Date : February 05, 2021

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 21B04-PTH01
Customer identification : Peppermint ORGANIC - India - P401092011R
Type : Essential oil
Source : *Mentha x piperita*
Customer : Plant Therapy

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 : February 05, 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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

Laboratoire PhytoChemia
628 Boulevard du Saguenay Ouest, Saguenay (Qc) G7J 1H4 | www.phytochemia.com

PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.4609 ± 0.0003 (20 °C; method PC-MAT-016)

EUROPEAN PHARMACOPOEIA 9.0 - 07/2012:0405 - PEPPERMINT OIL

Compound	Min. %	Max. %	Observed %	Complies?
Limonene	1.0	3.5	2.4	Yes
1,8-Cineole	3.5	8.0	5.7	Yes
Menthone	14.0	32.0	26.4	Yes
Menthofuran	1.0	8.0	2.6	Yes
Isomenthone	1.5	10.0	4.3	Yes
Menthyl acetate	2.8	10.0	4.5	Yes
Menthol	30.0	55.0	32.7	Yes
Pulegone		3.0	1.2	Yes
Carvone		1.0	0	Yes
Total isopulegol		0.20	0.14	Yes
Refractive index	1.457	1.467	1.461	Yes

NF T 75-210:2007 & ISO 856:2006 - OIL OF PEPPERMINT - "OTHER ORIGINS"

Compound	Min. %	Max. %	Observed %	Complies?
Octan-3-ol	0.1	0.5	0.2	Yes
1,8-Cineole	3.0	8.0	5.7	Yes
Limonene	1.0	3.0	2.4	Yes
cis-Sabinene hydrate	0.5	2.0	0.3	No
Menthone	13.0	28.0	26.4	Yes
Isomenthone	2.0	8.0	4.3	Yes
Menthofuran	1.0	8.0	2.6	Yes
neo-Menthol	2.0	6.0	3.1	Yes
Menthol	32.0	49.0	32.7	Yes
Pulegone	0.5	3.0	1.2	Yes
Menthyl acetate	2.0	8.0	4.5	Yes
β-Caryophyllene	1.0	3.5	2.8	Yes
Refractive index	1.459	1.465	1.461	Yes

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
2-Methyl-3-buten-2-ol	tr	Aliphatic alcohol
Isovaleral	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Isoamyl alcohol	0.02	Aliphatic alcohol
2-Methylbutanol	0.02	Aliphatic alcohol
Ethyl 2-methylbutyrate	0.01	Aliphatic ester
(3*Z*)-Hexenol	0.02	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
trans-2,5-Diethyltetrahydrofuran	0.04	Furan
α-Thujene	0.05	Monoterpene
α-Pinene	0.88	Monoterpene
Camphene	0.01	Monoterpene
α-Fenchene	tr	Monoterpene
3-Methylcyclohexanone	0.06	Aliphatic ketone
Thuja-2,4(10)-diene	0.01	Monoterpene
Benzaldehyde	0.01	Simple phenolic
Sabinene	0.51	Monoterpene
β-Pinene	1.24	Monoterpene
Octen-3-ol	0.08	Aliphatic alcohol
Octan-3-one	0.03	Aliphatic ketone
cis-Carane	0.01	Monoterpene
Myrcene	0.32	Monoterpene
Octan-3-ol	0.19	Aliphatic alcohol
α-Phellandrene	0.04	Monoterpene
Pseudolimonene	0.03	Monoterpene
Δ3-Carene	0.01	Monoterpene
α-Terpinene	0.24	Monoterpene
ortho-Cymene	0.01	Monoterpene
para-Cymene	0.20	Monoterpene
Limonene	2.36	Monoterpene
1,8-Cineole	5.71	Monoterpenic ether
(*Z*)-β-Ocimene	0.24	Monoterpene
(*E*)-β-Ocimene	0.07	Monoterpene
γ-Terpinene	0.40	Monoterpene
cis-Sabinene hydrate	0.34	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Octanol	0.03	Aliphatic alcohol
Terpinolene	0.13	Monoterpene
para-Cymenene	0.01	Monoterpene
trans-Sabinene hydrate	0.04	Monoterpenic alcohol
Linalool	0.20	Monoterpenic alcohol
Nonan-3-ol	0.01	Aliphatic alcohol
2-Methylbutyl 2-methylbutyrate	0.05	Aliphatic ester

