

Date : March 16, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21B23-FEP17

Customer identification : Marjoram - Egypt - 13013-02

Type : Essential oil

Source : *Origanum majorana*

Customer : Fern & Petal

ANALYSIS

Method: PC-MAT-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 : Seydou Ka, M. Sc.

Analysis date : March 09, 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid

Refractive index: 1.4735 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method.

ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Class
Ethanol	0.01	Aliphatic alcohol
Acetone	0.06	Aliphatic ketone
Methyl 2-methylbutyrate	0.03	Aliphatic ester
Hexanal	0.01	Aliphatic aldehyde
(2E)-Hexenal	0.01	Aliphatic aldehyde
(3Z)-Hexenol	0.02	Aliphatic alcohol
(2E)-Hexenol	0.01	Aliphatic alcohol
Hashishene	0.01	Monoterpene
α -Thujene	0.60	Monoterpene
α -Pinene	0.79	Monoterpene
Camphene	0.03*	Monoterpene
α -Fenchene	[0.03]*	Monoterpene
Sabinene	6.83	Monoterpene
β -Pinene	0.36	Monoterpene
Octen-3-ol	0.03	Aliphatic alcohol
Octan-3-one	0.04	Aliphatic ketone
Myrcene	1.67	Monoterpene
Pseudolimonene	0.06	Monoterpene
α -Phellandrene	0.25	Monoterpene
Δ^3 -Carene	0.15	Monoterpene
(3Z)-Hexenyl acetate	0.01	Aliphatic ester
α -Terpinene	7.42	Monoterpene
Carvomenthene	0.26	Aliphatic alcohol
para-Cymene	2.10	Monoterpene
1,8-Cineole	tr	Monoterpenic ether
Limonene	2.05	Monoterpene
β -Phellandrene	1.34	Monoterpene
(Z)- β -Ocimene	0.02	Monoterpene
(E)- β -Ocimene	0.03	Monoterpene
γ -Terpinene	12.76	Monoterpene
cis-Sabinene hydrate	5.59	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.04	Monoterpenic alcohol
Isoperillene	0.01	Monoterpenic ether
Terpinolene	2.91	Monoterpene
trans-Sabinene hydrate	13.97	Monoterpenic alcohol
Linalool	0.98	Monoterpenic alcohol
Unknown	0.04	Monoterpenic alcohol
trans-para-Mentha-2,8-dien-1-ol	0.02	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	1.33	Monoterpenic alcohol
α -Campholenal	0.07	Monoterpenic aldehyde
4-Hydroxy-4-methylcyclohex-2-enone	0.04	Aliphatic alcohol
trans-Pinocarveol	0.08	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.89	Monoterpenic alcohol
Epoxyterpinolene	0.01	Monoterpenic ether
Unknown	0.01	Unknown

