Date : February 23, 2018

Certificate of Analysis - GC Profiling

Sample identification

Internal code : 18B20-PLG4-1-CC
Customer identification : Peppermint
Type : Essential oil
Source : *Mentha x piperita*
Customer : Plant Guru

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 : Sarah-Eve Tremblay, M. Sc. A., Chimiste
Analysis date : February 23, 2018

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4600 ± 0.0003 (20 °C)

CONCLUSION

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

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ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Isobutanol	tr	tr	Aliphatic alcohol
Isovaleral	0.01	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.01	0.01	Aliphatic alcohol
2-Methylbutanol	0.01	0.01	Aliphatic alcohol
Toluene	tr	0.03*	Simple phenolic
Octane	tr		Alkane
Ethyl 2-methylbutyrate	0.01	tr	Aliphatic ester
(3*Z*)-Hexenol	0.01	0.02	Aliphatic alcohol
Hexanol	0.01	0.01	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.02	0.02	Furan
Nonane	tr		Alkane
α-Thujene	0.03	[0.03]*	Monoterpene
α-Pinene	0.49	0.50	Monoterpene
3-Methylcyclohexanone	0.02	0.02*	Aliphatic ketone
Camphene	0.02	0.02	Monoterpene
Thuja-2,4(10)-diene	tr	0.28*	Monoterpene
β-Pinene	0.99*	0.72	Monoterpene
Sabinene	[0.99]*	[0.28]*	Monoterpene
trans-2-para-Menthene	0.01		Monoterpene
Octen-3-ol	0.06*	0.08	Aliphatic alcohol
Hexahydroacetophenone epimer I	[0.06]*		Aliphatic ketone
Hexahydroacetophenone epimer II	[0.06]*		Aliphatic ketone
Octan-3-one	0.02	0.04*	Aliphatic ketone
Myrcene	0.13	0.12	Monoterpene
Octan-3-ol	0.15*	0.12	Aliphatic alcohol
α-Phellandrene	[0.15]*	0.02	Monoterpene
Δ3-Carene	tr	tr	Monoterpene
α-Terpinene	0.12	0.12	Monoterpene
para-Cymene	0.14	0.15*	Monoterpene
1,8-Cineole	6.13*	4.48*	Monoterpenic ether
β-Phellandrene	[6.13]*	[4.48]*	Monoterpene
Limonene	[6.13]*	1.70	Monoterpene
2-Ethylhexanol	0.01	0.01	Aliphatic alcohol
(*Z*)-β-Ocimene	0.11	0.11	Monoterpene
(*E*)-β-Ocimene	0.04	[0.04]*	Monoterpene
γ-Terpinene	0.24	0.25	Monoterpene
cis-Sabinene hydrate	0.32*	2.29*	Monoterpenic alcohol
para-Mentha-3,8-diene	[0.32]*	[0.15]*	Monoterpene
cis-Linalool oxide (fur.)	0.01	0.01	Monoterpenic alcohol
Octanol	0.07	0.05	Aliphatic alcohol
Terpinolene	0.08	0.08	Monoterpene
para-Cymenene	0.01	0.02	Monoterpene
trans-Sabinene hydrate	0.04	0.03	Monoterpenic alcohol
2-Methylbutyl isovalerate?	0.02	[0.02]*	Aliphatic ester
Linalool	0.17	0.16	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.01	0.03	Aliphatic ester
Amyl isovalerate	0.03	0.03	Aliphatic ester