endo-Fenchol	0.03	Monoterpenic alcohol
Amyl isovalerate	0.02	Aliphatic ester
Octen-3-yl acetate	0.01	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.05	Monoterpenic alcohol
Octan-3-yl acetate	0.02	Aliphatic ester
allo-Ocimene	0.01	Monoterpene
trans-Sabinol	0.02	Monoterpenic alcohol
cis-α-Dihydroterpineol	0.06	Monoterpenic alcohol
Isopulegol	0.14	Monoterpenic alcohol
Menthone	26.42	Monoterpenic ketone
Isomenthone	4.29	Monoterpenic ketone
Menthofuran	2.65	Monoterpenic ether
neo-Menthol	3.08	Monoterpenic alcohol
δ-Terpineol	0.14	Monoterpenic alcohol
Menthol	32.67	Monoterpenic alcohol
Terpinen-4-ol	0.70	Monoterpenic alcohol
Isomenthol	0.49	Monoterpenic alcohol
para-Cymen-8-ol	0.06	Monoterpenic alcohol
α-Terpineol	0.34	Monoterpenic alcohol
neoiso-Menthol	0.24	Monoterpenic alcohol
Methylchavicol	0.09	Phenylpropanoid
trans-Isopiperitenol	0.03	Monoterpenic alcohol
Unknown	0.02	Unknown
trans-Piperitol	0.02	Monoterpenic alcohol
Citronellol	0.04	Monoterpenic alcohol
Pulegone	1.21	Monoterpenic ketone
Carvone	0.02	Monoterpenic ketone
(3*Z*)-Hexenyl isovalerate	0.05	Aliphatic ester
Piperitone	0.58	Monoterpenic ketone
Isopiperitenone	0.02	Monoterpenic ketone
neo-Menthyl acetate	0.25	Monoterpenic ester
Decanol	0.01	Aliphatic alcohol
2-Ethylmenthone?	0.08	Aliphatic ketone
Dihydroedulan I	0.05	Terpenic ether
Menthyl acetate	4.46	Monoterpenic ester
Dihydroedulan II	0.02	Terpenic ether
Thymol	0.08	Monoterpenic alcohol
Isomenthyl acetate	0.20	Monoterpenic alcohol
Bicycloelemene	0.05	Sesquiterpene
α-Cubebene	0.01	Sesquiterpene
Evodone	0.02	Monoterpenic ketone
Eugenol	0.03	Phenylpropanoid
α-Copaene	0.05	Sesquiterpene
Unknown	0.03	Unknown
β-Bourbonene	0.26	Sesquiterpene
β-Cubebene	0.03	Sesquiterpene
β-Elemene	0.12	Sesquiterpene
Unknown	0.05	Unknown
Unknown	0.02	Sesquiterpene
Isocaryophyllene	0.06	Sesquiterpene
β-Caryophyllene	2.79	Sesquiterpene
β-Ylangene	0.18	Sesquiterpene

β-Copaene	0.05	Sesquiterpene
trans-α-Bergamotene	0.04	Sesquiterpene
Isogermacrene D	0.04	Sesquiterpene
α-Humulene	0.17	Sesquiterpene
Muurola-4,11-diene	0.03	Sesquiterpene
(*E*)-β-Farnesene	0.33	Sesquiterpene
γ-Muurolene	0.04	Sesquiterpene
Germacrene D	1.46	Sesquiterpene
Viridiflorene	0.08	Sesquiterpene
Bicyclogermacrene	0.16	Sesquiterpene
α-Muurolene	0.07	Sesquiterpene
γ-Cadinene	0.03	Sesquiterpene
δ-Cadinene	0.09	Sesquiterpene
Isocaryophyllene epoxide B	0.01	Sesquiterpenic ether
(*E*)-Nerolidol	0.01	Sesquiterpenic alcohol
Spathulenol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.06	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
Viridiflorol	0.14	Sesquiterpenic alcohol
Isospathulenol	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.02	Sesquiterpenic alcohol
α-Cadinol	0.01	Sesquiterpenic alcohol
Consolidated total	**98.93%**	