1,4-Dimethyl-4-acetylcyclohexene	0.04	Monoterpenic ketone
Isomenthone	0.01	Monoterpenic ketone
Borneol	0.05	Monoterpenic alcohol
Terpinen-4-ol	24.10	Monoterpenic alcohol
para-Cymen-8-ol	0.15	Monoterpenic alcohol
α -Terpineol	3.20	Monoterpenic alcohol
Myrtenal	0.03	Monoterpenic aldehyde
<i>cis</i> -Piperitol	0.46	Monoterpenic alcohol
Myrtenol	0.06	Monoterpenic alcohol
Methylchavicol	0.06	Phenylpropanoid
Unknown	0.05	Unknown
<i>trans</i> -Piperitol	0.55	Monoterpenic alcohol
<i>trans</i> -Carveol	0.04	Monoterpenic alcohol
Nerol	0.04	Monoterpenic alcohol
Citronellol	0.06	Monoterpenic alcohol
Unknown	0.03	Oxygenated monoterpene
Neral	0.02	Monoterpenic aldehyde
Carvenone	0.04	Monoterpenic ketone
<i>trans</i> -Sabinene hydrate acetate	0.10	Monoterpenic ester
Linalyl acetate	1.72	Monoterpenic ester
Geraniol	0.09	Monoterpenic alcohol
<i>trans</i> -Ascaridole glycol	0.15	Monoterpenic alcohol
Geranial	0.03	Monoterpenic aldehyde
Citronellyl formate	0.03	Monoterpenic ester
(<i>E</i>)-Anethole	0.10	Phenylpropanoid
Thymol analogue I	0.02	Monoterpenic alcohol
Terpinen-4-yl acetate	0.01	Monoterpenic ester
Thymol	0.13	Monoterpenic alcohol
Unknown	0.17	Monoterpenic alcohol
Bicycloelemene	0.02	Sesquiterpene
α -Terpinyl acetate	0.01	Monoterpenic ester
Eugenol	0.04	Phenylpropanoid
Neryl acetate	0.07	Monoterpenic ester
α -Copaene	0.01	Sesquiterpene
Geranyl acetate	0.09	Monoterpenic ester
β -Elemene	0.02	Sesquiterpene
β -Caryophyllene	1.98	Sesquiterpene
β -Copaene	0.10	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.05	Sesquiterpene
α -Humulene	0.09	Sesquiterpene
allo-Aromadendrene	0.04	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.07	Sesquiterpene
Germacrene D	0.02	Sesquiterpene
(1 <i>S</i> ,2 <i>S</i> ,4 <i>S</i>)-para-Menthane-1,2,4-triol	0.03	Monoterpenic alcohol
α -Selinene	0.01	Sesquiterpene
Bicyclogermacrene	0.84	Sesquiterpene
Viridiflorene	0.07	Sesquiterpene
α -Muurolene	0.03	Sesquiterpene
γ -Cadinene	0.04	Sesquiterpene
δ -Cadinene	0.04	Sesquiterpene
Isocaryophyllene epoxide B	0.01	Sesquiterpenic ether
Spathulenol	0.08	Sesquiterpenic alcohol

Caryophyllene oxide	0.09	Sesquiterpenic ether
Caryophyllene oxide isomer	0.03	Sesquiterpenic ether
Viridiflorol	0.01	Sesquiterpenic alcohol
10-epi- γ -Eudesmol	0.02	Sesquiterpenic alcohol
Caryophylladienol II	0.01	Sesquiterpenic alcohol
Isospathulenol	0.13	Sesquiterpenic alcohol
τ -Cadinol	0.03	Sesquiterpenic alcohol
τ -Muurolol	0.01	Sesquiterpenic alcohol
α -Muurolol	0.02	Sesquiterpenic alcohol
α -Cadinol	0.02	Sesquiterpenic alcohol
14-Hydroxy-(<i>Z</i>)-caryophyllene	0.01	Sesquiterpenic alcohol
(3 <i>Z</i>)-Caryophylla-3,8(13)-dien-5 β -ol	0.01	Sesquiterpenic alcohol
2-Methylbutyral	0.01	Aliphatic aldehyde
Isovaleral	tr	Aliphatic aldehyde
Consolidated total	98.63%	

