Date : July 23, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19G16-PTH05-1-SCC
Customer identification : Orange Sweet - O2010894R
Type : Essential oil
Source : *Citrus sinensis*
Customer : Plant Therapy

Analysis

Method: PC-PA-014 - 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 : July 22, 2019

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Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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: Bright yellow liquid
Refractive index: 1.4734 ± 0.0003 (20 °C)

ISO 3140:2011 - OIL OF SWEET ORANGE, OBTAINED BY PHYSICAL EXTRACTION OF THE PEEL

Compound	Min. %	Max. %	Observed %	Complies?
β-Sinensal	0.01	0.06	0.03	Yes
Geranial	0.05	0.20	0.11	Yes
Valencene	0.01	0.40	0.07	Yes
Neral	0.03	0.10	0.08	Yes
Linalool	0.15	0.70	0.46	Yes
Decanal	0.1	0.7	0.3	Yes
Nonanal	0.01	0.06	0.05	Yes
Octanal	0.1	0.4	0.3	Yes
Limonene	93.0	96.0	92.6	No
Myrcene	1.5	3.5	1.8	Yes
Sabinene	0.2	0.8	0.3	Yes
β-Pinene	0.02	0.15	0.03	Yes
α-Pinene	0.4	0.8	0.5	Yes
Refractive index	1.4700	1.4760	1.4734	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil marginally does not comply with the ISO standard for sweet orange oil.

Analysis summary – Consolidated contents

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

Identification	%	Classe
α-Thujene	tr	Monoterpene
α-Pinene	0.50	Monoterpene
Sabinene	0.34	Monoterpene
β-Pinene	0.03	Monoterpene
Myrcene	1.83	Monoterpene
Octanal	0.26	Aliphatic aldehyde
α-Phellandrene	0.03	Monoterpene
Δ3-Carene	0.11	Monoterpene
1,8-Cineole	0.26	Monoterpenic ether
Limonene	92.59	Monoterpene
(*Z*)-β-Ocimene	tr	Monoterpene
(*E*)-β-Ocimene	0.02	Monoterpene
γ-Terpinene	0.01	Monoterpene
cis-Sabinene hydrate	0.01	Monoterpenic alcohol
Octanol	0.04	Aliphatic alcohol
Terpinolene	0.02	Monoterpene
Linalool	0.46	Monoterpenic alcohol
Nonanal	0.05	Aliphatic aldehyde
trans-para-Mentha-2,8-dien-1-ol	0.03	Monoterpenic alcohol
cis-Limonene oxide	0.02	Monoterpenic ether
cis-para-Mentha-2,8-dien-1-ol	0.02	Monoterpenic alcohol
trans-Limonene oxide	0.02	Monoterpenic ether
Citronellal	0.05	Monoterpenic aldehyde
Terpinen-4-ol	0.01	Monoterpenic alcohol
α-Terpineol	0.07	Monoterpenic alcohol
Decanal	0.26	Aliphatic aldehyde
trans-Carveol	0.03	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
cis-Carveol	0.02	Monoterpenic alcohol
Neral	0.08	Monoterpenic aldehyde
Geraniol	0.02	Monoterpenic alcohol
Perillaldehyde	0.02	Monoterpenic aldehyde
Geranial	0.11	Monoterpenic aldehyde
Decanol	0.02	Aliphatic alcohol
Limonen-10-ol	0.02	Monoterpenic alcohol
Undecanal	0.02	Aliphatic aldehyde
Neryl acetate	0.01	Monoterpenic ester
α-Copaene	0.03	Sesquiterpene
Geranyl acetate	0.01	Monoterpenic ester
β-Elemene	0.01	Sesquiterpene
Dodecanal	0.06	Aliphatic aldehyde
β-Caryophyllene	0.06	Sesquiterpene
β-Copaene	0.04	Sesquiterpene
α-Humulene	0.01	Sesquiterpene
Germacrene D	0.03	Sesquiterpene
Valencene	0.07	Sesquiterpene
α-Muurolene	0.02	Sesquiterpene

γ-Cadinene	0.06	Sesquiterpene
δ-Cadinene	0.05	Sesquiterpene
Caryophyllene oxide	0.03	Sesquiterpenic ether
β-Sinensal	0.03	Sesquiterpenic aldehyde
α-Sinensal	0.02	Sesquiterpenic aldehyde
Palmitic acid	0.09	Aliphatic acid
Linoleic acid	0.04	Aliphatic acid
Oleic acid	0.04	Aliphatic acid
Stearic acid	0.04	Aliphatic acid
Tetramethoxyflavone isomer	0.04	Flavonoid
Tangeretin	0.05	Flavonoid
3,3',4',5,6,7,8-Heptamethoxyflavone	0.09	Flavonoid
Nobiletin	0.09	Flavonoid
Consolidated total	**98.41%**	

