Date : July 22, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19G19-PTH06-1-SCC
Customer identification : Oregano - Spain - O40105810R
Type : Essential oil
Source : *Origanum vulgare* ct. Carvacrol
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 : Alexis St-Gelais, M. Sc., chimiste
Analysis date : July 21, 2019

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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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: Dark yellow liquid
Refractive index: 1.5097 ± 0.0003 (20 °C)

ISO 13171:2016 (ESSENTIAL OIL OF OREGANO)

Compound	Min. %	Max. %	Observed %	Complies?
β-Caryophyllene	0.5	4.0	1.6	Yes
Carvacrol	60.0	80.0	68.9	Yes
Thymol	0.5	5.0	4.2	Yes
Terpinen-4-ol	0.5	2.0	0.7	Yes
Linalool	tr	3.00	0.07	Yes
γ-Terpinene	3.0	9.0	6.4	Yes
para-Cymene	4.0	10.0	8.1	Yes
α-Terpinene	0.5	2.0	1.5	Yes
Myrcene	0.5	3.0	1.6	Yes
α-Pinene	0.2	2.5	1.0	Yes
α-Thujene	0.2	1.5	1.1	Yes
Refractive index	1.5000	1.5130	1.5097	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for oregano essential oil.

Analysis summary – Consolidated contents

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

Identification	%	Classe
Isobutyral	tr	Aliphatic aldehyde
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Isoamyl alcohol	tr	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
Methyl 2-methylbutyrate	0.04	Aliphatic ester
Methyl isovalerate	0.01	Aliphatic ester
Heptan-3-one	0.01	Aliphatic ketone
Hashishene	tr	Monoterpene
Tricyclene	0.01	Monoterpene
α-Thujene	1.10	Monoterpene
α-Pinene	0.98	Monoterpene
Unknown	0.02	Monoterpene
Camphene	0.09	Monoterpene
Sabinene	0.01	Monoterpene
β-Pinene	0.09	Monoterpene
Octen-3-ol	0.30	Aliphatic alcohol
Octan-3-one	0.14	Aliphatic ketone
Myrcene	1.59	Monoterpene
Octan-3-ol	0.04	Aliphatic alcohol
α-Phellandrene	0.15	Monoterpene
Pseudolimonene	0.02	Monoterpene
Δ3-Carene	0.05	Monoterpene
α-Terpinene	1.46	Monoterpene
para-Cymene	8.06	Monoterpene
Limonene	0.16	Monoterpene
1,8-Cineole	0.02	Monoterpenic ether
β-Phellandrene	0.18	Monoterpene
(*Z*)-β-Ocimene	0.01	Monoterpene
(*E*)-β-Ocimene	0.03	Monoterpene
γ-Terpinene	6.36	Monoterpene
cis-Sabinene hydrate	0.15	Monoterpenic alcohol
Terpinolene	0.08	Monoterpene
para-Cymenene	0.04	Monoterpene
trans-Sabinene hydrate	0.08	Monoterpenic alcohol
Linalool	0.07	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Unknown	0.01	Oxygenated monoterpene
cis-para-Menth-2-en-1-ol	0.03	Monoterpenic alcohol
trans-Pinocarveol	0.01	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
Borneol	0.17	Monoterpenic alcohol
Terpinen-4-ol	0.68	Monoterpenic alcohol
para-Cymen-8-ol	0.03	Monoterpenic alcohol
α-Terpineol	0.10	Monoterpenic alcohol
cis-Dihydrocarvone	0.08	Monoterpenic ketone

