Date : May 31, 2022

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 22E24-PTH04
Customer identification : Marjoram - Egypt - M20111R
Type : Essential oil
Source : *Origanum majorana* ct. Sabinene hydrate
Customer : Plant Therapy

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 : Sylvain Mercier, M. Sc., Chimiste 2014-005
Analysis date : May 26, 2022

Checked and approved by :

Alexis St-Gelais, Ph. D., 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

Méthode certifiée ISO 17025:2017 Certified method

Laboratoire PhytoChemia

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4722 ± 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	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Ethylfuran	0.01	Furan
Methyl 2-methylbutyrate	0.03	Aliphatic ester
Octane	tr	Alkane
(2*E*)-Hexenal	0.02	Aliphatic aldehyde
(3*Z*)-Hexenol	0.02	Aliphatic alcohol
(2*E*)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.02	Aliphatic alcohol
Hashishene	0.01	Monoterpene
α-Thujene	0.62	Monoterpene
α-Pinene	0.78	Monoterpene
Thujadiene isomer	0.01	Monoterpene
Camphene	0.03	Monoterpene
Sabinene	7.94	Monoterpene
β-Pinene	0.44	Monoterpene
Octan-3-one	0.05	Aliphatic ketone
Myrcene	2.12	Monoterpene
α-Phellandrene	0.34	Monoterpene
Pseudolimonene	0.06	Monoterpene
(3*Z*)-Hexenyl acetate	0.01	Aliphatic ester
α-Terpinene	7.73	Monoterpene
Carvomenthene	0.02	Aliphatic alcohol
para-Cymene	1.19	Monoterpene
β-Phellandrene	1.98*	Monoterpene
1,8-Cineole	1.98*	Monoterpenic ether
Limonene	2.18	Monoterpene
(*Z*)-β-Ocimene	0.03	Monoterpene
(*E*)-β-Ocimene	0.05	Monoterpene
γ-Terpinene	12.42	Monoterpene
cis-Sabinene hydrate	4.43	Monoterpenic alcohol
para-Cymenene	0.02	Monoterpene
Terpinolene	2.85	Monoterpene
trans-Sabinene hydrate	19.38	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Linalool	0.81	Monoterpenic alcohol
Unknown	0.03	Unknown
Unknown	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	1.51	Monoterpenic alcohol
α-Campholenal	0.04	Monoterpenic aldehyde
4-Hydroxy-4-methylcyclohex-2-enone	0.01	Aliphatic alcohol
trans-Pinocarveol	0.07	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.84	Monoterpenic alcohol
Epoxyterpinolene	0.01	Monoterpenic ether
Unknown	0.01	Unknown

