

Date : May 04, 2022

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 22D27-PTH01

Customer identification : Spearmint ORGANIC - India - S40106R

Type : Essential oil

Source : *Mentha spicata*

Customer : Plant Therapy

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 : Sylvain Mercier, M. Sc., Chimiste 2014-005

Analysis date : May 02, 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid

Refractive index: 1.4886 ± 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
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Methyl 2-methylbutyrate	0.01	Aliphatic ester
Ethyl 2-methylbutyrate	0.02	Aliphatic ester
(3Z)-Hexenol	0.02	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.08	Furan
Hashishene	0.10	Monoterpene
α -Thujene	0.05	Monoterpene
α -Pinene	0.91	Monoterpene
<i>trans</i> -3-Methylcyclohexanol	0.01	Aliphatic alcohol
3-Methylcyclohexanone	0.03	Aliphatic ketone
Camphene	0.04	Monoterpene
Thuja-2,4(10)-diene	0.02	Monoterpene
β -Pinene	1.03	Monoterpene
Sabinene	0.51	Monoterpene
Octen-3-ol	0.02	Aliphatic alcohol
Octan-3-one	0.07	Aliphatic ketone
6-Methyl-5-hepten-2-one	0.01	Aliphatic ketone
Myrcene	1.87	Monoterpene
Octan-3-ol	0.36	Aliphatic alcohol
α -Phellandrene	0.03	Monoterpene
Pseudolimonene	0.05	Monoterpene
Octanal	0.03	Aliphatic aldehyde
Menthatriene isomer I	0.05	Monoterpene
Δ^3 -Carene	0.02	Monoterpene
α -Terpinene	0.16	Monoterpene
Carvomenthene	0.04	Aliphatic alcohol
para-Cymene	0.23	Monoterpene
1,8-Cineole	1.65	Monoterpenic ether
Limonene	20.05	Monoterpene
2-Ethylhexanol	0.02	Aliphatic alcohol
(Z)- β -Ocimene	0.07	Monoterpene
(E)- β -Ocimene	0.05	Monoterpene
γ -Terpinene	0.31	Monoterpene
<i>cis</i> -Sabinene hydrate	0.30	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.05	Aliphatic alcohol
para-Cymenene	0.03	Monoterpene
<i>trans</i> -Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Terpinolene	0.11	Monoterpene
<i>trans</i> -Sabinene hydrate	0.03	Monoterpenic alcohol

Linalool	0.04	Monoterpenic alcohol
Nonanal	0.02	Aliphatic aldehyde
2-Methylbutyl 2-methylbutyrate	0.01	Aliphatic ester
Isoamyl isovalerate	0.01	Aliphatic ester
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.08	Monoterpenic alcohol
Octan-3-yl acetate	0.09	Aliphatic ester
<i>cis</i> -Limonene oxide	0.02	Monoterpenic ether
<i>cis</i> -para-Mentha-2,8-dien-1-ol	0.06	Monoterpenic alcohol
<i>trans</i> -Limonene oxide	0.04	Monoterpenic ether
Camphor	0.02	Monoterpenic ketone
<i>trans</i> -para-Menth-2-en-1-ol	0.02	Monoterpenic alcohol
Isopulegol	0.04	Monoterpenic alcohol
Menthone	0.24	Monoterpenic ketone
Unknown	0.01	Unknown
Menthofuran	tr	Monoterpenic ether
Isomenthone	0.10	Monoterpenic ketone
neo-Menthol	tr	Monoterpenic alcohol
Borneol	0.30	Monoterpenic alcohol
Menthol	0.73	Monoterpenic alcohol
Terpinen-4-ol	0.69	Monoterpenic alcohol
Isomenthol	0.03	Monoterpenic alcohol
para-Cymen-8-ol	0.04	Monoterpenic alcohol
α -Terpineol	0.05	Monoterpenic alcohol
neoiso-Menthol	0.02	Monoterpenic alcohol
neo-Dihydrocarveol	0.41	Monoterpenic alcohol
<i>cis</i> -Dihydrocarvone	1.43	Monoterpenic ketone
<i>cis</i> -Piperitol	0.02	Monoterpenic alcohol
<i>trans</i> -Isopiperitenol	0.05	Monoterpenic alcohol
Methylchavicol	0.08	Phenylpropanoid
Dihydrocarveol	0.18	Monoterpenic alcohol
<i>trans</i> -Dihydrocarvone	0.23	Monoterpenic ketone
<i>trans</i> -Piperitol	0.02	Monoterpenic alcohol
iso-Dihydrocarveol ?	0.05	Monoterpenic alcohol
<i>trans</i> -Carveol	0.41	Monoterpenic alcohol
(3Z)-Hexenyl 2-methylbutyrate	0.02	Aliphatic ester
<i>cis</i> -Carveol	0.20	Monoterpenic alcohol
Carvone	59.18	Monoterpenic ketone
Piperitone	0.18	Monoterpenic ketone
Isopiperitenone	0.05	Monoterpenic ketone
<i>trans</i> -Carvone oxide	0.07	Monoterpenic ketone
Decanol	0.03	Aliphatic alcohol
2-Ethylmenthone?	0.02	Aliphatic ketone
Dihydroedulan I	0.02	Terpenic ether
Menthyl acetate	0.07	Monoterpenic ester
Thymol	0.01	Monoterpenic alcohol
Isomenthyl acetate	0.01	Monoterpenic alcohol
Dihydrocarvyl acetate	0.22	Monoterpenic ester
Bicycloelemene	0.03	Sesquiterpene
<i>trans</i> -Carvyl acetate	0.01	Monoterpenic ester
Menthofuro lactone	0.04	Aliphatic alcohol
iso-Dihydrocarvyl acetate	0.07	Monoterpenic ester
Eugenol	0.04	Phenylpropanoid