*: 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

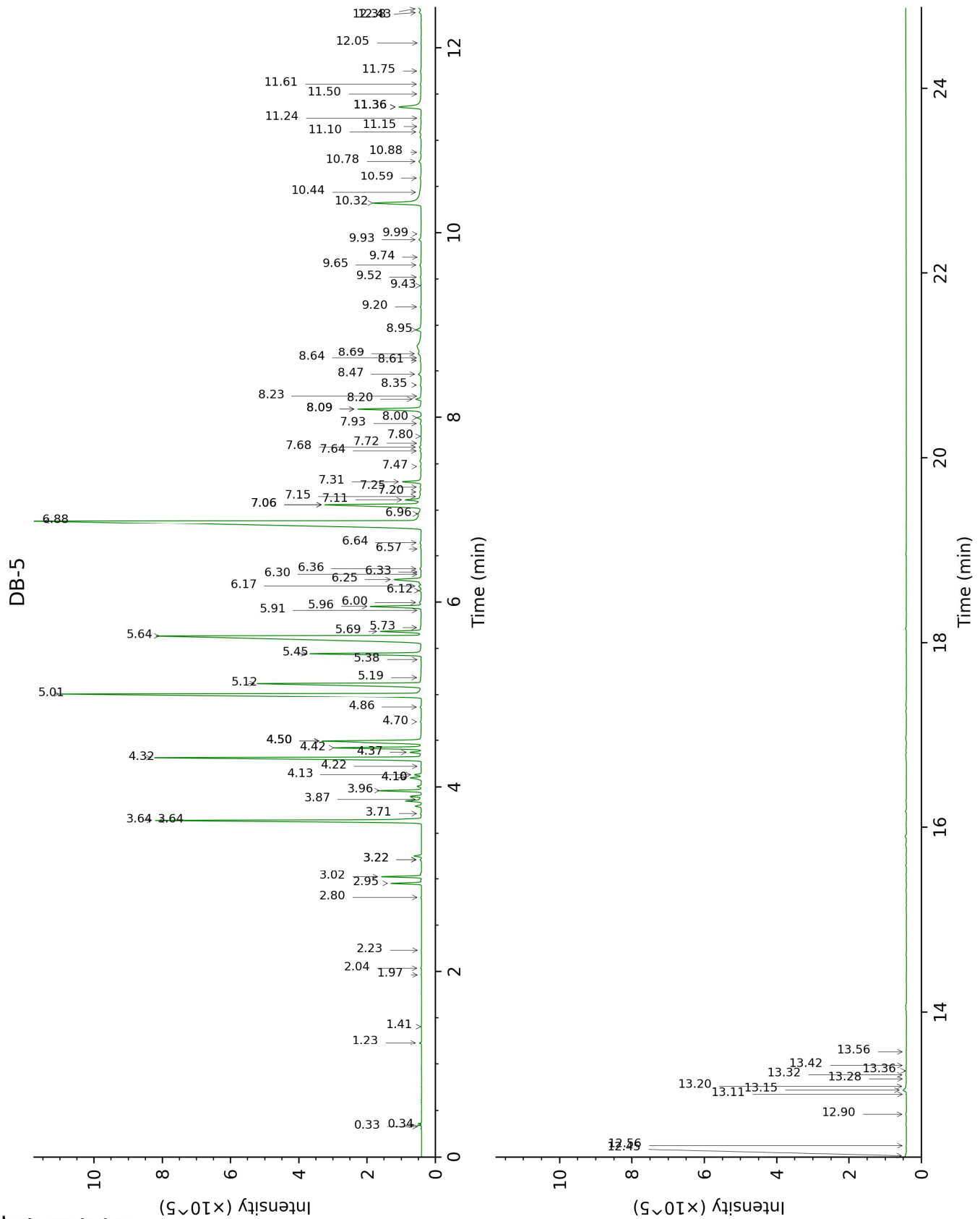
tr: The compound has been detected below 0.005% of total signal.

