Date : November 26, 2020

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 20K20-PTH07
Customer identification : Tea Tree Organic - T3011498R
Type : Essential oil
Source : *Melaleuca alternifolia* ct. Terpinen-4-ol
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 : November 23, 2020

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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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

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

PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4769 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 4730:2017 - TEA TREE OIL

Compound	Min. %	Max. %	Observed %	Complies?
Viridiflorol	tr	1.0	0.1	Yes
Globulol	tr	1.0	0.2	Yes
δ-Cadinene	0.2	3.0	0.5	Yes
Viridiflorene	0.1	3.0	0.4	Yes
Aromadendrene	0.2	3.0	0.4	Yes
α-Terpineol	2.0	5.0	2.6	Yes
Terpinen-4-ol	35.0	48.0	39.3	Yes
Terpinolene	1.5	5.0	3.7	Yes
γ-Terpinene	14.0	28.0	21.5	Yes
1,8-Cineole	tr	10.0	4.5	Yes
para-Cymene	0.5	8.0	2.0	Yes
Limonene	0.5	1.5	1.0	Yes
α-Terpinene	6.0	12.0	10.9	Yes
Sabinene	tr	3.5	0.9	Yes
α-Pinene	1.0	4.0	2.4	Yes
Refractive index	1.4750	1.4820	1.4769	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
Ethanol	0.01	Aliphatic alcohol
Isobutyral	0.01	Aliphatic aldehyde
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
(3*Z*)-Hexenol	0.01	Aliphatic alcohol
α-Thujene	0.94	Monoterpene
α-Pinene	2.39	Monoterpene
Camphene	0.01	Monoterpene
α-Fenchene	tr	Monoterpene
β-Pinene	0.78	Monoterpene
Sabinene	0.92	Monoterpene
3-Methyl-3-cyclohexenone	0.01	Aliphatic ketone
Myrcene	0.91	Monoterpene
α-Phellandrene	0.46	Monoterpene
Pseudolimonene	0.01	Monoterpene
α-Terpinene	10.89	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	2.04	Monoterpene
Limonene	1.03	Monoterpene
1,8-Cineole	4.51	Monoterpenic ether
(*Z*)-β-Ocimene	0.01	Monoterpene
(*E*)-β-Ocimene	0.02	Monoterpene
γ-Terpinene	21.53	Monoterpene
cis-Sabinene hydrate	0.23	Monoterpenic alcohol
Terpinolene	3.69	Monoterpene
para-Cymenene	0.04	Monoterpene
trans-Sabinene hydrate	0.46	Monoterpenic alcohol
Linalool	0.06	Monoterpenic alcohol
endo-Fenchol	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.42	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.01	Aliphatic alcohol
Cosmene isomer I	0.02	Monoterpene
trans-para-Menth-2-en-1-ol	0.31	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Unknown	0.02	Unknown
δ-Terpineol	0.02	Monoterpenic alcohol
Terpinen-4-ol	39.26	Monoterpenic alcohol
para-Cymen-8-ol	0.02	Monoterpenic alcohol
α-Terpineol	2.61	Monoterpenic alcohol
cis-Piperitol	0.11	Monoterpenic alcohol
trans-Piperitol	0.18	Monoterpenic alcohol
exo-2-Hydroxycineole	0.02	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
Piperitone	0.02	Monoterpenic ketone