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

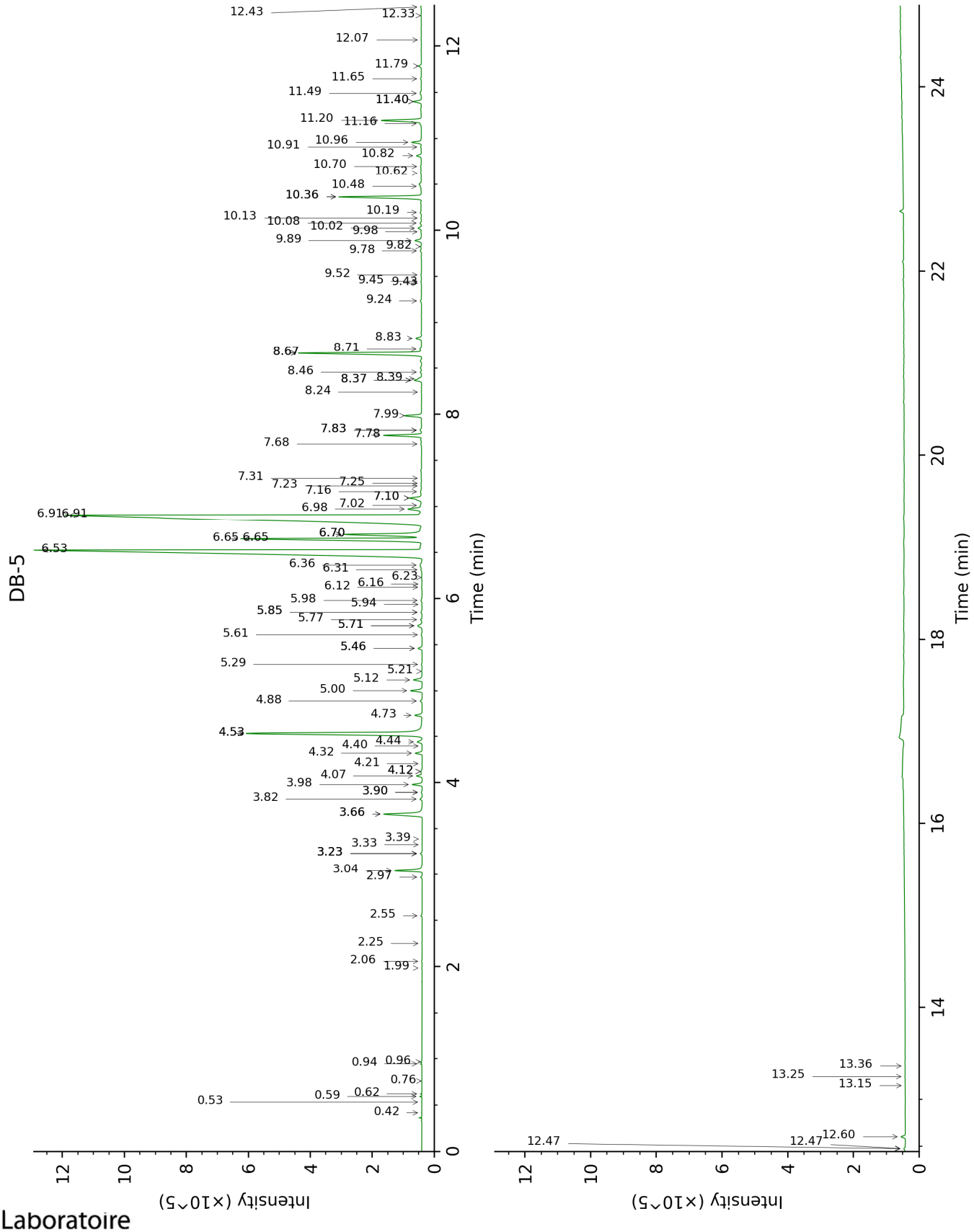
Note: no correction factor was applied

