CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21B23-FEP20
Customer identification : Sweet Orange - Brazil - 51274-16
Type : Essential oil
Source : *Citrus sinensis*
Customer : Fern & Petal

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 : Seydou Ka, M. Sc.
Analysis date : March 11, 2021

Checked and approved by :

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

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MÉTHODE CERTIFIÉE
✴ISO 17025:2017
CERTIFIED METHOD

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PHYSICOCHEMICAL DATA

Physical aspect: Bright yellow liquid
Refractive index: 1.4740 ± 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
α-Pinene	0.52	Monoterpene
Sabinene	0.35	Monoterpene
β-Pinene	0.09	Monoterpene
Myrcene	1.74	Monoterpene
α-Phellandrene	0.03	Monoterpene
Octanal	0.14	Aliphatic aldehyde
Δ3-Carene	0.16	Monoterpene
para-Cymene	0.05	Monoterpene
Limonene	92.86	Monoterpene
β-Phellandrene	0.26	Monoterpene
(*Z*)-β-Ocimene	0.02	Monoterpene
(*E*)-β-Ocimene	0.03	Monoterpene
γ-Terpinene	0.07	Monoterpene
cis-Sabinene hydrate	0.01	Monoterpenic alcohol
Octanol	0.06	Aliphatic alcohol
Terpinolene	0.06	Monoterpene
Linalool	0.39	Monoterpenic alcohol
Nonanal	0.04	Aliphatic aldehyde
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	0.02	Monoterpenic alcohol
trans-Limonene oxide	0.03	Monoterpenic ether
Citronellal	0.05	Monoterpenic aldehyde
Unknown	0.01	Unknown
Nonanol	0.02	Aliphatic alcohol
Terpinen-4-ol	0.01	Monoterpenic alcohol
para-Cymen-8-ol	0.01	Monoterpenic alcohol
α-Terpineol	0.12	Monoterpenic alcohol
cis-Piperitol	0.02	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
trans-Isopiperitenol	0.01	Monoterpenic alcohol
trans-Dihydrocarvone	0.01	Monoterpenic ketone
Decanal	0.22	Aliphatic aldehyde
Octyl acetate	0.01	Aliphatic ester
trans-Carveol	0.04	Monoterpenic alcohol
1-para-Menthen-9-al	0.01	Monoterpenic aldehyde
Nerol	0.03	Monoterpenic alcohol
Citronellol	0.03	Monoterpenic alcohol
Neral	0.07	Monoterpenic aldehyde
Geraniol	0.02	Monoterpenic alcohol
Perillaldehyde	0.03	Monoterpenic aldehyde
Geranial	0.07	Monoterpenic aldehyde
Decanol	0.03	Aliphatic alcohol
Limonen-10-ol	0.02	Monoterpenic alcohol
Perilla alcohol	0.01	Monoterpenic alcohol