cis-Carvenone oxide?	0.01	Monoterpenic ketone
trans-Ascaridole glycol	0.07	Monoterpenic alcohol
cis-Ascaridole glycol	0.04	Monoterpenic alcohol
Thymol	0.03	Monoterpenic alcohol
Carvacrol	0.01	Monoterpenic alcohol
Unknown	0.08	Monoterpenic alcohol
Bicycloelemene	0.02	Sesquiterpene
α-Cubebene	0.04	Sesquiterpene
Unknown	0.01	Unknown
Isoledene	0.03	Sesquiterpene
α-Copaene	0.06	Sesquiterpene
7-Cubebene	0.03	Sesquiterpene
7-Cubebene epimer?	0.01	Aliphatic alcohol
β-Cubebene	0.01	Sesquiterpene
β-Elemene	0.03	Sesquiterpene
Unknown	0.02	Sesquiterpene
α-Gurjunene	0.15	Sesquiterpene
Methyleugenol	0.04	Phenylpropanoid
β-Maaliene	0.01	Sesquiterpene
β-Caryophyllene	0.21	Sesquiterpene
β-Ylangene	0.01	Sesquiterpene
γ-Maaliene	0.04	Sesquiterpene
β-Gurjunene	0.01	Sesquiterpene
α-Maaliene	0.03	Sesquiterpene
Aromadendrene	0.44	Sesquiterpene
Selina-5,11-diene	0.08	Sesquiterpene
Cadina-3,5-diene isomer I?	0.07	Sesquiterpene
trans-Muurola-3,5-diene	0.08	Sesquiterpene
α-Humulene	0.07	Sesquiterpene
allo-Aromadendrene	0.23	Sesquiterpene
Valerena-4,7(11)-diene	0.03	Sesquiterpene
γ-Gurjunene	0.03	Sesquiterpene
trans-Cadina-1(6),4-diene	0.12	Sesquiterpene
Selina-4,11-diene	0.01	Sesquiterpene
γ-Muurolene	0.06	Sesquiterpene
β-Selinene	0.04	Sesquiterpene
allo-Aromadendr-9-ene	0.05	Sesquiterpene
δ-Selinene	0.07	Sesquiterpene
Bicyclogermacrene	0.49	Sesquiterpene
Viridiflorene	0.36	Sesquiterpene
Epizonarene	0.01	Sesquiterpene
α-Muurolene	0.09	Sesquiterpene
γ-Cadinene	0.05	Sesquiterpene
trans-Calamenene	0.04	Sesquiterpene
δ-Cadinene	0.52	Sesquiterpene
Zonarene	0.08	Sesquiterpene
trans-Cadina-1,4-diene	0.09	Sesquiterpene
α-Calacorene	0.01	Sesquiterpene
Epiglobulol	0.06	Sesquiterpenic alcohol
Maaliol	0.03	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
Palustrol	0.03	Sesquiterpenic alcohol

Spathulenol	0.05	Sesquiterpenic alcohol
Globulol	0.25	Sesquiterpenic alcohol
Gleenol	0.03	Sesquiterpenic alcohol
Viridiflorol	0.10	Sesquiterpenic alcohol
Cubeban-11-ol	0.10	Sesquiterpenic alcohol
Ledol	0.09	Sesquiterpenic alcohol
Rosifoliol	0.10	Sesquiterpenic alcohol
1-epi-Cubenol	0.14	Sesquiterpenic alcohol
Isospathulenol	0.06	Sesquiterpenic alcohol
Cubenol	0.08	Sesquiterpenic alcohol
α-Muurolol	0.03	Sesquiterpenic alcohol
Consolidated total	**99.34%**	