Thymol methyl ether	0.02	Monoterpenic ether
Carvone	0.01	Monoterpenic ketone
Carvacrol methyl ether	0.02	Monoterpenic ether
Geraniol	0.02	Monoterpenic alcohol
Geranial	0.01	Monoterpenic aldehyde
(*E*)-Anethole	0.08	Phenylpropanoid
Thymol analogue I	0.05	Monoterpenic alcohol
Thymol	4.16	Monoterpenic alcohol
Thymol analogue II	0.05	Monoterpenic alcohol
Carvacrol	68.90	Monoterpenic alcohol
α-Terpinyl acetate	0.01	Monoterpenic ester
Carvacryl acetate	0.01	Monoterpenic ester
β-Bourbonene	0.02	Sesquiterpene
Geranyl acetate	0.01	Monoterpenic ester
β-Elemene	0.01	Sesquiterpene
β-Caryophyllene	1.59	Sesquiterpene
β-Copaene	0.03	Sesquiterpene
Unknown	0.07	Oxygenated monoterpene
α-Humulene	0.14	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
β-Bisabolene	0.23	Sesquiterpene
γ-Cadinene	0.05	Sesquiterpene
δ-Cadinene	0.02	Sesquiterpene
Spathulenol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.22	Sesquiterpenic ether
Caryophyllene oxide isomer	0.11	Sesquiterpenic ether
Humulene epoxide I	0.05	Sesquiterpenic ether
Humulene epoxide II	0.02	Sesquiterpenic ether
10-epi-Cubenol	0.01	Sesquiterpenic alcohol
Caryophylladienol I	0.02	Sesquiterpenic alcohol
Caryophylladienol II	0.03	Sesquiterpenic alcohol
τ-Cadinol	0.02	Sesquiterpenic alcohol
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	0.04	Sesquiterpenic alcohol
α-Bisabolol	0.04	Sesquiterpenic alcohol
Phytone	0.01	Terpenic ketone
Unknown	0.06	Unknown
Unknown	0.02	Unknown
Unknown	0.08	Unknown
Unknown	0.01	Unknown
Unknown	0.10	Unknown
Unknown	0.02	Unknown
meta-Camphorene	0.03	Diterpene
Unknown	0.03	Unknown
para-Camphorene	0.01	Diterpene
Unknown	0.02	Unknown
Consolidated total	**99.00%**	

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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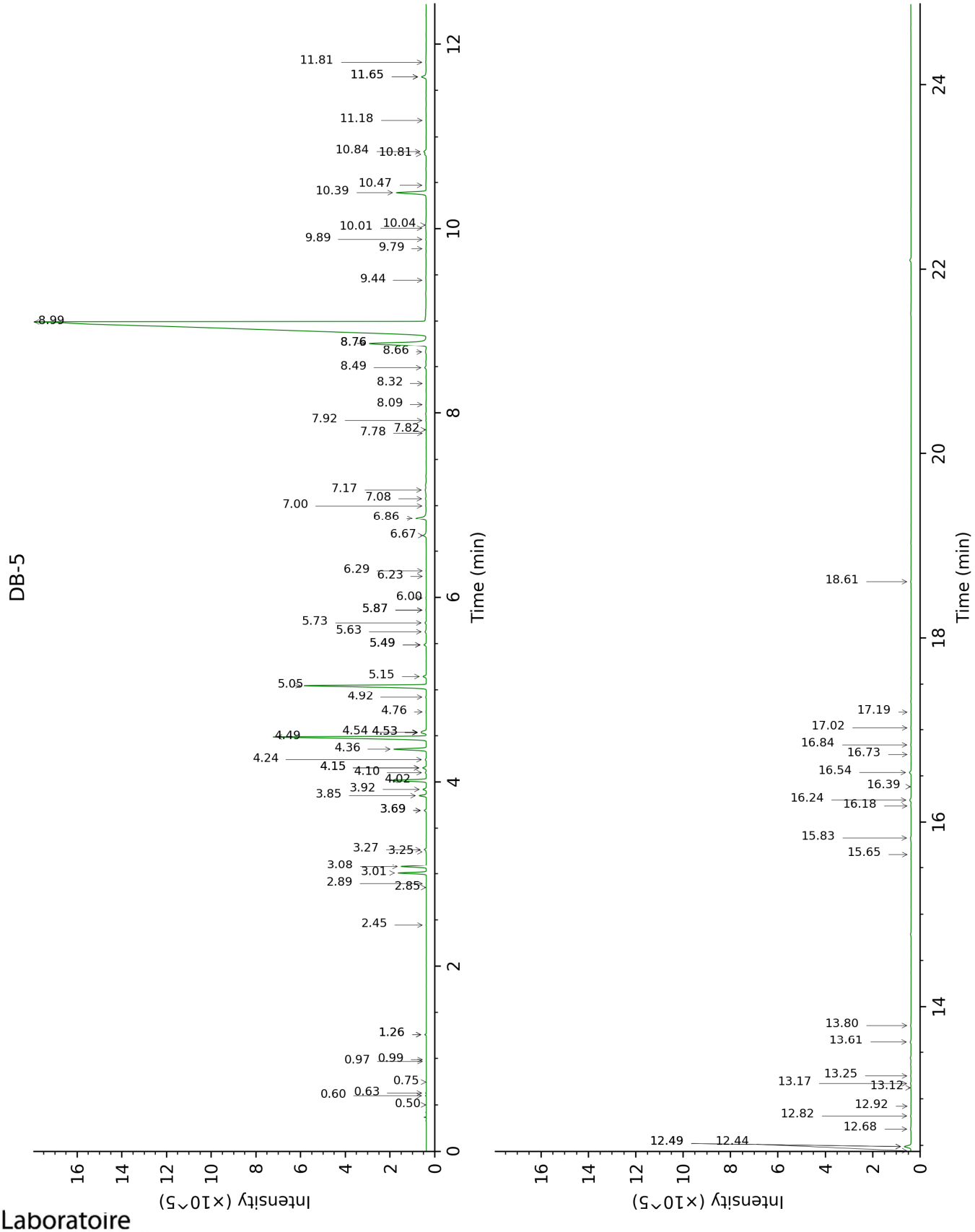