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cis-para-Menth-2-en-1-ol	0.04	0.13*	Monoterpenic alcohol
Octan-3-yl acetate	0.01	0.01	Aliphatic ester
Camphor	0.02	0.04	Monoterpenic ketone
Isopulegol	0.17	[0.13]*	Monoterpenic alcohol
Menthone	23.12	23.11	Monoterpenic ketone
Isomenthone	5.50*	3.60	Monoterpenic ketone
Menthofuran	[5.50]*	[2.29]*	Monoterpenic ether
Borneol	3.29*	1.15*	Monoterpenic alcohol
neo-Menthol	[3.29]*	3.71*	Monoterpenic alcohol
Menthol	43.90*	43.32	Monoterpenic alcohol
Terpinen-4-ol	[43.90]*	[3.71]*	Monoterpenic alcohol
Isomenthol	0.68	[3.71]*	Monoterpenic alcohol
α-Terpineol	0.19	[1.15]*	Monoterpenic alcohol
neoiso-Menthol	0.32	0.21	Monoterpenic alcohol
Methylchavicol	0.02	0.15*	Phenylpropanoid
trans-Isopiperitenol	0.01	[0.15]*	Monoterpenic alcohol
trans-Piperitol	0.01	[0.15]*	Monoterpenic alcohol
Unknown	0.03		Unknown
Pulegone	1.15	1.64*	Monoterpenic ketone
Carvone	0.11	0.16*	Monoterpenic ketone
Piperitone	0.52	0.53	Monoterpenic ketone
neo-Menthyl acetate	0.22	0.21	Monoterpenic ester
Decanol	0.07	0.10	Aliphatic alcohol
2-Ethylmenthone?	0.08		Aliphatic ketone
Dihydroedulan I	0.04	0.04	Terpenic ether
Menthyl acetate	4.88	4.99	Monoterpenic ester
Dihydroedulan II	0.01	0.03	Terpenic ether
Isomenthyl acetate	0.20	0.17	Monoterpenic alcohol
Bicycloelemene	0.03	0.04	Sesquiterpene
Piperitenone	0.01	0.01	Monoterpenic ketone
α-Cubebene	0.02	0.02	Sesquiterpene
Eugenol	0.06*	0.01	Phenylpropanoid
Menthofurolactone	[0.06]*	0.03	Aliphatic alcohol
α-Copaene	0.04	0.04	Sesquiterpene
β-Bourbonene	0.20	0.19	Sesquiterpene
1,5-diepi-β-Bourbonene	0.01	0.02	Sesquiterpene
β-Elemene	0.09	2.13*	Sesquiterpene
Isocaryophyllene	0.04		Sesquiterpene
β-Caryophyllene	2.16	[2.13]*	Sesquiterpene
β-Copaene	0.07	0.05	Sesquiterpene
Isogermacrene D	0.02	[1.64]*	Sesquiterpene
α-Humulene	0.17	0.09	Sesquiterpene
(*E*)-β-Farnesene	0.22*	0.11*	Sesquiterpene
9-epi-β-Caryophyllene	[0.22]*	[0.15]*	Sesquiterpene
γ-Muurolene	0.03	[0.11]*	Sesquiterpene
Germacrene D	0.84	[1.15]*	Sesquiterpene
Menthalactone	0.23*	0.04	Monoterpenic lactone
Bicyclogermacrene	[0.23]*	0.12	Sesquiterpene
Viridiflorene	0.02	0.03	Sesquiterpene
5-Methyl-2,4-diisopropylphenol	0.04	0.01	Terpene derivative
ε-Amorphene	0.01	[0.16]*	Sesquiterpene
γ-Cadinene	0.04	0.15	Sesquiterpene

δ-Cadinene	0.10	[0.15]*	Sesquiterpene
7α-Hydroxymintlactone	0.01		Monoterpenic alcohol
(*E*)-Nerolidol	0.02	0.02	Sesquiterpenic alcohol
Spathulenol	0.04	0.03	Sesquiterpenic alcohol
Caryophyllene oxide	0.07*	0.07	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.07]*	0.02	Sesquiterpenic ether
Viridiflorol	0.12	0.12	Sesquiterpenic alcohol
Isospathulenol	0.02	0.03*	Sesquiterpenic alcohol
τ-Cadinol	0.02	0.01	Sesquiterpenic alcohol
α-Cadinol	0.01	[0.03]*	Sesquiterpenic alcohol
Total identified	**98.84%**	**98.22%**	

