Date : April 28, 2022

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 22D25-PTH04
Customer identification : Galanga Root - GF2100R
Type : Essential oil
Source : *Kaempferia galanga*
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 2014-005
Analysis date : April 28, 2022

Checked and approved by :

Alexis St-Gelais, Ph. D., Chimiste 2013-174

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MÉTHODE CERTIFIÉE ISO 17025:2017 CERTIFIED METHOD

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PHYSICOCHEMICAL DATA

Physical aspect: Yellow orange liquid
Refractive index: 1.4772 ± 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
Ethanol	0.01	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
Toluene	0.04	Simple phenolic
2-Methylbutyric acid	0.01	Aliphatic acid
Tricyclene	0.22	Monoterpene
α-Thujene	0.11	Monoterpene
α-Pinene	1.66	Monoterpene
α-Fenchene	0.03	Monoterpene
Camphene	2.67	Monoterpene
Thuja-2,4(10)-diene	0.03	Monoterpene
3,7,7-Trimethylcyclohepta-1,3,5-triene	0.41	Monoterpene
Sabinene	0.07	Monoterpene
β-Pinene	0.59	Monoterpene
Myrcene	0.14	Monoterpene
Menthatriene isomer I	0.02	Monoterpene
α-Phellandrene	0.02	Monoterpene
Pseudolimonene	0.01	Monoterpene
Δ3-Carene	9.32	Monoterpene
meta-Cymene	0.07	Monoterpene
para-Cymene	0.90	Monoterpene
1,8-Cineole	3.66	Monoterpenic ether
Limonene	0.90	Monoterpene
γ-Terpinene	0.03	Monoterpene
Octanol	0.06	Aliphatic alcohol
(*E*)-5-octen-1-ol	0.07	Aliphatic alcohol
Terpinolene	0.08	Monoterpene
Linalool	0.04	Monoterpenic alcohol
2-Nonanol	0.05	Aliphatic alcohol
Unknown	0.03	Unknown
cis-Limonene oxide	0.01	Monoterpenic ether
cis-para-Mentha-2,8-dien-1-ol	0.03	Monoterpenic alcohol
Camphor	0.07	Monoterpenic ketone
trans-Verbenol	0.03	Monoterpenic alcohol
para-Vinylanisole	0.09	Simple phenolic
Eucarvone	0.05	Monoterpenic ketone
Isoborneol	0.02	Monoterpenic alcohol
Unknown	0.11	Oxygenated monoterpene
Pinocarvone	0.03	Monoterpenic ketone
Borneol	1.16	Monoterpenic alcohol
α-Phellandren-8-ol	0.12	Monoterpenic alcohol
Terpinen-4-ol	0.11	Monoterpenic alcohol
4-Methylacetophenone	0.04	Simple phenolic
meta-Cymen-8-ol	0.37	Monoterpenic alcohol
para-Cymen-8-ol	0.22	Monoterpenic alcohol
α-Terpineol	0.14	Monoterpenic alcohol