<i>cis</i> -Carvyl acetate	0.19	Monoterpenic ester
α -Copaene	0.04	Sesquiterpene
β -Bourbonene	0.96	Sesquiterpene
1,5-diepi- β -Bourbonene	0.06	Sesquiterpene
Unknown	0.02	Unknown
β -Elemene	0.09	Sesquiterpene
(<i>Z</i>)-Jasmone	0.13	Jasmonate
Unknown	0.01	Sesquiterpene
Isocaryophyllene	0.04	Sesquiterpene
β -Ylangene	0.11	Sesquiterpene
β -Caryophyllene	0.68	Sesquiterpene
β -Copaene	0.14	Sesquiterpene
Aromadendrene	0.03	Sesquiterpene
Isogermacrene D	0.11	Sesquiterpene
α -Humulene	0.06	Sesquiterpene
allo-Aromadendrene	0.01	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.38	Sesquiterpene
Unknown	0.08	Sesquiterpene
γ -Murolene	0.02	Sesquiterpene
Germacrene D	0.54	Sesquiterpene
Menthallactone	0.04	Monoterpenic lactone
Viridiflorene	0.03	Sesquiterpene
α -Murolene	0.03	Sesquiterpene
γ -Cadinene	0.02	Sesquiterpene
δ -Cadinene	0.06	Sesquiterpene
α -Cadinene	0.01	Sesquiterpene
1,5-Epoxy-salvial-4(14)-ene	0.01	Sesquiterpenic ether
(<i>E</i>)-Nerolidol	0.01	Sesquiterpenic alcohol
Spathulenol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.03	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Viridiflorol	0.07	Sesquiterpenic alcohol
τ -Murolol	0.01	Sesquiterpenic alcohol
α -Cadinol	0.01	Sesquiterpenic alcohol
meta-Camphorene	0.01	Diterpene
para-Camphorene	0.01	Diterpene
Consolidated total	98.41%	