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

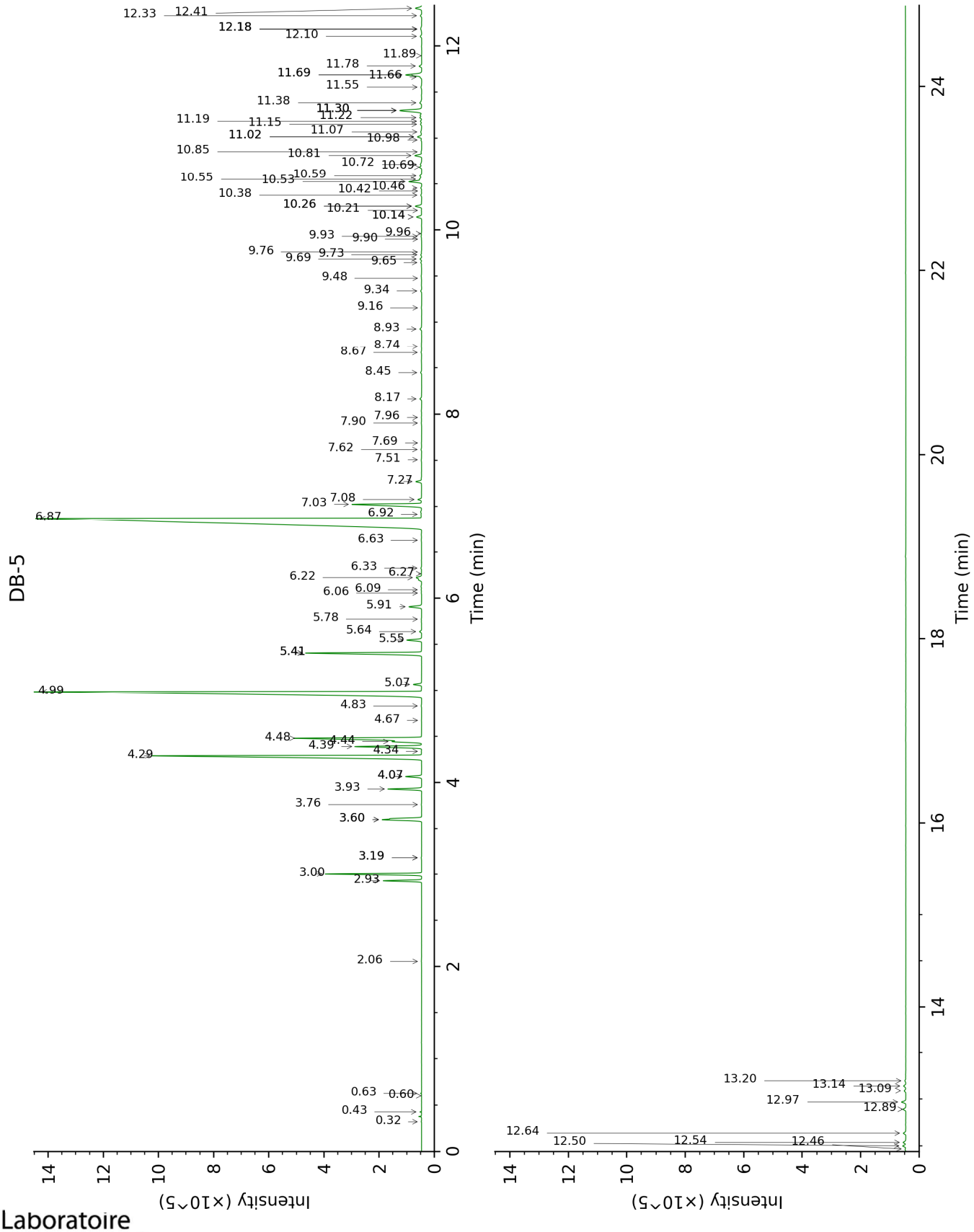
Note: no correction factor was applied

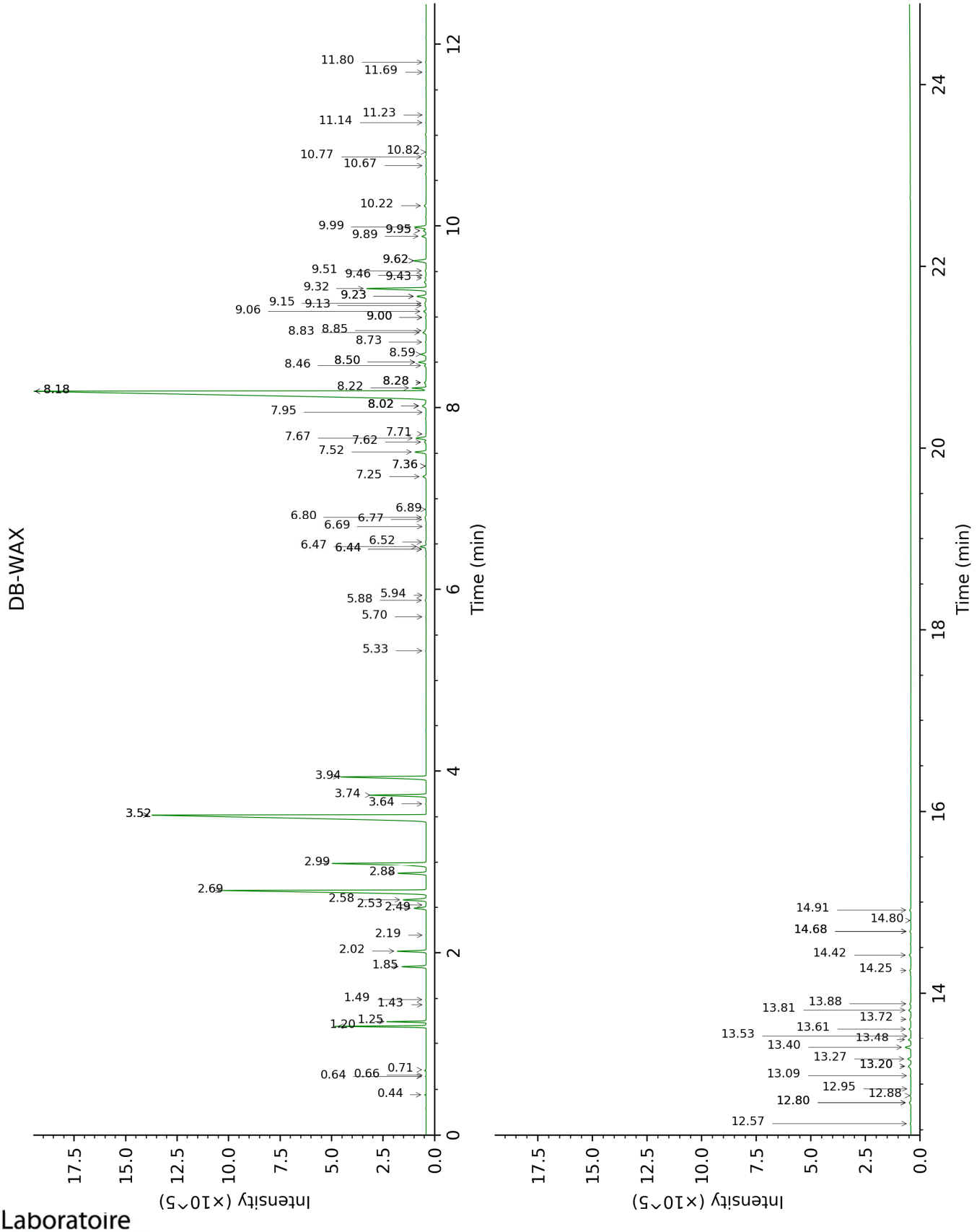
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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)
12.33
12.41
12.18
12.10
11.89
11.78
11.69
11.66
11.55
11.38
11.30
11.22
11.19
11.15
11.07
11.02
10.98
10.85
10.81
10.72
10.69
10.59
10.55
10.53
10.46
10.42
10.38
10.26
10.21
10.14
9.96
9.93
9.90
9.76
9.73
9.69
9.65
9.48
9.34
9.16
8.93
8.74
8.67
8.45
8.17
7.96
7.90
7.69
7.62
7.51
7.27
7.08
7.03
6.92
6.87
6.63
6.33
6.27
6.22
6.09
6.06
5.91
5.78
5.64
5.55
5.41
5.07
4.99
4.83
4.67
4.48
4.44
4.39
4.34
4.29
4.07
3.93
3.76
3.60
3.19
3.00
2.93
2.06
0.63
0.60
0.43
0.32
13.20
13.14
13.09
12.97
12.89
12.64
12.50
12.54
12.46


DB-WAX
Time (min)
Intensity (×10^5)
11.80
11.69
11.23
11.14
10.77
10.82
10.67
10.22
9.99
9.89
9.95
9.62
9.51
9.46
9.43
9.32
9.23
9.15
9.13
9.06
9.00
8.83
8.85
8.73
8.59
8.46
8.50
8.22
8.28
8.18
8.02
7.95
7.67
7.71
7.62
7.52
7.36
7.25
6.80
6.89
6.77
6.69
6.47
6.44
6.52
5.88
5.94
5.70
5.33
3.94
3.74
3.64
3.52
2.99
2.88
2.69
2.58
2.53
2.49
2.19
2.02
1.85
1.49
1.43
1.20
1.25
0.64
0.66
0.71
0.44
14.91
14.80
14.68
14.42
14.25
13.81
13.88
13.72
13.61
13.53
13.48
13.40
13.27
13.20
13.09
12.95
12.88
12.80
12.57