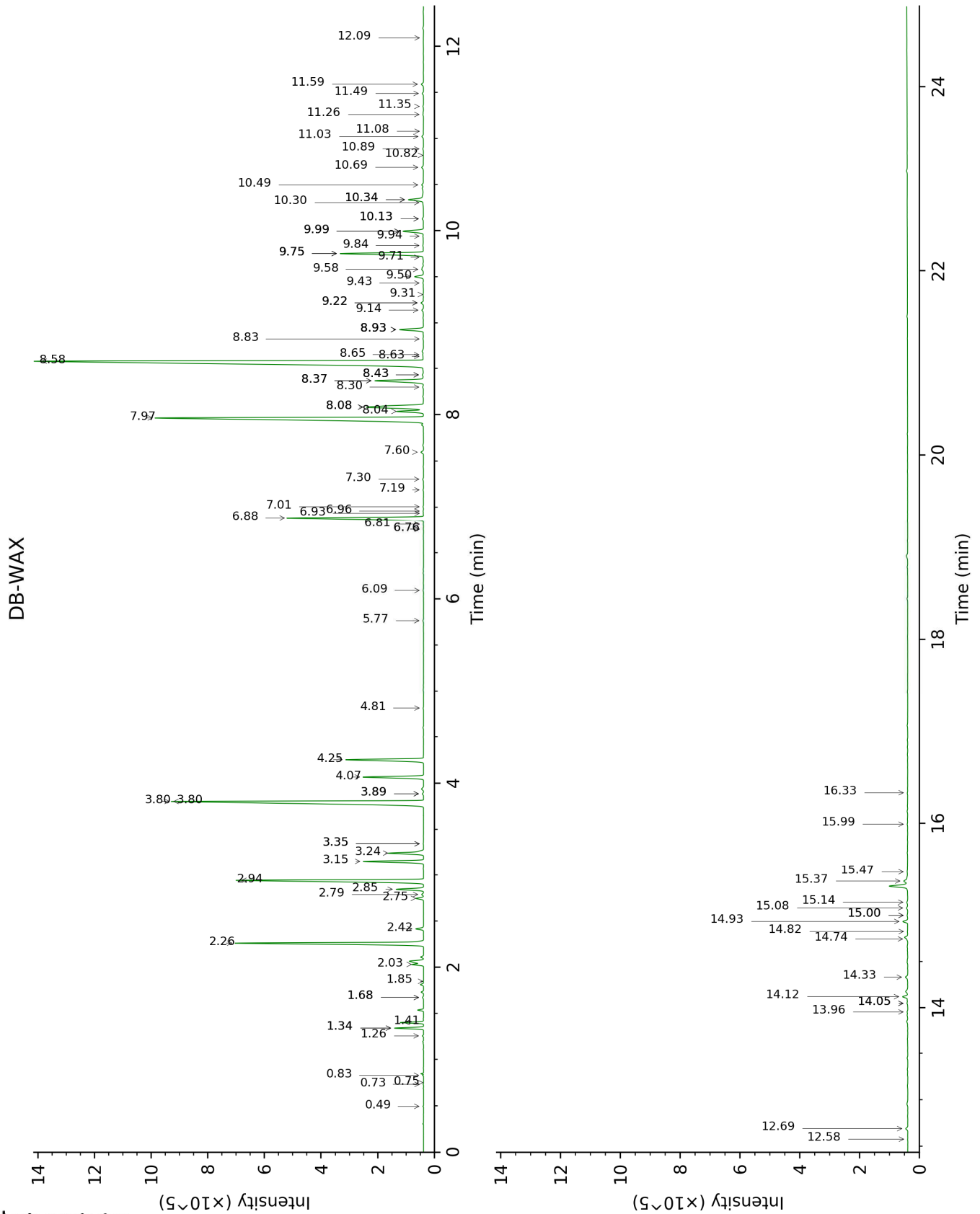
Note: no correction factor was applied

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.

This page was intentionally left blank. The following pages present the complete data of the analysis.