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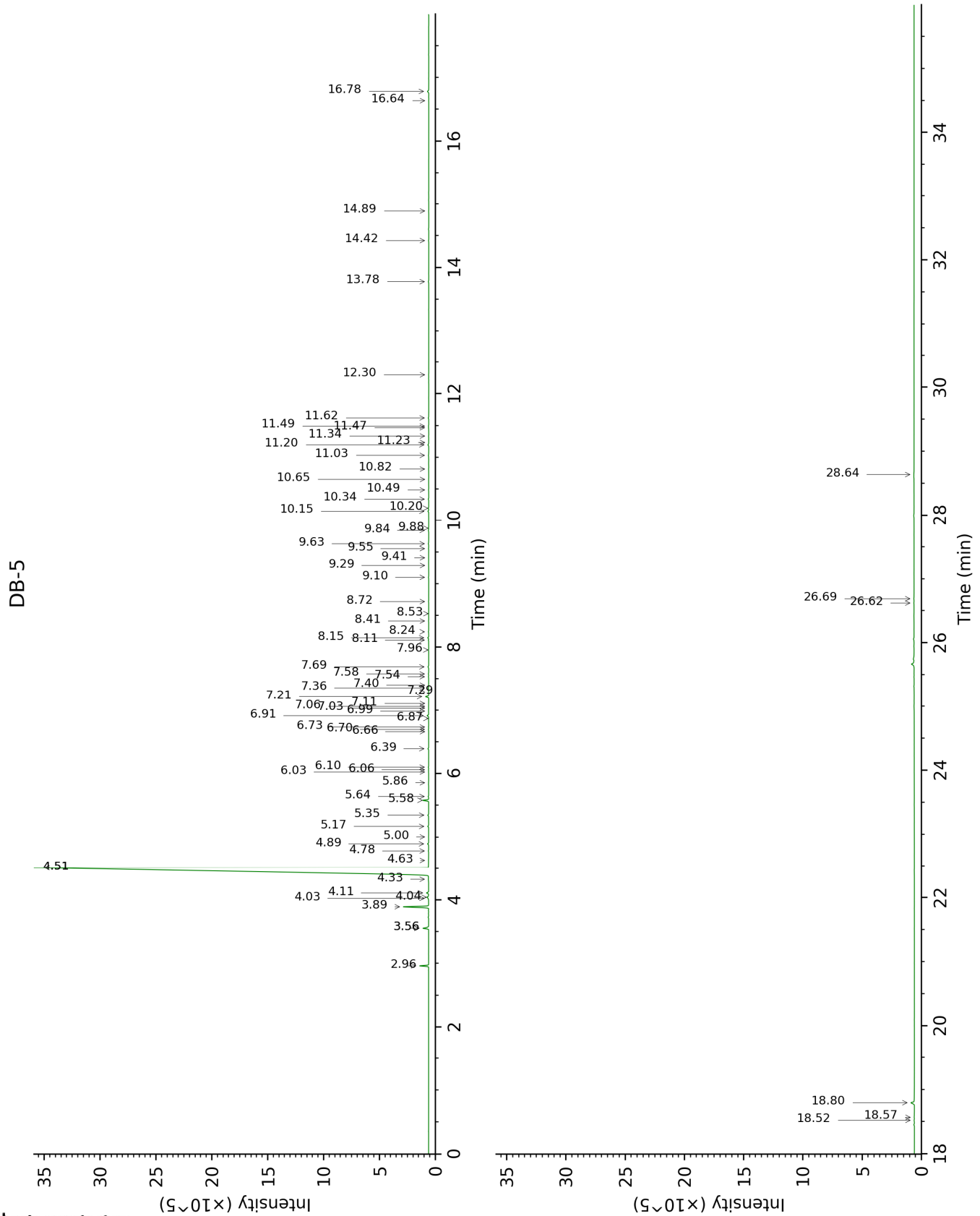
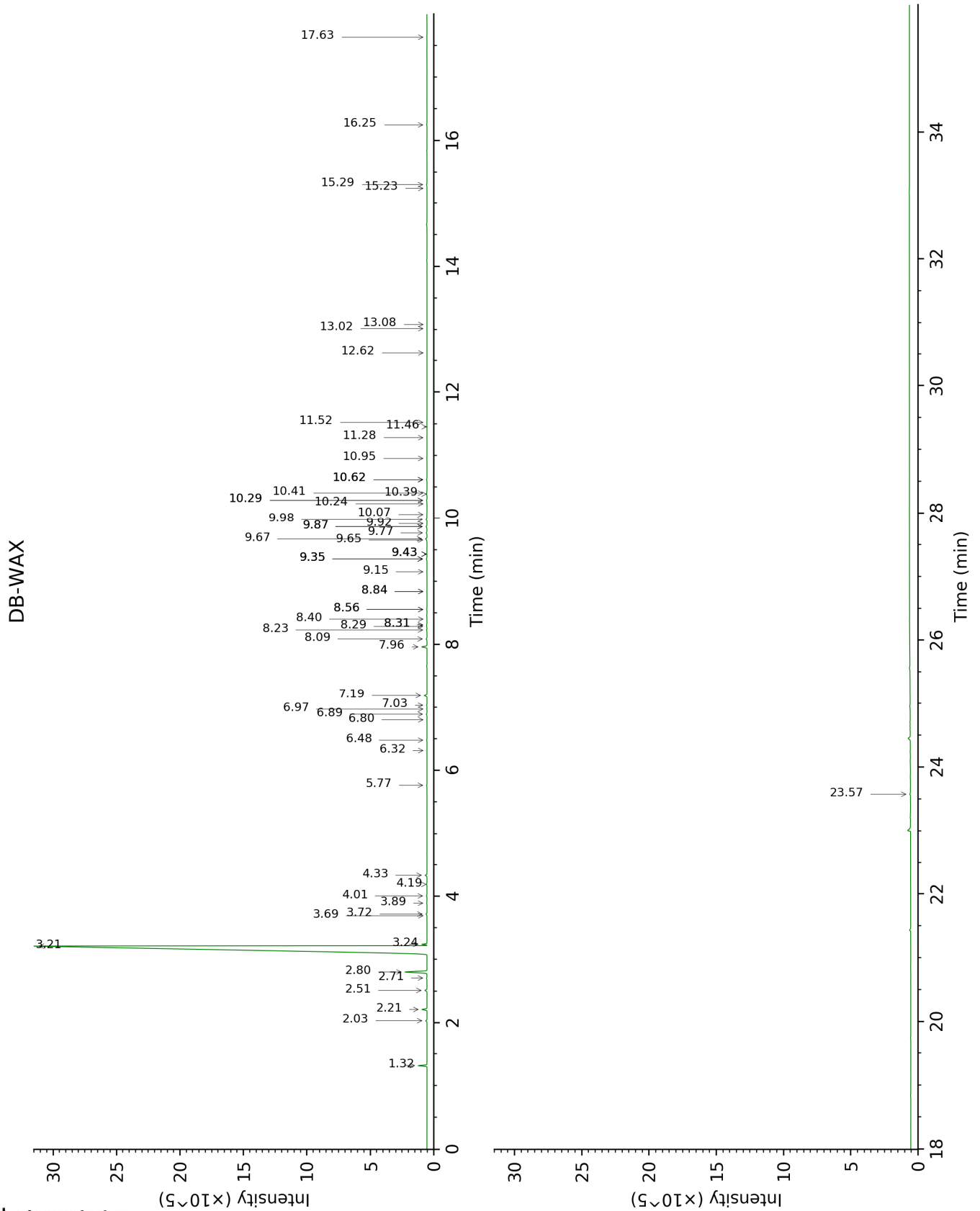|		
Undecanal	0.02	Aliphatic aldehyde
para-Mentha-1,8-diene-4-hydroperoxide	0.02	Monoterpenic peroxide
α-Cubebene	0.01	Sesquiterpene
Citronellyl acetate	0.01	Monoterpenic ester
Neryl acetate	0.02	Monoterpenic ester
α-Copaene	0.04	Sesquiterpene
Geranyl acetate	0.03	Monoterpenic ester
β-Elemene	0.02	Sesquiterpene
Dodecanal	0.06	Aliphatic aldehyde
β-Caryophyllene	0.04	Sesquiterpene
β-Copaene	0.04	Sesquiterpene
trans-α-Bergamotene	0.02	Sesquiterpene
α-Humulene	0.01	Sesquiterpene
(*E*)-β-Farnesene	0.01	Sesquiterpene
Germacrene D	0.03	Sesquiterpene
Valencene	0.07	Sesquiterpene
Bicyclogermacrene	0.01	Sesquiterpene
α-Muurolene	0.02	Sesquiterpene
γ-Cadinene	0.02	Sesquiterpene
(3*E*,6*E*)-α-Farnesene	0.02	Sesquiterpene
δ-Cadinene	0.04	Sesquiterpene
Caryophyllene oxide	0.02	Sesquiterpenic ether
β-Sinensal	0.04	Sesquiterpenic aldehyde
α-Sinensal	0.02	Sesquiterpenic aldehyde
Nootkatone	0.01	Sesquiterpenic ketone
meta-Camphorene	0.01	Diterpene
Palmitic acid	0.14	Aliphatic acid
Linoleic acid	0.04	Aliphatic acid
Oleic acid	0.03	Aliphatic acid
Stearic acid	0.37	Aliphatic acid
Tetramethoxyflavone isomer	0.02	Flavonoid
Tangeretin	0.03	Flavonoid
Nobiletin	0.03	Flavonoid
Consolidated total	**99.09%**	

