

Date : May 31, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19E22-BUB01-1-SCC

Customer identification : Organic Peppermint Oil - India - Lot# 10004

Type : Essential oil

Source : *Mentha x piperita*

Customer : Buhbli Organics

ANALYSIS

Method: PC-PA-014-17J19 - 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

Analysis date : May 27, 2019

Checked and approved by :

Alexis St-Gelais, M. Sc., chimiste 2013-174

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid

Refractive index: 1.4610 ± 0.0003 (20 °C)

CONCLUSION

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Isovaleral	tr	tr	Aliphatic aldehyde
2-Methylbutyral	tr		Aliphatic aldehyde
Isoamyl alcohol	0.01	0.02*	Aliphatic alcohol
2-Methylbutanol	0.01	[0.02]*	Aliphatic alcohol
Ethyl 2-methylbutyrate	tr	0.01*	Aliphatic ester
(3Z)-Hexenol	0.01	0.01*	Aliphatic alcohol
Hexanol	0.01	0.01	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.03	0.03	Furan
Hashishene	tr	0.72*	Monoterpene
α -Thujene	0.04	0.03	Monoterpene
α -Pinene	0.76	[0.72]*	Monoterpene
3-Methylcyclohexanone	0.04	0.06*	Aliphatic ketone
α -Fenchene	0.04*	[0.01]*	Monoterpene
Camphene	[0.04]*	0.03	Monoterpene
Thuja-2,4(10)-diene	0.01	0.36*	Monoterpene
β -Pinene	1.50*	1.08	Monoterpene
Sabinene	[1.50]*	[0.36]*	Monoterpene
Octen-3-ol	0.05	0.11*	Aliphatic alcohol
Octan-3-one	0.03	0.02	Aliphatic ketone
Myrcene	0.18	0.18	Monoterpene
Octan-3-ol	0.19	0.19	Aliphatic alcohol
α -Phellandrene	0.06*	0.03	Monoterpene
Pseudolimonene	[0.06]*	0.01	Monoterpene
Δ^3 -Carene	tr	tr	Monoterpene
α -Terpinene	0.16	0.16	Monoterpene
para-Cymene	0.23	0.21	Monoterpene
β -Phellandrene	6.99*	4.57*	Monoterpene
1,8-Cineole	[6.99]*	[4.57]*	Monoterpenic ether
Limonene	[6.99]*	2.22	Monoterpene
2-Ethylhexanol	0.05	0.05	Aliphatic alcohol
(Z)- β -Ocimene	0.11	0.10	Monoterpene
(E)- β -Ocimene	0.06	0.05	Monoterpene
γ -Terpinene	0.28	0.30	Monoterpene
<i>cis</i> -Sabinene hydrate	0.22	3.14*	Monoterpenic alcohol
para-Mentha-3,8-diene	0.01	0.01	Monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.02	0.01	Monoterpenic alcohol
Octanol	0.16	0.47*	Aliphatic alcohol
Isoterpinolene	0.02	0.01	Monoterpene
Terpinolene	0.12*	0.10	Monoterpene
para-Cymenene	[0.12]*	0.03	Monoterpene
<i>trans</i> -Sabinene hydrate	0.03	0.04	Monoterpenic alcohol
Isoamyl 2-methylbutyrate	0.16	tr	Aliphatic ester
Linalool	[0.16]	0.13	Monoterpenic alcohol
Nonanal	0.01	0.01	Aliphatic aldehyde
2-Methylbutyl 2-methylbutyrate	0.03	0.04	Aliphatic ester
endo-Fenchol	0.04*	2.99*	Monoterpenic alcohol
Amyl isovalerate	[0.04]*	[0.06]*	Aliphatic ester
Octen-3-yl acetate	0.01	[0.01]*	Aliphatic ester