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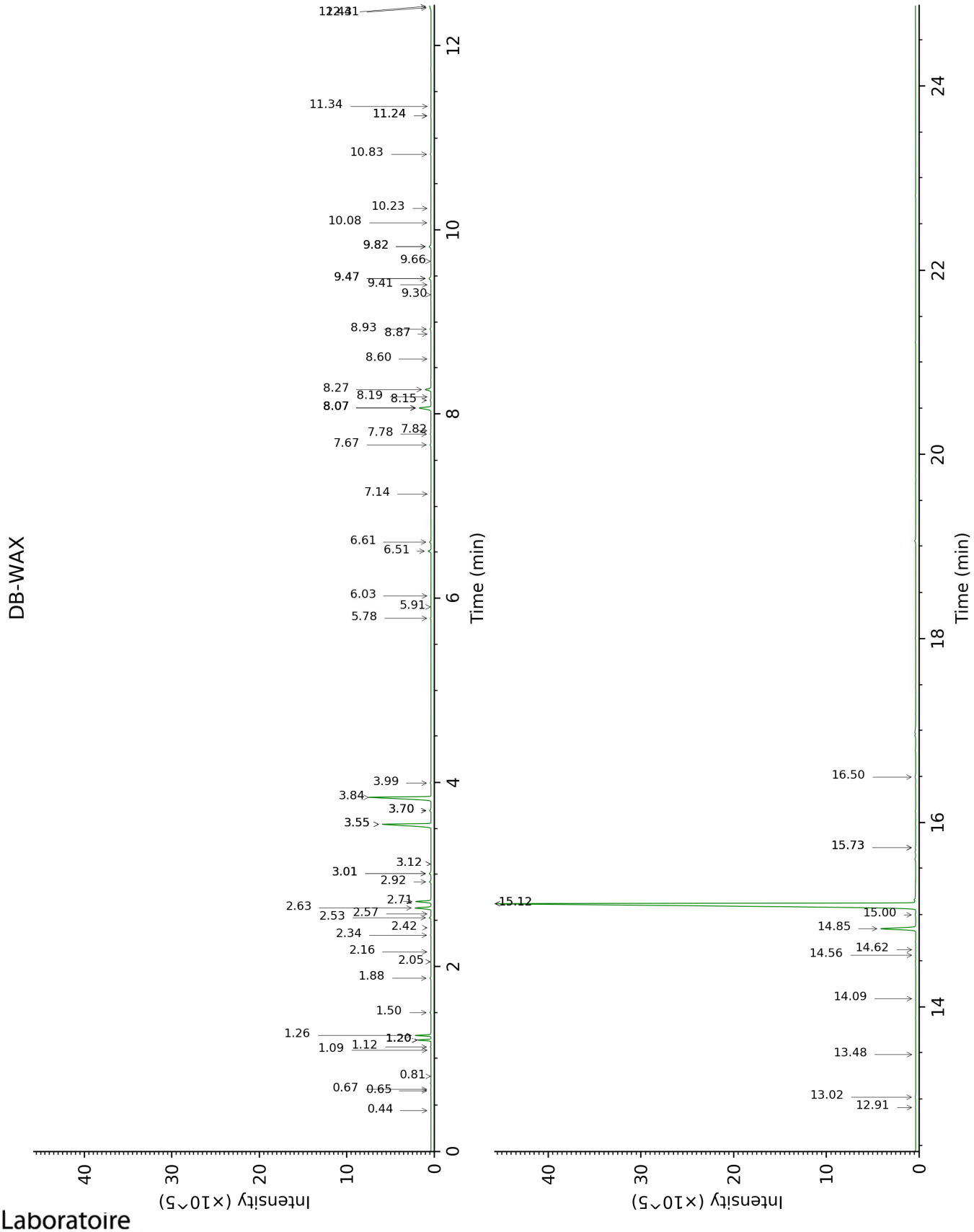
DB-WAX
Time (min)
Intensity (×10^5)
12.31
11.34
11.24
10.83
10.23
10.08
9.82
9.66
9.47
9.41
9.30
8.93
8.87
8.60
8.27
8.19
8.15
8.07
7.78
7.82
7.67
7.14
6.61
6.51
6.03
5.91
5.78
3.99
3.84
3.70
3.55
3.12
3.01
2.92
2.71
2.63
2.53
2.57
2.42
2.34
2.16
2.05
1.88
1.50
1.26
1.20
1.09
1.12
0.81
0.67
0.65
0.44
16.50
15.73
15.12
15.00
14.85
14.62
14.56
14.09
13.48
13.02
12.91

