

Date : April 06, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21C19-PTH11


Customer identification : Spearmint ORGANIC - India - S40105205R

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 : Seydou Ka, M. Sc.

Analysis date : March 31, 2021

Checked and approved by :

Sylvain Mercier, M. Sc., chimiste 2014-005

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow liquid

Refractive index: 1.4888 ± 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
Isobutyral	tr	Aliphatic aldehyde
3-Buten-2-one	tr	Aliphatic ketone
Isobutanol	tr	Aliphatic alcohol
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	Aliphatic alcohol
Toluene	tr	Simple phenolic
Methyl 2-methylbutyrate	0.01	Aliphatic ester
Hexanal	tr	Aliphatic aldehyde
Ethyl 2-methylbutyrate	0.01	Aliphatic ester
Ethyl isovalerate	0.01	Aliphatic ester
(3Z)-Hexenol	0.01	Aliphatic alcohol
(2E)-Hexenol	tr	Aliphatic alcohol
Hexanol	tr	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.07	Furan
Hashishene	0.10	Monoterpene
α -Thujene	0.04	Monoterpene
α -Pinene	0.63	Monoterpene
Camphene	0.02	Monoterpene
3-Methylcyclohexanone	0.02	Aliphatic ketone
Thuja-2,4(10)-diene	0.01	Monoterpene
Benzaldehyde	0.01	Simple phenolic
β -Pinene	0.80	Monoterpene
Sabinene	0.48	Monoterpene
Octen-3-one	tr	Aliphatic ketone
Octen-3-ol	0.01	Aliphatic alcohol
Octan-3-one	0.04	Aliphatic ketone
Myrcene	1.71	Monoterpene
Octan-3-ol	0.37	Aliphatic alcohol
α -Phellandrene	0.01	Monoterpene
Pseudolimonene	0.03	Monoterpene
Octanal	0.06	Aliphatic aldehyde
Δ^3 -Carene	tr	Monoterpene
α -Terpinene	0.14	Monoterpene
para-Cymene	0.19	Monoterpene
1,8-Cineole	1.47*	Monoterpenic ether
β -Phellandrene	[1.47]*	Monoterpene
Limonene	17.45	Monoterpene
2-Ethylhexanol	0.01	Aliphatic alcohol
(Z)- β -Ocimene	0.07	Monoterpene
Unknown	0.09	Unknown
(E)- β -Ocimene	0.05	Monoterpene
γ -Terpinene	0.27	Monoterpene