<i>cis</i> -para-Menth-2-en-1-ol	0.04	6.14*	Monoterpenic alcohol
Octan-3-yl acetate	0.02	0.01	Aliphatic ester
allo-Ocimene	0.02	0.02	Monoterpene
<i>trans</i> -Sabinol	0.03	0.03	Monoterpenic alcohol
neo-Isopulegol	0.21	[0.47]*	Monoterpenic alcohol
Isopulegol	[0.21]	[0.47]*	Monoterpenic alcohol
Menthone	24.07	23.73	Monoterpenic ketone
Isomenthone	7.26*	4.23	Monoterpenic ketone
Menthofuran	[7.26]*	[3.14]*	Monoterpenic ether
Borneol	[7.26]*	1.12*	Monoterpenic alcohol
neo-Menthol	3.94	3.82	Monoterpenic alcohol
δ -Terpineol	0.10	0.12	Monoterpenic alcohol
Terpinen-4-ol	34.68*	0.60	Monoterpenic alcohol
Menthol	[34.68]*	34.00	Monoterpenic alcohol
Isomenthol	0.64*	1.79*	Monoterpenic alcohol
para-Cymen-8-ol	[0.64]*	0.02	Monoterpenic alcohol
α -Terpineol	0.96*	[1.12]*	Monoterpenic alcohol
neoiso-Menthol	[0.96]*	0.56	Monoterpenic alcohol
Myrtenal	[0.96]*	0.03	Monoterpenic aldehyde
Myrtenol	0.01	0.02	Monoterpenic alcohol
Methylchavicol	0.08	0.19	Phenylpropanoid
<i>trans</i> -Isopiperitenol	0.03	0.17*	Monoterpenic alcohol
Unknown	0.02		Unknown
<i>trans</i> -Piperitol	0.03	[0.17]*	Monoterpenic alcohol
Unknown	0.04		Unknown
<i>trans</i> -Carveol	0.02	0.02	Monoterpenic alcohol
<i>cis</i> -Carveol	0.02	0.01	Monoterpenic alcohol
Citronellol	0.03	0.23*	Monoterpenic alcohol
Pulegone	1.18	[1.79]*	Monoterpenic ketone
Carvone	0.10	0.10	Monoterpenic ketone
Piperitone	0.71	0.74	Monoterpenic ketone
Isopiperitenone	0.02	0.02	Monoterpenic ketone
neo-Menthyl acetate	0.53*	0.37	Monoterpenic ester
Decanol	[0.53]*	[0.23]*	Aliphatic alcohol
2-Ethylmenthone?	0.02		Aliphatic ketone
Dihydroedulan I	0.04	0.04	Terpenic ether
Menthyl acetate	6.09	[6.14]*	Monoterpenic ester
Dihydroedulan II	0.01	0.03	Terpenic ether
Isomenthyl acetate	0.22	0.26	Monoterpenic alcohol
Bicycloelemene	0.11	0.12	Sesquiterpene
Piperitenone	0.01	0.01	Monoterpenic ketone
α -Cubebene	0.05*	[0.11]*	Sesquiterpene
Evodone	[0.05]*	0.02	Monoterpenic ketone
Menthofuroolactone	0.04	0.03	Aliphatic alcohol
α -Copaene	0.08	0.07	Sesquiterpene
β -Bourbonene	0.26*	0.23	Sesquiterpene
1,5-diepi- β -Bourbonene	[0.26]*	0.08	Sesquiterpene
β -Elemene	0.13	[2.99]*	Sesquiterpene
Unknown	0.04		Unknown
Unknown	0.05		Sesquiterpene
β -Caryophyllene	3.08	[2.99]*	Sesquiterpene
β -Copaene	0.18	0.10	Sesquiterpene

