Date : May 04, 2021

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 21D20-ORA01
Customer identification : Peppermint - India - 3 years - B634024
Type : Essential oil
Source : *Mentha x piperita*
Customer : Organic Aromas Inc.

Analysis

Method: PC-MAT-014 ISO - 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 04, 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

Méthode certifiée ISO 17025:2017 Certified method

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.4604 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

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

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Analysis summary – Consolidated contents

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

Identification	%	Class
Isobutanol	tr	Aliphatic alcohol
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
Ethyl 2-methylbutyrate	tr	Aliphatic ester
(3*Z*)-Hexenol	tr	Aliphatic alcohol
Hexanol	tr	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.01	Furan
Hashishene	tr	Monoterpene
α-Thujene	0.02	Monoterpene
α-Pinene	0.79	Monoterpene
trans-3-Methylcyclohexanol	0.03	Aliphatic alcohol
α-Fenchene	0.01	Monoterpene
Camphene	0.04	Monoterpene
3-Methylcyclohexanone	0.06	Aliphatic ketone
Thuja-2,4(10)-diene	0.01	Monoterpene
β-Pinene	1.23	Monoterpene
Sabinene	0.40	Monoterpene
Octen-3-ol	0.03	Aliphatic alcohol
cis-Carane	0.01	Monoterpene
Octan-3-one	0.02	Aliphatic ketone
Myrcene	0.16	Monoterpene
Octan-3-ol	0.11	Aliphatic alcohol
α-Phellandrene	0.02	Monoterpene
Pseudolimonene	0.03	Monoterpene
Δ3-Carene	0.01	Monoterpene
α-Terpinene	0.10	Monoterpene
para-Cymene	0.24	Monoterpene
Limonene	2.76	Monoterpene
1,8-Cineole	5.71	Monoterpenic ether
2-Ethylhexanol	0.02	Aliphatic alcohol
(*Z*)-β-Ocimene	0.08	Monoterpene
(*E*)-β-Ocimene	0.04	Monoterpene
γ-Terpinene	0.14	Monoterpene
cis-Sabinene hydrate	0.15	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.03	Aliphatic alcohol
Terpinolene	0.06	Monoterpene
para-Cymenene	0.02	Monoterpene
trans-Sabinene hydrate	0.02	Monoterpenic alcohol
Linalool	0.12	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.02	Aliphatic ester
Amyl isovalerate	0.02	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.03	Monoterpenic alcohol

Octan-3-yl acetate	0.01	Aliphatic ester
trans-β-Dihydroterpineol	0.03	Monoterpenic alcohol
trans-Sabinol	0.01	Monoterpenic alcohol
cis-α-Dihydroterpineol	0.03	Monoterpenic alcohol
Isopulegol	0.14	Monoterpenic alcohol
para-Menthan-4-ol isomer	0.10	Monoterpenic alcohol
Menthone	22.72	Monoterpenic ketone
Menthofuran	1.81	Monoterpenic ether
Isomenthone	3.75	Monoterpenic ketone
δ-Terpineol	0.03	Monoterpenic alcohol
neo-Menthol	3.12	Monoterpenic alcohol
Terpinen-4-ol	0.32	Monoterpenic alcohol
Menthol	41.16	Monoterpenic alcohol
Isomenthol	0.48	Monoterpenic alcohol
para-Cymen-8-ol	0.07	Monoterpenic alcohol
α-Terpineol	0.55	Monoterpenic alcohol
neoiso-Menthol	0.45	Monoterpenic alcohol
cis-Piperitol	0.05	Monoterpenic alcohol
Myrtenol	0.02	Monoterpenic alcohol
Methylchavicol	0.04	Phenylpropanoid
Unknown	0.03	Unknown
trans-Piperitol	0.03	Monoterpenic alcohol
iso-Dihydrocarveol ?	0.01	Monoterpenic alcohol
trans-Carveol	tr	Monoterpenic alcohol
(3*Z*)-Hexenyl 2-methylbutyrate	0.02	Aliphatic ester
Citronellol	0.02	Monoterpenic alcohol
Pulegone	0.99	Monoterpenic ketone
Carvone	0.08	Monoterpenic ketone
Piperitone	0.36	Monoterpenic ketone
Isopiperitenone	0.01	Monoterpenic ketone
neo-Menthyl acetate	0.18	Monoterpenic ester
Decanol	0.05	Aliphatic alcohol
2-Ethylmenthone?	0.03	Aliphatic ketone
Dihydroedulan I	0.03	Terpenic ether
Thymol	0.02	Monoterpenic alcohol
Dihydroedulan II	0.04	Terpenic ether
Menthyl acetate	5.08	Monoterpenic ester
Isomenthyl acetate	0.09	Monoterpenic alcohol
neoiso-Menthyl acetate?	0.01	Monoterpenic ester
Bicycloelemene	0.09	Sesquiterpene
Piperitenone	0.02	Monoterpenic ketone
α-Cubebene	0.02	Sesquiterpene
Evodone	0.03	Monoterpenic ketone
Menthofurolactone	0.02	Aliphatic alcohol
α-Ylangene	0.02	Sesquiterpene
α-Copaene	0.05	Sesquiterpene
β-Bourbonene	0.16	Sesquiterpene
1,5-diepi-β-Bourbonene	0.01	Sesquiterpene
β-Cubebene	0.02	Sesquiterpene
β-Elemene	0.06	Sesquiterpene
Unknown	0.03	Unknown
Unknown	0.02	Sesquiterpene