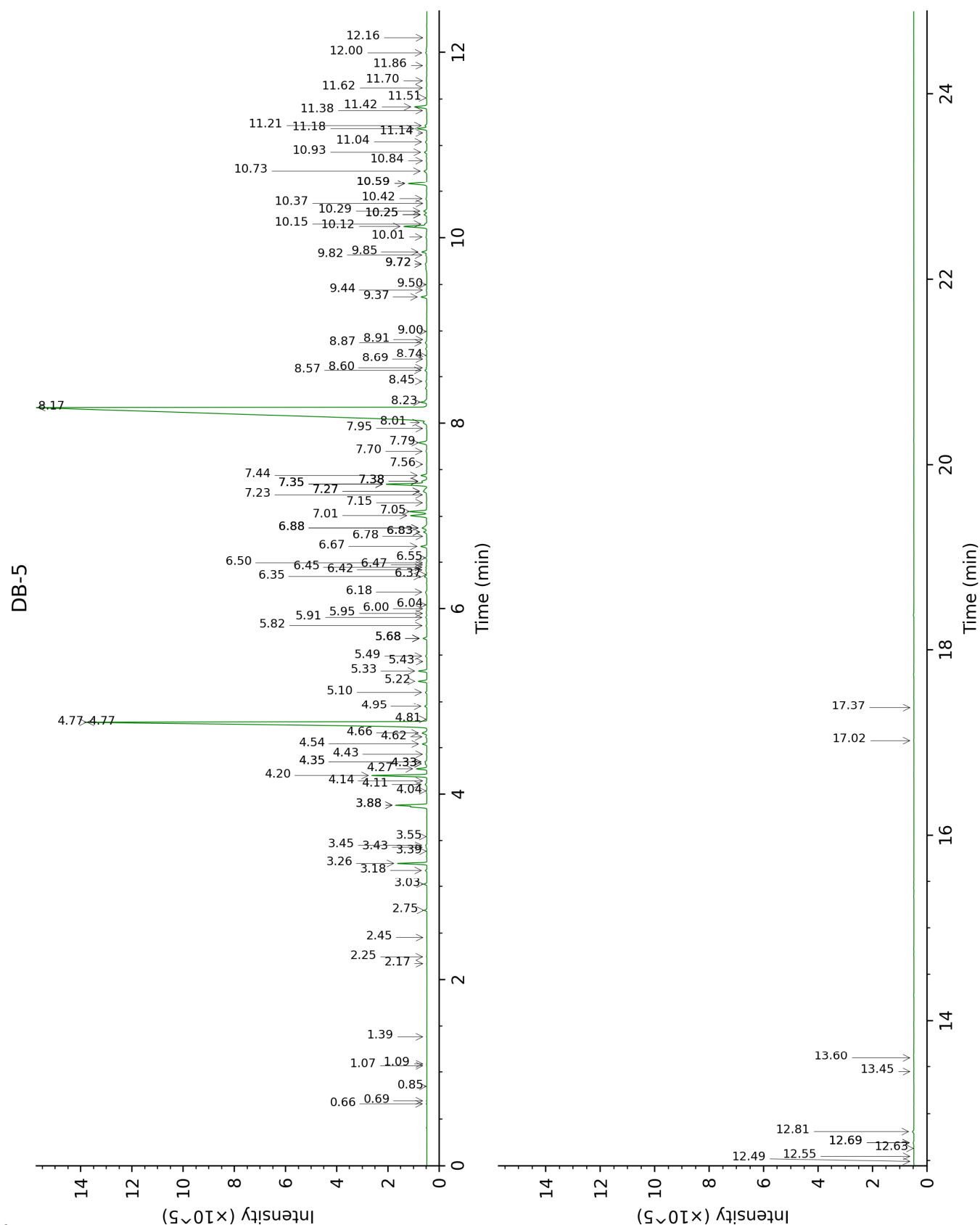
tr: The compound has been detected below 0.005% of total signal.