1,4-Dimethyl-4-acetylcyclohexene	0.04	Monoterpenic ketone
Pinocarvone	0.02	Monoterpenic ketone
Isomenthone	0.01	Monoterpenic ketone
Borneol	0.04	Monoterpenic alcohol
δ-Terpineol	0.02	Monoterpenic alcohol
Terpinen-4-ol	20.60	Monoterpenic alcohol
para-Cymen-8-ol	0.11	Monoterpenic alcohol
α-Terpineol	3.01	Monoterpenic alcohol
cis-Piperitol	0.35	Monoterpenic alcohol
Methylchavicol	0.02	Phenylpropanoid
Unknown	0.02	Unknown
trans-Piperitol	0.43	Monoterpenic alcohol
trans-Carveol	0.03	Monoterpenic alcohol
Nerol	0.04	Monoterpenic alcohol
Citronellol	0.04	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Neral	0.01	Monoterpenic aldehyde
Carvenone	0.04	Monoterpenic ketone
trans-Sesquisabinene hydrate	0.04	Sesquiterpenic alcohol
Geraniol	0.09	Monoterpenic alcohol
Linalyl acetate	1.94	Monoterpenic ester
trans-Ascaridole glycol	0.06	Monoterpenic alcohol
Geranial	0.01	Monoterpenic aldehyde
Citronellyl formate	0.02	Monoterpenic ester
Bornyl acetate	0.05	Monoterpenic ester
Thymol	0.01	Monoterpenic alcohol
Terpinen-4-yl acetate	0.03	Monoterpenic ester
Unknown	0.04	Monoterpenic alcohol
Unknown	0.06	Monoterpenic alcohol
Bicycloelemene	0.03	Sesquiterpene
α-Cubebene	0.01	Sesquiterpene
Eugenol	0.03	Phenylpropanoid
Neryl acetate	0.03	Monoterpenic ester
Geranyl acetate	0.06	Monoterpenic ester
β-Elemene	0.01	Sesquiterpene
β-Caryophyllene	2.28	Sesquiterpene
Aromadendrene	0.02	Sesquiterpene
α-Humulene	0.10	Sesquiterpene
allo-Aromadendrene	0.02	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
Bicyclogermacrene	1.05	Sesquiterpene
Viridiflorene	0.03	Sesquiterpene
α-Muurolene	0.01	Sesquiterpene
γ-Cadinene	0.06	Sesquiterpene
δ-Cadinene	0.02	Sesquiterpene
Spathulenol	0.04	Sesquiterpenic alcohol
Globulol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.06	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Humulene epoxide II	0.01	Sesquiterpenic ether
10-epi-γ-Eudesmol	0.02	Sesquiterpenic alcohol

Isospathulenol	0.04	Sesquiterpenic alcohol
τ-Muurolol	0.01	Sesquiterpenic alcohol
Unknown	0.02	Diterpene
Consolidated total	**99.40%**	