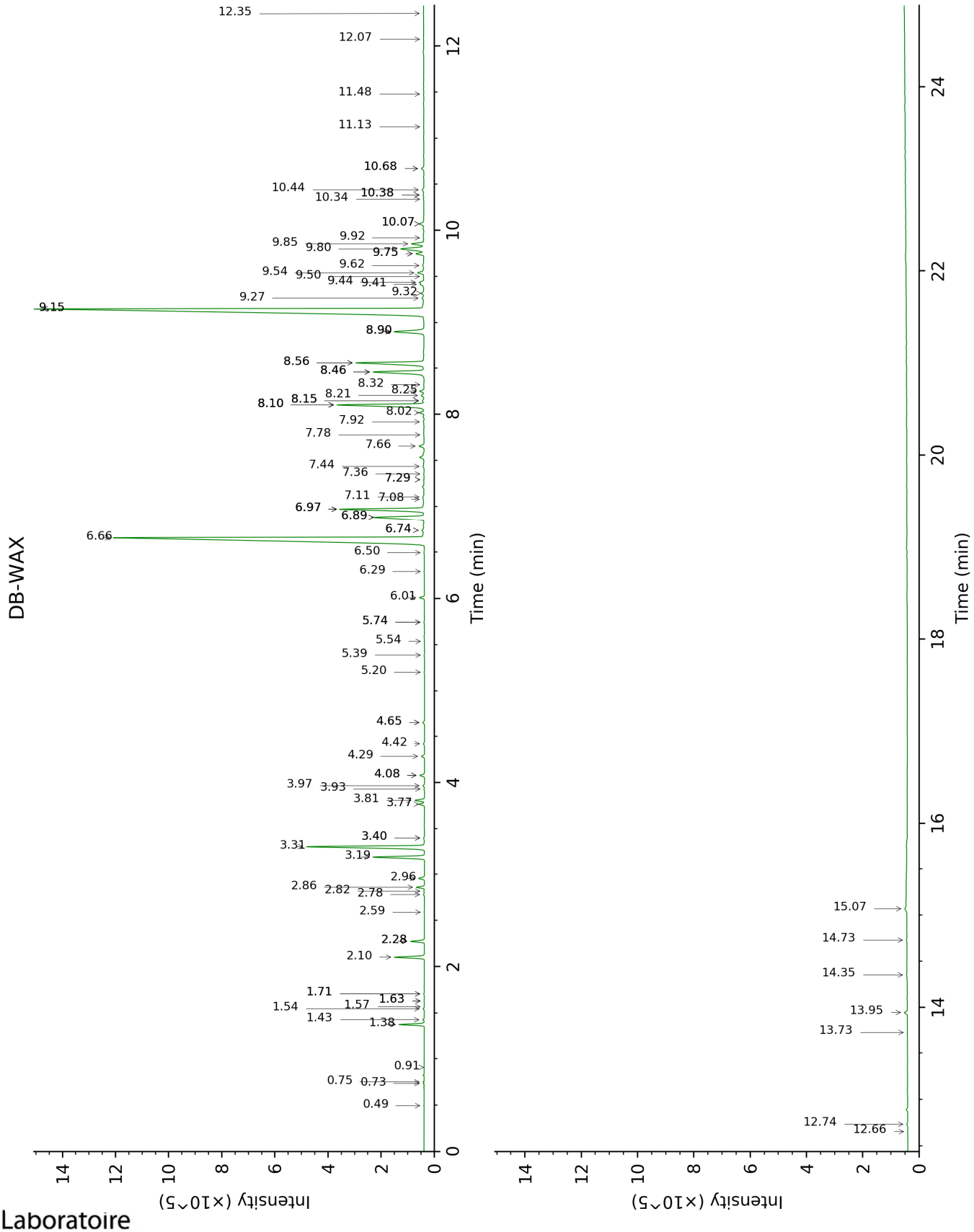
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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.

