Date : March 16, 2021

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 21C09-PTH01
Customer identification : Orange Sweet - Brazil - O201112010R
Type : Essential oil
Source : *Citrus sinensis*
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 : March 16, 2021

Checked and approved by :

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

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Méthode certifiée ISO 17025:2017 Certified method

Laboratoire PhytoChemia

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PHYSICOCHEMICAL DATA

Physical aspect: Bright yellow liquid
Refractive index: 1.4733 ± 0.0003 (20 °C; method PC-MAT-016)

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

Compound	Min. %	Max. %	Observed %	Complies?
α-Pinene	0.4	0.8	0.5	Yes
β-Pinene	0.02	0.15	0.03	Yes
Sabinene	0.2	0.8	0.3	Yes
Myrcene	1.5	3.5	1.8	Yes
Limonene	93.0	96.0	93.5	Yes
Octanal	0.1	0.4	0.3	Yes
Nonanal	0.01	0.06	0.05	Yes
Decanal	0.1	0.7	0.2	Yes
Linalool	0.15	0.70	0.41	Yes
Neral	0.03	0.10	0.07	Yes
Valencene	0.01	0.40	0.05	Yes
Geranial	0.05	0.20	0.10	Yes
β-Sinensal	0.01	0.06	0.03	Yes
Refractive index	1.4700	1.4760	1.4733	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
α-Thujene	0.01	Monoterpene
α-Pinene	0.51	Monoterpene
Camphene	0.01	Monoterpene
Sabinene	0.33	Monoterpene
β-Pinene	0.03	Monoterpene
Myrcene	1.81	Monoterpene
α-Phellandrene	0.04	Monoterpene
Pseudolimonene	0.01	Monoterpene
Octanal	0.28	Aliphatic aldehyde
Δ3-Carene	0.13	Monoterpene
para-Cymene	0.01	Monoterpene
(*Z*)-β-Ocimene	0.01	Monoterpene
Limonene	93.52	Monoterpene
β-Phellandrene	0.26	Monoterpene
(*E*)-β-Ocimene	0.03	Monoterpene
γ-Terpinene	0.01	Monoterpene
cis-Sabinene hydrate	0.01	Monoterpenic alcohol
Octanol	0.04	Aliphatic alcohol
Terpinolene	0.06	Monoterpene
Linalool	0.41	Monoterpenic alcohol
Nonanal	0.05	Aliphatic aldehyde
(*E*)-4,8-Dimethylnona-1,3,7-triene	0.01	Terpene derivative
trans-para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
cis-Limonene oxide	0.01	Monoterpenic ether
cis-para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
trans-Limonene oxide	0.02	Monoterpenic ether
Citronellal	0.06	Monoterpenic aldehyde
Terpinen-4-ol	0.01	Monoterpenic alcohol
para-Cymen-8-ol	0.01	Monoterpenic alcohol
α-Terpineol	0.06	Monoterpenic alcohol
cis-Piperitol	0.01	Monoterpenic alcohol
Decanal	0.25	Aliphatic aldehyde
Octyl acetate	0.02	Aliphatic ester
trans-Carveol	0.01	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
Citronellol	0.02	Monoterpenic alcohol
Neral	0.07	Monoterpenic aldehyde
Carvone	0.01	Monoterpenic ketone
Geraniol	0.01	Monoterpenic alcohol
Geranial	0.10	Monoterpenic aldehyde
Limonen-10-ol	0.02	Monoterpenic alcohol
Undecanal	0.02	Aliphatic aldehyde
α-Copaene	0.03	Sesquiterpene
Geranyl acetate	0.03	Monoterpenic ester
β-Elemene	0.01	Sesquiterpene