<i>cis</i> -Sabinene hydrate	0.32	Monoterpenic alcohol
Octanol	0.06	Aliphatic alcohol
Terpinolene	0.11	Monoterpene
para-Cymenene	0.03	Monoterpene
<i>trans</i> -Sabinene hydrate	0.04	Monoterpenic alcohol
2-Methylbutyl isovalerate?	0.01	Aliphatic ester
Linalool	0.05	Monoterpenic alcohol
Isoamyl isovalerate	tr	Aliphatic ester
2-Methylbutyl 2-methylbutyrate	0.02	Aliphatic ester
Nonanal	0.02	Aliphatic aldehyde
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.09	Monoterpenic alcohol
<i>cis</i> -Limonene oxide	0.02	Monoterpenic ether
allo-Ocimene	0.01	Monoterpene
Octan-3-yl acetate	0.10	Aliphatic ester
<i>trans</i> -Pinocarveol	0.05	Monoterpenic alcohol
<i>cis</i> -para-Mentha-2,8-dien-1-ol	0.07	Monoterpenic alcohol
<i>trans</i> -Limonene oxide	0.04	Monoterpenic ether
Camphor	0.01	Monoterpenic ketone
<i>cis</i> -Verbenol	0.01	Monoterpenic alcohol
<i>trans</i> -para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
Isopulegol	0.03	Monoterpenic alcohol
Menthone	0.11	Monoterpenic ketone
Menthofuran	0.01	Monoterpenic ether
Isomenthone	0.04	Monoterpenic ketone
Borneol	0.02	Monoterpenic alcohol
neo-Menthol	0.16	Monoterpenic alcohol
Menthol	0.84	Monoterpenic alcohol
Terpinen-4-ol	0.79	Monoterpenic alcohol
Isomenthol	tr	Monoterpenic alcohol
para-Cymen-8-ol	tr	Monoterpenic alcohol
α -Terpineol	0.02	Monoterpenic alcohol
<i>cis</i> -Dihydrocarvone	1.59	Monoterpenic ketone
Myrtenal	0.01	Monoterpenic aldehyde
neo-Dihydrocarveol	0.65	Monoterpenic alcohol
Methylchavicol	0.01	Phenylpropanoid
<i>trans</i> -Dihydrocarvone	0.25	Monoterpenic ketone
Dihydrocarveol	0.22	Monoterpenic alcohol
<i>trans</i> -Piperitol	tr	Monoterpenic alcohol
Decanal	0.01	Aliphatic aldehyde
iso-Dihydrocarveol ?	0.04	Monoterpenic alcohol
<i>trans</i> -Carveol	0.51	Monoterpenic alcohol
(3Z)-Hexenyl 2-methylbutyrate	0.01	Aliphatic ester
Carvone	61.18	Monoterpenic ketone
Piperitone	0.44	Monoterpenic ketone
<i>cis</i> -Carvone oxide	0.01	Monoterpenic ketone
Isopiperitenone	0.06	Monoterpenic ketone
Unknown	0.02	Unknown
<i>trans</i> -Carvone oxide	0.08	Monoterpenic ketone
Decanol	0.03	Aliphatic alcohol
2-Ethylmenthone?	0.01	Aliphatic ketone
Dihydroedulan I	0.02	Terpenic ether
Menthyl acetate	0.10	Monoterpenic ester

Dihydroedulan II	0.01	Terpenic ether
Isomenthyl acetate	0.01	Monoterpenic alcohol
Bicycloelemene analog	tr	Sesquiterpene
Dihydrocarvyl acetate	0.23	Monoterpenic ester
Bicycloelemene	0.03	Sesquiterpene
<i>trans</i> -Carvyl acetate	0.02	Monoterpenic ester
α -Cubebene	0.01	Sesquiterpene
Menthofuroolactone	0.03	Aliphatic alcohol
iso-Dihydrocarvyl acetate	0.03	Monoterpenic ester
<i>cis</i> -Carvyl acetate	0.21	Monoterpenic ester
α -Copaene	0.04	Sesquiterpene
β -Bourbonene	1.15	Sesquiterpene
1,5-diepi- β -Bourbonene	0.11	Sesquiterpene
β -Elemene	0.11	Sesquiterpene
(<i>Z</i>)-Jasmone	0.16	Jasmonate
Unknown	0.01	Sesquiterpene
Isocaryophyllene	0.03	Sesquiterpene
β -Caryophyllene	0.72	Sesquiterpene
β -Ylangene	0.15	Sesquiterpene
β -Copaene	0.18	Sesquiterpene
Isogermacrene D	0.13	Sesquiterpene
α -Humulene	0.07	Sesquiterpene
allo-Aromadendrene	0.02	Sesquiterpene
Unknown	0.04	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.49	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.01	Sesquiterpene
Germacrene D	0.57	Sesquiterpene
Menthylactone	0.03	Monoterpenic lactone
Bicyclogermacrene	0.05	Sesquiterpene
α -Muurolene	0.06	Sesquiterpene
γ -Cadinene	0.02	Sesquiterpene
δ -Cadinene	0.07	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	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.04	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Viridiflorol	0.08	Sesquiterpenic alcohol
Isospathulenol	0.02	Sesquiterpenic alcohol
τ -Cadinol	0.03	Sesquiterpenic alcohol
τ -Muurolol	0.01	Sesquiterpenic alcohol
α -Muurolol	0.02	Sesquiterpenic alcohol
α -Cadinol	0.03	Sesquiterpenic alcohol
Unknown	0.05	Unknown
meta-Camphorene	0.02	Diterpene
para-Camphorene	0.03	Diterpene
Consolidated total	97.73%	