*: 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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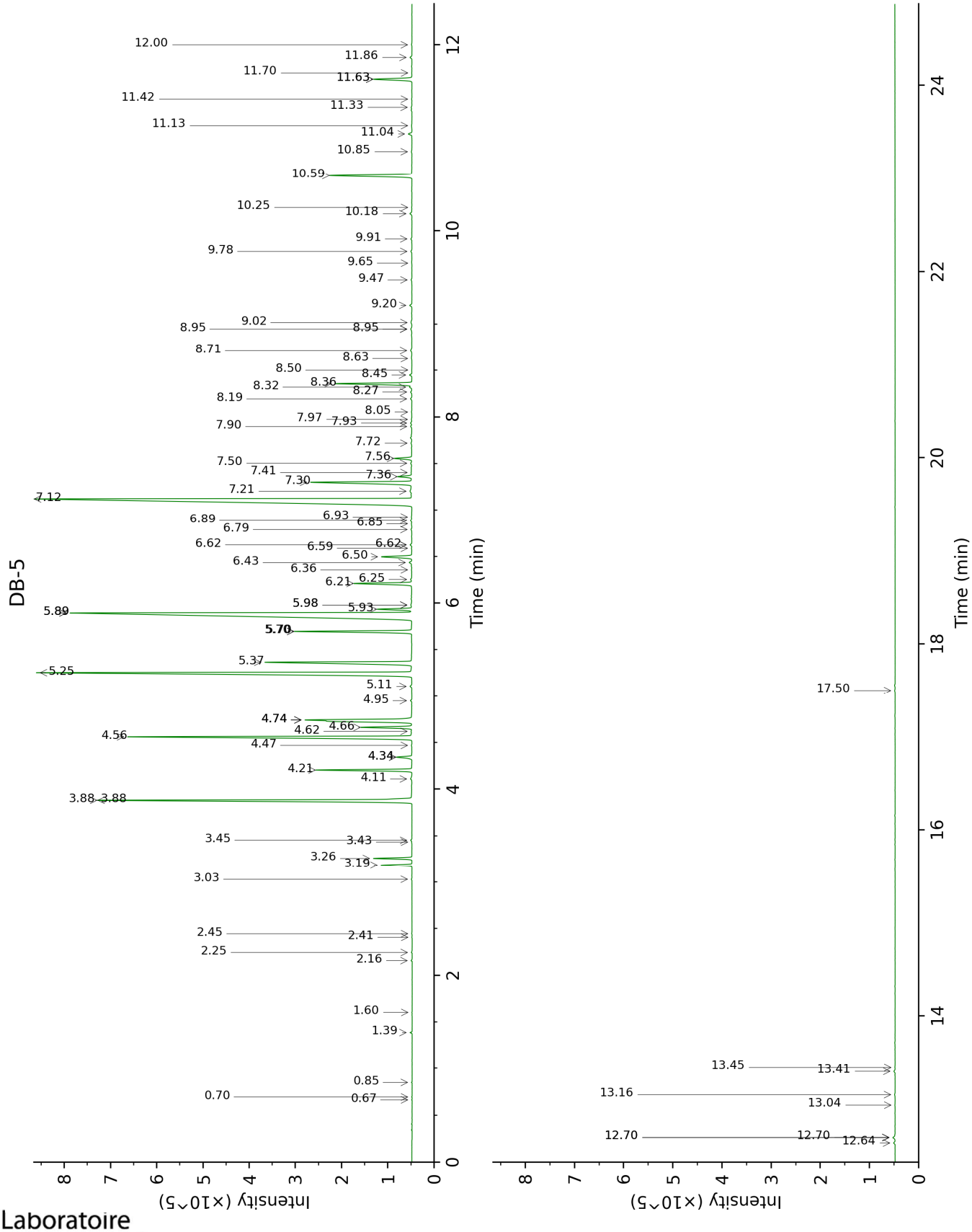
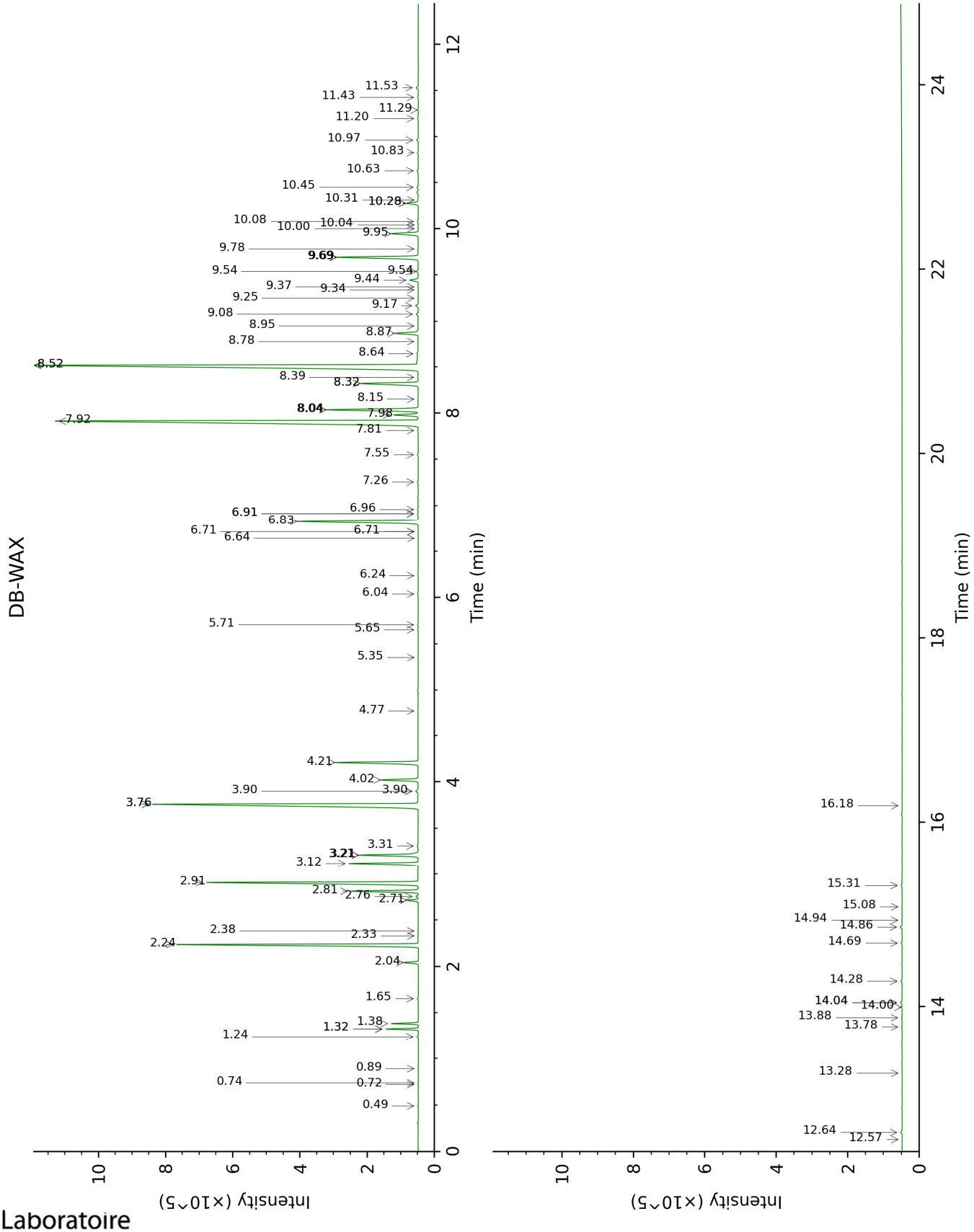