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Verbenone	0.37	Monoterpenic ketone
Unknown	0.01	Unknown
Unknown	0.05	Unknown
trans-Carveol	0.05	Monoterpenic alcohol
Bornyl formate	0.01	Monoterpenic ester
Carvone	0.03	Monoterpenic ketone
Carvotanacetone	0.02	Monoterpenic ketone
Car-3-en-2-one	0.19	Monoterpenic ketone
Bornyl acetate	0.01	Monoterpenic ester
2-Undecanone	0.05	Aliphatic ketone
Terpinen-4-yl acetate	0.02	Monoterpenic ester
Tridecane	0.14	Alkane
Car-3-en-5-one	0.09	Monoterpenic ketone
Carvacrol	0.01	Monoterpenic alcohol
2,3-Dihydro-3,6-dihydroxyterpinolene	0.05	Monoterpenic alcohol
3-Carene-2,5-dione	0.11	Monoterpenic ketone
Unknown	0.08	Unknown
α-Cubebene	0.01	Sesquiterpene
α-Terpinyl acetate	0.07	Monoterpenic ester
α-Ylangene	0.16	Sesquiterpene
Unknown	0.05	Unknown
β-Elemene	0.28	Sesquiterpene
Cyperene	1.72	Sesquiterpene
Tetradecane	1.29	Alkane
α-Gurjunene	0.50	Sesquiterpene
β-Caryophyllene	0.08	Sesquiterpene
β-Copaene	0.02	Sesquiterpene
γ-Elemene	0.11	Sesquiterpene
6,9-Guaiadiene	0.07	Sesquiterpene
Unknown	0.05	Sesquiterpene
Rotundene	0.05	Sesquiterpene
α-Humulene	0.13	Sesquiterpene
allo-Aromadendrene	0.05	Sesquiterpene
cis-Muurola-4(15),5-diene	0.11	Sesquiterpene
Ethyl (*E*)-cinnamate	9.18	Phenylpropanoid ester
Unknown	0.11	Sesquiterpene
Unknown	0.29	Sesquiterpene
β-Selinene	0.20	Sesquiterpene
δ-Selinene	0.06	Sesquiterpene
Valencene	0.22	Sesquiterpene
1-Pentadecene	0.11	Alkene
Cubebol	0.02	Sesquiterpenic alcohol
δ-Guaiene	0.16	Sesquiterpene
Pentadecane	41.41	Alkane
γ-Cadinene	0.74	Sesquiterpene
Unknown	0.32	Sesquiterpene
δ-Cadinene	0.37	Sesquiterpene
10-epi-Cubebol?	0.04	Sesquiterpenic alcohol
α-Cadinene	0.04	Sesquiterpene
α-Calacorene	0.03	Sesquiterpene
Furopelargone isomer II	0.08	Sesquiterpenic ketone
α-Elemol	0.08	Sesquiterpenic alcohol

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Germacrene B	0.11	Sesquiterpene
Palustrol	0.01	Sesquiterpenic alcohol
β-Calacorene	0.03	Sesquiterpene
Caryophyllene oxide	0.12	Sesquiterpenic ether
Ledol	0.04	Sesquiterpenic alcohol
Humulene epoxide II	0.15	Sesquiterpenic ether
Hexadecane	0.11	Alkane
10-epi-Cubenol	0.13	Sesquiterpenic alcohol
Humulene 9,10-epoxide	0.01	Sesquiterpenic ether
τ-Cadinol	0.05	Sesquiterpenic alcohol
α-Cadinol	0.07	Sesquiterpenic alcohol
Ethyl (*Z*)-para-methoxycinnamate	0.16	Phenylpropanoid ester
Unknown	0.27	Unknown
Unknown	0.14	Unknown
(8*Z*)-Heptadecene	0.87	Alkene
Heptadecane	1.17	Alkane
2-Pentadecanol	0.06	Aliphatic alcohol
Ethyl (*E*)-para-methoxycinnamate	9.42	Phenylpropanoid ester
Ethyl myristate	0.04	Aliphatic ester
Octadecane	0.03	Alkane
Cryptomeridiol	0.02	Sesquiterpenic alcohol
Pimaradiene	0.24	Diterpene
Unknown	0.01	Unknown
Unknown	0.09	Unknown
Consolidated total	**96.61%**	