Dodecanal	0.06	Aliphatic aldehyde
β-Caryophyllene	0.03	Sesquiterpene
β-Copaene	0.06	Sesquiterpene
α-Humulene	0.01	Sesquiterpene
(*E*)-β-Farnesene	0.01	Sesquiterpene
Germacrene D	0.03	Sesquiterpene
Valencene	0.05	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
δ-Cadinene	0.04	Sesquiterpene
α-Elemol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.02	Sesquiterpenic ether
β-Sinensal	0.03	Sesquiterpenic aldehyde
α-Sinensal	0.02	Sesquiterpenic aldehyde
Myristic acid	0.02	Aliphatic acid
Nootkatone	0.01	Sesquiterpenic ketone
Palmitic acid	0.09	Aliphatic acid
Linoleic acid	0.03	Aliphatic acid
Oleic acid	0.02	Aliphatic acid
cis-Vaccenic acid	0.02	Aliphatic acid
Stearic acid	0.18	Aliphatic acid
Pentamethoxyflavone isomer	0.04	Flavonoid
Tetramethoxyflavone isomer	0.02	Flavonoid
Tangeretin	0.04	Flavonoid
Nobiletin	0.04	Flavonoid
Consolidated total	**99.24%**	

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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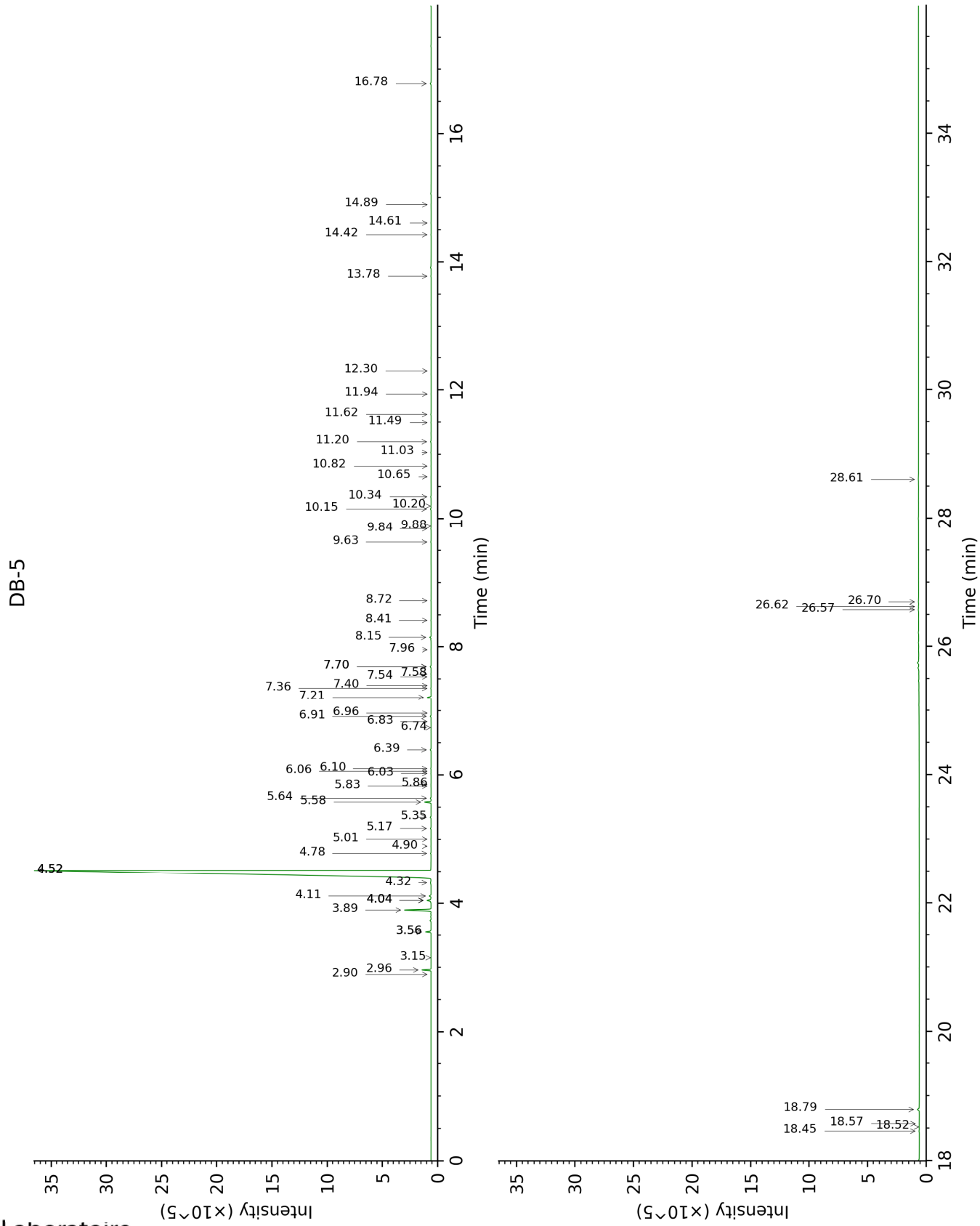
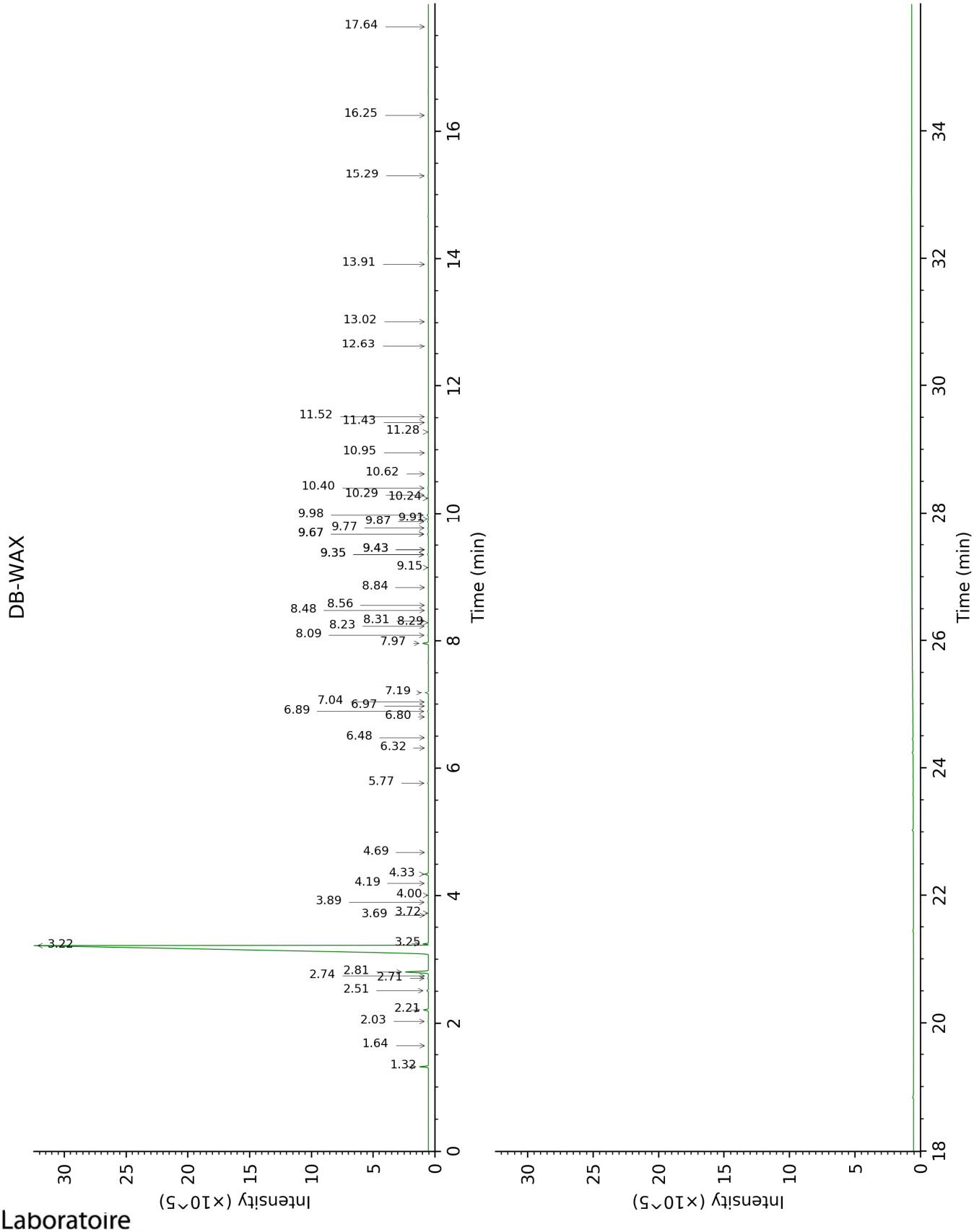