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

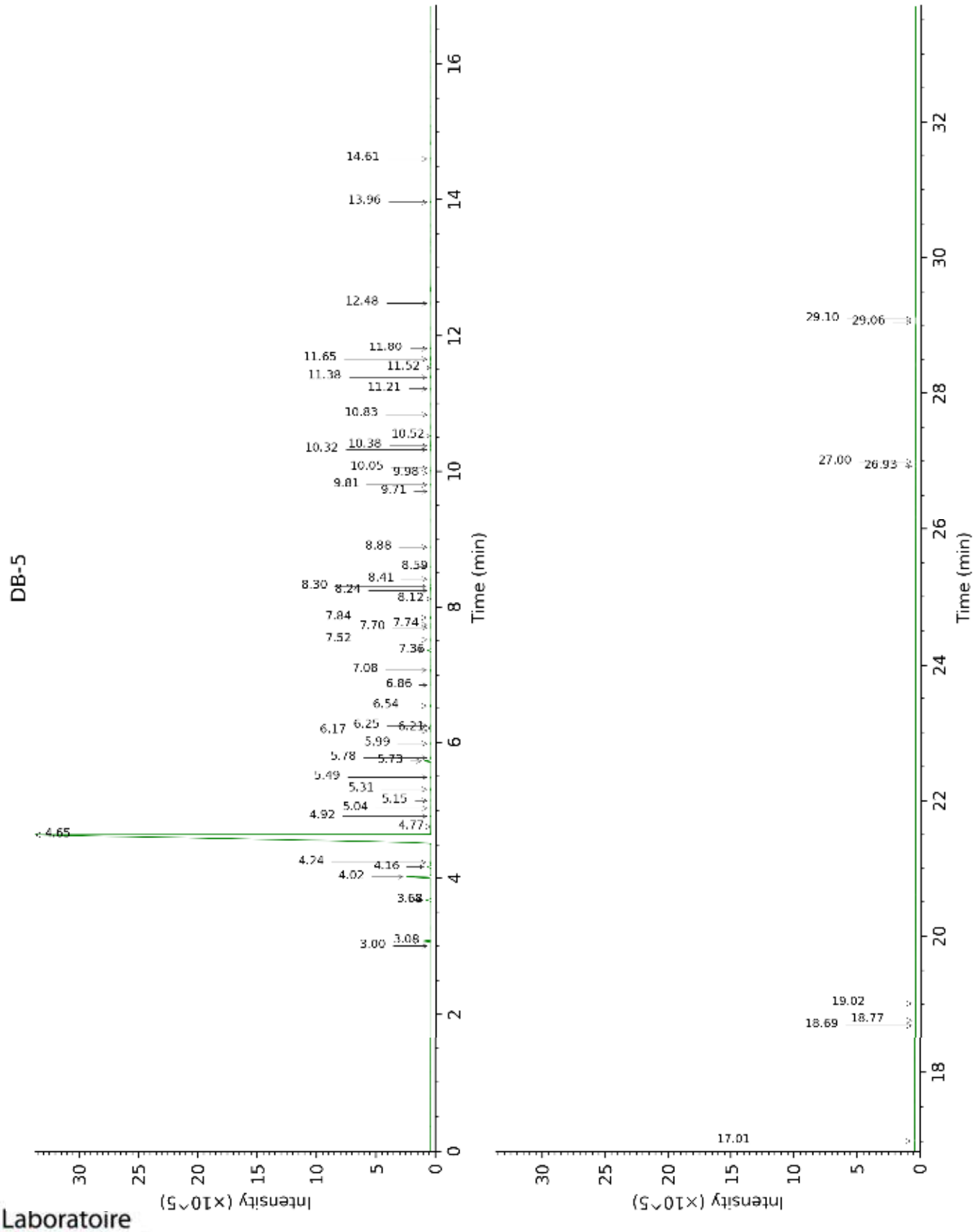
Note: no correction factor was applied

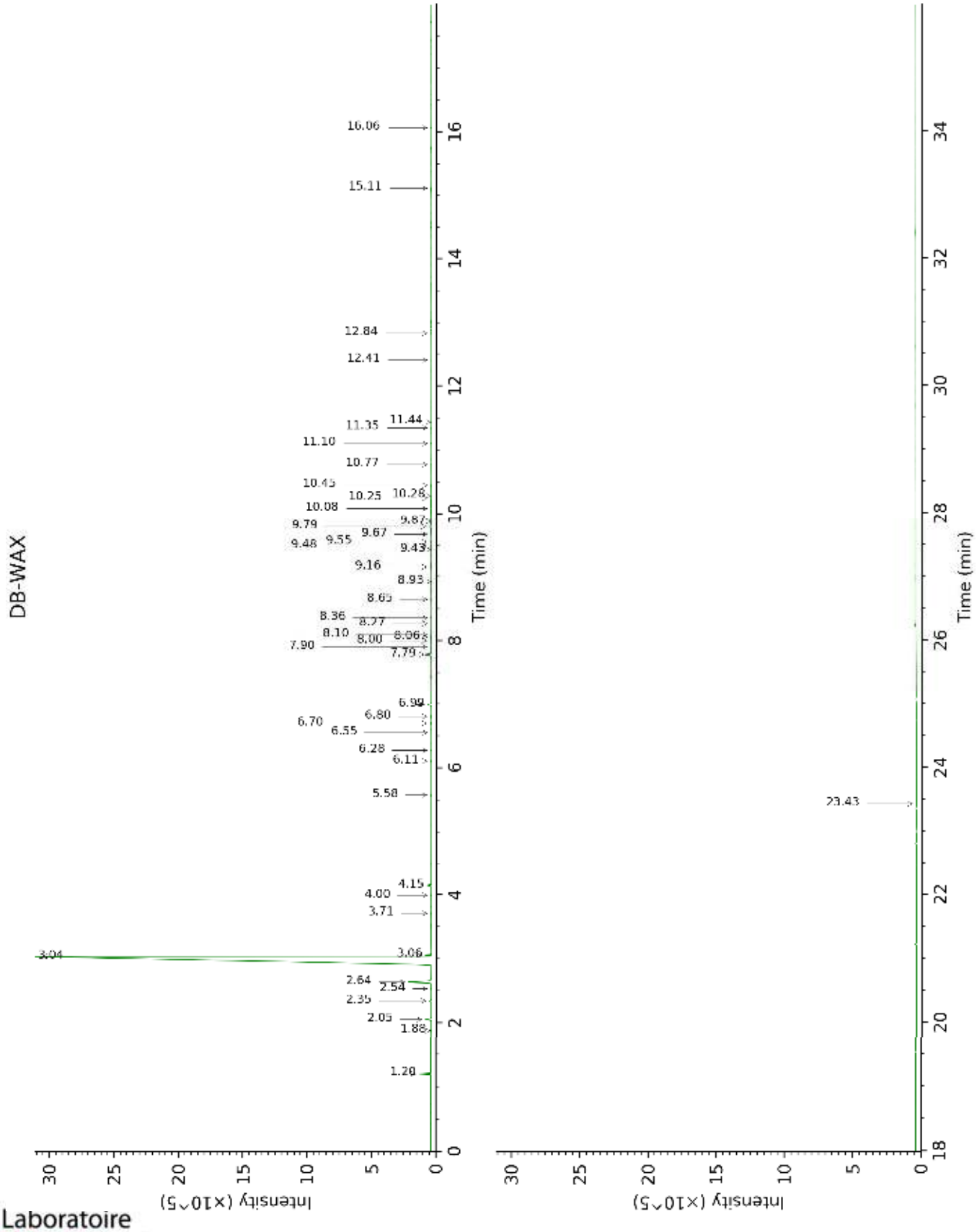
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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 (x10^5)
14.61
13.96
12.48
11.80
11.65
11.52
11.38
11.21
10.83
10.52
10.32
10.38
10.05
9.98
9.81
9.71
8.88
8.59
8.41
8.30
8.21
8.12
7.84
7.70
7.74
7.52
7.36
7.08
6.86
6.54
6.17
6.25
6.21
5.99
5.78
5.73
5.49
5.31
5.15
5.04
4.92
4.77
4.65
4.74
4.16
4.02
3.68
3.00
3.08
29.10
29.06
27.00
26.93
19.02
18.77
18.69
17.01


DB-WAX
Time (min)
Intensity (x10^5)
16.06
15.11
12.84
12.41
11.44
11.35
11.10
10.77
10.45
10.25
10.26
10.08
9.79
9.87
9.67
9.55
9.48
9.43
9.16
8.93
8.65
8.36
8.77
8.10
8.00
8.06
7.90
7.79
6.99
6.80
6.70
6.55
6.28
6.11
5.58
4.15
4.00
3.71
3.04
3.06
2.64
2.54
2.35
2.05
1.88
1.20
23.43