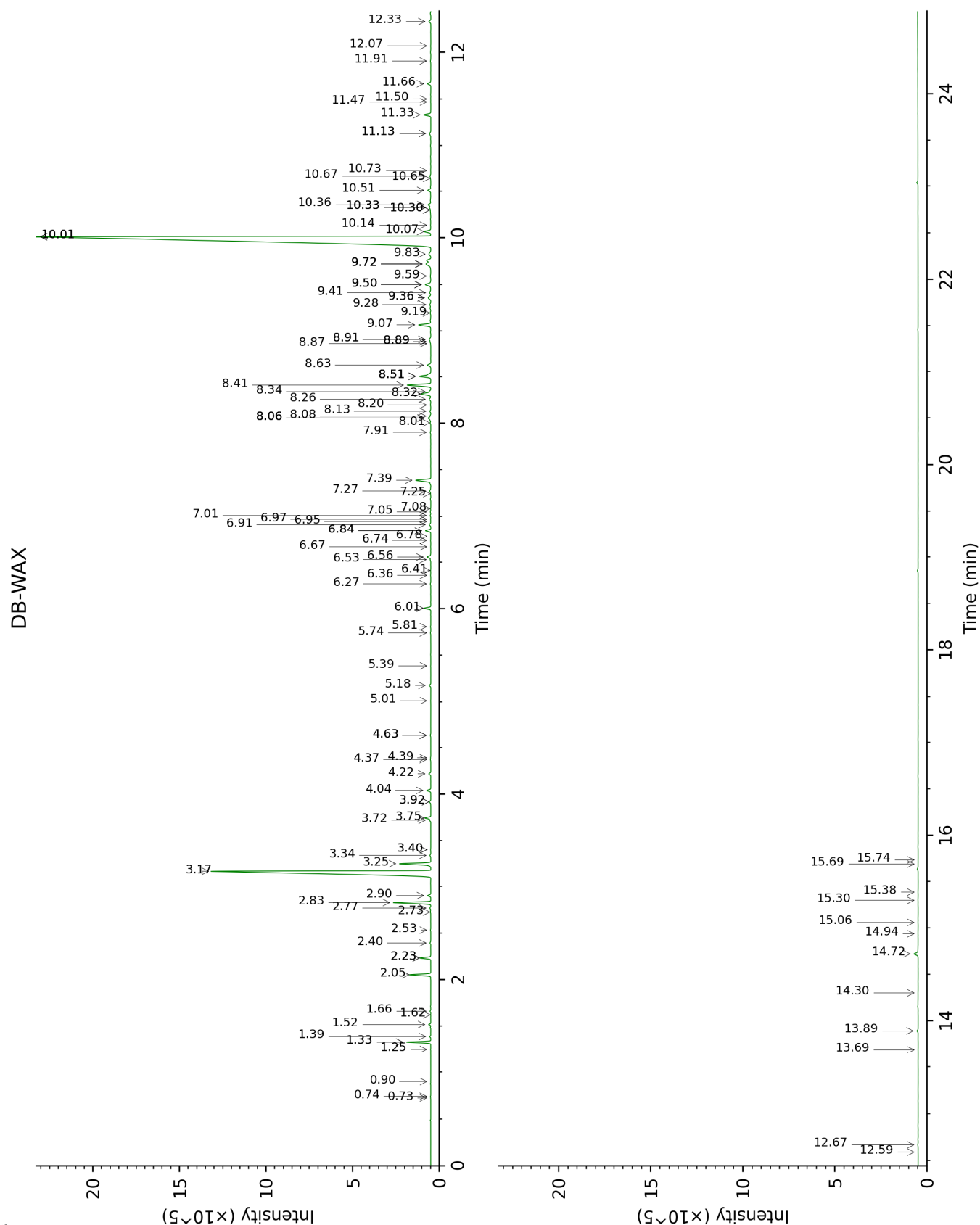
Note: no correction factor was applied

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	%
Isovaleral	0.66	643	0.01	0.74	887	0.01
2-Methylbutyral	0.70	653	tr	0.73	880	0.01
2-Ethylfuran	0.85	702	tr	0.90	918	tr
Isoamyl alcohol	1.07	732	0.01	3.40*	1179	0.02
2-Methylbutanol	1.09	735	0.01	3.40*	1179	[0.02]
Methyl 2-methylbutyrate	1.39	774	0.01	1.25	977	0.01
Ethyl 2-methylbutyrate	2.17	849	0.02	1.62	1022	0.01
(3Z)-Hexenol	2.25	855	0.02	5.74	1350	0.03
Hexanol	2.45	871	0.01	5.39	1325	0.01
trans-2,5-Diethyltetrahydrofuran	2.75	895	0.08	1.52	1012	0.08
Hashishene	3.03	915	0.10	1.33*	990	1.01
α-Thujene	3.18	925	0.05	1.39	999	0.05
α-Pinene	3.26	930	0.91	1.33*	990	[1.01]
trans-3-Methylcyclohexanol	3.39	939	0.01	6.74	1422	0.02
3-Methylcyclohexanone	3.43	941	0.03	4.63*	1271	0.03
Camphene	3.45	943	0.04	1.66	1026	0.04
Thuja-2,4(10)-diene	3.55	949	0.02	2.23*	1084	0.52
β-Pinene	3.88*	971	1.55	2.05	1066	1.03
Sabinene	3.88*	971	[1.55]	2.23*	1084	[0.52]
Octen-3-ol	4.04	981	0.02	6.67	1417	0.01
Octan-3-one	4.11	986	0.07	3.92*	1219	0.10
6-Methyl-5-hepten-2-one	4.14	988	0.01	5.01	1299	0.01
Myrcene	4.20	992	1.87	2.83	1134	1.86
Octan-3-ol	4.27	997	0.36	6.01	1369	0.36
α-Phellandrene	4.33*†	1000	0.14	2.73	1126	0.03
Pseudolimonene	4.33*†	1000	[0.14]	2.77	1129	0.05
Octanal	4.35*†	1002	[0.14]	4.37	1252	0.03
Menthatriene isomer I	4.35*†	1002	[0.14]	3.34	1174	0.05
Δ3-Carene	4.43	1007	0.02	2.53	1110	0.02
α-Terpinene	4.54	1014	0.16	2.90	1140	0.17
Carvomenthene	4.62	1019	0.04	2.40	1099	0.05
para-Cymene	4.66	1021	0.23	4.04	1228	0.22
1,8-Cineole	4.77*	1029	21.83	3.25	1167	1.65
Limonene	4.77*	1029	[21.83]	3.17	1161	20.05
2-Ethylhexanol	4.81	1031	0.02	7.24	1460	0.02
(Z)-β-Ocimene	4.95	1040	0.07	3.72	1204	0.07
(E)-β-Ocimene	5.10	1049	0.05	3.92*	1219	[0.10]
γ-Terpinene	5.22	1057	0.31	3.75	1206	0.32
cis-Sabinene hydrate	5.33	1064	0.30	6.84*	1430	0.30
cis-Linalool oxide (fur.)	5.43	1070	0.01	6.41	1398	0.01
Octanol	5.49	1074	0.05	8.13	1527	0.06
para-Cymenene	5.68*	1086	0.14	6.27	1388	0.03