Isocaryophyllene	0.03	Sesquiterpene
β-Caryophyllene	2.60	Sesquiterpene
Unknown	0.02	Unknown
β-Copaene	0.04	Sesquiterpene
trans-α-Bergamotene	0.01	Sesquiterpene
Isogermacrene D	0.03	Sesquiterpene
α-Humulene	0.11	Sesquiterpene
Muurola-4,11-diene	0.02	Sesquiterpene
(*E*)-β-Farnesene	0.08	Sesquiterpene
9-epi-β-Caryophyllene	0.03	Sesquiterpene
γ-Muurolene	0.02	Sesquiterpene
Germacrene D	0.38	Sesquiterpene
Menthalactone	0.03	Monoterpenic lactone
Viridiflorene	0.03	Sesquiterpene
Bicyclogermacrene	0.07	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
δ-Cadinene	0.01	Sesquiterpene
trans-Calamenene	0.01	Sesquiterpene
Spathulenol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Caryophyllene oxide	0.07	Sesquiterpenic ether
Viridiflorol	0.04	Sesquiterpenic alcohol
Unknown	0.01	Unknown
Consolidated total	**98.81%**	

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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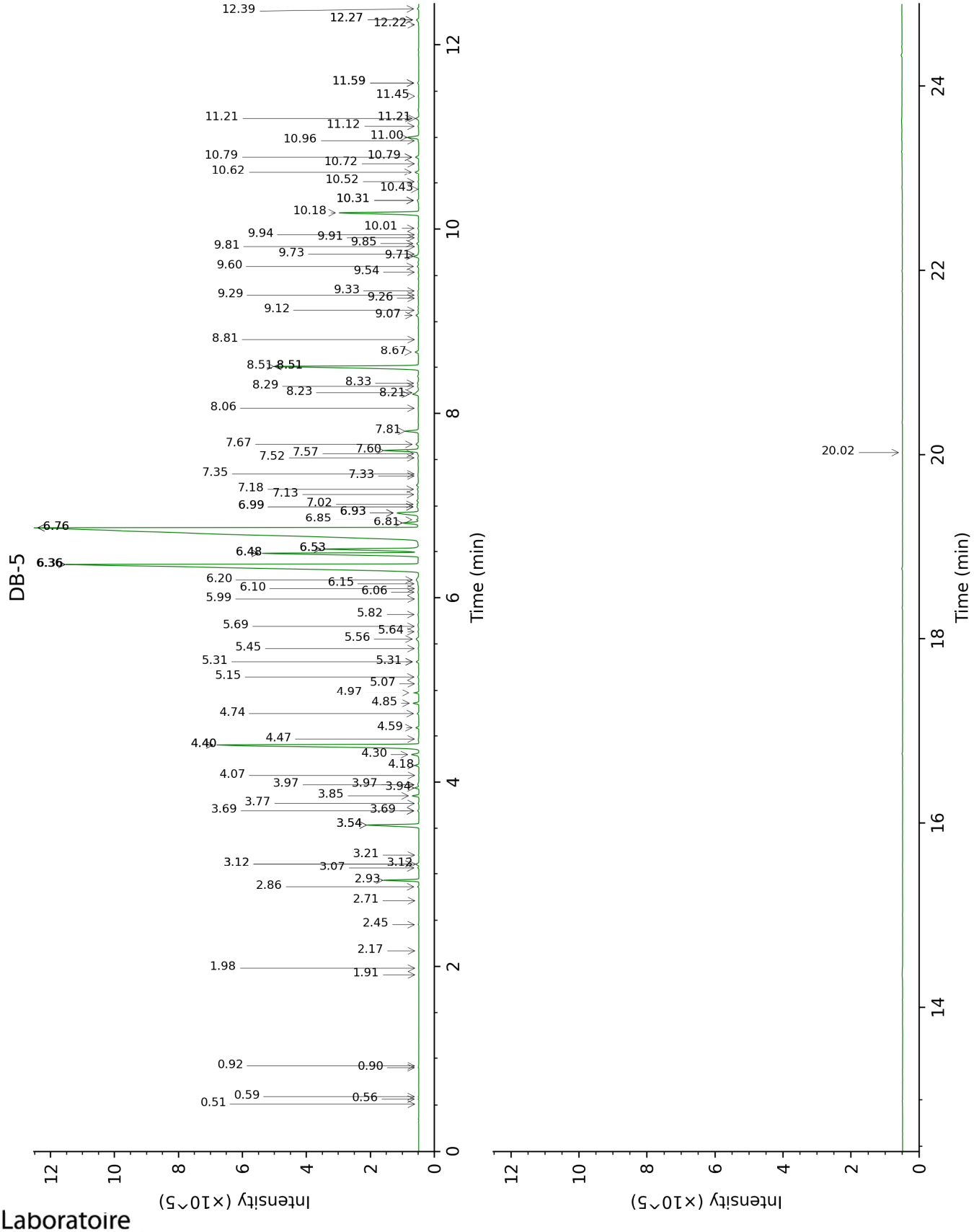
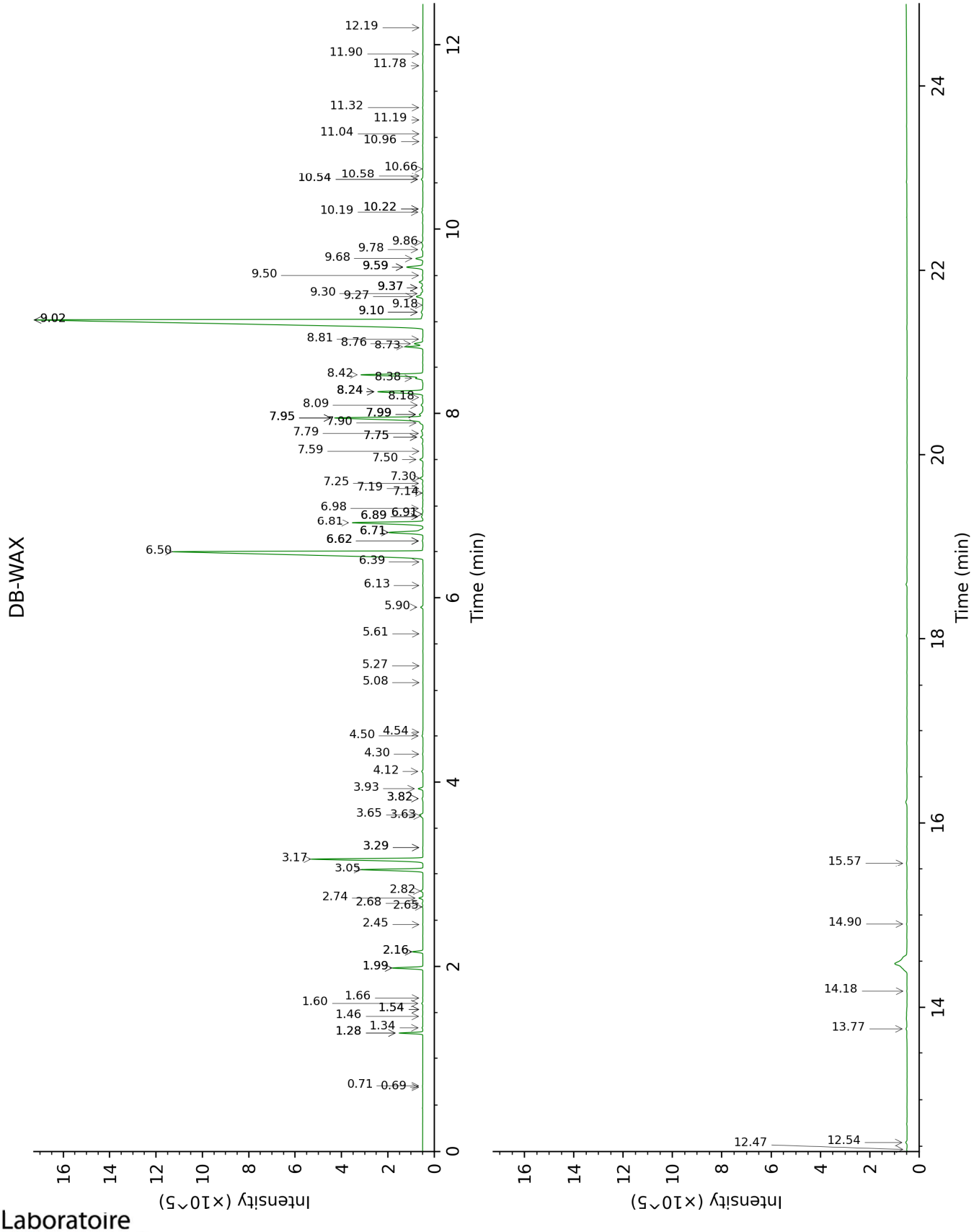