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.32	507	0.01	0.72	906	0.01
Isobutyral	0.43	536	0.01	0.44	780	0.02
Isovaleral	0.60	642	tr	0.66	883	tr
2-Methylbutyral	0.63	652	0.01	0.64	878	0.01
(3*Z*)-Hexenol	2.06	857	0.01	5.33	1342	0.02
α-Thujene	2.93	925	0.94	1.25	1001	0.95
α-Pinene	3.00	930	2.39	1.20	992	2.41
Camphene	3.19*	943	0.02	1.49	1027	0.01
α-Fenchene	3.19*	943	[0.02]	1.43	1021	tr
β-Pinene	3.60*	970	1.69	1.85	1065	0.78
Sabinene	3.60*	970	[1.69]	2.02	1083	0.92
3-Methyl-3-cyclohexenone	3.76	981	0.01	5.70	1369	0.01
Myrcene	3.93	992	0.91	2.58	1133	0.92
α-Phellandrene	4.07*	1002	0.46	2.49	1126	0.46
Pseudolimonene	4.07*	1002	[0.46]	2.53	1128	0.01
α-Terpinene	4.29	1016	10.89	2.69	1142	10.95
Carvomenthene	4.34	1019	0.01	2.20	1101	0.01
para-Cymene	4.39	1022	2.04	3.74	1226	2.05
Limonene	4.44†	1026	5.52	2.88	1157	1.03
1,8-Cineole	4.48†	1028	[5.52]	2.99	1166	4.51
(*Z*)-β-Ocimene	4.67	1040	0.01	3.52*	1210	21.61
(*E*)-β-Ocimene	4.83	1050	0.02	3.64	1219	0.02
γ-Terpinene	4.99	1060	21.53	3.52*	1210	[21.61]
cis-Sabinene hydrate	5.07	1065	0.23	6.47†	1426	[0.26]
Terpinolene	5.41*	1087	3.71	3.94	1242	3.69
para-Cymenene	5.41*	1087	[3.71]	5.88	1382	0.04
trans-Sabinene hydrate	5.55	1096	0.46	7.52	1504	0.46
Linalool	5.64	1102	0.06	7.62	1512	0.07
endo-Fenchol	5.78	1110	0.01	8.02*	1543	0.25
cis-para-Menth-2-en-1-ol	5.91	1119	0.42	7.67	1516	0.42
4-Hydroxy-4-methylcyclohex-2-enone	6.06	1129	0.01	13.61	2029	0.08
Cosmene isomer I	6.09	1131	0.02	5.94	1386	0.01
trans-para-Menth-2-en-1-ol	6.22	1139	0.31	8.50*	1581	0.33
Unknown [m/z 109, 43 (73), 71 (54), 124 (51), 69 (37), 41 (35)...152 (5)]	6.27	1142	0.01			
Unknown [m/z 109, 124 (45), 119	6.33	1146	0.02	6.44*†	1424	0.26

(41), 43 (35), 91 (28), 95 (25)...]						
δ-Terpineol	6.63	1166	0.02	9.00*	1620	0.03
Terpinen-4-ol	6.87	1181	39.26	8.18*	1556	39.09
para-Cymen-8-ol	6.92	1184	0.02	11.14	1801	0.02
α-Terpineol	7.02	1191	2.61	9.32	1647	2.61
cis-Piperitol	7.08	1195	0.11	9.06	1626	0.10
trans-Piperitol	7.27	1208	0.18	9.89	1694	0.18
exo-2-Hydroxycineole	7.51	1224	0.02	11.23	1808	0.01
Nerol	7.62	1231	0.02	10.67	1760	0.01
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.69	1236	0.01	10.82	1773	0.01
Piperitone	7.90	1251	0.02	9.51	1662	0.04
cis-Carvenone oxide?	7.96	1255	0.01			
trans-Ascaridole glycol	8.17	1269	0.07	13.72	2040	0.06
cis-Ascaridole glycol	8.45	1288	0.04	14.25	2092	0.05
Thymol	8.67	1303	0.03	14.68*	2136	0.04
Carvacrol	8.74	1304	0.01	14.80	2148	0.01
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.93	1318	0.08	14.42	2109	0.08
Bicycloelemene	9.16	1334	0.02	6.69	1442	0.01
α-Cubebene	9.34	1347	0.04	6.44*†	1424	[0.26]
Unknown [m/z 43, 95 (62), 107 (45), 110 (41), 55 (28), 67 (25)...]	9.48	1357	0.01	13.53	2022	0.01
Isoledene	9.65	1369	0.03	6.52	1429	0.03
α-Copaene	9.69	1371	0.06	6.80	1450	0.05
7-Cubebene	9.73	1375	0.03	6.77	1448	0.03
7-Cubebene epimer?	9.76	1377	0.01	6.89	1457	0.02
β-Cubebene	9.90	1386	0.01	7.36*	1492	0.02
β-Elemene	9.93	1389	0.03	8.02*	1543	[0.25]
Unknown [m/z 93, 122 (98), 161 (98), 107 (86), 95 (46), 105 (72)... 204 (34)]	9.96	1391	0.02			
α-Gurjunene	10.14*	1404	0.19	7.25	1484	0.15
Methyleugenol	10.14*	1404	[0.19]	12.88	1959	0.04
β-Maaliene	10.21	1409	0.01	7.36*	1492	[0.02]
β-Caryophyllene	10.26*	1412	0.23	8.02*	1543	[0.25]
β-Ylangene	10.26*	1412	[0.23]	7.71	1519	0.01
γ-Maaliene	10.38	1421	0.04	8.18*	1556	[39.09]
β-Gurjunene	10.42	1425	0.01	7.95	1538	tr