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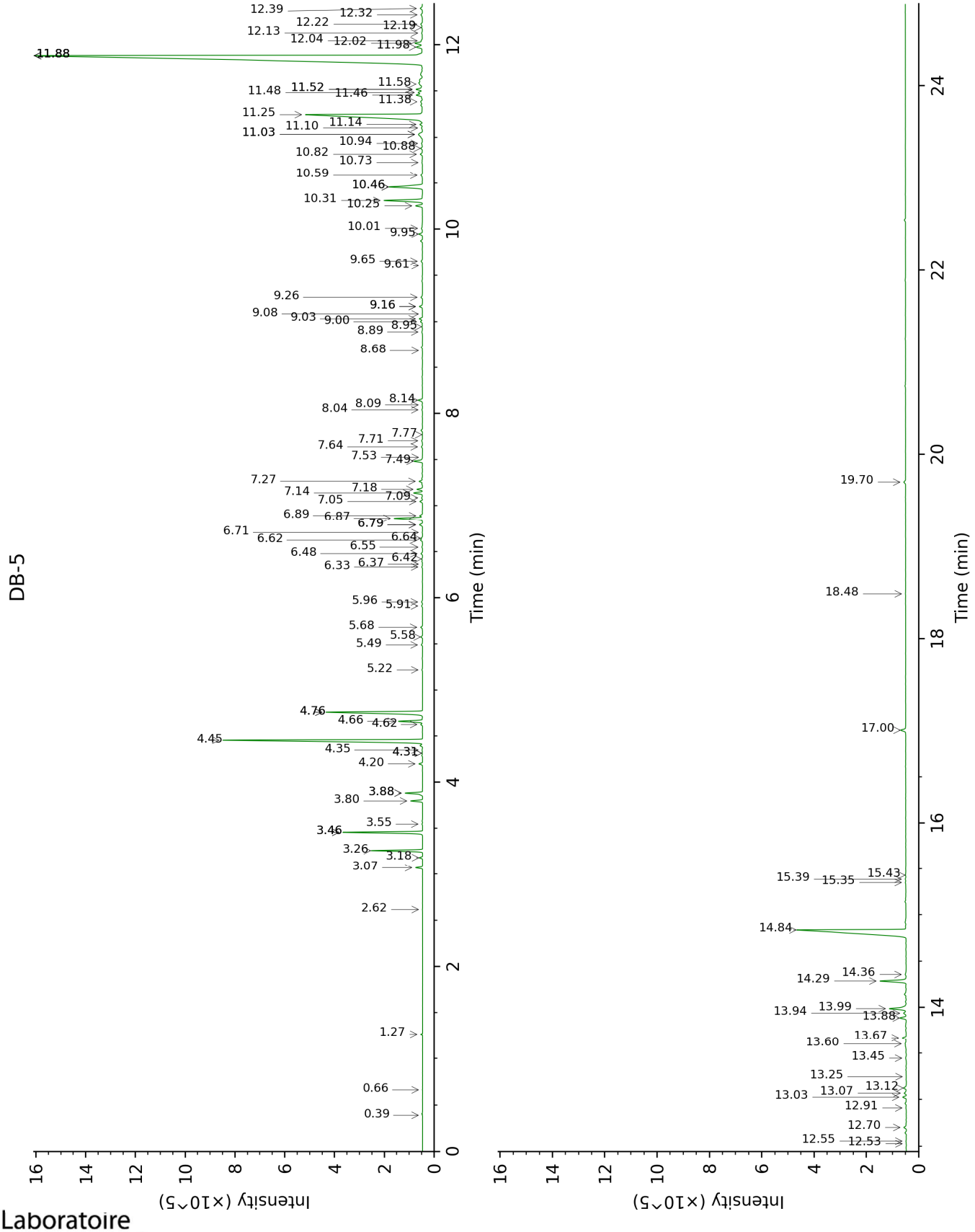