DB-5
Intensity (×10^5)
Time (min)
12.00
11.86
11.70
11.63
11.42
11.33
11.13
11.04
10.85
10.59
10.25
10.18
9.91
9.78
9.65
9.47
9.20
9.02
8.95
8.95
8.71
8.63
8.50
8.45
8.36
8.32
8.27
8.19
8.05
7.97
7.93
7.90
7.72
7.56
7.50
7.41
7.36
7.30
7.21
7.12
6.93
6.89
6.85
6.79
6.62
6.62
6.59
6.50
6.43
6.36
6.25
6.21
5.98
5.93
5.89
5.70
5.37
5.25
5.11
4.95
4.74
4.66
4.62
4.56
4.47
4.34
4.21
4.11
3.88
3.88
3.45
3.43
3.26
3.19
3.03
2.45
2.41
2.25
2.16
1.60
1.39
0.85
0.70
0.67
17.50
13.45
13.41
13.16
13.04
12.70
12.70
12.64


DB-WAX
Intensity (×10^5)
Time (min)
11.53
11.43
11.29
11.20
10.97
10.83
10.63
10.45
10.31
10.28
10.08
10.00
10.04
9.95
9.78
9.69
9.54
9.54
9.44
9.37
9.34
9.25
9.17
9.08
8.95
8.87
8.78
8.64
8.52
8.39
8.32
8.15
8.04
7.98
7.92
7.81
7.55
7.26
6.91
6.96
6.83
6.71
6.71
6.64
6.24
6.04
5.71
5.65
5.35
4.77
4.21
4.02
3.90
3.90
3.76
3.31
3.21
3.12
2.91
2.81
2.76
2.71
2.38
2.33
2.24
2.04
1.65
1.38
1.32
1.24
0.89
0.74
0.72
0.49
16.18
15.31
15.08
14.94
14.86
14.69
14.28
14.04
14.00
13.88
13.78
13.28
12.64
12.57

