CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19A10-ORA02-1-CC
Customer identification : Organic bergamot
Type : Essential oil
Source : *Citrus aurantium* var. *bergamia*
Customer : Organic Aromas Inc.

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 : Benoit Roger, Ph. D.
Analysis date : January 15, 2019

Checked and approved by :

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

Note: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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

Laboratoire
PhytoChemia

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

PHYSICOCHEMICAL DATA

Physical aspect: Bright yellow liquid
Refractive index: 1.4640 ± 0.0003 (20 °C)

CONCLUSION

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

Laboratoire
PhytoChemia

Plus que des analyses... des conseils

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Nonane	tr	tr	Alkane
Tricyclene	tr	tr	Monoterpene
α-Thujene	0.24	0.24	Monoterpene
α-Pinene	1.07	1.06	Monoterpene
α-Fenchene	0.03*	tr	Monoterpene
Camphene	[0.03]*	0.03	Monoterpene
β-Pinene	7.98*	6.71	Monoterpene
Sabinene	[7.98]*	1.16	Monoterpene
Myrcene	1.01	1.00	Monoterpene
α-Phellandrene	0.06*	0.02	Monoterpene
Pseudolimonene	[0.06]*	tr	Monoterpene
Octanal	0.02	0.14*	Aliphatic aldehyde
Δ3-Carene	tr	tr	Monoterpene
α-Terpinene	0.11	0.11	Monoterpene
para-Cymene	0.21	0.41	Monoterpene
Limonene	42.12*	41.19	Monoterpene
1,8-Cineole	[42.12]*	0.21*	Monoterpenic ether
β-Phellandrene	[42.12]*	[0.21]*	Monoterpene
(*Z*)-β-Ocimene	0.03	4.32*	Monoterpene
(*E*)-β-Ocimene	0.09	0.09	Monoterpene
γ-Terpinene	4.33	[4.32]*	Monoterpene
cis-Sabinene hydrate	0.02	0.07*	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.03	0.03	Monoterpenic alcohol
Octanol	tr	11.50*	Aliphatic alcohol
Terpinolene	0.19*	[0.14]*	Monoterpene
trans-Linalool oxide (fur.)	[0.19]*	[0.07]*	Monoterpenic alcohol
trans-Sabinene hydrate	tr	tr	Monoterpenic alcohol
Linalool	11.45*	[11.50]*	Monoterpenic alcohol
Nonanal	[11.45]*	0.01	Aliphatic aldehyde
cis-Limonene oxide	0.02	0.01	Monoterpenic ether
trans-Limonene oxide	0.02	0.01	Monoterpenic ether
Camphor	0.01	0.01	Monoterpenic ketone
Citronellal	tr	tr	Monoterpenic aldehyde
Terpinen-4-ol	0.01	0.01	Monoterpenic alcohol
α-Terpineol	0.03	0.03*	Monoterpenic alcohol
γ-Terpineol	0.02	0.01	Monoterpenic alcohol
Unknown	tr	tr	Unknown
Decanal	0.01	0.01	Aliphatic aldehyde
Octyl acetate	0.03	0.03	Aliphatic ester
Nerol	0.03*	0.02	Monoterpenic alcohol
Citronellol	[0.03]*	0.01	Monoterpenic alcohol
Neral	0.06	0.05	Monoterpenic aldehyde
Linalyl acetate	28.23*	28.35*	Monoterpenic ester
Geraniol	[28.23]*	0.01	Monoterpenic alcohol
Unknown	[28.23]*	0.06	Unknown
Geranial	0.13	0.07	Monoterpenic aldehyde
Bornyl acetate	0.01	[28.35]*	Monoterpenic ester
Unknown	0.01		Unknown