α-Maaliene	10.46	1427	0.03	8.28*†	1563	0.08
Aromadendrene	10.53	1432	0.44	8.22	1559	0.41
Selina-5,11-diene	10.55	1434	0.08	8.28*†	1563	[0.08]
Cadina-3,5-diene isomer I?	10.59	1437	0.07			
trans-Muurola-3,5-diene	10.69	1444	0.08	8.46	1578	0.07
α-Humulene	10.72	1447	0.07	8.85†	1609	[0.19]
allo-Aromadendrene	10.81	1454	0.23	8.59	1588	0.25
Valerena-4,7(11)-diene	10.85	1457	0.03	8.50*	1581	[0.33]
γ-Gurjunene	10.98	1466	0.03	8.73	1599	0.03
trans-Cadina-1(6),4-diene	11.02*	1469	0.16	8.83†	1607	0.19
Selina-4,11-diene	11.02*	1469	[0.16]	9.00*	1620	[0.03]
γ-Muurolene	11.07	1473	0.06	9.15	1633	0.07
β-Selinene	11.15	1479	0.04	9.43	1656	0.05
allo-Aromadendr-9-ene	11.18	1482	0.05	9.13	1631	0.05
δ-Selinene	11.22	1484	0.07	9.23*	1640	0.42
Bicyclogermacrene	11.30*	1490	0.94	9.62*	1672	0.58
Viridiflorene	11.30*	1490	[0.94]	9.23*	1640	[0.42]
Epizonarene	11.30*	1490	[0.94]	9.46	1658	0.01
α-Muurolene	11.38	1496	0.09	9.62*	1672	[0.58]
γ-Cadinene	11.55	1509	0.05	9.95*	1698	0.13
trans-Calamenene	11.66	1518	0.04	10.77	1769	0.05
δ-Cadinene	11.69*	1520	0.63	9.99	1702	0.52
Zonarene	11.69*	1520	[0.63]	9.95*	1698	[0.13]
trans-Cadina-1,4-diene	11.78	1527	0.09	10.22	1722	0.09
α-Calacorene	11.89	1536	0.01	11.69	1850	0.01
Epiglobulol	12.10	1553	0.06	12.80*	1952	0.08
Maaliol	12.18*	1559	0.07	12.57	1930	0.03
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.18*	1559	[0.07]	12.80*	1952	[0.08]
Palustrol	12.18*	1559	[0.07]	11.80	1860	0.03
Spathulenol	12.33	1570	0.05	13.88	2057	0.05
Globulol	12.41	1577	0.25	13.40	2009	0.26
Gleenol	12.46	1581	0.03	13.09	1980	0.03
Viridiflorol	12.50	1584	0.10	13.48	2017	0.11
Cubeban-11-ol	12.54	1587	0.10	13.20*	1989	0.16
Ledol	12.64	1595	0.09	12.95	1966	0.01
Rosifoliol	12.89	1616	0.10	13.82	2050	0.10
1-epi-Cubenol	12.97	1622	0.14	13.27	1997	0.14
Isospathulenol	13.09	1632	0.06	14.91	2160	0.05
Cubenol	13.14	1636	0.08	13.20*	1989	[0.16]
α-Muurolol	13.20	1641	0.03	14.68*	2136	[0.04]

Total identified	**99.27%**	**99.04%**
Total reported	**99.42%**	**99.14%**

*: 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

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