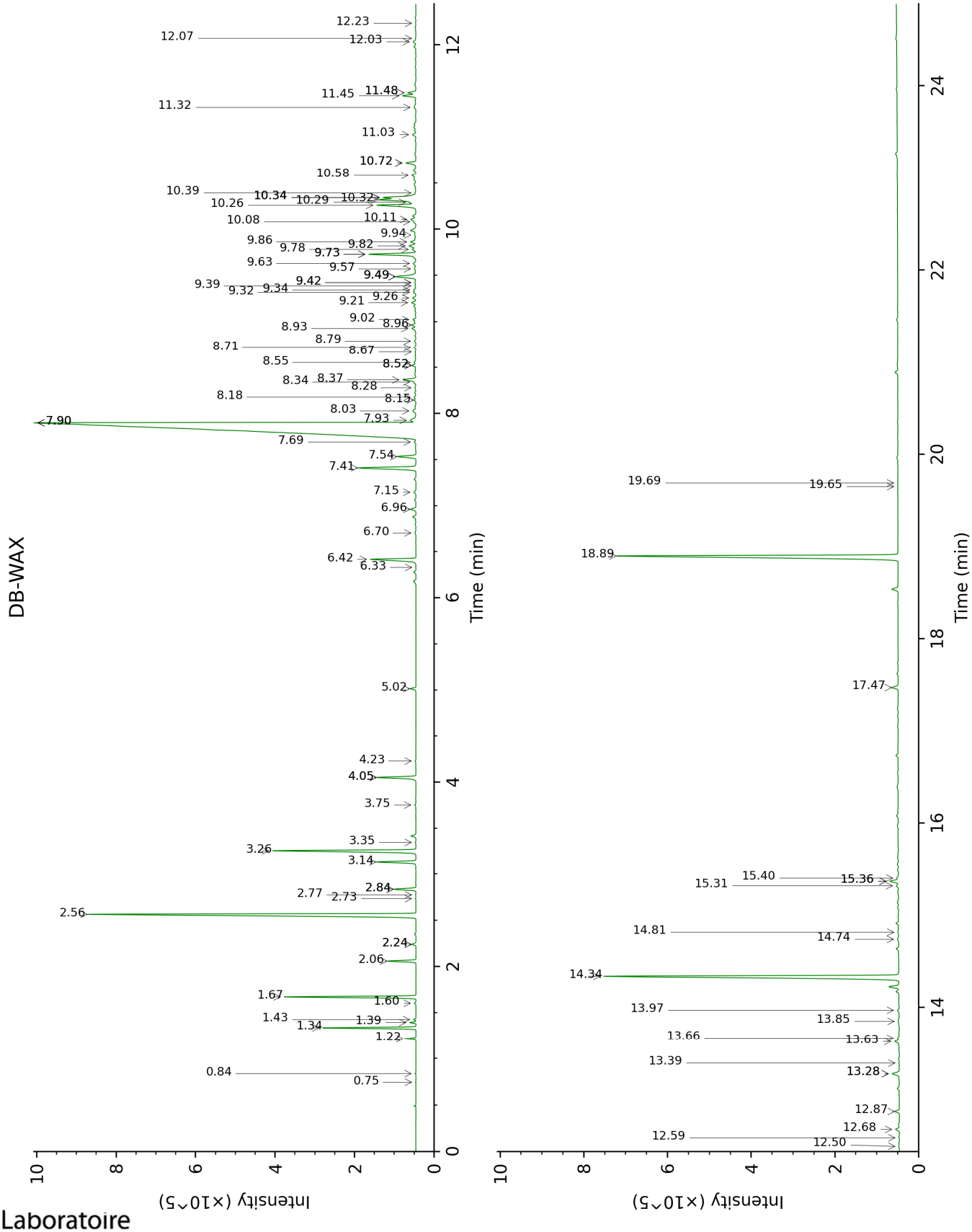
628 Boulevard du Saguenay, Saguenay (Qc) G7J 1H4 | www.phytochemia.com