Laboratoire
PhytoChemia

Plus que des analyses... des conseils

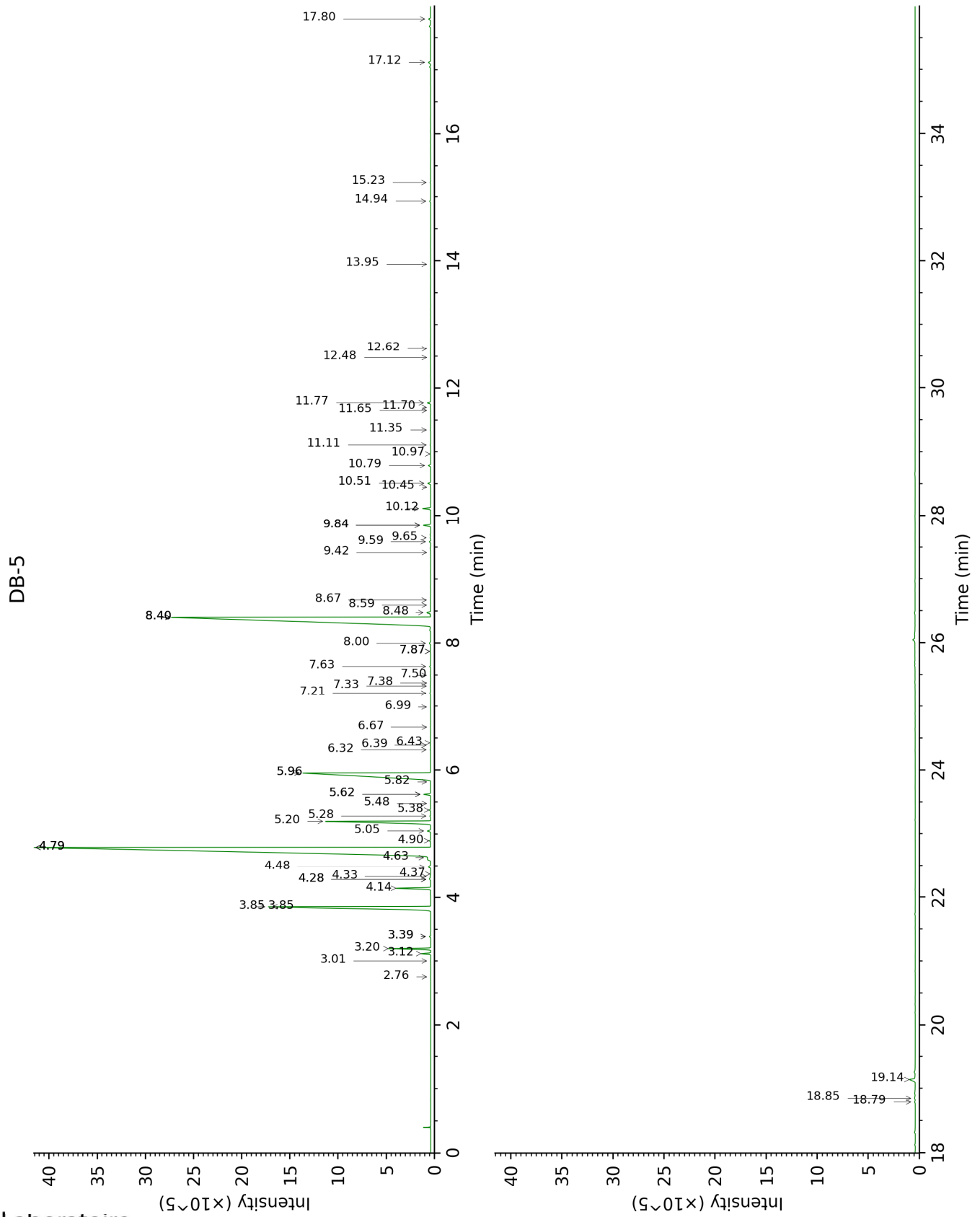|			
Linalyl propionate	tr	0.01	Monoterpenic ester
α-Terpinyl acetate	0.04	0.04	Monoterpenic ester
Unknown	0.02		Monoterpenic ester
Hodiendiol derivative III	0.22*		Oxygenated monoterpene
Neryl acetate	[0.22]*	0.33*	Monoterpenic ester
Geranyl acetate	0.24	0.25	Monoterpenic ester
Dodecanal	tr	tr	Aliphatic aldehyde
β-Caryophyllene	0.09	0.15*	Sesquiterpene
trans-α-Bergamotene	0.07	[0.15]*	Sesquiterpene
α-Humulene	0.01	0.01	Sesquiterpene
(*E*)-β-Farnesene	0.02	0.02	Sesquiterpene
Germacrene D	0.02	[0.03]*	Sesquiterpene
(*Z*)-α-Bisabolene	tr	tr	Sesquiterpene
Hodiendiol derivative II	0.01	0.02*	Oxygenated monoterpene
β-Bisabolene	0.10	[0.33]*	Sesquiterpene
(*E*)-Nerolidol	0.01	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	tr	[0.02]*	Sesquiterpenic ether
α-Bisabolol	tr	0.01	Sesquiterpenic alcohol
Myristic acid	0.04		Aliphatic acid
Nootkatone	0.02	0.02	Sesquiterpenic ketone
Citropten	0.09	0.06	Furanocoumarin
Bergapten	0.07		Furanocoumarin
Linoleic acid	0.02		Aliphatic acid
Oleic acid	0.04		Aliphatic acid
Stearic acid	0.27		Aliphatic acid
Total identified	**98.97%**	**97.90%**	