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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This page was intentionally left blank. The following pages present the complete data of the analysis.

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DB-5

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DB-WAX

Top chromatogram (Time 0–17 min):

17.63
16.25
15.29 15.23
13.02 13.08
12.62
11.52 11.46
11.28
10.95
10.62
10.29 10.41 10.24 10.39
9.98 10.07
9.87 9.92
9.67 9.65 9.77
9.35 9.43
9.15
8.84
8.56
8.40 8.29 8.31
8.23
8.09
7.96
7.19 7.03
6.97 6.89 6.80
6.48
6.32
5.77
4.33 4.19
4.01 3.89
3.69 3.72
3.21 3.24
2.80 2.71
2.51
2.03 2.21
1.32

Time (min)

Intensity (×10^5)

Bottom chromatogram (Time 18–35 min):

23.57

Time (min)

Intensity (×10^5)

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
α-Pinene	2.96	930	0.52	1.32	992	0.52
Sabinene	3.56*	969	0.44	2.21	1084	0.35
β-Pinene	3.56*	969	[0.44]	2.03	1066	0.09
Myrcene	3.89	992	1.74	2.80	1135	1.80
α-Phellandrene	4.03	1001	0.03	2.71	1127	0.04
Octanal	4.04	1002	0.14	4.33	1253	0.13
Δ3-Carene	4.11	1007	0.16	2.51	1112	0.16
para-Cymene	4.33	1020	0.05	4.01	1228	0.04
Limonene	4.51*	1032	92.64	3.21	1167	92.86
β-Phellandrene	4.51*	1032	[92.64]	3.24	1169	0.26
(*Z*)-β-Ocimene	4.63	1040	0.02	3.69	1205	0.01
(*E*)-β-Ocimene	4.78	1049	0.03	3.89	1220	0.02
γ-Terpinene	4.90	1056	0.07	3.72	1207	0.07
cis-Sabinene hydrate	5.00	1063	0.01	6.80	1430	0.01
Octanol	5.17	1074	0.06	8.09	1528	0.06
Terpinolene	5.35	1085	0.06	4.19	1242	0.03
Linalool	5.58	1100	0.39	7.96	1518	0.39
Nonanal	5.64	1104	0.04	5.77	1354	0.03
trans-para-Mentha-2,8-dien-1-ol	5.86	1118	0.01	8.84*	1586	0.02
cis-Limonene oxide	6.03	1129	0.01	6.32	1394	0.01
cis-para-Mentha-2,8-dien-1-ol	6.06	1131	0.02	9.43*	1634	0.02
trans-Limonene oxide	6.10	1134	0.03	6.48	1406	0.03
Citronellal	6.39	1153	0.05	6.89	1437	0.05
Unknown [m/z 57, 95 (81), 43 (75), 41 (65), 82 (58), 55 (55)...]	6.66	1170	0.01			
Nonanol	6.70	1173	0.02	9.35*	1627	0.07
Terpinen-4-ol	6.73	1175	0.01	8.40	1552	0.01
para-Cymen-8-ol	6.87	1184	0.01	11.46	1803	0.01
α-Terpineol	6.91	1187	0.12	9.67	1653	0.11
cis-Piperitol	6.98	1192	0.02	9.43*	1634	[0.02]
Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	7.03	1195	0.01			
trans-Isopiperitenol	7.06	1196	0.01	10.24	1699	0.02
trans-Dihydrocarvone	7.11	1199	0.01	8.56*	1564	0.02
Decanal	7.21	1206	0.22	7.19	1459	0.21
Octyl acetate	7.29	1212	0.01	6.97	1443	0.02
trans-Carveol	7.36	1216	0.04	11.28	1789	0.02
1-para-Menthen-9-al	7.40	1219	0.01	8.84*	1586	[0.02]
Nerol	7.54	1228	0.03	10.95	1761	0.02
Citronellol	7.58	1232	0.03	10.62*	1732	0.05
Neral	7.69	1239	0.07	9.35*	1627	[0.07]