628 Boulevard du Saguenay, Saguenay (Qc) G7J 1H4 | www.phytochemia.com


DB-5
Time (min)
Intensity (×10^5)
12.43
12.33
12.07
11.79
11.65
11.49
11.40
11.20
11.16
10.96
10.91
10.82
10.70
10.62
10.48
10.36
10.19
10.13
10.08
10.02
9.98
9.89
9.82
9.78
9.52
9.45
9.43
9.24
8.83
8.71
8.67
8.46
8.39
8.37
8.24
7.99
7.83
7.78
7.68
7.31
7.25
7.23
7.16
7.10
7.02
6.98
6.91
6.70
6.65
6.53
6.36
6.31
6.23
6.16
6.12
5.98
5.94
5.85
5.77
5.71
5.61
5.46
5.29
5.21
5.12
5.00
4.88
4.73
4.53
4.44
4.40
4.32
4.21
4.12
4.07
3.98
3.90
3.82
3.66
3.39
3.33
3.23
3.04
2.97
2.55
2.25
2.06
1.99
0.96
0.94
0.76
0.62
0.59
0.53
0.42
13.36
13.25
13.15
12.60
12.47
12.47


DB-WAX
Time (min)
Intensity (×10^5)
12.35
12.07
11.48
11.13
10.68
10.44
10.34
10.38
10.07
9.92
9.85
9.80
9.75
9.62
9.54
9.50
9.44
9.41
9.32
9.27
9.15
8.90
8.56
8.46
8.32
8.25
8.21
8.10
8.15
8.02
7.92
7.78
7.66
7.44
7.36
7.29
7.11
7.08
6.97
6.89
6.74
6.66
6.50
6.29
6.01
5.74
5.54
5.39
5.20
4.65
4.42
4.29
4.08
3.97
3.93
3.81
3.77
3.40
3.31
3.19
2.96
2.86
2.82
2.78
2.59
2.28
2.10
1.71
1.63
1.54
1.57
1.43
1.38
0.91
0.75
0.73
0.49
15.07
14.73
14.35
13.95
13.73
12.74
12.66