DB-5
Intensity (×10^5)
Time (min)
12.39
12.27
12.22
11.59
11.45
11.21
11.12
11.21
10.96
11.00
10.79
10.72
10.79
10.62
10.52
10.43
10.31
10.18
10.01
9.94
9.91
9.85
9.81
9.73
9.71
9.60
9.54
9.29
9.33
9.26
9.12
9.07
8.81
8.67
8.51
8.51
8.29
8.33
8.23
8.21
8.06
7.81
7.67
7.60
7.52
7.57
7.35
7.33
7.18
7.13
6.99
7.02
6.93
6.85
6.81
6.76
6.48
6.53
6.36
6.20
6.10
6.15
6.06
5.99
5.82
5.69
5.64
5.56
5.45
5.31
5.31
5.15
5.07
4.97
4.85
4.74
4.59
4.47
4.40
4.30
4.18
4.07
3.97
3.97
3.94
3.85
3.77
3.69
3.69
3.54
3.21
3.12
3.07
3.12
2.93
2.86
2.71
2.45
2.17
1.98
1.91
0.92
0.90
0.59
0.51
0.56
20.02


DB-WAX
Time (min)
Intensity (×10^5)
12.19
11.90
11.78
11.32
11.19
11.04
10.96
10.66
10.58
10.54
10.22
10.19
9.86
9.78
9.68
9.59
9.50
9.37
9.30
9.27
9.18
9.10
9.02
8.81
8.76
8.73
8.42
8.38
8.24
8.18
8.09
7.99
7.95
7.90
7.79
7.75
7.59
7.50
7.30
7.25
7.19
7.14
6.98
6.91
6.89
6.81
6.71
6.62
6.50
6.39
6.13
5.90
5.61
5.27
5.08
4.54
4.50
4.30
4.12
3.93
3.82
3.65
3.63
3.29
3.17
3.05
2.82
2.74
2.68
2.65
2.45
2.16
1.99
1.66
1.60
1.54
1.46
1.34
1.28
0.71
0.69
15.57
14.90
14.18
13.77
12.54
12.47