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.66	644	0.01	0.74	885	tr
2-Methylbutyral	0.70	653	0.01	0.72	879	0.01
2-Ethylfuran	0.85	702	0.01	0.89	917	0.01
Methyl 2-methylbutyrate	1.39	774	0.03	1.24	975	0.03
Octane	1.60	803	tr	0.49	787	0.01
(2*E*)-Hexenal	2.16	848	0.02	3.31	1172	0.04
(3*Z*)-Hexenol	2.25	855	0.02	5.71	1348	0.02
(2*E*)-Hexenol	2.41	868	0.01	6.04	1372	0.03
Hexanol	2.45	871	0.02	5.35	1322	0.01
Hashishene	3.03	915	0.01	1.32*	989	0.79
α-Thujene	3.19	925	0.62	1.38	998	0.62
α-Pinene	3.26	930	0.78	1.32*	989	[0.79]
Thujadiene isomer	3.43	942	0.01	2.33	1093	0.01
Camphene	3.45	943	0.03	1.65	1025	0.03
Sabinene	3.88*	971	8.41	2.24	1084	7.94
β-Pinene	3.88*	971	[8.41]	2.04	1064	0.44
Octan-3-one	4.11	986	0.05	3.90*	1217	0.08
Myrcene	4.21	992	2.12	2.81	1132	2.12
α-Phellandrene	4.34*	1002	0.40	2.71	1125	0.34
Pseudolimonene	4.34*	1002	[0.40]	2.76	1128	0.06
(3*Z*)-Hexenyl acetate	4.47	1010	0.01	4.77	1281	0.02
α-Terpinene	4.56	1015	7.73	2.91	1140	7.71
Carvomenthene	4.62	1019	0.02	2.38	1099	0.01
para-Cymene	4.66	1022	1.19	4.02	1226	1.19
β-Phellandrene	4.74*	1027	4.16	3.21*	1164	2.00
1,8-Cineole	4.74*	1027	[4.16]	3.21*	1164	[2.00]
Limonene	4.74*	1027	[4.16]	3.12	1157	2.18
(*Z*)-β-Ocimene	4.95	1040	0.03	3.76*	1207	12.41
(*E*)-β-Ocimene	5.11	1050	0.05	3.90*	1217	[0.08]
γ-Terpinene	5.26	1059	12.42	3.76*	1207	[12.41]
cis-Sabinene hydrate	5.37	1066	4.43	6.82	1429	4.43
para-Cymenene	5.70*	1087	2.87	6.24	1386	0.02
Terpinolene	5.70*	1087	[2.87]	4.21	1240	2.85
trans-Sabinene hydrate	5.90*	1099	19.40	7.92	1510	19.38
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.90*	1099	[19.40]	5.65	1344	0.02
Linalool	5.94	1102	0.81	7.98	1515	0.82
Unknown [m/z 139, 95 (95), 109 (64), 121 (40), 41 (23), 136 (22)...]	5.98*	1105	0.04			
Unknown [m/z 119, 109 (94), 43	5.98*	1105	[0.04]	8.39	1547	0.01