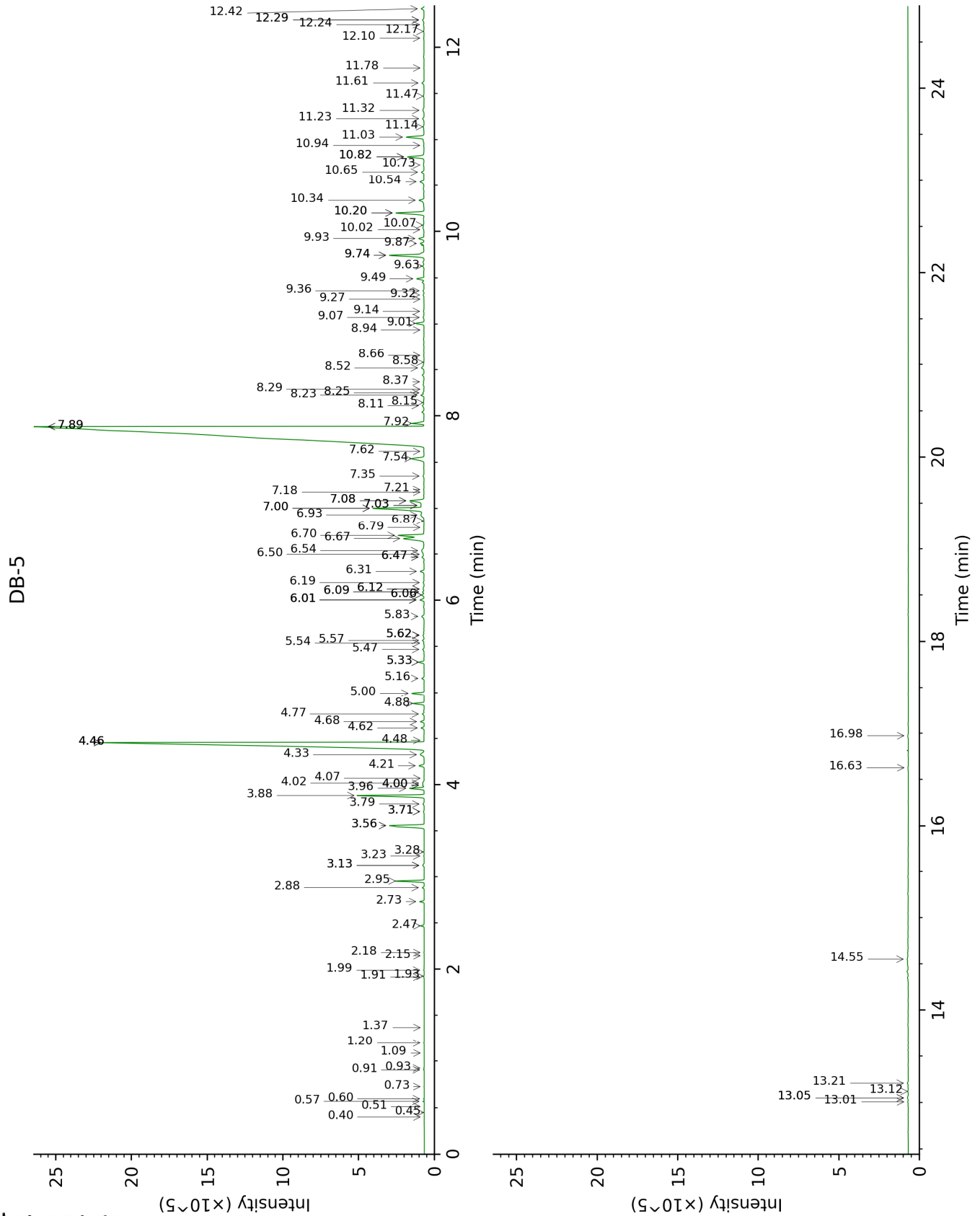
*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total
tr: The compound has been detected below 0.005% of total signal.