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.33	507	0.01	0.83	906	0.02
Acetone	0.34	507	0.06	0.50	783	0.01
Methyl 2-methylbutyrate	1.23	774	0.03	1.26	977	0.03
Hexanal	1.41	799	0.01	1.85	1044	tr
(2E)-Hexenal	1.96	848	0.01	3.34*	1172	0.01
(3Z)-Hexenol	2.04	854	0.02	5.77	1349	0.02
(2E)-Hexenol	2.23	870	0.01	6.09	1373	0.02
Hashishene	2.80	915	0.01	1.34*	991	0.81
α -Thujene	2.95	925	0.60	1.40	1000	0.61
α -Pinene	3.02	930	0.79	1.34*	991	[0.81]
Camphene	3.22*	942	0.03	1.68*	1027	0.04
α -Fenchene	3.22*	942	[0.03]	1.68*	1027	[0.04]
Sabinene	3.64*	970	7.16	2.26	1085	6.83
β -Pinene	3.64*	970	[7.16]	2.03	1062	0.36
Octen-3-ol	3.71	975	0.03	6.76*	1421	0.01
Octan-3-one	3.87	986	0.04	3.89*	1213	0.04
Myrcene	3.96	992	1.67	2.85	1133	0.94
Pseudolimonene	4.10*	1001	0.30	2.79	1129	0.06
α -Phellandrene	4.10*	1001	[0.30]	2.75	1126	0.25
Δ^3 -Carene	4.13	1003	0.15			
(3Z)-Hexenyl acetate	4.22	1009	0.01	4.81	1280	0.02
α -Terpinene	4.32	1015	7.42	2.94	1141	7.46
Carvomenthene	4.37	1018	0.26	2.42	1100	0.25
para-Cymene	4.42	1022	2.10	4.07	1226	2.13
1,8-Cineole	4.50*	1026	3.41	3.34*	1172	[0.01]
Limonene	4.50*	1026	[3.41]	3.16	1157	2.05
β -Phellandrene	4.50*	1026	[3.41]	3.24	1164	1.34
(Z)- β -Ocimene	4.70	1039	0.02	3.80*	1207	12.87
(E)- β -Ocimene	4.86	1049	0.03	3.89*	1213	[0.04]
γ -Terpinene	5.01	1059	12.76	3.80*	1207	[12.87]
cis-Sabinene hydrate	5.12	1066	5.59	6.88	1431	5.51
cis-Linalool oxide (fur.)	5.19	1070	0.04			
Isoperillene	5.38	1082	0.01			
Terpinolene	5.44	1086	2.91	4.26	1240	2.92
trans-Sabinene hydrate	5.64	1098	13.97	7.97	1512	13.92
Linalool	5.69	1101	0.98	8.04	1518	0.95
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.73	1104	0.04	8.43*	1549	0.05

<i>trans</i> -para-Mentha-2,8-dien-1-ol	5.91	1116	0.02	8.83	1580	0.02
<i>cis</i> -para-Menth-2-en-1-ol	5.96	1119	1.33	8.08*	1522	3.09
α -Campholenal	6.00	1121	0.07	6.96	1437	0.02
4-Hydroxy-4-methylcyclohex-2-enone	6.12	1130	0.04	14.05*	2034	0.04
<i>trans</i> -Pinocarveol	6.17	1133	0.08	9.14	1604	0.06
<i>trans</i> -para-Menth-2-en-1-ol	6.24	1137	0.89	8.93*	1587	0.91
Epoxyterpinolene	6.30	1141	0.01	6.76*	1421	[0.01]
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.33	1143	0.01	6.81	1426	0.01
1,4-Dimethyl-4-acetylcyclohexene	6.36	1145	0.04	7.30	1462	0.03
Isomenthone	6.57	1159	0.01	6.93	1435	0.01
Borneol	6.64	1163	0.05	9.75*	1654	3.27
Terpinen-4-ol	6.88	1179	24.10	8.58	1560	24.08
para-Cymen-8-ol	6.96	1184	0.15	11.49	1800	0.05
α -Terpineol	7.06*	1190	3.24	9.75*	1654	[3.27]
Myrtenal	7.06*	1190	[3.24]	8.65	1566	0.03
<i>cis</i> -Piperitol	7.11	1193	0.46	9.50	1633	0.34
Myrtenol	7.15	1196	0.06	10.82	1743	0.01
Methylchavicol	7.20	1199	0.06	9.31	1618	0.02
Unknown [m/z 95, 93 (32), 121 (24), 79 (22), 91 (21), 105 (16)... 154 (2)]	7.25	1202	0.05	10.89	1748	0.02
<i>trans</i> -Piperitol	7.31	1206	0.55	10.34*	1701	0.64
<i>trans</i> -Carveol	7.47	1217	0.04	11.35	1788	0.02
Nerol	7.64	1229	0.04	11.03	1760	0.07
Citronellol	7.68	1231	0.06	10.69	1732	0.07
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.72	1234	0.03	11.26	1780	0.02
Neral	7.80	1239	0.02	9.43	1628	0.02
Carvenone	7.94	1249	0.04	9.84	1661	0.02
<i>trans</i> -Sabinene hydrate acetate	8.00	1253	0.10	7.60	1484	0.10
Linalyl acetate	8.09*	1259	1.81	8.08*	1522	[3.09]
Geraniol	8.09*	1259	[1.81]	11.59	1808	0.09
<i>trans</i> -Ascaridole glycol	8.20	1267	0.15	14.12	2041	0.20
Geranial	8.23	1269	0.03	10.13*	1684	0.05
Citronellyl formate	8.35	1277	0.03	8.93*	1587	[0.91]
(<i>E</i>)-Anethole	8.47	1285	0.10	11.08	1765	0.01
Thymol analogue I	8.61	1295	0.02	15.00*	2126	0.03