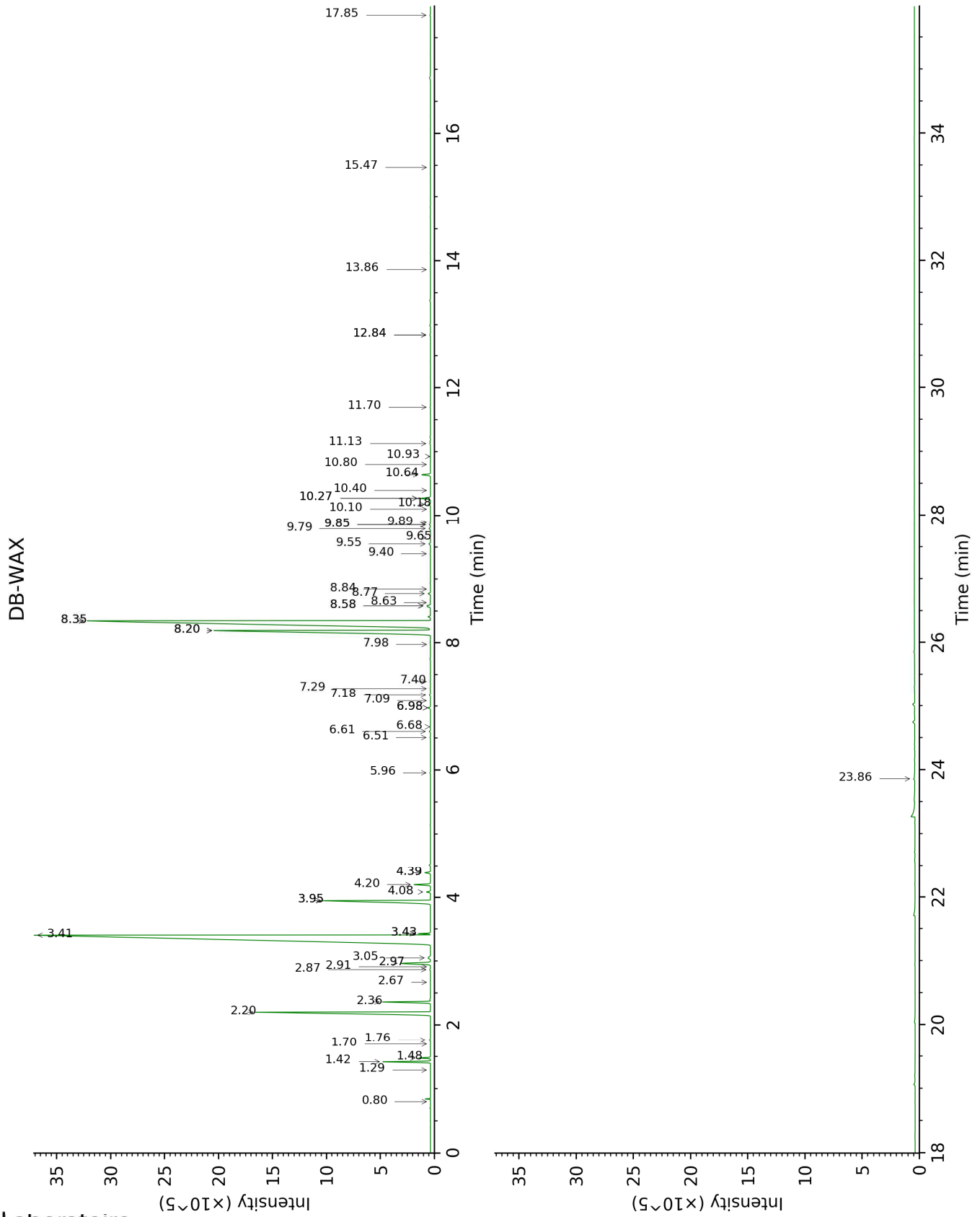*: Two or more compounds are coeluting on this column