DB-5
Intensity (×10^5)
Time (min)
12.39
12.32
12.22
12.19
12.13
12.04
12.02
11.98
11.88
11.58
11.48
11.52
11.46
11.38
11.25
11.14
11.10
11.03
10.94
10.88
10.82
10.73
10.59
10.46
10.31
10.25
10.01
9.95
9.65
9.61
9.26
9.16
9.08
9.03
9.00
8.95
8.89
8.68
8.14
8.09
8.04
7.77
7.71
7.64
7.53
7.49
7.27
7.18
7.14
7.09
7.05
6.89
6.87
6.79
6.71
6.64
6.62
6.55
6.48
6.42
6.37
6.33
5.96
5.91
5.68
5.58
5.49
5.22
4.76
4.66
4.62
4.45
4.35
4.31
4.20
3.88
3.80
3.55
3.46
3.26
3.18
3.07
2.62
1.27
0.66
0.39
19.70
18.48
17.00
15.43
15.39
15.35
14.84
14.36
14.29
13.99
13.94
13.88
13.67
13.60
13.45
13.25
13.12
13.07
13.03
12.91
12.70
12.55
12.53


DB-WAX
Intensity (×10^5)
Time (min)
12.23
12.07
12.03
11.45
11.48
11.32
11.03
10.72
10.58
10.39
10.34
10.29
10.32
10.26
10.08
10.11
9.94
9.86
9.82
9.78
9.73
9.63
9.57
9.49
9.42
9.39
9.34
9.32
9.26
9.21
9.02
8.96
8.93
8.79
8.71
8.67
8.55
8.52
8.37
8.34
8.28
8.18
8.15
8.03
7.93
7.90
7.69
7.54
7.41
7.15
6.96
6.70
6.42
6.33
5.02
4.23
4.05
3.75
3.35
3.26
3.14
2.84
2.77
2.73
2.56
2.24
2.06
1.67
1.60
1.43
1.39
1.34
1.22
0.84
0.75
19.69
19.65
18.89
17.47
15.40
15.36
15.31
14.81
14.74
14.34
13.97
13.85
13.66
13.63
13.39
13.28
12.87
12.68
12.59
12.50

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.39	504	0.01	0.84	908	0.01
Isovaleral	0.66	643	tr	0.75	888	tr
Toluene	1.27	758	0.04	1.43	1003	0.04
2-Methylbutyric acid	2.62	885	0.01			
Tricyclene	3.07	918	0.22	1.22	971	0.21
α-Thujene	3.18	925	0.11	1.39	999	0.10
α-Pinene	3.26	930	1.66	1.34	992	1.65
α-Fenchene	3.46*	943	2.73	1.60	1020	0.03
Camphene	3.46*	943	[2.73]	1.67	1027	2.67
Thuja-2,4(10)-diene	3.55	949	0.03	2.24*	1084	0.10
3,7,7-Trimethylcyclohepta-1,3,5-triene	3.80	966	0.41	2.84*	1134	0.53
Sabinene	3.88*	971	0.67	2.24*	1084	[0.10]
β-Pinene	3.88*	971	[0.67]	2.06	1066	0.59
Myrcene	4.20	992	0.14	2.84*	1134	[0.53]
Menthatriene isomer I	4.31*†	1000	0.05	3.35	1175	0.02
α-Phellandrene	4.31*†	1000	[0.05]	2.73	1126	0.02
Pseudolimonene	4.35†	1002	[0.05]	2.78	1129	0.01
Δ3-Carene	4.45	1008	9.32	2.56	1113	9.26
meta-Cymene	4.62	1019	0.07	4.05*	1228	0.96
para-Cymene	4.66	1021	0.90	4.05*	1228	[0.96]
1,8-Cineole	4.76*	1028	4.57	3.26	1168	3.66
Limonene	4.76*	1028	[4.57]	3.14	1158	0.90
γ-Terpinene	5.22	1057	0.03	3.75	1206	0.03
Octanol	5.49	1074	0.06	8.15	1528	0.05
(*E*)-5-octen-1-ol	5.58	1079	0.07			
Terpinolene	5.68	1086	0.08	4.23	1241	0.02
Linalool	5.91	1100	0.04	8.03	1519	0.12
2-Nonanol	5.96	1103	0.05	7.69	1493	0.05
Unknown [m/z 69, 41 (61), 84 (60), 43 (24), 67 (8)...]	6.33	1128	0.03			
cis-Limonene oxide	6.36	1130	0.01	6.33	1392	tr
cis-para-Mentha-2,8-dien-1-ol	6.42	1133	0.03	9.39	1626	0.03
Camphor	6.48	1137	0.07	7.15	1453	0.06
trans-Verbenol	6.55	1142	0.03	9.42*	1628	0.04
para-Vinylanisole	6.62	1147	0.09	9.34	1622	0.06
Eucarvone	6.64	1148	0.05	9.49*	1634	0.70
Isoborneol	6.71	1152	0.02	9.32	1620	0.07
Unknown [m/z 93, 108 (98), 95 (50), 91 (49), 79 (40), 94 (40)... 166 (1)]	6.79*	1157	0.14	10.58	1724	0.11
Pinocarvone	6.79*	1157	[0.14]	7.90*	1509	40.95
Borneol	6.86	1162	1.16	9.73*	1653	1.25