Terpinen-4-yl acetate	8.64	1297	0.01	8.63	1564	0.01
Thymol	8.69	1300	0.13	15.08	2134	0.05
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.95	1319	0.17	14.93	2120	0.18
Bicycloelemene	9.20	1332	0.02	7.01	1440	0.02
α -Terpinyl acetate	9.43	1348	0.01	9.71	1650	0.01
Eugenol	9.52	1355	0.04	14.74	2101	0.03
Neryl acetate	9.65	1364	0.07	10.13*	1684	[0.05]
α -Copaene	9.74	1370	0.01	7.19	1454	0.02
Geranyl acetate	9.93	1383	0.09	10.50	1715	0.07
β -Elemene	9.99	1388	0.02	8.43*	1549	[0.05]
β -Caryophyllene	10.32	1411	1.98	8.37*	1544	2.14
β -Copaene	10.44	1420	0.10	8.30	1538	0.03
<i>trans</i> - α -Bergamotene	10.59	1431	0.05	8.37*	1544	[2.14]
α -Humulene	10.78	1445	0.09	9.22*	1610	0.09
allo-Aromadendrene	10.88	1453	0.04	8.93*	1587	[0.91]
<i>trans</i> -Cadina-1(6),4-diene	11.10	1469	0.07	9.22*	1610	[0.09]
Germacrene D	11.15	1473	0.02	9.75*	1654	[3.27]
(1S,2S,4S)-para-Menthane-1,2,4-triol	11.24	1480	0.03			
α -Selinene	11.36*	1489	0.96	9.94	1669	0.01
Bicyclogermacrene	11.36*	1489	[0.96]	9.99*	1673	0.87
Viridiflorene	11.36*	1489	[0.96]	9.58	1640	0.07
α -Muurolene	11.50	1499	0.03	9.99*	1673	[0.87]
γ -Cadinene	11.61	1507	0.04	10.30	1698	0.03
δ -Cadinene	11.75	1518	0.04	10.34*	1701	[0.64]
Isocaryophyllene epoxide B	12.05	1542	0.01	12.09	1853	0.01
Spathulenol	12.38	1568	0.08	14.33	2061	0.12
Caryophyllene oxide	12.43	1572	0.09	12.69	1909	0.09
Caryophyllene oxide isomer	12.45	1573	0.03	12.58	1896	0.01
Viridiflorol	12.56	1582	0.01	13.96	2025	0.03
10-epi- γ -Eudesmol	12.90	1608	0.02	14.05*	2034	[0.04]
Caryophylladienol II	13.11	1626	0.01	15.99	2226	0.02
Isospathulenol	13.16	1630	0.13	15.37	2163	0.21
τ -Cadinol	13.20	1633	0.03	14.82	2109	0.01
τ -Muurolol	13.28	1640	0.01	15.00*	2126	[0.03]
α -Muurolol	13.32	1643	0.02	15.14	2140	0.05
α -Cadinol	13.36	1647	0.02	15.47	2173	0.01
14-Hydroxy-(Z)-caryophyllene	13.42	1652	0.01	16.33	2261	0.01

(3Z)-Caryophylla-3,8(13)-dien-5 β -ol	13.56	1664	0.01			
2-Methylbutyral				0.73	880	0.01
Isovaleral				0.75	887	tr
Total identified		98.35%			96.86%	
Total reported		98.64%			97.10%	

*: 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