*: 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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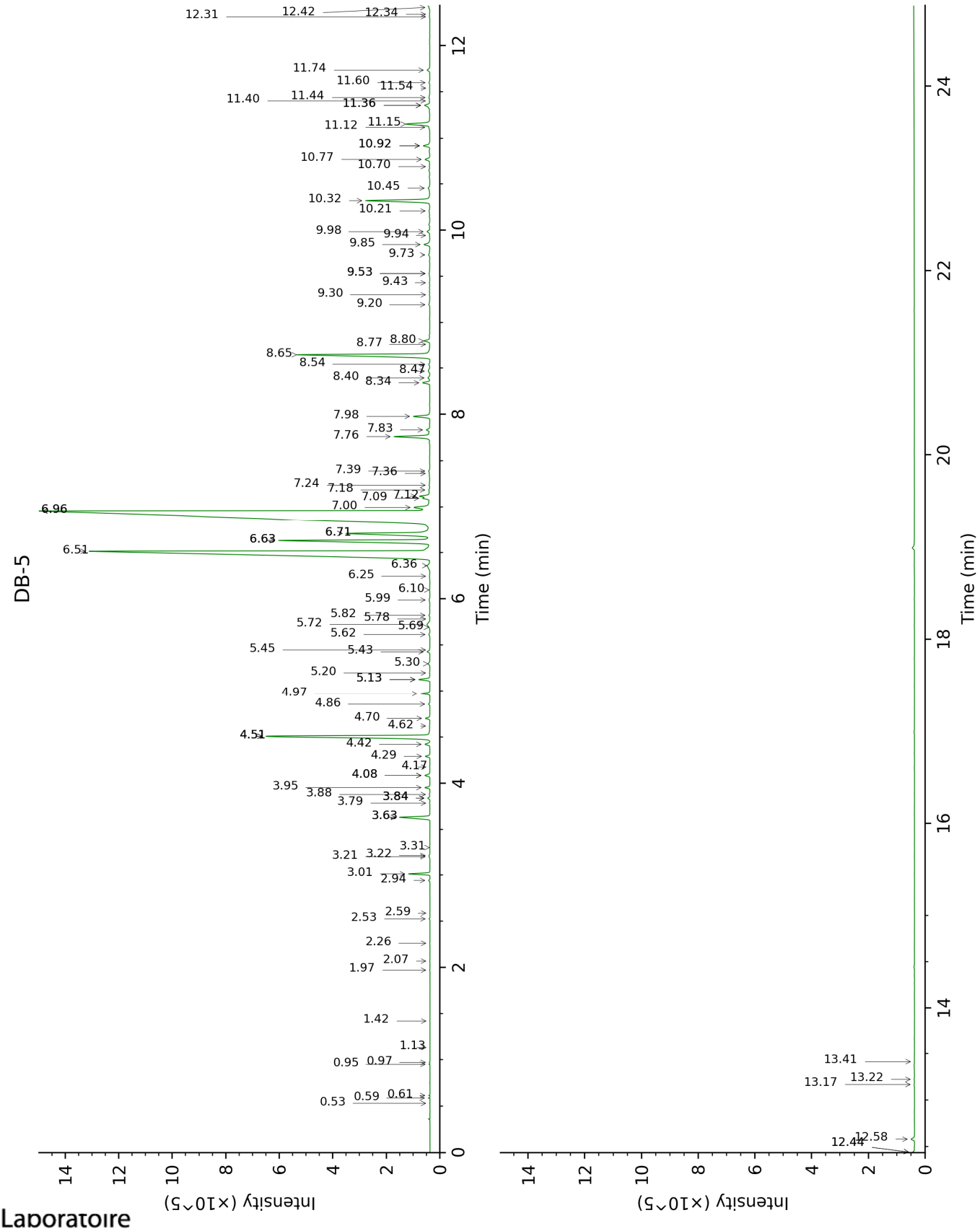
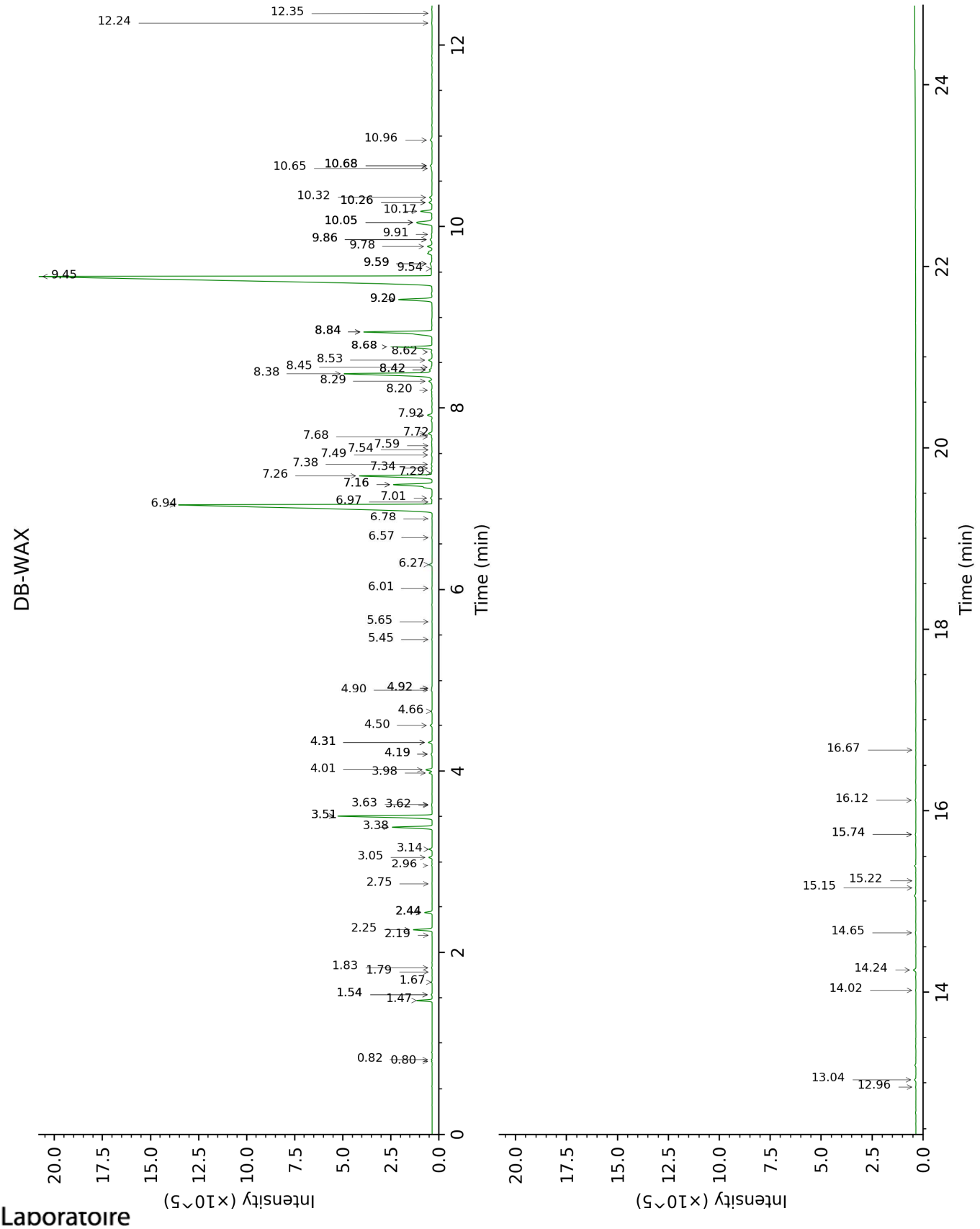