[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

Laboratoire
Phy̆toChemia

Plus que des analyses... des conseils

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

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

Laboratoire
Ph☘toChemia

Plus que des analyses... des conseils

DB-5

Time (min)

Intensity (×10^5)

Time (min)

Intensity (×10^5)

DB-WAX

17.85
15.47
13.86
12.84
11.70
11.13
10.93
10.80
10.64
10.40
10.27
10.10
10.18
9.89
9.85
9.79
9.65
9.55
9.40
8.84
8.77
8.63
8.58
8.35
8.20
7.98
7.40
7.29
7.18
7.09
6.98
6.68
6.61
6.51
5.96
4.39
4.20
4.08
3.95
3.43
3.41
3.05
2.97
2.91
2.87
2.67
2.36
2.20
1.76
1.70
1.48
1.42
1.29
0.80

23.86

Time (min)

Time (min)

Intensity (×10^5)

Intensity (×10^5)

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Nonane	2.76	900	tr	0.80	896	tr
Tricyclene	3.01	917	tr	1.29	975	tr
α-Thujene	3.12	924	0.24	1.48	1003	0.24
α-Pinene	3.20	930	1.07	1.42	994	1.06
α-Fenchene	3.39*	942	0.03	1.70	1023	tr
Camphene	3.39*	942	[0.03]	1.76	1030	0.03
β-Pinene	3.85*	973	7.98	2.20	1071	6.71
Sabinene	3.85*	973	[7.98]	2.36	1086	1.16
Myrcene	4.14	992	1.01	2.97	1136	1.00
α-Phellandrene	4.28*†	1001	0.06	2.87	1128	0.02
Pseudolimonene	4.28*†	1001	[0.06]	2.91	1132	tr
Octanal	4.33	1004	0.02	4.39*	1247	0.14
Δ3-Carene	4.37	1006	tr	2.67	1113	tr
α-Terpinene	4.48	1014	0.11	3.05	1143	0.11
para-Cymene	4.63	1023	0.21	4.20	1233	0.41
Limonene	4.79*	1033	42.12	3.41	1171	41.19
1,8-Cineole	4.79*	1033	[42.12]	3.43*	1173	0.21
β-Phellandrene	4.79*	1033	[42.12]	3.43*	1173	[0.21]
(Z)-β-Ocimene	4.90	1040	0.03	3.95*	1214	4.32
(E)-β-Ocimene	5.05	1049	0.09	4.08	1224	0.09
γ-Terpinene	5.20	1059	4.33	3.95*	1214	[4.32]
cis-Sabinene hydrate	5.28	1064	0.02	6.98*	1429	0.07
cis-Linalool oxide (fur.)	5.38	1070	0.03	6.61	1402	0.03
Octanol	5.48	1076	tr	8.20*	1522	11.50
Terpinolene	5.62*	1086	0.19	4.39*	1247	[0.14]
trans-Linalool oxide (fur.)	5.62*	1086	[0.19]	6.98*	1429	[0.07]
trans-Sabinene hydrate	5.82	1098	tr	7.98	1505	tr
Linalool	5.96*	1107	11.45	8.20*	1522	[11.50]
Nonanal	5.96*	1107	[11.45]	5.96	1354	0.01
cis-Limonene oxide	6.32	1130	0.02	6.51	1395	0.01
trans-Limonene oxide	6.39	1135	0.02	6.68	1407	0.01
Camphor	6.43	1137	0.01	7.28	1452	0.01
Citronellal	6.67	1153	tr	7.09	1438	tr
Terpinen-4-ol	6.99	1174	0.01	8.63	1556	0.01
α-Terpineol	7.21	1188	0.03	9.85*	1654	0.03
γ-Terpineol	7.33	1195	0.02	9.89	1656	0.01
Unknown [m/z 43, 71 (80), 67 (55), 59 (51), 68 (44), 41 (43)...]	7.38	1198	tr	10.93	1743	tr
Decanal	7.50	1206	0.01	7.40	1461	0.01
Octyl acetate	7.63	1216	0.03	7.18	1444	0.03