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Compound	R.T.	R.I.	%	R.T.	R.I.	%
Geraniol	7.96	1257	0.02	11.52	1810	0.02
Perillaldehyde	8.11	1268	0.03	10.62*	1732	[0.05]
Geranial	8.15	1270	0.07	9.98	1678	0.07
Decanol	8.24	1277	0.03	10.62*	1732	[0.05]
Limonen-10-ol	8.41	1289	0.02	13.02	1944	0.02
Perilla alcohol	8.53	1296	0.01	13.08	1951	0.01
Undecanal	8.72	1306	0.02	8.56*	1564	[0.02]
para-Mentha-1,8-diene-4-hydroperoxide	9.10	1333	0.02			
α-Cubebene	9.29	1347	0.01			
Citronellyl acetate	9.41	1355	0.01	9.35*	1627	[0.07]
Neryl acetate	9.55	1365	0.02	10.07	1686	0.02
α-Copaene	9.63	1371	0.04	7.03	1447	0.03
Geranyl acetate	9.84	1386	0.03	10.41	1714	0.04
β-Elemene	9.88	1388	0.02	8.31*	1545	0.03
Dodecanal	10.15	1408	0.06	9.87*	1669	0.08
β-Caryophyllene	10.20	1412	0.04	8.23	1539	0.04
β-Copaene	10.34	1422	0.04	8.29	1543	0.03
trans-α-Bergamotene	10.49	1433	0.02	8.31*	1545	[0.03]
α-Humulene	10.65	1446	0.01	9.15	1611	0.03
(E)-β-Farnesene	10.82	1458	0.01	9.43*	1634	[0.02]
Germacrene D	11.03	1474	0.03	9.65	1652	0.03
Valencene	11.20	1486	0.07	9.77	1661	0.07
Bicyclogermacrene	11.24	1489	0.01	9.92	1673	0.01
α-Muurolene	11.34	1496	0.02	9.87*	1669	[0.08]
γ-Cadinene	11.47	1506	0.02	10.29*	1704	0.04
(3E,6E)-α-Farnesene	11.49	1509	0.02	10.39	1712	0.02
δ-Cadinene	11.62	1519	0.04	10.29*	1704	[0.04]
Caryophyllene oxide	12.30	1572	0.02	12.62	1908	0.01
β-Sinensal	13.78	1693	0.04	15.29	2165	0.04
α-Sinensal	14.42	1749	0.02	16.25	2263	0.03
Nootkatone	14.89	1789	0.01	17.63	2413	0.02
meta-Camphorene	16.64	1950	0.01	15.23	2159	0.01
Palmitic acid	16.78	1964	0.14			
Linoleic acid	18.52	2137	0.04			
Oleic acid	18.57	2142	0.03	23.58	3154	0.07
Stearic acid	18.80	2166	0.37			
Tetramethoxyflavone isomer	26.62	3131	0.02			
Tangeretin	26.69	3139	0.03			
Nobiletin	28.64	3328	0.03			
Total identified		**98.57%**			**98.31%**	
Total reported		**98.59%**			**98.31%**	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

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

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