<i>trans</i> - α -Bergamotene	0.06	[2.99]*	Sesquiterpene
Isogermacrene D	0.06	[1.79]*	Sesquiterpene
α -Humulene	0.27	0.17	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.18	0.17	Sesquiterpene
γ -Muurolene	0.07	0.12*	Sesquiterpene
Germacrene D	0.62	[1.12]	Sesquiterpene
Menthylactone	0.06	0.04	Monoterpenic lactone
Bicyclogermacrene	0.21*	0.12	Sesquiterpene
Viridiflorene	[0.21]*	[0.12]*	Sesquiterpene
α -Muurolene	0.05	0.06	Sesquiterpene
ϵ -Amorphene	0.01	0.02	Sesquiterpene
γ -Cadinene	0.04	[0.17]*	Sesquiterpene
δ -Cadinene	0.10	[0.17]	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.01	0.01	Sesquiterpene
(<i>E</i>)-Nerolidol	0.01	0.02	Sesquiterpenic alcohol
Spathulenol	0.02	0.03	Sesquiterpenic alcohol
Caryophyllene oxide	0.07*	0.06	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.07]*	0.01	Sesquiterpenic ether
Viridiflorol	0.07	0.08	Sesquiterpenic alcohol
Isospathulenol	0.01	0.01	Sesquiterpenic alcohol
τ -Cadinol	0.01	0.01	Sesquiterpenic alcohol
α -Muurolol	0.01	0.02	Sesquiterpenic alcohol
Unknown	0.02	0.05	Sesquiterpenic alcohol
α -Cadinol	0.01	0.01	Sesquiterpenic alcohol
Benzyl benzoate	0.01	0.01	Phenolic ester
Total identified	98.68%	97.63%	

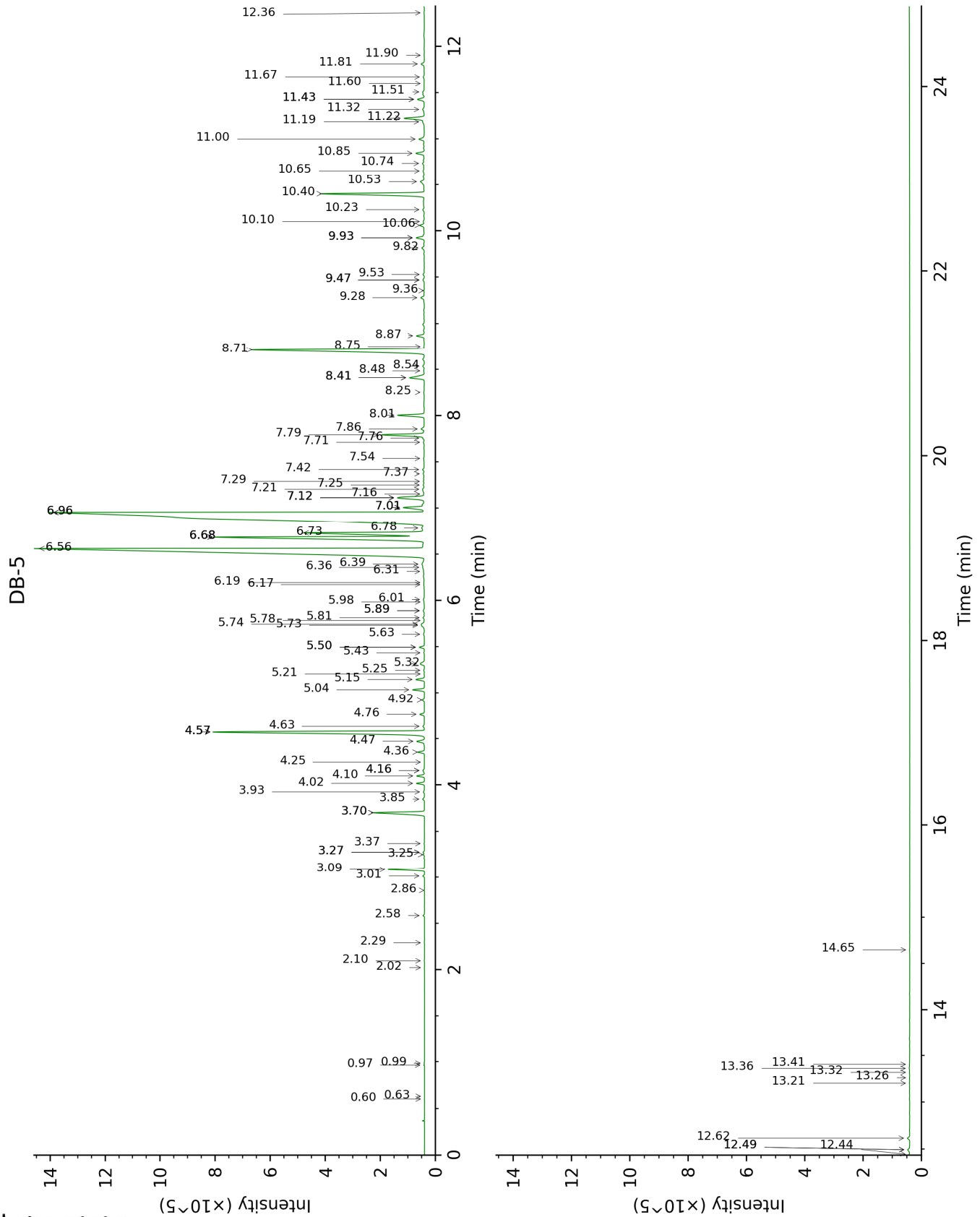
*: Two or more compounds are coeluting on this column