<i>trans</i> -Linalool oxide (fur.)	5.68*	1086	[0.14]	6.78	1426	0.01
Terpinolene	5.68*	1086	[0.14]	4.22	1241	0.11
<i>trans</i> -Sabinene hydrate	5.82	1095	0.03	7.90	1510	0.04
Linalool	5.91	1100	0.04	8.01	1517	0.04
Nonanal	5.95	1103	0.02	5.81	1355	0.02
2-Methylbutyl 2-methylbutyrate	6.00	1106	0.01	4.39	1253	0.01
Isoamyl isovalerate	6.04	1109	0.01	4.63*	1271	[0.03]
<i>trans</i> -para-Mentha-2,8-dien-1-ol	6.18	1118	0.08	8.91*†	1587	[0.18]
Octan-3-yl acetate	6.35	1129	0.09	5.18	1310	0.09
<i>cis</i> -Limonene oxide	6.37	1130	0.02	6.36	1395	0.02
<i>cis</i> -para-Mentha-2,8-dien-1-ol	6.42	1133	0.06	9.41	1628	0.11
<i>trans</i> -Limonene oxide	6.45	1135	0.04	6.53	1407	0.04
Camphor	6.47	1137	0.02	7.08	1448	0.01
<i>trans</i> -para-Menth-2-en-1-ol	6.50	1138	0.02	8.86	1584	0.01
Isopulegol	6.55	1142	0.04	8.08	1523	0.03
Menthone	6.67	1150	0.24	6.56	1409	0.24
Unknown [m/z 93, 79 (83), 108 (61), 94 (58), 112 (56), 69 (51)...]	6.78	1157	0.01			
Menthofuran	6.83*	1160	0.15	6.84*	1430	[0.30]
Isomenthone	6.83*	1160	[0.15]	6.91	1436	0.10
neo-Menthol	6.88*	1163	0.31	8.51*	1556	0.72
Borneol	6.88*	1163	[0.31]	9.72*†	1652	0.82
Menthol	7.01	1172	0.73	9.07	1600	0.77
Terpinen-4-ol	7.05	1174	0.69	8.51*	1556	[0.72]
Isomenthol	7.15	1180	0.03	8.89*†	1586	0.18
para-Cymen-8-ol	7.23	1186	0.04	11.47	1799	0.01
α-Terpineol	7.27*†	1189	2.47	9.72*†	1652	[0.82]
neoiso-Menthol	7.27*†	1189	[2.47]	9.36*	1623	0.24
neo-Dihydrocarveol	7.35*†	1194	[2.47]	10.07	1681	0.41
<i>cis</i> -Dihydrocarvone	7.35*†	1194	[2.47]	8.41	1549	1.43
<i>cis</i> -Piperitol	7.35*†	1194	[2.47]	9.50*	1635	0.42
<i>trans</i> -Isopiperitenol	7.38*†	1196	[2.47]	10.33*	1702	0.11
Methylchavicol	7.38*†	1196	[2.47]	9.28	1617	0.08
Dihydrocarveol	7.38*†	1196	[2.47]	10.36	1704	0.18
<i>trans</i> -Dihydrocarvone	7.44†	1200	[2.47]	8.63	1565	0.23
<i>trans</i> -Piperitol	7.56	1208	0.02	10.30*	1700	0.05
iso-Dihydrocarveol ?	7.70	1217	0.05	10.67	1731	0.07
<i>trans</i> -Carveol	7.79	1223	0.41	11.33	1787	0.41
(3Z)-Hexenyl 2-methylbutyrate	7.95	1234	0.02	6.97	1440	0.01
<i>cis</i> -Carveol	8.01	1238	0.20	11.66	1816	0.21
Carvone	8.17†	1249	59.79	10.01*	1676	59.21
Piperitone	8.23†	1253	[59.79]	9.83	1661	0.18
Isopiperitenone	8.45	1268	0.05	11.13*	1770	0.11
<i>trans</i> -Carvone oxide	8.57	1277	0.07	11.13*	1770	[0.11]