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutyral	0.50	590	tr	0.44	784	0.01
Isovaleral	0.60	640	0.01	0.67	890	0.01
2-Methylbutyral	0.63	651	0.01	0.65	883	0.01
2-Ethylfuran	0.75	696	tr	0.81	921	tr
Isoamyl alcohol	0.97	735	tr	3.12*	1175	0.01
2-Methylbutanol	0.99	738	tr	3.12*	1175	[0.01]
Methyl 2-methylbutyrate	1.26*	776	0.05	1.12	979	0.04
Methyl isovalerate	1.26*	776	[0.05]	1.20*	992	0.99
Heptan-3-one	2.45	884	0.01	2.42	1118	0.01
Hashishene	2.85	915	tr	1.20*	992	[0.99]
Tricyclene	2.89	918	0.01	1.09	972	0.01
α-Thujene	3.01	925	1.10	1.26	1001	1.11
α-Pinene	3.08	930	0.98	1.20*	992	[0.99]
Unknown [m/z 91, 92 (47), 65 (11)... 134 (1)]	3.24	941	0.02	2.16	1096	0.02
Camphene	3.27	942	0.09	1.50	1027	0.08
Sabinene	3.69*	970	0.10	2.05	1085	0.01
β-Pinene	3.69*	970	[0.10]	1.88	1066	0.09
Octen-3-ol	3.85	981	0.30	6.51	1425	0.30
Octan-3-one	3.92	985	0.14	3.70*	1220	0.16
Myrcene	4.02	992	1.59	2.64	1135	1.59
Octan-3-ol	4.10	997	0.04	5.78	1372	0.04
α-Phellandrene	4.15*	1001	0.17	2.53	1127	0.15
Pseudolimonene	4.15*	1001	[0.17]	2.57	1130	0.02
Δ3-Carene	4.24	1006	0.05	2.34	1111	0.05
α-Terpinene	4.36	1014	1.46	2.70	1141	1.47
para-Cymene	4.49	1022	8.06	3.84	1231	8.05
Limonene	4.53*	1025	0.18	2.92	1158	0.16
1,8-Cineole	4.53*	1025	[0.18]	3.01*	1166	0.20
β-Phellandrene	4.54	1025	0.18	3.01*	1166	[0.20]
(*Z*)-β-Ocimene	4.76	1039	0.01	3.55*	1209	6.34
(*E*)-β-Ocimene	4.92	1049	0.03	3.70*	1220	[0.16]
γ-Terpinene	5.05	1057	6.36	3.55*	1209	[6.34]
cis-Sabinene hydrate	5.15	1063	0.15	6.61	1433	0.15
Terpinolene	5.49*	1085	0.11	3.99	1242	0.08
para-Cymenene	5.49*	1085	[0.11]	6.03	1390	0.04
trans-Sabinene hydrate	5.63	1094	0.08	7.67	1512	0.08
Linalool	5.73	1100	0.07	7.78	1521	0.05
Unknown [m/z 109, 81 (54), 91 (32), 79 (22)...]	5.86*	1109	0.03	5.91	1381	0.02
Unknown [m/z 109, 91 (57), 93	5.86*	1109	[0.03]			