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isobutyral	0.42	538	tr	0.50	785	0.01
2-Methyl-3-buten-2-ol	0.53	612	tr	1.57	1016	0.01
Isovaleral	0.59	640	0.02	0.75	887	0.02
2-Methylbutyral	0.62	652	0.01	0.73	881	0.01
2-Ethylfuran	0.76	710	tr	0.91	920	tr
Isoamyl alcohol	0.94	736	0.02	3.40*	1178	0.06
2-Methylbutanol	0.96	739	0.02	3.40*	1178	[0.06]
Ethyl 2-methylbutyrate	1.99	850	0.01	1.63*	1022	0.01
(3*Z*)-Hexenol	2.06	856	0.02	5.74*	1349	0.03
Hexanol	2.25	872	0.01	5.39	1323	0.01
trans-2,5-Diethyltetrahydrofuran	2.55	897	0.04	1.54	1014	0.04
α-Thujene	2.97	926	0.05	1.43	1003	0.06
α-Pinene	3.04	930	0.88	1.38	995	0.89
Camphene	3.23*	943	0.07	1.71*	1030	0.03
α-Fenchene	3.23*	943	[0.07]	1.63*	1022	[0.01]
3-Methylcyclohexanone	3.23*	943	[0.07]	4.65*	1272	0.08
Thuja-2,4(10)-diene	3.33	949	0.01	2.28*	1086	0.54
Benzaldehyde	3.39	953	0.01	7.29*	1463	0.02
Sabinene	3.66*	971	1.75	2.28*	1086	[0.54]
β-Pinene	3.66*	971	[1.75]	2.10	1069	1.24
Octen-3-ol	3.82	982	0.08	6.74*	1421	0.15
Octan-3-one	3.90*	986	0.04	3.93	1219	0.03
cis-Carane	3.90*	986	[0.04]	1.71*	1030	[0.03]
Myrcene	3.98	992	0.32	2.86	1135	0.32
Octan-3-ol	4.07	998	0.19	6.01	1368	0.20
α-Phellandrene	4.12*	1001	0.08	2.78	1129	0.04
Pseudolimonene	4.12*	1001	[0.08]	2.82	1132	0.03
Δ3-Carene	4.21	1007	0.01	2.59	1114	0.01
α-Terpinene	4.32	1014	0.24	2.96	1143	0.25
ortho-Cymene	4.40	1019	0.01	4.08*	1230	0.20
para-Cymene	4.44	1021	0.20	4.08*	1230	[0.20]
Limonene	4.53*	1027	7.99	3.20	1162	2.36
1,8-Cineole	4.53*	1027	[7.99]	3.31	1170	5.71
(*Z*)-β-Ocimene	4.73	1039	0.24	3.77	1207	0.24
(*E*)-β-Ocimene	4.88	1049	0.07	3.97	1221	0.07
γ-Terpinene	5.00	1057	0.40	3.81	1210	0.41
cis-Sabinene hydrate	5.12	1064	0.34	6.89*	1432	2.99
cis-Linalool oxide (fur.)	5.21	1070	0.02	6.50	1403	0.02
Octanol	5.29	1075	0.03	8.15*†	1527	[4.72]
Terpinolene	5.46*	1086	0.14	4.28	1245	0.13
para-Cymenene	5.46*	1086	[0.14]	6.29	1389	0.01
trans-Sabinene hydrate	5.61	1095	0.04	7.92	1510	0.04
Linalool	5.71*	1101	0.22	8.02	1517	0.20
Nonan-3-ol	5.71*	1101	[0.22]	7.29*	1463	[0.02]

2-Methylbutyl 2-methylbutyrate	5.77	1106	0.05	4.42	1255	0.06
endo-Fenchol	5.85*	1111	0.05	8.32	1541	0.03
Amyl isovalerate	5.85*	1111	[0.05]	4.65*	1272	[0.08]
Octen-3-yl acetate	5.94	1116	0.01	5.74*	1349	[0.03]
cis-para-Menth-2-en-1-ol	5.98	1119	0.05	8.10*†	1524	4.72
Octan-3-yl acetate	6.12	1128	0.02	5.20	1310	0.02
allo-Ocimene	6.16	1130	0.01	5.54	1334	0.01
trans-Sabinol	6.23	1135	0.02	9.75*	1654	0.36
cis-α-Dihydroterpineol	6.31	1141	0.06	8.15*†	1527	[4.72]
Isopulegol	6.36	1144	0.14	8.10*†	1524	[4.72]
Menthone	6.52	1154	26.42	6.66	1415	26.54
Isomenthone	6.65*	1162	6.90	6.97*	1439	4.38
Menthofuran	6.65*	1162	[6.90]	6.89*	1432	[2.99]
neo-Menthol	6.70*	1166	3.23	8.56*	1560	3.82
δ-Terpineol	6.70*	1166	[3.23]	9.42†	1627	0.39
Menthol	6.91*†	1180	33.86	9.15*	1606	32.70
Terpinen-4-ol	6.91*†	1180	[33.86]	8.56*	1560	[3.82]
Isomenthol	6.98†	1184	[33.86]	8.90*	1586	1.74
para-Cymen-8-ol	7.02	1186	0.06	11.48	1800	0.01
α-Terpineol	7.10*	1192	0.58	9.75*	1654	[0.36]
neoiso-Menthol	7.10*	1192	[0.58]	9.44†	1629	[0.39]
Methylchavicol	7.16	1196	0.09	9.26	1615	0.11
trans-Isopiperitenol	7.23	1200	0.03	10.38*	1706	0.04
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.26	1202	0.02			
trans-Piperitol	7.31	1206	0.02	10.34	1702	0.02
Citronellol	7.68	1232	0.04	10.68*	1731	0.13
Pulegone	7.78	1238	1.21	8.90*	1586	[1.74]
Carvone	7.83*	1242	0.07	9.92	1668	0.02
(3*Z*)-Hexenyl isovalerate	7.83*	1242	[0.07]	7.08	1447	0.05
Piperitone	7.99	1253	0.58	9.85	1663	0.61
Isopiperitenone	8.24	1270	0.02	11.13	1770	0.02
neo-Menthyl acetate	8.37*	1279	0.26	7.66	1490	0.25
Decanol	8.37*	1279	[0.26]	10.68*	1731	[0.13]
2-Ethylmenthone?	8.39	1280	0.08			
Dihydroedulan I	8.46	1286	0.05	6.97*	1439	[4.38]
Menthyl acetate	8.67*	1300	4.48	8.10*†	1524	[4.72]
Dihydroedulan II	8.67*	1300	[4.48]	7.36	1467	0.02
Thymol	8.71	1303	0.08	15.07	2134	0.08
Isomenthyl acetate	8.83	1306	0.20	8.20	1532	0.15
Bicycloelemene	9.24	1335	0.05	6.97*	1439	[4.38]
α-Cubebene	9.43	1348	0.01	6.74*	1421	[0.15]
Evodone	9.45	1350	0.02	12.35	1877	0.02
Eugenol	9.52	1354	0.03	14.73	2100	0.02
α-Copaene	9.78	1373	0.05	7.11	1449	0.08