DB-5
16.78
14.89
14.61
14.42
13.78
12.30
11.94
11.62
11.49
11.20
11.03
10.82
10.65
10.34
10.20
10.15
9.84
9.88
9.63
8.72
8.41
8.15
7.96
7.70
7.54
7.58
7.36
7.40
7.21
6.91
6.96
6.83
6.74
6.39
6.06
6.10
6.03
5.83
5.86
5.64
5.58
5.35
5.17
5.01
4.90
4.78
4.52
4.32
4.11
4.04
3.89
3.56
3.15
2.90
2.96
Time (min)
Intensity (×10^5)
28.61
26.62
26.57
26.70
18.79
18.45
18.57
18.52
Time (min)
Intensity (×10^5)


DB-WAX
17.64
16.25
15.29
13.91
13.02
12.63
11.52
11.43
11.28
10.95
10.62
10.40
10.29
10.24
9.98
9.87
9.91
9.77
9.67
9.35
9.43
9.15
8.84
8.56
8.48
8.23
8.31
8.29
8.09
7.97
7.19
7.04
6.97
6.89
6.80
6.48
6.32
5.77
4.69
4.33
4.19
4.00
3.89
3.72
3.69
3.25
3.22
2.81
2.74
2.71
2.51
2.21
2.03
1.64
1.32
Time (min)
Intensity (×10^5)