Laboratoire PhytoChemia

Plus que des analyses... des conseils

Nerol	7.87*	1232	0.03	11.13	1760	0.02
Citronellol	7.87*	1232	[0.03]	10.80	1733	0.01
Neral	8.00	1241	0.06	9.55	1629	0.05
Linalyl acetate	8.40*	1269	28.23	8.35*	1534	28.35
Geraniol	8.40*	1269	[28.23]	11.70	1809	0.01
Unknown [m/z 43, 111 (47), 93 (41), 55 (28), 67 (23), 41 (22)...]	8.40*	1269	[28.23]	8.77	1567	0.06
Geranial	8.48	1274	0.13	10.18	1680	0.07
Bornyl acetate	8.59	1282	0.01	8.35*	1534	[28.35]
Unknown [m/z 43, 121 (74), 93 (42), 95 (38), 107 (29), 41 (29), 136 (28)...]	8.67	1287	0.01			
Linalyl propionate	9.42	1336	tr	8.84	1572	0.01
α-Terpinyl acetate	9.59	1348	0.04	9.79	1648	0.04
Unknown [m/z 43, 121 (52), 93 (48), 79 (33), 41 (30), 136 (26), 81 (25)...]	9.65	1352	0.02			
Hodiendiol derivative III	9.84*	1366	0.22			
Neryl acetate	9.84*	1366	[0.22]	10.27*	1688	0.33
Geranyl acetate	10.12	1385	0.24	10.64	1719	0.25
Dodecanal	10.45	1409	tr	10.10	1674	tr
β-Caryophyllene	10.51	1414	0.09	8.58*	1552	0.15
trans-α-Bergamotene	10.79	1435	0.07	8.58*	1552	[0.15]
α-Humulene	10.97	1448	0.01	9.40	1616	0.01
(*E*)-β-Farnesene	11.11	1459	0.02	9.65	1637	0.02
Germacrene D	11.34	1476	0.02	9.85*	1654	[0.03]
(*Z*)-α-Bisabolene	11.65	1499	tr	10.40	1698	tr
Hodiendiol derivative II	11.70	1503	0.01	12.84*	1912	0.02
β-Bisabolene	11.77	1508	0.10	10.27*	1688	[0.33]
(*E*)-Nerolidol	12.48	1564	0.01	13.86	2007	0.01
Caryophyllene oxide	12.62	1575	tr	12.84*	1912	[0.02]
α-Bisabolol	13.95	1684	tr	15.47	2165	0.01
Myristic acid	14.94	1768	0.04			
Nootkatone	15.23	1794	0.02	17.85	2417	0.02
Citropten	17.12	1968	0.09	23.86	3168	0.06
Bergapten	17.80	2034	0.07			
Linoleic acid	18.79	2134	0.02			
Oleic acid	18.85	2140	0.04			
Stearic acid	19.14	2170	0.27			
Total identified		**98.97%**			**97.90%**	

Laboratoire
PhytoChemia

Plus que des analyses... des conseils

Total reported	99.01%	97.96%

*: 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

Laboratoire
Ph**y**toChemia

Plus que des analyses... des conseils

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