Unknown [m/z 81, 163 (41), 80 (31), 107 (15), 79 (14), 93 (10)...]	9.82	1376	0.03			
β-Bourbonene	9.89	1381	0.26	7.44	1474	0.06
β-Cubebene	9.98	1387	0.03	7.78	1499	0.02
β-Elemene	10.02	1390	0.12	8.46*	1552	2.95
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.08	1394	0.05			
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.13	1398	0.02			
Isocaryophyllene	10.19	1402	0.06	8.15*†	1527	[4.72]
β-Caryophyllene	10.36*	1415	2.96	8.46*	1552	[2.95]
β-Ylangene	10.36*	1415	[2.96]	8.10*†	1524	[4.72]
β-Copaene	10.48	1423	0.05	8.25	1536	0.21
trans-α-Bergamotene	10.62	1434	0.04	8.46*	1552	[2.95]
Isogermacrene D	10.70	1440	0.04	8.90*	1586	[1.74]
α-Humulene	10.82	1448	0.17	9.32	1619	0.15
Muurola-4,11-diene	10.91	1455	0.03	9.15*	1606	[32.70]
(*E*)-β-Farnesene	10.96	1459	0.33	9.54	1637	0.34
γ-Muurolene	11.16	1474	0.04	9.50	1634	0.03
Germacrene D	11.20	1477	1.46	9.80	1658	1.40
Viridiflorene	11.40*	1492	0.28	9.62	1644	0.08
Bicyclogermacrene	11.40*	1492	[0.28]	10.07*	1681	0.23
α-Muurolene	11.49	1498	0.07	10.07*	1681	[0.23]
γ-Cadinene	11.65	1510	0.03	10.38*	1706	[0.04]
δ-Cadinene	11.79	1521	0.09	10.44	1711	0.11
Isocaryophyllene epoxide B	12.07	1544	0.01	12.08	1852	0.02
(*E*)-Nerolidol	12.33	1564	0.01	13.73	2004	0.01
Spathulenol	12.43	1572	0.02	14.35	2064	0.02
Caryophyllene oxide	12.47*	1575	0.06	12.74	1912	0.06
Caryophyllene oxide isomer	12.47*	1575	[0.06]	12.66	1904	0.02
Viridiflorol	12.60	1585	0.14	13.95	2025	0.14
Isospathulenol	13.15	1630	0.01			
τ-Cadinol	13.25	1638	0.02			
α-Cadinol	13.36	1647	0.01			
Total identified		**98.74%**			**98.68%**	
Total reported		**98.87%**			**98.68%**	

*: 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