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutanol	0.51	618	tr	1.98*	1066	1.23
Isovaleral	0.56	639	0.01	0.71	887	0.01
2-Methylbutyral	0.59	650	tr	0.69	880	tr
Isoamyl alcohol	0.90	731	0.01	3.29*	1178	0.01
2-Methylbutanol	0.92	734	tr	3.29*	1178	[0.01]
Ethyl 2-methylbutyrate	1.91	850	tr	1.54*	1021	0.01
(3*Z*)-Hexenol	1.98	856	tr	5.61	1348	0.01
Hexanol	2.17	873	tr	5.27	1323	0.01
trans-2,5-Diethyltetrahydrofuran	2.45	897	0.01	1.46	1013	0.02
Hashishene	2.71	916	tr	1.28*	992	0.80
α-Thujene	2.86	927	0.02	1.34	1001	0.03
α-Pinene	2.93	931	0.79	1.28*	992	[0.80]
trans-3-Methylcyclohexanol	3.07	940	0.03	6.62*	1421	0.05
α-Fenchene	3.12*	944	0.09	1.54*	1021	[0.01]
Camphene	3.12*	944	[0.09]	1.60	1027	0.04
3-Methylcyclohexanone	3.12*	944	[0.09]	4.50	1269	0.06
Thuja-2,4(10)-diene	3.21	950	0.01	2.16*	1084	0.41
β-Pinene	3.54*	972	1.64	1.98*	1066	[1.23]
Sabinene	3.54*	972	[1.64]	2.16*	1084	[0.41]
Octen-3-ol	3.69*	983	0.04	6.62*	1421	[0.05]
cis-Carane	3.69*	983	[0.04]	1.66	1033	0.01
Octan-3-one	3.77	988	0.02	3.82*	1219	0.05
Myrcene	3.85	994	0.16	2.74	1133	0.16
Octan-3-ol	3.94	999	0.11	5.90	1369	0.11
α-Phellandrene	3.97*†	1002	0.05	2.64	1126	0.02
Pseudolimonene	3.97*†	1002	[0.05]	2.68	1129	0.03
Δ3-Carene	4.07	1008	0.01	2.45	1111	0.01
α-Terpinene	4.18	1015	0.10	2.82	1140	0.10
para-Cymene	4.30	1022	0.24	3.93	1227	0.22
Limonene	4.40*	1029	8.45	3.05	1158	2.76
1,8-Cineole	4.40*	1029	[8.45]	3.17	1168	5.71
2-Ethylhexanol	4.47	1033	0.02	7.14	1460	0.02
(*Z*)-β-Ocimene	4.59	1041	0.08	3.64	1205	0.08
(*E*)-β-Ocimene	4.74	1051	0.04	3.82*	1219	[0.05]
γ-Terpinene	4.85	1058	0.14	3.65	1206	0.16
cis-Sabinene hydrate	4.97	1065	0.15	6.71*†	1428	1.99
cis-Linalool oxide (fur.)	5.07	1072	0.01	6.39	1404	0.02
Octanol	5.15	1076	0.03	7.99*	1525	0.23
Terpinolene	5.31*	1086	0.07	4.12	1241	0.06
para-Cymenene	5.31*	1086	[0.07]	6.14	1386	0.02
trans-Sabinene hydrate	5.45	1096	0.02	7.75*	1506	0.12
Linalool	5.56	1102	0.12	7.90	1518	0.12
2-Methylbutyl 2-methylbutyrate	5.64	1107	0.02	4.30	1254	0.03

Amyl isovalerate	5.69	1111	0.02	4.54	1272	0.02
cis-para-Menth-2-en-1-ol	5.82	1119	0.03	7.95*	1522	5.27
Octan-3-yl acetate	5.99	1130	0.01	5.08	1309	0.01
trans-β-Dihydroterpineol	6.06	1135	0.03	7.79	1509	0.03
trans-Sabinol	6.10	1137	0.01	9.59*	1652	0.94
cis-α-Dihydroterpineol	6.15	1140	0.03	7.99*	1525	[0.23]
Isopulegol	6.20	1143	0.14	7.99*	1525	[0.23]
para-Menthan-4-ol isomer	6.36*	1154	22.82	7.75*	1506	[0.12]
Menthone	6.36*	1154	[22.82]	6.50	1412	22.72
Menthofuran	6.48*	1162	5.56	6.71*†	1428	[1.99]
Isomenthone	6.48*	1162	[5.56]	6.81	1436	3.75
δ-Terpineol	6.53*	1165	3.15	9.30†	1629	[0.48]
neo-Menthol	6.53*	1165	[3.15]	8.42	1559	3.12
Terpinen-4-ol	6.76*	1179	41.87	8.38	1556	0.32
Menthol	6.76*	1179	[41.87]	9.02*	1606	41.19
Isomenthol	6.81	1183	0.48	8.76	1586	0.44
para-Cymen-8-ol	6.85	1185	0.07	11.32	1798	0.02
α-Terpineol	6.93*	1190	0.89	9.59*	1652	[0.94]
neoiso-Menthol	6.93*	1190	[0.89]	9.27†	1626	0.48
cis-Piperitol	6.99*	1194	0.06	9.37*	1634	0.12
Myrtenol	6.99*	1194	[0.06]	10.66	1742	0.02
Methylchavicol	7.02	1196	0.04	9.10*	1612	0.14
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.13	1203	0.03			
trans-Piperitol	7.18	1207	0.03	10.22*	1704	0.04
iso-Dihydrocarveol ?	7.33	1216	0.01	10.58	1734	0.01
trans-Carveol	7.35	1218	tr	11.19	1787	0.01
(3*Z*)-Hexenyl 2-methylbutyrate	7.52	1230	0.02	6.91*	1444	0.04
Citronellol	7.57	1232	0.02	10.54*	1731	0.08
Pulegone	7.60	1235	0.99	8.73	1582	1.03
Carvone	7.67	1239	0.08	9.78	1668	0.08
Piperitone	7.81	1249	0.36	9.68	1660	0.37
Isopiperitenone	8.06	1266	0.01	10.96	1767	0.01
neo-Menthyl acetate	8.21	1276	0.18	7.50	1488	0.16
Decanol	8.23	1277	0.05	10.54*	1731	[0.08]
2-Ethylmenthone?	8.30	1282	0.03			
Dihydroedulan I	8.33	1284	0.03	6.91*	1444	[0.04]
Thymol	8.51*	1296	5.14	14.90	2133	0.02
Dihydroedulan II	8.51*	1296	[5.14]	7.25	1468	0.04
Menthyl acetate	8.51*	1296	[5.14]	7.95*	1522	[5.27]
Isomenthyl acetate	8.67	1306	0.09	8.09	1533	0.10
neoiso-Menthyl acetate?	8.81	1317	0.01			
Bicycloelemene	9.07	1335	0.09	6.89*	1441	0.09
Piperitenone	9.12	1339	0.02	11.90	1850	0.03
α-Cubebene	9.26	1348	0.02	6.62*	1421	[0.05]