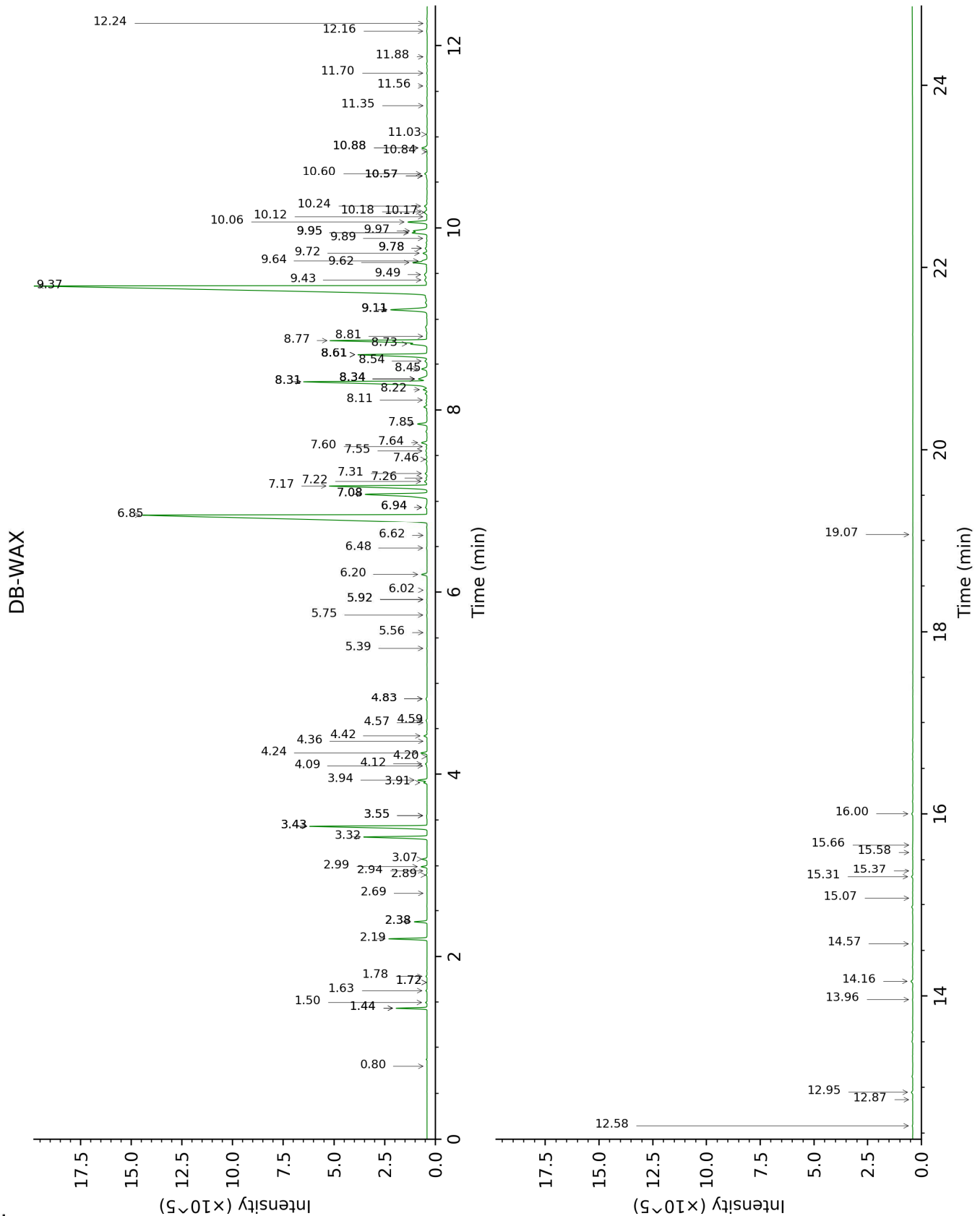
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.60	640	tr	0.80	888	tr
2-Methylbutyral	0.63	651	tr			
Isoamyl alcohol	0.97	734	0.01	3.55*	1178	0.02
2-Methylbutanol	0.99	737	0.01	3.55*	1178	[0.02]
Ethyl 2-methylbutyrate	2.02	850	tr	1.72*	1022	0.01
(3Z)-Hexenol	2.10	856	0.01	5.92*	1347	0.01
Hexanol	2.29	872	0.01	5.56	1321	0.01
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.58	896	0.03	1.63	1013	0.03
Hashishene	2.86	915	tr	1.44*	993	0.72
α -Thujene	3.01	925	0.04	1.50	1001	0.03
α -Pinene	3.09	930	0.76	1.44*	993	[0.72]
3-Methylcyclohexanone	3.25	941	0.04	4.83*	1273	0.06
α -Fenchene	3.28*	942	0.04	1.72*	1022	[0.01]
Camphene	3.28*	942	[0.04]	1.78	1028	0.03
Thuja-2,4(10)-diene	3.37	949	0.01	2.38*	1086	0.36
β -Pinene	3.70*	971	1.50	2.20	1068	1.08
Sabinene	3.70*	971	[1.50]	2.38*	1086	[0.36]
Octen-3-ol	3.85	980	0.05	6.94*†	1421	0.11
Octan-3-one	3.93	986	0.03	4.09	1219	0.02
Myrcene	4.02	992	0.18	2.99	1135	0.18
Octan-3-ol	4.10	997	0.19	6.20	1367	0.19
α -Phellandrene	4.16*	1001	0.06	2.89	1128	0.03