DB-5
Intensity (×10^5)
Time (min)
12.31
12.42
12.34
11.74
11.60
11.54
11.40
11.44
11.36
11.12
11.15
10.92
10.77
10.70
10.45
10.32
10.21
9.98
9.94
9.85
9.73
9.53
9.43
9.30
9.20
8.77
8.80
8.65
8.54
8.47
8.40
8.34
7.98
7.83
7.76
7.39
7.36
7.24
7.18
7.09
7.12
7.00
6.96
6.71
6.63
6.51
6.36
6.25
6.10
5.99
5.82
5.78
5.72
5.69
5.62
5.45
5.43
5.30
5.20
5.13
4.97
4.86
4.70
4.62
4.51
4.42
4.29
4.17
4.08
3.95
3.88
3.84
3.79
3.63
3.31
3.21
3.22
3.01
2.94
2.59
2.53
2.26
2.07
1.97
1.42
1.13
0.95
0.97
0.59
0.61
0.53
13.41
13.17
13.22
12.58
12.44


DB-WAX
Time (min)
Intensity (×10^5)
12.35
12.24
10.96
10.65
10.68
10.32
10.26
10.17
10.05
9.91
9.86
9.78
9.59
9.54
9.45
9.20
8.84
8.68
8.62
8.53
8.45
8.42
8.38
8.29
8.20
7.92
7.72
7.68
7.59
7.54
7.49
7.38
7.34
7.29
7.26
7.16
7.01
6.97
6.94
6.78
6.57
6.27
6.01
5.65
5.45
4.92
4.90
4.66
4.50
4.31
4.19
4.01
3.98
3.63
3.62
3.51
3.38
3.14
3.05
2.96
2.75
2.44
2.25
2.19
1.83
1.79
1.67
1.54
1.47
0.82
0.80
16.67
16.12
15.74
15.22
15.15
14.65
14.24
14.02
13.04
12.96