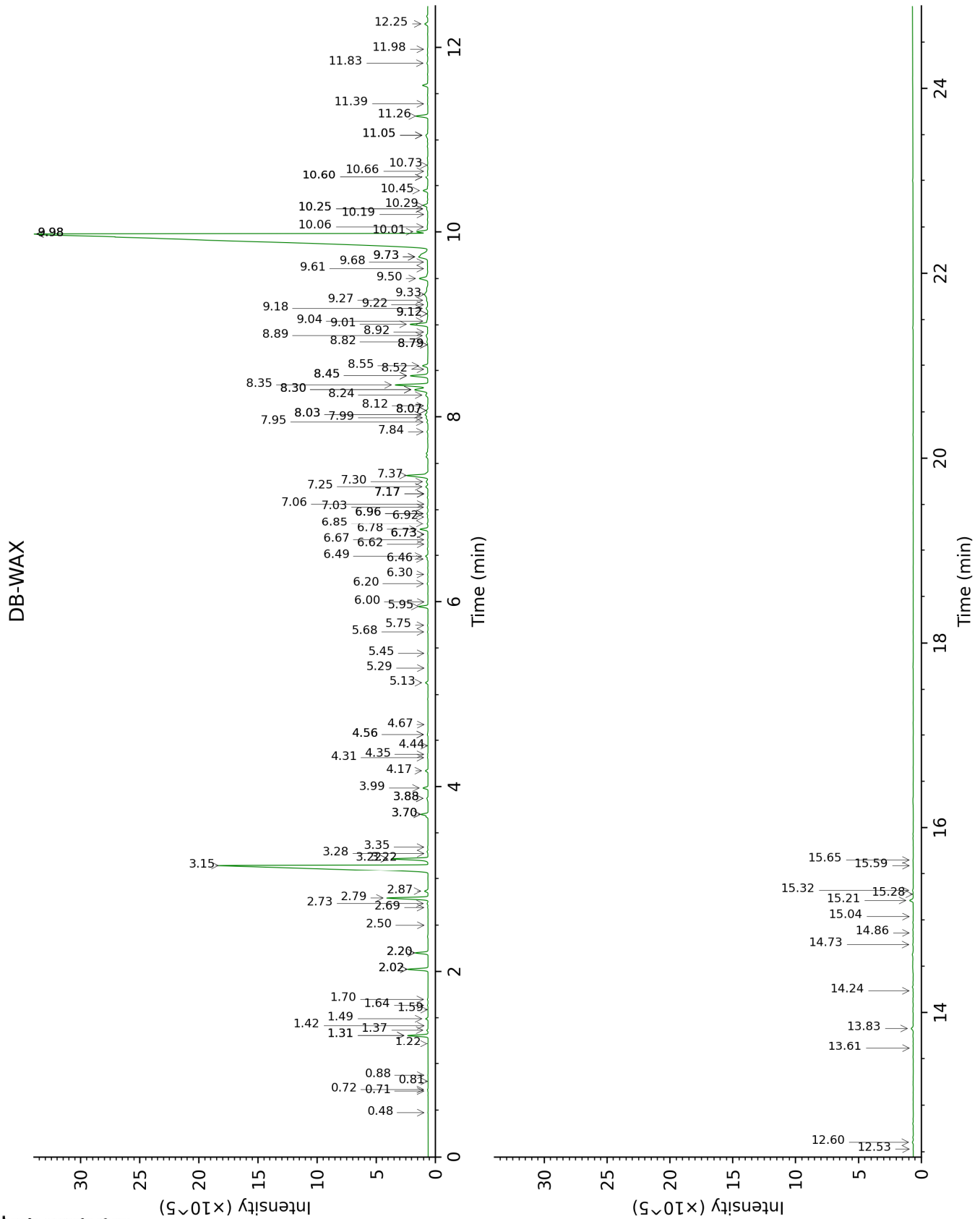
Note: no correction factor was applied

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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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutyral	0.40	536	tr	0.48	785	tr
3-Buten-2-one	0.45	580	tr	0.81	908	tr
Isobutanol	0.51	619	tr	2.02*	1068	0.81
Isovaleral	0.57	640	0.01	0.72	886	0.01
2-Methylbutyral	0.60	651	0.01	0.71	880	0.01
2-Ethylfuran	0.73	701	tr	0.88	919	0.01
Isoamyl alcohol	0.91	730	0.01	3.28	1174	0.01
2-Methylbutanol	0.93	733	0.01	3.35	1179	0.02
Toluene	1.09	758	tr	1.42	1006	tr
Methyl 2-methylbutyrate	1.20	774	0.01	1.22	977	0.01
Hexanal	1.37	800	tr			
Ethyl 2-methylbutyrate	1.91	849	0.01	1.59	1024	0.01
Ethyl isovalerate	1.92	850	0.01	1.70	1035	0.02
(3Z)-Hexenol	1.99	856	0.01	5.68	1350	0.02
(2E)-Hexenol	2.15	869	tr	6.00	1373	0.01
Hexanol	2.18	872	tr	5.29	1321	tr
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.47	897	0.07	1.49	1014	0.08
Hashishene	2.73	916	0.10	1.31*	993	0.73
α -Thujene	2.88	926	0.04	1.37	1002	0.05
α -Pinene	2.95	931	0.63	1.31*	993	[0.73]