Evodone	9.29	1351	0.03	12.19	1875	0.01
Menthofurolactone	9.33	1354	0.02	11.78	1838	0.02
α-Ylangene	9.54	1368	0.02	6.89*	1441	[0.09]
α-Copaene	9.60	1373	0.05	6.98	1448	0.05
β-Bourbonene	9.71	1380	0.16	7.30	1473	0.16
1,5-diepi-β-Bourbonene	9.73	1382	0.01	7.19	1464	0.03
β-Cubebene	9.81	1388	0.02	7.59	1494	0.01
β-Elemene	9.85	1390	0.06	8.24*	1544	2.59
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	9.91	1394	0.03			
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	9.94	1397	0.02			
Isocaryophyllene	10.01	1402	0.03	7.95*	1522	[5.27]
β-Caryophyllene	10.18	1414	2.60	8.24*	1544	[2.59]
Unknown [m/z 177, 109 (32), 192 (26), 95 (25), 137 (23)]	10.31*	1424	0.06			
β-Copaene	10.31*	1424	[0.06]	8.18	1540	0.04
trans-α-Bergamotene	10.43	1433	0.01	8.24*	1544	[2.59]
Isogermacrene D	10.52	1439	0.03	8.81	1589	0.03
α-Humulene	10.62	1447	0.11	9.10*	1612	[0.14]
Muurola-4,11-diene	10.72	1454	0.02	9.02*	1606	[41.19]
(*E*)-β-Farnesene	10.79*	1460	0.10	9.37*	1634	[0.12]
9-epi-β-Caryophyllene	10.79*	1460	[0.10]	9.18	1619	0.03
γ-Muurolene	10.96	1473	0.02	9.37*	1634	[0.12]
Germacrene D	11.00	1476	0.38	9.59*	1652	[0.94]
Menthalactone	11.12	1484	0.03	15.57	2200	0.03
Viridiflorene	11.21*	1491	0.10	9.50	1645	0.03
Bicyclogermacrene	11.21*	1491	[0.10]	9.86	1674	0.07
γ-Cadinene	11.45	1509	0.02	10.19	1701	0.07
δ-Cadinene	11.59*	1520	0.04	10.22*	1704	[0.04]
trans-Calamenene	11.59*	1520	[0.04]	11.04	1774	0.01
Spathulenol	12.22	1570	0.01	14.18	2062	0.01
Caryophyllene oxide isomer	12.27*	1574	0.10	12.47	1900	0.02
Caryophyllene oxide	12.27*	1574	[0.10]	12.54	1907	0.07
Viridiflorol	12.39	1583	0.04	13.77	2022	0.04
Unknown [m/z 165, 166 (48), 137 (11), 67 (9), 124 (7), 43 (7)...]	20.02	2300	0.01			
Total identified		**98.99%**			**98.71%**	
Total reported		**99.08%**			**98.71%**	

*: 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

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