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutanol	0.53	618	tr	2.19	1063	tr
Isovaleral	0.59	638	0.01	0.82	886	0.02
2-Methylbutyral	0.62	648	0.01	0.80	878	0.01
Isoamyl alcohol	0.95	727	0.01	3.63	1178	0.01
2-Methylbutanol	0.97	730	0.01	3.62	1178	0.01
Toluene	1.13	753	tr	1.54*	1002	0.03
Octane	1.42	796	tr			
Ethyl 2-methylbutyrate	1.97	844	0.01	1.79	1025	tr
(3*Z*)-Hexenol	2.07	852	0.01	6.01	1349	0.02
Hexanol	2.26	869	0.01	5.65	1322	0.01
trans-2,5-Diethyltetrahydrofuran	2.53	891	0.02	1.67	1015	0.02
Nonane	2.59	896	tr			
α-Thujene	2.94	920	0.03	1.54*	1002	[0.03]
α-Pinene	3.01	925	0.49	1.47	995	0.50
3-Methylcyclohexanone	3.21	938	0.02	4.92*	1271	0.02
Camphene	3.22	939	0.02	1.83	1030	0.02
Thuja-2,4(10)-diene	3.30	945	tr	2.44*	1086	0.28
β-Pinene	3.63*	966	0.99	2.25	1069	0.72
Sabinene	3.63*	966	[0.99]	2.44*	1086	[0.28]
trans-2-para-Menthene	3.78	977	0.01			
Octen-3-ol	3.84*	980	0.06	7.01	1421	0.08
Hexahydroacetophenone epimer I	3.84*	980	[0.06]			
Hexahydroacetophenone epimer II	3.84*	980	[0.06]			
Octan-3-one	3.88	983	0.02	4.19*	1219	0.04
Myrcene	3.95	988	0.13	3.05	1134	0.12
Octan-3-ol	4.08*	996	0.15	6.27	1367	0.12
α-Phellandrene	4.08*	996	[0.15]	2.96	1127	0.02
Δ3-Carene	4.18	1002	tr	2.75	1112	tr
α-Terpinene	4.29	1010	0.12	3.14	1141	0.12
para-Cymene	4.42	1018	0.14	4.31*	1228	0.15
1,8-Cineole	4.51*	1023	6.13	3.51*	1169	4.48
β-Phellandrene	4.51*	1023	[6.13]	3.51*	1169	[4.48]
Limonene	4.51*	1023	[6.13]	3.38	1160	1.70
2-Ethylhexanol	4.62	1030	0.01	7.54	1460	0.01
(*Z*)-β-Ocimene	4.70	1035	0.11	3.98	1204	0.11
(*E*)-β-Ocimene	4.86	1045	0.04	4.19*	1219	[0.04]
γ-Terpinene	4.97	1052	0.24	4.01	1207	0.25
cis-Sabinene hydrate	5.13*	1062	0.32	7.16*	1432	2.29
para-Mentha-3,8-diene	5.13*	1062	[0.32]	4.31*	1228	[0.15]
cis-Linalool oxide (fur.)	5.20	1067	0.01	6.78	1404	0.01
Octanol	5.30	1073	0.07	8.45	1528	0.05
Terpinolene	5.43	1081	0.08	4.50	1241	0.08
para-Cymenene	5.45	1082	0.01	6.57	1388	0.02
trans-Sabinene hydrate	5.62	1093	0.04	8.20	1509	0.03
2-Methylbutyl	5.69	1098	0.02	4.92*	1271	[0.02]