Camphene	3.13*	943	0.05	1.64	1028	0.02
3-Methylcyclohexanone	3.13*	943	[0.05]	4.56*	1269	0.03
Thuja-2,4(10)-diene	3.23	950	0.01	2.20*	1086	0.48
Benzaldehyde	3.28	953	0.01	7.17*	1460	0.01
β -Pinene	3.56*	972	1.28	2.02*	1068	[0.81]
Sabinene	3.56*	972	[1.28]	2.20*	1086	[0.48]
Octen-3-one	3.71*	982	0.02	4.44	1260	tr
Octen-3-ol	3.71*	982	[0.02]	6.62	1419	0.01
Octan-3-one	3.79	988	0.04	3.88*	1219	0.07
Myrcene	3.88	994	1.71	2.79	1135	1.69
Octan-3-ol	3.96	999	0.37	5.95	1369	0.37
α -Phellandrene	4.00*	1002	0.04	2.69	1127	0.01
Pseudolimonene	4.00*	1002	[0.04]	2.73	1131	0.03
Octanal	4.02	1003	0.06	4.31	1251	0.02
Δ^3 -Carene	4.07	1006	tr	2.50	1112	tr
α -Terpinene	4.21	1015	0.14	2.87	1141	0.14
para-Cymene	4.33	1023	0.19	3.99	1227	0.20
1,8-Cineole	4.46*	1031	18.92	3.22*	1169	1.49
β -Phellandrene	4.46*	1031	[18.92]	3.22*	1169	[1.49]
Limonene	4.46*	1031	[18.92]	3.15	1164	17.45
2-Ethylhexanol	4.48	1032	0.01	7.17*	1460	[0.01]
(Z)- β -Ocimene	4.62	1041	0.07	3.70*	1206	0.29
Unknown [m/z 57, 73 (44), 43 (26), 115 (25), 55 (14), 97 (8)...]	4.68	1045	0.09			