Pseudolimonene	4.16*	1001	[0.06]	2.94	1131	0.01
Δ 3-Carene	4.25	1006	tr	2.69	1112	tr
α -Terpinene	4.36	1013	0.16	3.07	1142	0.16
para-Cymene	4.47	1021	0.23	4.24	1230	0.21
β -Phellandrene	4.57*	1027	6.99	3.43*	1170	4.57
1,8-Cineole	4.57*	1027	[6.99]	3.43*	1170	[4.57]
Limonene	4.57*	1027	[6.99]	3.32	1160	2.22
2-Ethylhexanol	4.63	1031	0.05	7.46	1460	0.05
(Z)- β -Ocimene	4.76	1039	0.11	3.91	1206	0.10
(E)- β -Ocimene	4.92	1049	0.06	4.12	1221	0.05
γ -Terpinene	5.04	1056	0.28	3.94	1208	0.30
<i>cis</i> -Sabinene hydrate	5.15	1063	0.22	7.08*	1432	3.14
para-Mentha-3,8-diene	5.21	1067	0.01	4.20	1227	0.01
<i>cis</i> -Linalool oxide (fur.)	5.25	1069	0.02	6.62	1398	0.01
Octanol	5.32	1074	0.16	8.34*	1526	0.47
Isoterpinolene	5.44	1081	0.02	4.36	1239	0.01
Terpinolene	5.50*	1085	0.12	4.42	1243	0.10
para-Cymenene	5.50*	1085	[0.12]	6.48	1388	0.03
<i>trans</i> -Sabinene hydrate	5.64	1094	0.03	8.11	1509	0.04
Isoamyl 2-methylbutyrate	5.73†	1100	0.16	4.57	1254	tr
Linalool	5.74†	1101	[0.16]	8.22	1518	0.13
Nonanal	5.78	1103	0.01	6.02	1354	0.01