Decanol	8.60	1278	0.03	10.65	1729	0.01
2-Ethylmenthone?	8.69	1285	0.02			
Dihydroedulan I	8.74	1288	0.02	7.05	1446	0.03
Menthyl acetate	8.87	1298	0.07	8.06*	1521	0.23
Thymol	8.91	1300	0.01	15.06	2134	0.01
Isomenthyl acetate	9.00	1306	0.01	8.20	1532	0.03
Dihydrocarvyl acetate	9.37	1327	0.22	9.36*	1623	[0.24]
Bicycloelemene	9.44	1332	0.03	6.95	1438	0.01
<i>trans</i> -Carvyl acetate	9.50	1336	0.01	10.14	1686	0.02
Menthofuroolactone	9.72*	1352	0.11	11.91	1838	0.04
iso-Dihydrocarvyl acetate	9.72*	1352	[0.11]			
Eugenol	9.82	1359	0.04	14.72	2100	0.28
<i>cis</i> -Carvyl acetate	9.85	1361	0.19	10.51	1718	0.19
α -Copaene	10.01	1373	0.04	7.01	1443	0.04
β -Bourbonene	10.12	1381	0.96	7.39	1471	0.97
1,5-diepi- β -Bourbonene	10.15	1383	0.06	7.27	1462	0.09
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.25*	1390	0.11			
β -Elemene	10.25*	1390	[0.11]	8.34†	1543	[0.77]
(Z)-Jasmone	10.29	1392	0.13	12.33	1875	0.13
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.37	1398	0.01	11.50	1802	0.01
Isocaryophyllene	10.42	1402	0.04	8.06*	1521	[0.23]
β -Ylangene	10.59*	1414	0.79	8.06*	1521	[0.23]
β -Caryophyllene	10.59*	1414	[0.79]	8.32†	1542	0.77
β -Copaene	10.73	1424	0.14	8.26	1537	0.12
Aromadendrene	10.84	1433	0.03	8.51*	1556	[0.72]
Isogermacrene D	10.93	1440	0.11	8.91*†	1587	[0.18]
α -Humulene	11.04	1448	0.06	9.19	1610	0.05
allo-Aromadendrene	11.14	1455	0.01	8.89*†	1586	[0.18]
(E)- β -Farnesene	11.18	1458	0.38	9.50*	1635	[0.42]
Unknown [m/z 161, 105 (56), 91 (50), 93 (36), 119 (33), 79 (31)...204 (5)]	11.22	1461	0.08			
γ -Murolene	11.38	1473	0.02	9.50*	1635	[0.42]
Germacrene D	11.42	1476	0.54	9.72*†	1652	[0.82]
Menthylactone	11.51	1483	0.04	15.74	2202	0.01
Viridiflorene	11.62	1491	0.03	9.59	1642	0.05
α -Murolene	11.70	1497	0.03	10.01*	1676	[59.21]
γ -Cadinene	11.86	1509	0.02	10.30*	1700	[0.05]
δ -Cadinene	12.00	1520	0.06	10.33*	1702	[0.11]
α -Cadinene	12.16	1533	0.01	10.73	1736	0.01
1,5-Epoxysalvial-4(14)-ene	12.49	1559	0.01	12.07	1852	0.01
(E)-Nerolidol	12.55	1563	0.01	13.69	2000	0.01

Spathulenol	12.63	1570	0.01	14.30	2059	0.02
Caryophyllene oxide	12.69*	1575	0.04	12.67	1906	0.03
Caryophyllene oxide isomer	12.69*	1575	[0.04]	12.59	1898	0.01
Viridiflorol	12.81	1584	0.07	13.89	2020	0.06
τ-Murolol	13.45	1636	0.01	14.94	2121	0.02
α-Cadinol	13.60	1648	0.01	15.38	2166	0.01
meta-Camphorene	17.02	1951	0.01	15.30	2158	0.02
para-Camphorene	17.37	1984	0.01	15.69	2198	0.01
Total identified	98.86%			98.39%		
Total reported	98.96%			98.40%		

*: 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