(E)-β-Ocimene	4.77	1051	0.05	3.88*	1219	[0.07]
γ-Terpinene	4.88	1058	0.27	3.70*	1206	[0.29]
cis-Sabinene hydrate	5.00	1065	0.32	6.78	1431	0.33
Octanol	5.16	1075	0.06	8.07*	1528	0.07
Terpinolene	5.33*	1086	0.13	4.17	1241	0.11
para-Cymenene	5.33*	1086	[0.13]	6.20	1387	0.03
trans-Sabinene hydrate	5.47	1095	0.04	7.84	1510	0.04
2-Methylbutyl isovalerate?	5.54	1100	0.01	4.56*	1269	[0.03]
Linalool	5.57	1101	0.05	7.95	1518	0.04
Isoamyl isovalerate	5.62*	1105	0.04	4.67	1277	tr
2-Methylbutyl 2-methylbutyrate	5.62*	1105	[0.04]	4.35	1253	0.02
Nonanal	5.62*	1105	[0.04]	5.75	1355	0.02
trans-para-Mentha-2,8-dien-1-ol	5.83	1118	0.09	8.89	1592	0.12
cis-Limonene oxide	6.01*	1130	0.12	6.30	1394	0.02
allo-Ocimene	6.01*	1130	[0.12]	5.45	1333	0.01
Octan-3-yl acetate	6.01*	1130	[0.12]	5.13	1310	0.10
trans-Pinocarveol	6.06*	1133	0.07	9.04	1604	0.05
cis-para-Mentha-2,8-dien-1-ol	6.06*	1133	[0.07]	9.27	1623	0.07
trans-Limonene oxide	6.09*	1135	0.04	6.46	1407	0.04
Camphor	6.09*	1135	[0.04]	7.06	1452	0.01
cis-Verbenol	6.12*	1137	0.05	9.12*	1611	0.02
trans-para-Menth-2-en-1-ol	6.12*	1137	[0.05]	8.79*	1584	0.01
Isopulegol	6.19	1142	0.03	8.03*	1525	0.18
Menthone	6.31	1149	0.11	6.49	1409	0.10
Menthofuran	6.47*	1159	0.07	6.73*	1427	0.01
Isomenthone	6.47*	1159	[0.07]	6.85	1435	0.04
Borneol	6.50	1161	0.02	9.61	1650	0.02
neo-Menthol	6.54	1164	0.16	8.45*	1558	0.79
Menthol	6.67	1172	0.84	9.01	1602	0.86
Terpinen-4-ol	6.70	1174	0.79	8.45*	1558	[0.79]
Isomenthol	6.79	1180	tr	8.79*	1584	[0.01]
para-Cymen-8-ol	6.86	1185	tr	11.39	1801	0.02
α-Terpineol	6.93†	1189	2.74	9.68	1656	0.02
cis-Dihydrocarvone	7.00*†	1194	[2.74]	8.35	1550	1.59
Myrtenal	7.00*†	1194	[2.74]	8.52	1563	0.01
neo-Dihydrocarveol	7.03*†	1196	[2.74]	10.01†	1683	[61.94]
Methylchavicol	7.03*†	1196	[2.74]	9.22	1619	0.01
trans-Dihydrocarvone	7.08*†	1199	[2.74]	8.55	1566	0.25
Dihydrocarveol	7.08*†	1199	[2.74]	10.29	1706	0.22
trans-Piperitol	7.18	1205	tr	10.19	1698	0.01
Decanal	7.21	1207	0.01	7.17*	1460	[0.01]
iso-Dihydrocarveol ?	7.35	1217	0.04	10.60*	1733	0.09
trans-Carveol	7.54	1229	0.51	11.26	1789	0.53
(3Z)-Hexenyl 2-methylbutyrate	7.62	1234	0.01	6.92	1441	0.02
Carvone	7.89*†	1252	62.40	9.98*†	1681	61.94