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α-Phellandren-8-ol	6.89	1164	0.12	10.11	1684	0.19
Terpinen-4-ol	7.05	1174	0.11	8.52*	1557	0.11
4-Methylacetophenone	7.09	1177	0.04	10.39	1707	0.02
meta-Cymen-8-ol	7.14	1180	0.37	11.45	1797	0.35
para-Cymen-8-ol	7.18	1183	0.22	11.48*	1800	0.22
α-Terpineol	7.27	1188	0.14	9.73*	1653	[1.25]
Verbenone	7.48	1202	0.37	9.49*	1634	[0.70]
Unknown [m/z 93, 71 (74), 92 (35), 41 (24), 69 (23), 136 (21)...]	7.53	1205	0.01			
Unknown [m/z 67, 108 (88), 82 (86), 107 (85), 95 (66), 110 (58)...]	7.64	1213	0.05			
trans-Carveol	7.71	1217	0.05	11.32	1786	0.09
Bornyl formate	7.77	1222	0.01	7.93	1511	0.25
Carvone	8.04	1240	0.03	9.94	1670	0.03
Carvotanacetone	8.09	1244	0.02	9.42*	1628	[0.04]
Car-3-en-2-one	8.14	1247	0.19	10.29	1699	0.11
Bornyl acetate	8.68	1284	0.01	8.18	1531	0.05
2-Undecanone	8.89	1298	0.05	8.55	1560	0.06
Terpinen-4-yl acetate	8.95	1302	0.02	8.67	1569	0.02
Tridecane	9.03	1303	0.14	5.02	1300	0.13
Car-3-en-5-one	9.00	1306	0.09	12.03	1849	0.09
Carvacrol	9.08	1307	0.01	15.32	2159	0.07
2,3-Dihydro-3,6-dihydroxyterpinolene	9.16*	1313	0.15	14.74	2101	0.05
3-Carene-2,5-dione	9.16*	1313	[0.15]			
Unknown [m/z 93, 92 (36), 121 (27), 43 (23), 136 (23), 91 (22)...]	9.26	1320	0.08			
α-Cubebene	9.61	1344	0.01	6.70	1420	0.03
α-Terpinyl acetate	9.65	1347	0.07	9.63	1645	0.10
α-Ylangene	9.95	1368	0.16	6.96	1439	0.15
Unknown [m/z 93, 43 (59), 41 (40), 91 (40), 69 (33), 77 (22)...]	10.01	1373	0.05			
β-Elemene	10.25	1390	0.28	8.36	1545	0.38
Cyperene	10.31	1394	1.72	7.41	1472	1.68
Tetradecane	10.46*	1404	1.78	6.42	1399	1.29
α-Gurjunene	10.46*	1404	[1.78]	7.54	1482	0.50
β-Caryophyllene	10.58	1414	0.08	8.34	1543	0.05
β-Copaene	10.73	1424	0.02	8.28	1538	0.04
γ-Elemene	10.82	1431	0.11	8.96†	1592	[0.24]
6,9-Guaiadiene	10.88	1436	0.07	8.52*	1557	[0.11]
Unknown [m/z 91, 161 (92), 105 (85), 119 (63), 133 (53), 79 (49), 204 (46)]	10.94	1440	0.05	8.72	1572	0.05
Rotundene	11.03*	1447	0.38	8.79	1578	0.05
α-Humulene	11.03*	1447	[0.38]	9.21	1611	0.13