isovalerate?						
Linalool	5.72	1100	0.17	8.30	1516	0.16
2-Methylbutyl 2-methylbutyrate	5.78	1103	0.01	4.66	1252	0.03
Amyl isovalerate	5.82	1106	0.03	4.90	1269	0.03
cis-para-Menth-2-en-1-ol	5.99	1116	0.04	8.42*	1526	0.13
Octan-3-yl acetate	6.10	1123	0.01	5.45	1309	0.01
Camphor	6.24	1133	0.02	7.49	1456	0.04
Isopulegol	6.36	1140	0.17	8.42*	1526	[0.13]
Menthone	6.52	1150	23.12	6.94	1415	23.11
Isomenthone	6.63*	1157	5.50	7.26	1439	3.60
Menthofuran	6.63*	1157	[5.50]	7.16*	1432	[2.29]
Borneol	6.71*	1162	3.29	10.05*	1654	1.15
neo-Menthol	6.71*	1162	[3.29]	8.84*	1558	3.71
Menthol	6.96*	1178	43.90	9.45	1606	43.32
Terpinen-4-ol	6.96*	1178	[43.90]	8.84*	1558	[3.71]
Isomenthol	7.00	1181	0.68	8.84*	1558	[3.71]
α-Terpineol	7.10	1187	0.19	10.05*	1654	[1.15]
neoiso-Menthol	7.12	1188	0.32	9.78	1632	0.21
Methylchavicol	7.18	1193	0.02	9.59*	1617	0.15
trans-Isopiperitenol	7.24	1196	0.01	10.68*†	1705	[0.15]
trans-Piperitol	7.36	1204	0.01	10.68*†	1705	[0.15]
Unknown [m/z 146, 145 (94), 43 (72), 99 (41), 81 (29), 115 (25), 86 (24)...]	7.39	1206	0.03			
Pulegone	7.76	1231	1.15	9.20*	1586	1.64
Carvone	7.83	1236	0.11	10.26*	1671	0.16
Piperitone	7.98	1246	0.52	10.17	1664	0.53
neo-Menthyl acetate	8.34	1270	0.22	7.92	1488	0.21
Decanol	8.40	1273	0.07	10.96	1729	0.10
2-Ethylmenthone?	8.47	1278	0.08			
Dihydroedulan I	8.54	1283	0.04	7.34	1445	0.04
Menthyl acetate	8.65	1290	4.88	8.38	1523	4.99
Dihydroedulan II	8.77	1298	0.01	7.68	1470	0.03
Isomenthyl acetate	8.80	1300	0.20	8.53	1534	0.17
Bicycloelemene	9.20	1328	0.03	7.29	1441	0.04
Piperitenone	9.30	1336	0.01	12.35	1849	0.01
α-Cubebene	9.43	1345	0.02	6.97	1418	0.02
Eugenol	9.53*	1352	0.06	15.15	2110	0.01
Menthofurolactone	9.53*	1352	[0.06]	12.24	1839	0.03
α-Copaene	9.73	1366	0.04	7.38	1448	0.04
β-Bourbonene	9.84	1374	0.20	7.72	1473	0.19
1,5-diepi-β-Bourbonene	9.94	1381	0.01	7.59	1463	0.02
β-Elemene	9.98	1384	0.09	8.68*	1546	2.13
Isocaryophyllene	10.21	1399	0.04			
β-Caryophyllene	10.32	1408	2.16	8.68*	1546	[2.13]
β-Copaene	10.45	1418	0.07	8.62	1541	0.05
Isogermacrene D	10.70	1435	0.02	9.20*	1586	[1.64]
α-Humulene	10.77	1441	0.17	9.54	1613	0.09
(*E*)-β-Farnesene	10.92*	1452	0.22	9.86*	1639	0.11
9-epi-β-Caryophyllene	10.92*	1452	[0.22]	9.59*	1617	[0.15]
γ-Muurolene	11.12	1467	0.03	9.86*	1639	[0.11]

Germacrene D	11.15	1470	0.84	10.05*	1654	[1.15]
Menthalactone	11.36*	1485	0.23	16.12	2207	0.04
Bicyclogermacrene	11.36*	1485	[0.23]	10.32	1676	0.12
Viridiflorene	11.40	1488	0.02	9.92	1643	0.03
5-Methyl-2,4-diisopropylphenol	11.44	1491	0.04	16.67	2264	0.01
ε-Amorphene	11.54	1498	0.01	10.26*	1671	[0.16]
γ-Cadinene	11.60	1503	0.04	10.65†	1703	0.15
δ-Cadinene	11.74	1514	0.10	10.68*†	1705	[0.15]
7α-Hydroxymintlactone	12.31	1559	0.01			
(*E*)-Nerolidol	12.34	1561	0.02	14.02	2001	0.02
Spathulenol	12.42	1567	0.04	14.65	2061	0.03
Caryophyllene oxide	12.44*	1568	0.07	13.04	1910	0.07
Caryophyllene oxide isomer	12.44*	1568	[0.07]	12.96	1902	0.02
Viridiflorol	12.58	1580	0.12	14.24	2022	0.12
Isospathulenol	13.17	1627	0.02	15.74*	2169	0.03
τ-Cadinol	13.22	1632	0.02	15.22	2117	0.01
α-Cadinol	13.42	1647	0.01	15.74*	2169	[0.03]
Total identified		**98.84%**			**98.22%**	
Total reported		**98.87%**			**98.22%**	

*: 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