Piperitone	7.89*†	1252	[62.40]	9.74*	1661	1.01
<i>cis</i> -Carvone oxide	7.92†	1255	[62.40]	10.73	1744	0.01
Isopiperitenone	8.11	1268	0.06	11.05*	1772	0.14
Unknown [m/z 82, 109 (35), 135 (22), 127 (19), 54 (16), 43 (14)...]	8.15	1270	0.02			
<i>trans</i> -Carvone oxide	8.23	1275	0.08	11.05*	1772	[0.14]
Decanol	8.25	1277	0.03	10.60*	1733	[0.09]
2-Ethylmenthone?	8.29	1280	0.01			
Dihydroedulan I	8.37	1285	0.02	6.96*	1444	0.04
Menthyl acetate	8.52	1295	0.10	7.99	1522	0.10
Dihydroedulan II	8.58	1299	0.01	7.30	1470	0.10
Isomenthyl acetate	8.66	1304	0.01	8.12	1532	0.02
Bicycloelemene analog	8.94	1324	tr	6.73*	1427	[0.01]
Dihydrocarvyl acetate	9.01	1329	0.23	9.33	1628	0.35
Bicycloelemene	9.07	1334	0.03	6.96*	1444	[0.04]
<i>trans</i> -Carvyl acetate	9.14	1338	0.02	10.06	1687	0.02
α -Cubebene	9.27	1348	0.01	6.67	1422	0.02
Menthofuroolactone	9.32	1351	0.03	11.83	1840	0.04
iso-Dihydrocarvyl acetate	9.36	1354	0.03			
<i>cis</i> -Carvyl acetate	9.49	1363	0.21	10.45	1720	0.21
α -Copaene	9.63	1373	0.04	7.03	1449	0.03
β -Bourbonene	9.74*	1381	1.15	7.37	1475	1.15
1,5-diepi- β -Bourbonene	9.74*	1381	[1.15]	7.25	1466	0.11
β -Elemene	9.87	1390	0.11	8.30*	1546	0.83
(<i>Z</i>)-Jasmone	9.93	1394	0.16	12.25	1877	0.15
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.02	1401	0.01			
Isocaryophyllene	10.07	1404	0.03	8.07*	1528	[0.07]
β -Caryophyllene	10.20*	1414	0.91	8.30*	1546	[0.83]
β -Ylangene	10.20*	1414	[0.91]	8.03*	1525	[0.18]
β -Copaene	10.34	1424	0.18	8.24	1541	0.13
Isogermacrene D	10.54	1440	0.13	8.82	1587	0.06
α -Humulene	10.65	1448	0.07	9.18	1615	0.10
allo-Aromadendrene	10.73	1454	0.02	8.92	1595	0.01
Unknown [m/z 161, 105 (56), 91 (50), 93 (36), 119 (33), 79 (31)...204 (5)]	10.82*	1460	0.53			
(<i>E</i>)- β -Farnesene	10.82*	1460	[0.53]	9.50	1642	0.49
<i>trans</i> -Cadina-1(6),4-diene	10.94	1469	0.01	9.12*	1611	[0.02]
Germacrene D	11.03	1476	0.57	9.74*	1661	[1.01]
Menthylactone	11.14	1484	0.03	15.65	2204	0.02
Bicylogermacrene	11.23	1491	0.05	9.98*†	1681	[61.94]
α -Muulolene	11.32	1498	0.06	9.98*†	1681	[61.94]
γ -Cadinene	11.47	1509	0.02	10.25*	1703	0.07
δ -Cadinene	11.61	1520	0.07	10.25*	1703	[0.07]

α-Cadinene	11.78	1533	0.01	10.66	1738	0.02
1,5-Epoxysalvial-4(14)-ene	12.10	1559	0.01	11.98	1853	0.03
(E)-Nerolidol	12.17	1564	0.01	13.61	2003	tr
Spathulenol	12.24	1570	0.02	14.24	2063	0.01
Caryophyllene oxide	12.30*	1574	0.06	12.60	1909	0.04
Caryophyllene oxide isomer	12.30*	1574	[0.06]	12.53	1902	0.01
Viridiflorol	12.42	1584	0.08	13.83	2024	0.11
Isospathulenol	13.01	1632	0.02	15.28	2167	0.01
τ-Cadinol	13.05*	1635	0.03	14.74	2112	0.03
τ-Muurolol	13.05*	1635	[0.03]	14.86	2125	0.01
α-Muurolol	13.12	1641	0.02	15.04	2142	0.01
α-Cadinol	13.21	1648	0.03	15.32	2171	0.03
Unknown [m/z 95, 139 (69), 55 (65), 81 (55), 108 (51)...]	14.55	1762	0.05			
meta-Camphorene	16.63	1952	0.02	15.21	2160	0.15
para-Camphorene	16.98	1985	0.03	15.59	2198	0.01
Total identified		98.25%			97.65%	
Total reported		98.42%			97.65%	

*: 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