	0.17	11.49	1800	0.18
α-Terpineol	7.03	1188	0.81	9.74*	1653	[0.81]
Myrtenol	7.10	1193	0.26	10.83	1743	0.22
Methylchavicol	7.14	1195	0.03	9.32	1618	0.01
cis-α-Phellandrene epoxide (IPP vs Me)	7.17	1197	0.03	10.91	1750	0.01
Verbenone	7.25*	1202	0.54	9.55	1637	0.09
Unknown [m/z 109, 91 (100), 81 (88), 94 (75), 119 (74), 96 (73), 41 (63)... 150 (2)]	7.25*	1202	[0.54]	10.79	1740	0.49
trans-Carveol	7.47	1217	0.12	11.36	1788	0.08
Thymol methyl ether	7.72	1234	0.03	8.42*	1548	0.04
Carvone	7.80	1239	0.03	10.00	1674	0.01
Piperitone	7.94	1249	0.01	9.84*	1661	0.02
(7*Z*)-Undecen-2-one	8.38	1279	0.04			
Bornyl acetate	8.46	1284	0.88	8.19	1530	0.88
2-Undecanone	8.61	1295	0.03	8.53*	1556	0.05
Unknown [m/z 43, 93 (66), 91 (44), 41 (38), 69 (35)... 152? (1)]	8.66	1298	0.15			
Unknown [m/z 69, 41 (79), 91	8.76	1305	0.29			

(56), 92 (54), 79 (50), 77 (35)...]						
Bicycloelemene	9.14	1333	0.01	6.96	1436	0.01
α-Longipinene	9.35*	1342	0.09	6.68	1416	0.07
Unknown [m/z 93, 43 (61), 91 (31), 41 (20), 135 (19), 77 (16)...]	9.35*	1342	[0.09]			
Unknown [m/z 133, 105 (45), 91 (38), 119 (36)... 150 (3)]	9.39	1345	0.03			
α-Terpinyl acetate	9.43	1348	0.01	9.60	1642	0.05
Longicyclene	9.61	1361	0.04	7.03*	1442	[0.04]
Unknown [m/z 93, 43 (59), 41 (40), 91 (40), 69 (33), 77 (22)...]	9.74*	1370	0.12			
α-Copaene	9.74*	1370	[0.12]	7.09	1446	0.09
β-Bourbonene	9.85	1378	0.01	7.40	1470	0.02
Geranyl acetate	9.92	1382	0.03	10.48	1713	0.01
β-Elemene	9.98	1387	0.01	8.42*	1548	[0.04]
β-Longipinene	10.04	1392	0.01	7.73	1494	0.01
Longifolene	10.10	1395	0.88	7.91	1508	0.89
Methyleugenol	10.19	1402	0.02	13.28*	1963	0.08
β-Caryophyllene	10.32	1411	0.74	8.35*	1542	[0.86]
β-Copaene	10.44	1420	0.03	8.29	1538	0.03
Aromadendrene	10.60	1432	0.04	8.53*	1556	[0.05]
cis-Muurola-3,5-diene	10.71	1440	0.02	8.91*	1586	[0.04]
trans-Muurola-3,5-diene	10.74	1443	0.02	8.91*	1586	[0.04]
α-Humulene	10.78	1445	0.12	9.22	1610	0.15
cis-Muurola-4(15),5-diene	10.92	1456	0.02	9.26*	1614	[0.02]
γ-Humulene?	11.12	1471	0.03	9.86*	1663	0.03
β-Selinene	11.24	1480	0.03	9.86*	1663	[0.03]
trans-Muurola-4(15),5-diene	11.28	1483	0.01	9.84*	1661	[0.02]
γ-Amorphene	11.31	1485	0.02	9.79	1657	0.03
α-Muurolene	11.45	1495	0.03	10.05	1678	0.03
γ-Cadinene	11.61	1507	0.02	10.32	1700	0.02
δ-Cadinene	11.75	1518	0.06	10.35	1702	0.08
trans-Cadina-1,4-diene	11.88	1529	0.01			
Isocaryophyllene epoxide B	12.05	1542	0.06	12.08	1852	0.06
Caryophyllene oxide	12.44*	1572	1.27	12.70	1909	0.98
Caryophyllene oxide isomer	12.44*	1572	[1.27]	12.62	1899	0.28

Humulene epoxide II	12.77	1598	0.08	13.28*	1963	[0.08]
1-epi-Cubenol	13.04	1620	0.01	13.75	2006	0.01
τ-Cadinol	13.21	1634	0.01	14.80	2106	0.01
α-Muurolol	13.32	1644	0.22	15.14	2140	0.03
α-Cadinol	13.39	1649	0.02	15.38	2164	0.01
Bulnesol	13.51	1659	0.04	15.22	2148	0.03
meta-Camphorene	16.78	1949	0.04	15.29	2155	0.04
Unknown [m/z 159, 241 (59), 185 (24), 117 (23), 69 (23), 41 (22)... 256 (14)]	16.97	1966	0.01	17.51	2387	0.02
para-Camphorene	17.14	1982	0.02	15.73	2199	0.01
Unknown [m/z 191, 81 (47), 95 (41), 69 (39), 109 (32), 93 (32)...]	18.24	2090	0.01	19.82	2652	0.01
Dehydroabietal	19.76	2248	0.01	21.91	2916	0.01
Total identified		**96.52%**			**94.97%**	
Total reported		**97.24%**			**95.63%**	

*: Two or more compounds are coeluting on this column
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

Note: no correction factor was applied
R.T.: Retention time (minutes)
R.I.: Retention index