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
α-Thujene	2.90	925	0.01			
α-Pinene	2.96	930	0.51	1.32	992	0.51
Camphene	3.15	942	0.01	1.64	1027	0.01
Sabinene	3.56*	969	0.37	2.21	1084	0.33
β-Pinene	3.56*	969	[0.37]	2.03	1066	0.03
Myrcene	3.89	992	1.81	2.81	1135	1.86
α-Phellandrene	4.04*	1002	0.34	2.71	1127	0.04
Pseudolimonene	4.04*	1002	[0.34]	2.74	1130	0.01
Octanal	4.04*	1002	[0.34]	4.33	1253	0.28
Δ3-Carene	4.11	1007	0.13	2.51	1112	0.12
para-Cymene	4.32†	1020	93.39	4.00	1228	0.01
(*Z*)-β-Ocimene	4.52*†	1032	[93.39]	3.69	1205	0.01
Limonene	4.52*†	1032	[93.39]	3.22	1168	93.52
β-Phellandrene	4.52*†	1032	[93.39]	3.24	1170	0.26
(*E*)-β-Ocimene	4.78	1049	0.03	3.89	1220	0.03
γ-Terpinene	4.90	1057	0.01	3.72	1208	0.01
cis-Sabinene hydrate	5.01	1064	0.01	6.80	1430	0.01
Octanol	5.17	1074	0.04	8.09	1528	0.04
Terpinolene	5.35	1085	0.06	4.19	1242	0.03
Linalool	5.58	1100	0.41	7.97	1518	0.41
Nonanal	5.64	1104	0.05	5.77	1354	0.05
(*E*)-4,8-Dimethylnona-1,3,7-triene	5.83	1116	0.01	4.69	1279	0.01
trans-para-Mentha-2,8-dien-1-ol	5.86	1118	0.01	8.84	1586	0.01
cis-Limonene oxide	6.03	1129	0.01	6.32	1394	0.02
cis-para-Mentha-2,8-dien-1-ol	6.06	1131	0.01	9.35*	1627	0.07
trans-Limonene oxide	6.10	1134	0.02	6.48	1406	0.02
Citronellal	6.39	1153	0.06	6.89	1437	0.06
Terpinen-4-ol	6.74	1175	0.01	8.48	1558	0.01
para-Cymen-8-ol	6.83	1182	0.01	11.43	1801	0.02
α-Terpineol	6.91	1187	0.06	9.67*	1653	0.09
cis-Piperitol	6.96	1190	0.01	9.43*	1633	0.02
Decanal	7.21	1206	0.25	7.19	1459	0.24
Octyl acetate	7.36	1216	0.02	6.97	1443	0.01
trans-Carveol	7.40	1219	0.01	11.28	1788	0.01
Nerol	7.54	1228	0.02	10.95	1761	0.02
Citronellol	7.58	1232	0.02	10.62	1732	0.03
Neral	7.70*	1239	0.08	9.35*	1627	[0.07]
Carvone	7.70*	1239	[0.08]	9.92	1673	0.01
Geraniol	7.96	1257	0.01	11.52	1809	0.03
Geranial	8.15	1270	0.10	9.98	1678	0.10
Limonen-10-ol	8.41	1289	0.02	13.02	1944	0.02
Undecanal	8.72	1306	0.02	8.56	1564	0.02
α-Copaene	9.63	1371	0.03	7.04	1448	0.03
Geranyl acetate	9.84	1386	0.03	10.40	1714	0.06
β-Elemene	9.88	1388	0.01	8.29	1543	0.02

Dodecanal	10.15	1408	0.06	9.87	1669	0.06
β-Caryophyllene	10.20	1412	0.03	8.31	1545	0.01
β-Copaene	10.34	1422	0.06	8.23	1539	0.03
α-Humulene	10.66	1446	0.01	9.15	1611	0.01
(*E*)-β-Farnesene	10.82	1458	0.01	9.43*	1633	[0.02]
Germacrene D	11.03	1474	0.03	9.67*	1653	[0.09]
Valencene	11.20	1486	0.05	9.77	1661	0.05
γ-Cadinene	11.50	1509	0.02	10.24	1700	0.02
δ-Cadinene	11.62	1519	0.04	10.29	1704	0.06
α-Elemol	11.94	1544	0.01	13.91	2029	0.01
Caryophyllene oxide	12.30	1572	0.02	12.63	1908	0.01
β-Sinensal	13.78	1693	0.03	15.30	2165	0.03
α-Sinensal	14.42	1749	0.02	16.25	2264	0.02
Myristic acid	14.60	1764	0.02			
Nootkatone	14.89	1789	0.01	17.64	2413	0.01
Palmitic acid	16.78	1964	0.09			
Linoleic acid	18.45	2130	0.03			
Oleic acid	18.52	2137	0.02			
cis-Vaccenic acid	18.57	2142	0.02			
Stearic acid	18.79	2165	0.18			
Pentamethoxyflavone isomer	26.57	3126	0.04			
Tetramethoxyflavone isomer	26.62	3131	0.02			
Tangeretin	26.70	3140	0.04			
Nobiletin	28.61	3326	0.04			
Total identified		**98.85%**			**98.81%**	
Total reported		**98.85%**			**98.81%**	

*: 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

Note: no correction factor was applied
R.T.: Retention time (minutes)
R.I.: Retention index