2-Methylbutyl 2-methylbutyrate	5.81	1105	0.03	4.59	1256	0.04
endo-Fenchol	5.89*	1110	0.04	8.61*	1547	2.99
Amyl isovalerate	5.89*	1110	[0.04]	4.83*	1273	[0.06]
Octen-3-yl acetate	5.98	1116	0.01	5.92*	1347	[0.01]
cis-para-Menth-2-en-1-ol	6.01	1118	0.04	8.31*	1524	6.14
Octan-3-yl acetate	6.17	1128	0.02	5.39	1309	0.01
allo-Ocimene	6.19	1130	0.02	5.75	1335	0.02
trans-Sabinol	6.31	1138	0.03	9.89	1648	0.03
neo-Isopulegol	6.36†	1140	0.21	8.34*	1526	[0.47]
Isopulegol	6.39†	1143	[0.21]	8.34*	1526	[0.47]
Menthone	6.56	1154	24.07	6.85	1415	23.73
Isomenthone	6.68*	1162	7.26	7.17	1438	4.23
Menthofuran	6.68*	1162	[7.26]	7.08*	1432	[3.14]
Borneol	6.68*	1162	[7.26]	9.95*†	1654	1.12
neo-Menthol	6.73	1165	3.94	8.77	1560	3.82
δ-Terpineol	6.78	1168	0.10	9.64	1628	0.12
Terpinen-4-ol	6.96*	1180	34.68	8.73	1557	0.60
Menthol	6.96*	1180	[34.68]	9.36	1606	34.00
Isomenthol	7.01*	1183	0.64	9.11*	1586	1.79
para-Cymen-8-ol	7.01*	1183	[0.64]	11.70	1800	0.02
α-Terpineol	7.12*	1190	0.96	9.95*†	1654	[1.12]
neoiso-Menthol	7.12*	1190	[0.96]	9.62	1627	0.56
Myrtenal	7.12*	1190	[0.96]	8.82	1563	0.03
Myrtenol	7.16	1192	0.01	11.03	1743	0.02
Methylchavicol	7.21	1196	0.08	9.49	1616	0.19
trans-Isopiperitenol	7.25	1199	0.03	10.57*†	1704	0.17
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.29	1202	0.02			
trans-Piperitol	7.37	1207	0.03	10.57*†	1704	[0.17]
Unknown [m/z 146, 145 (94), 43 (72), 99 (41), 81 (29), 115 (25), 86 (24)...]	7.42	1210	0.04			
trans-Carveol	7.54	1218	0.02	11.56	1788	0.02
cis-Carveol	7.71	1230	0.02	11.88	1816	0.01
Citronellol	7.76	1233	0.03	10.88*	1731	0.23
Pulegone	7.80	1236	1.18	9.11*	1586	[1.79]
Carvone	7.86	1240	0.10	10.17	1672	0.10
Piperitone	8.01	1250	0.71	10.06	1663	0.74
Isopiperitenone	8.25	1267	0.02	11.34	1770	0.02
neo-Menthyl acetate	8.41*	1278	0.53	7.85	1489	0.37
Decanol	8.41*	1278	[0.53]	10.88*	1731	[0.23]
2-Ethylmenthone?	8.48	1284	0.02			
Dihydroedulan I	8.54	1287	0.04	7.26	1445	0.04
Menthyl acetate	8.71	1299	6.09	8.31*	1524	[6.14]
Dihydroedulan II	8.75	1302	0.01	7.60	1470	0.03
Isomenthyl acetate	8.87	1306	0.22	8.45	1535	0.26
Bicycloelemene	9.28	1335	0.11	7.22	1442	0.12