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allo-Aromadendrene	11.10	1452	0.05	8.93†	1589	0.24
cis-Muurola-4(15),5-diene	11.14	1455	0.11	9.26	1615	0.10
Ethyl (*E*)-cinnamate	11.25	1463	9.18	14.34	2062	9.12
Unknown [m/z 119, 132 (91), 105 (60), 91 (34), 41 (33), 131 (32)...202 (18)]	11.38	1474	0.11	10.34*†	1703	[2.07]
Unknown [m/z 189, 133 (75), 91 (71), 105 (69), 93 (44)... 204 (33)]	11.46	1479	0.29	9.49*	1634	[0.70]
β-Selinene	11.48	1481	0.20	9.78	1657	0.12
δ-Selinene	11.52*	1484	0.32	9.57	1640	0.06
Valencene	11.52*	1484	[0.32]	9.82	1660	0.22
1-Pentadecene	11.58	1488	0.11	7.90*	1509	[40.95]
Cubebol	11.88*	1511	42.33	12.50	1890	0.02
δ-Guaiene	11.88*	1511	[42.33]	9.86	1664	0.16
Pentadecane	11.88*	1511	[42.33]	7.90*	1509	[40.95]
γ-Cadinene	11.88*	1511	[42.33]	10.32†	1701	2.07
Unknown [m/z 161, 204 (65), 105 (53), 119 (49), 91 (49), 147 (48), 189 (33)]	11.98	1518	0.32	10.08	1682	0.05
δ-Cadinene	12.02	1522	0.37	10.34*†	1703	[2.07]
10-epi-Cubebol?	12.04	1524	0.04	13.66	1998	0.05
α-Cadinene	12.13	1530	0.04	10.72*	1735	0.29
α-Calacorene	12.19	1535	0.03	12.07	1852	0.01
Furopelargone isomer II	12.22	1538	0.08			
α-Elemol	12.32	1546	0.08	13.97	2027	0.06
Germacrene B	12.39	1551	0.11	11.03	1761	0.10
Palustrol	12.53	1562	0.01	12.23	1866	0.01
β-Calacorene	12.56	1564	0.03	12.59	1898	0.01
Caryophyllene oxide	12.70	1576	0.12	12.68	1907	0.11
Ledol	12.91	1592	0.04	13.28*	1962	0.25
Humulene epoxide II	13.03	1601	0.15	13.28*	1962	[0.25]
Hexadecane	13.07	1604	0.11	9.02	1596	0.08
10-epi-Cubenol	13.12	1609	0.13	13.63	1994	0.15
Humulene 9,10-epoxide	13.25	1619	0.01	13.39	1972	0.01
τ-Cadinol	13.45	1636	0.05	14.81	2109	0.04
α-Cadinol	13.60	1648	0.07	15.40	2168	0.04
Ethyl (*Z*)-para-methoxycinnamate	13.67	1654	0.16	17.47	2386	0.19
Unknown [m/z 67, 81 (85), 82 (64), 95 (62), 96 (48), 55 (44), 68 (43)...]	13.88	1672	0.27	10.72*	1735	[0.29]
Unknown [m/z 43, 55 (49), 71 (47), 41 (39),	13.94	1676	0.14	12.87	1924	0.12

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97 (37), 69 (37), 67 (35)...]						
(8*Z*)-Heptadecene	13.99	1680	0.87	10.34*†	1703	[2.07]
Heptadecane	14.28	1705	1.17	10.26	1696	1.13
2-Pentadecanol	14.36	1711	0.06	15.36*	2164	0.26
Ethyl (*E*)-para-methoxycinnamate	14.84	1753	9.42	18.89	2548	9.46
Ethyl myristate	15.35	1797	0.04	13.85	2016	0.07
Octadecane	15.39	1800	0.03	11.48*	1800	[0.22]
Cryptomeridiol	15.43	1804	0.02	19.69	2642	0.01
Pimaradiene	17.00	1949	0.24	15.36*	2164	[0.26]
Unknown [m/z 123, 138 (41), 107 (30), 135 (29), 205 (28), 164 (25)...]	18.48	2094	0.01	19.65	2638	0.01
Unknown [m/z 169, 91 (64), 69 (58), 41 (43), 170 (28), 238 (27)...]	19.70	2219	0.09			
Total identified	**95.40%**			**94.88%**		
Total reported	**96.89%**			**95.22%**		

*: 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