(61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]						
cis-para-Menth-2-en-1-ol	6.21	1120	1.51	8.04*	1520	3.48
α-Campholenal	6.25	1122	0.04	6.96	1439	0.03
4-Hydroxy-4-methylcyclohex-2-enone	6.36	1129	0.01	14.00	2030	0.02
trans-Pinocarveol	6.44	1134	0.07	9.08	1600	0.07
trans-para-Menth-2-en-1-ol	6.50	1138	0.84	8.87	1584	0.84
Epoxyterpinolene	6.59	1144	0.01	6.64	1415	0.01
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.62*	1147	0.04	6.71*	1421	0.02
1,4-Dimethyl-4-acetylcyclohexene	6.62*	1147	[0.04]	7.26	1461	0.04
Pinocarvone	6.79	1157	0.02	7.81	1502	0.02
Isomenthone	6.85	1161	0.01	6.91*	1436	0.04
Borneol	6.89	1164	0.04	9.69*	1650	3.04
δ-Terpineol	6.93	1166	0.02	9.37	1624	0.02
Terpinen-4-ol	7.12	1179	20.60	8.52*	1557	20.58
para-Cymen-8-ol	7.21	1184	0.11	11.43	1795	0.03
α-Terpineol	7.30	1191	3.01	9.69*	1650	[3.04]
cis-Piperitol	7.36	1194	0.35	9.44	1630	0.33
Methylchavicol	7.41	1197	0.02	9.25	1614	0.02
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.50	1204	0.02	10.83	1744	0.03
trans-Piperitol	7.56	1207	0.43	10.28*	1697	0.45
trans-Carveol	7.72	1218	0.03	11.29	1784	0.02
Nerol	7.90	1231	0.04	10.97	1756	0.07
Citronellol	7.94	1233	0.04	10.63	1728	0.06
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.97	1236	0.01	11.20	1776	0.03
Neral	8.05	1241	0.01	9.34	1622	0.01
Carvenone	8.19	1251	0.04	9.78	1658	0.02
trans-Sesquisabinene hydrate	8.27	1256	0.04	7.55	1483	0.03
Geraniol	8.32†	1260	2.03	11.53	1804	0.09
Linalyl acetate	8.36†	1262	[2.03]	8.04*	1520	[3.48]
trans-Ascaridole glycol	8.45	1268	0.06	14.04*	2034	0.07
Geranial	8.50	1272	0.01	10.04	1678	0.01
Citronellyl formate	8.63	1280	0.02	8.78	1577	0.01

Bornyl acetate	8.71	1286	0.05	8.15	1529	0.01
Thymol	8.95*	1303	0.05	15.08	2136	0.01
Terpinen-4-yl acetate	8.95*	1303	[0.05]	8.64	1567	0.03
Unknown analog	9.02	1307	0.04	13.88	2019	0.03
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.20	1316	0.06	14.86	2114	0.07
Bicycloelemene	9.48	1335	0.03	6.91*	1436	[0.04]
α-Cubebene	9.65	1348	0.01	6.71*	1421	[0.02]
Eugenol	9.78	1356	0.03	14.69	2096	0.04
Neryl acetate	9.91	1366	0.03	10.08	1681	0.03
Geranyl acetate	10.18	1385	0.06	10.45	1712	0.05
β-Elemene	10.25	1390	0.01	8.32*	1542	2.29
β-Caryophyllene	10.59	1415	2.28	8.32*	1542	[2.29]
Aromadendrene	10.85	1434	0.02	8.52*	1557	[20.58]
α-Humulene	11.04	1448	0.10	9.17	1608	0.10
allo-Aromadendrene	11.13	1455	0.02	8.95	1590	0.01
γ-Muurolene	11.33	1470	0.02	9.54*	1638	0.07
Germacrene D	11.42	1476	0.01	9.69*	1650	[3.04]
Bicyclogermacrene	11.63*	1492	1.08	9.95	1671	1.05
Viridiflorene	11.63*	1492	[1.08]	9.54*	1638	[0.07]
α-Muurolene	11.70	1497	0.01	10.00	1675	0.01
γ-Cadinene	11.86	1510	0.06	10.28*	1697	[0.45]
δ-Cadinene	12.00	1520	0.02	10.31	1700	0.01
Spathulenol	12.64	1571	0.04	14.28	2056	0.05
Globulol	12.70*	1575	0.08	13.78	2009	0.02
Caryophyllene oxide	12.70*	1575	[0.08]	12.64	1903	0.06
Caryophyllene oxide isomer	12.70*	1575	[0.08]	12.57	1896	0.01
Humulene epoxide II	13.04	1602	0.01	13.28	1962	0.01
10-epi-γ-Eudesmol	13.16	1612	0.02	14.04*	2034	[0.07]
Isospathulenol	13.41	1632	0.04	15.31	2159	0.04
τ-Muurolol	13.44	1636	0.01	14.94	2121	0.01
Unknown [m/z 257, 258 (20), 91 (19), 272 (18)]	17.50	1996	0.02	16.18	2248	0.01
Total identified		**99.27%**			**98.94%**	
Total reported		**99.44%**			**99.13%**	

*: 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