Piperitenone	9.36	1340	0.01	12.24	1848	0.01
α -Cubebene	9.47*	1348	0.05	6.94*†	1421	[0.11]
Evodone	9.47*	1348	[0.05]	12.58	1878	0.02
Menthofuro lactone	9.53	1352	0.04	12.16	1841	0.03
α -Copaene	9.82	1373	0.08	7.31	1448	0.07
β -Bourbonene	9.93*	1380	0.26	7.64	1474	0.23
1,5-diepi- β -Bourbonene	9.93*	1380	[0.26]	7.55	1467	0.08
β -Elemene	10.06	1390	0.13	8.61*	1547	[2.99]
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.10	1393	0.04			
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.23	1402	0.05			
β -Caryophyllene	10.40	1415	3.08	8.61*	1547	[2.99]
β -Copaene	10.53	1425	0.18	8.54	1542	0.10
<i>trans</i> - α -Bergamotene	10.65	1434	0.06	8.61*	1547	[2.99]
Isogermacrene D	10.74	1440	0.06	9.11*	1586	[1.79]
α -Humulene	10.85	1448	0.27	9.43	1612	0.17
(<i>E</i>)- β -Farnesene	11.00	1459	0.18	9.72	1635	0.17
γ -Muurolole	11.19	1473	0.07	9.78*†	1640	0.12
Germacrene D	11.22	1476	0.62	9.97†	1655	[1.12]
Menthylactone	11.32	1483	0.06	16.00	2206	0.04
Bicyclogermacrene	11.43*	1491	0.21	10.24	1677	0.12
Viridiflorene	11.43*	1491	[0.21]	9.78*†	1640	[0.12]
α -Muurolole	11.51	1497	0.05	10.18	1672	0.06
ϵ -Amorphene	11.60	1504	0.01	10.12	1668	0.02
γ -Cadinene	11.67	1510	0.04	10.57*†	1704	[0.17]
δ -Cadinene	11.81	1521	0.10	10.60†	1707	[0.17]
<i>trans</i> -Cadina-1,4-diene	11.90	1528	0.01	10.84	1727	0.01
(<i>E</i>)-Nerolidol	12.36	1564	0.01	13.96	2005	0.02
Spathulenol	12.44	1570	0.02	14.57	2064	0.03
Caryophyllene oxide	12.49*	1574	0.07	12.95	1911	0.06
Caryophyllene oxide isomer	12.49*	1574	[0.07]	12.86	1904	0.01
Viridiflorol	12.62	1584	0.07	14.16	2024	0.08
Isospathulenol	13.20	1632	0.01	15.58	2163	0.01
τ -Cadinol	13.26	1637	0.01	15.07	2112	0.01
α -Muurolol	13.32	1642	0.01	15.37	2142	0.02
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)]	13.36	1645	0.02	15.31	2136	0.05
α -Cadinol	13.41	1649	0.01	15.66	2171	0.01
Benzyl benzoate	14.65	1754	0.01	19.06	2538	0.01
Total identified		98.68%			97.63%	
Total reported		98.86%			97.68%	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken account in the identified 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