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
α-Thujene	3.00	925	tr			
α-Pinene	3.08	930	0.50	1.20	992	0.50
Sabinene	3.68*	969	0.36	2.05	1085	0.34
β-Pinene	3.68*	969	[0.36]	1.88	1066	0.03
Myrcene	4.02	992	1.83	2.64	1136	1.83
Octanal	4.16*	1001	0.30	4.15	1254	0.26
α-Phellandrene	4.16*	1001	[0.30]	2.54	1127	0.03
Δ3-Carene	4.24	1006	0.11	2.34	1112	0.11
1,8-Cineole	4.65*	1032	93.30	3.06	1170	0.26
Limonene	4.65*	1032	[93.30]	3.04	1168	92.59
(*Z*)-β-Ocimene	4.77	1039	tr			
(*E*)-β-Ocimene	4.92	1049	0.02	3.71	1221	0.02
γ-Terpinene	5.04	1056	0.01			
cis-Sabinene hydrate	5.15	1064	0.01	6.55	1429	0.01
Octanol	5.31	1074	0.04	7.90	1531	0.04
Terpinolene	5.49	1085	0.02	4.00	1242	0.02
Linalool	5.73	1100	0.46	7.79	1522	0.47
Nonanal	5.78	1103	0.05	5.58	1357	0.05
trans-para-Mentha-2,8-dien-1-ol	5.99	1117	0.03	8.65	1589	0.02
cis-Limonene oxide	6.17	1129	0.02	6.11	1396	0.02
cis-para-Mentha-2,8-dien-1-ol	6.21	1132	0.02	9.16*	1630	0.07
trans-Limonene oxide	6.25	1134	0.02	6.28	1408	0.02
Citronellal	6.54	1153	0.05	6.70	1440	0.05
Terpinen-4-ol	6.86	1174	0.01	8.27	1559	0.01
α-Terpineol	7.08	1188	0.07	9.48	1656	0.07
Decanal	7.36	1207	0.26	6.99	1461	0.26
trans-Carveol	7.52	1218	0.03	11.10	1792	0.02
Nerol	7.70	1230	0.02	10.77	1764	0.02
cis-Carveol	7.74	1233	0.02	11.44	1821	0.01
Neral	7.84	1240	0.08	9.16*	1630	[0.07]
Geraniol	8.12	1259	0.02	11.34	1813	0.02
Perillaldehyde	8.24	1268	0.02	10.28	1722	0.01
Geranial	8.30	1272	0.11	9.79	1681	0.18
Decanol	8.41	1280	0.02	10.44	1736	0.03
Limonen-10-ol	8.59	1292	0.02	12.84	1948	0.02
Undecanal	8.88	1306	0.02	8.36	1566	0.02
Neryl acetate	9.71	1366	0.01	9.87	1688	0.04
α-Copaene	9.81	1372	0.03	6.80	1447	0.03
Geranyl acetate	9.98	1385	0.01	10.25	1719	0.02
β-Elemene	10.05	1390	0.01	8.10	1546	0.01
Dodecanal	10.32	1409	0.06	9.67*	1671	0.08
β-Caryophyllene	10.38	1413	0.06	8.06	1543	0.02
β-Copaene	10.52	1424	0.04	8.00	1538	0.04
α-Humulene	10.83	1448	0.01	8.93	1611	0.01
Germacrene D	11.21	1476	0.03	9.43	1652	0.02
Valencene	11.38	1488	0.07	9.55	1661	0.05

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

α-Muurolene	11.52	1499	0.02	9.67*	1671	[0.08]
γ-Cadinene	11.65	1508	0.06	10.08*	1705	0.10
δ-Cadinene	11.80	1521	0.05	10.08*	1705	[0.10]
Caryophyllene oxide	12.48	1574	0.03	12.41	1908	0.01
β-Sinensal	13.96	1695	0.03	15.10	2167	0.04
α-Sinensal	14.61	1751	0.02	16.06	2266	0.02
Palmitic acid	17.01	1969	0.09			
Linoleic acid	18.69	2136	0.04			
Oleic acid	18.77	2143	0.04	23.43	3163	0.01
Stearic acid	19.02	2169	0.04			
Tetramethoxyflavone isomer	26.93	3127	0.04			
Tangeretin	27.00	3134	0.05			
3,3',4',5,6,7,8-Heptamethoxyflavone	29.06	3316	0.09			
Nobiletin	29.10	3320	0.09			
Total identified		**98.85%**			**97.92%**	
Total reported		**98.85%**			**97.92%**	

*: Two or more compounds are coeluting on this column
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total
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