(47), 81 (44), 77 (40)... 154 (1)]						
cis-para-Menth-2-en-1-ol	6.00	1118	0.03	7.82	1524	0.03
trans-Pinocarveol	6.23	1133	0.01	8.87	1606	0.01
trans-para-Menth-2-en-1-ol	6.29	1137	0.02	8.60	1585	0.02
Borneol	6.67	1162	0.17	9.48*	1655	0.26
Terpinen-4-ol	6.86	1174	0.68	8.27	1559	0.67
para-Cymen-8-ol	7.00	1183	0.03	11.24*	1804	0.04
α-Terpineol	7.08	1188	0.10	9.48*	1655	[0.26]
cis-Dihydrocarvone	7.17	1194	0.08	8.15	1550	0.06
Thymol methyl ether	7.78	1236	0.02	8.07*	1543	1.52
Carvone	7.82	1239	0.01	9.66	1670	0.03
Carvacrol methyl ether	7.92	1246	0.02	8.19	1553	0.01
Geraniol	8.09	1257	0.02	11.24*	1804	[0.04]
Geranial	8.32	1273	0.01	9.82*	1683	0.25
(*E*)-Anethole	8.49	1285	0.08	10.83	1768	0.07
Thymol analogue I	8.66	1297	0.05	14.62	2118	0.02
Thymol	8.76*	1304	4.22	14.85	2141	4.16
Thymol analogue II	8.76*	1304	[4.22]	15.00	2156	0.05
Carvacrol	8.99	1315	68.90	15.12*	2168	68.48
α-Terpinyl acetate	9.44	1347	0.01	9.41	1650	0.01
Carvacryl acetate	9.78	1371	0.01	11.34	1813	0.02
β-Bourbonene	9.89	1378	0.02	7.14	1472	0.01
Geranyl acetate	10.01	1387	0.01	10.23	1718	0.01
β-Elemene	10.04	1389	0.01	8.07*	1543	[1.52]
β-Caryophyllene	10.39	1414	1.59	8.07*	1543	[1.52]
β-Copaene	10.47	1420	0.03	8.07*	1543	[1.52]
Unknown [m/z 151, 166 (40), 105 (26)...]	10.81	1446	0.07			
α-Humulene	10.84	1448	0.14	8.93	1611	0.11
γ-Muurolene	11.18	1473	0.01	9.30	1641	0.01
β-Bisabolene	11.65*	1509	0.29	9.82*	1683	[0.25]
γ-Cadinene	11.65*	1509	[0.29]			
δ-Cadinene	11.81	1521	0.02	10.08	1705	0.03
Spathulenol	12.44	1571	0.02	14.09	2066	0.02
Caryophyllene oxide	12.49*	1575	0.37	12.43	1910	0.22
Caryophyllene oxide isomer	12.49*	1575	[0.37]	12.41	1908	0.11
Humulene epoxide I	12.68	1590	0.05	12.91	1954	0.02
Humulene epoxide II	12.82	1601	0.02	13.02	1965	0.07
10-epi-Cubenol	12.92	1609	0.01	13.48	2007	0.01

Caryophylladienol I	13.12	1626	0.02	15.73*	2231	0.04
Caryophylladienol II	13.17	1629	0.03	15.73*	2231	[0.04]
τ-Cadinol	13.25	1636	0.02	14.56	2112	0.03
(3*Z*)-Caryophylla-3,8(13)-dien-5β-ol	13.61	1666	0.04	16.50	2311	0.09
α-Bisabolol	13.80	1682	0.04	15.12*	2168	[68.48]
Phytone	15.65	1843	0.01			
Unknown [m/z 81, 150 (90), 136 (88), 135 (74), 93 (54), 121 (41)...]	15.83	1859	0.06			
Unknown [m/z 133, 150 (34), 105 (22), 135 (16), 134 (12)...]	16.18	1891	0.02			
Unknown [m/z 81, 150 (83), 136 (81), 135 (67), 93 (48), 121 (36)...]	16.24	1897	0.08			
Unknown [m/z 93, 149 (98), 150 (85), 135 (55), 43 (29)...]	16.39	1910	0.01			
Unknown [m/z 136, 81 (81), 150 (74), 135 (52), 93 (46), 121 (42)...]	16.54	1924	0.10			
Unknown [m/z 81, 136 (71), 150 (57), 93 (47), 135 (42)...]	16.73	1943	0.02			
meta-Camphorene	16.84	1953	0.03			
Unknown [m/z 151, 135 (46), 109 (41), 43 (26), 150 (24), 107 (23)...]	17.02	1970	0.03			
para-Camphorene	17.19	1986	0.01			
Unknown [m/z 201, 241 (93), 159 (74), 302 (57), 259 (38), 43 (29)...]	18.61	2127	0.02			
Total identified		**98.60%**			**97.81%**	
Total reported		**99.03%**			**97.85%**	

*: 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

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