



## GC/MS BATCH NUMBER: K20101

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**ESSENTIAL OIL:** KUMQUAT  
**BOTANICAL NAME:** FORTUNELLA JAPONICA  
**ORIGIN:** BRAZIL

KEY CONSTITUENTS PRESENT IN THIS BATCH OF KUMQUAT OIL	%
LIMONENE	90.3
MYRCENE	1.8
$\beta$ -PINENE	1.1

Comments from Robert Tisserand: Fresh, sophisticated, Orange/Lemon odor quality. Constituents are in expected amounts.

Date : July 19, 2018

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 18G12-PTH1-1-CC

**Customer identification :** Kumquat Oil - Brazil - K2010178R

**Type :** Essential oil

**Source :** *Fortunella japonica*

**Customer :** Plant Therapy

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 :** Sarah-Eve Tremblay, M. Sc. A., Chimiste

**Analysis date :** July 17, 2018

Checked and approved by :



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

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*This report is digitally signed, it is only considered valid if the digital signature is intact.*

#### *PHYSICOCHEMICAL DATA*

**Physical aspect:** Bright yellow liquid

**Refractive index:**  $1.4723 \pm 0.0003$  (20 °C)

#### *CONCLUSION*

No clear adulterant, contaminant or diluent has been detected using this method, based on the scarce reports from scientific literature.

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Toluene	tr	tr	Simple phenolic
Hexanal	tr	tr	Aliphatic aldehyde
Isoamyl acetate	tr	tr	Aliphatic ester
$\alpha$ -Thujene	0.05	0.06	Monoterpene
$\alpha$ -Pinene	0.63	0.63	Monoterpene
Camphene	0.01	0.01	Monoterpene
Sabinene	1.51*	0.40	Monoterpene
$\beta$ -Pinene	[1.51]*	1.11	Monoterpene
Myrcene	1.81	1.82	Monoterpene
Octanal	0.18*	0.15	Aliphatic aldehyde
$\alpha$ -Phellandrene	[0.18]*	0.04	Monoterpene
$\Delta^3$ -Carene	0.17	0.17	Monoterpene
$\alpha$ -Terpinene	0.02	0.02	Monoterpene
para-Cymene	90.34	0.15	Monoterpene
Limonene	[90.34]*	90.30	Monoterpene
$\beta$ -Phellandrene	[90.34]*	0.23	Monoterpene
(Z)- $\beta$ -Ocimene	0.06	0.96*	Monoterpene
(E)- $\beta$ -Ocimene	0.05	0.04	Monoterpene
$\gamma$ -Terpinene	0.92	[0.96]*	Monoterpene
cis-Sabinene hydrate	0.01	0.01	Monoterpenic alcohol
Octanol	0.05	0.05*	Aliphatic alcohol
Isoterpinolene	tr	0.01	Monoterpene
Terpinolene	0.06	0.06	Monoterpene
Linalool	0.39	0.40	Monoterpenic alcohol
Nonanal	0.04	0.03	Aliphatic aldehyde
trans-para-Mentha-2,8-dien-1-ol	0.02*	0.01	Monoterpenic alcohol
(E)-4,8-Dimethylnona-1,3,7-triene	[0.02]*	0.01	Terpene derivative
cis-Limonene oxide	0.02	0.02	Monoterpenic ether
trans-Limonene oxide	0.02	0.02	Monoterpenic ether
neo-Isopulegol	0.01	[0.05]*	Monoterpenic alcohol
Citronellal	0.44	0.43	Monoterpenic aldehyde
Nonanol	0.01	0.09*	Aliphatic alcohol
Terpinen-4-ol	0.01	tr	Monoterpenic alcohol
$\alpha$ -Terpineol	0.07	0.07	Monoterpenic alcohol
Unknown	0.01	tr	Unknown
Decanal	0.19	0.19	Aliphatic aldehyde
Octyl acetate	0.01	0.01	Aliphatic ester
trans-Carveol	0.01	0.01	Monoterpenic alcohol
Nerol	0.02	0.02	Monoterpenic alcohol
Citronellol	0.15	0.15*	Monoterpenic alcohol
Neral	0.06*	[0.09]*	Monoterpenic aldehyde
Carvone	[0.06]*	0.04	Monoterpenic ketone
Geraniol	0.25	0.25	Monoterpenic alcohol
Perillaldehyde	0.02	[0.15]*	Monoterpenic aldehyde
Geranial	0.08	0.09*	Monoterpenic aldehyde
Limonen-10-ol	0.01	tr	Monoterpenic alcohol
Undecanal	0.02	0.01	Aliphatic aldehyde
Limonene glycol isomer I	0.01	0.01	Monoterpenic alcohol

Citronellyl acetate	0.05	[0.09]*	Monoterpenic ester
Neryl acetate	0.01	0.01	Monoterpenic ester
$\alpha$ -Copaene	0.03	0.03	Sesquiterpene
Geranyl acetate	0.07*	0.05	Monoterpenic ester
$\beta$ -Cubebene	[0.07]*	0.01	Sesquiterpene
$\beta$ -Elemene	0.03	0.06*	Sesquiterpene
Dodecanal	0.04	0.06*	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.03	[0.06]*	Sesquiterpene
$\beta$ -Copaene	0.03	0.03	Sesquiterpene
$\alpha$ -Humulene	0.01	0.01	Sesquiterpene
$\gamma$ -Murolene	0.01	0.02	Sesquiterpene
Germacrene D	0.05	0.05	Sesquiterpene
Valencene	0.06	[0.06]*	Sesquiterpene
$\alpha$ -Murolene	0.03	[0.09]*	Sesquiterpene
$\gamma$ -Cadinene	0.02	0.03	Sesquiterpene
$\delta$ -Cadinene	0.05	0.05	Sesquiterpene
$\alpha$ -Elemol	0.04	0.04	Sesquiterpenic alcohol
Germacrene D-4-ol	0.02	0.02	Sesquiterpenic alcohol
$\beta$ -Sinensal	0.03	0.03	Sesquiterpenic aldehyde
$\alpha$ -Sinensal	0.02	0.02	Sesquiterpenic aldehyde
Myristic acid	0.06	0.06	Aliphatic acid
Nootkatone	0.01	0.01	Sesquiterpenic ketone
Palmitic acid	0.10	0.10	Aliphatic acid
Linoleic acid	0.07	0.07	Aliphatic acid
Oleic acid	0.04	0.07*	Aliphatic acid
<i>cis</i> -Vaccenic acid?	0.03	[0.07]*	Aliphatic acid
Stearic acid	0.06	0.07	Aliphatic acid
Tetramethoxyflavone isomer	0.03		Flavonoid
Tangeretin	0.04		Flavonoid
3,3',4',5,6,7,8-Heptamethoxyflavone	0.02		Flavonoid
Nobiletin	0.08		Flavonoid
<b>Total identified</b>	<b>98.88%</b>	<b>98.99%</b>	

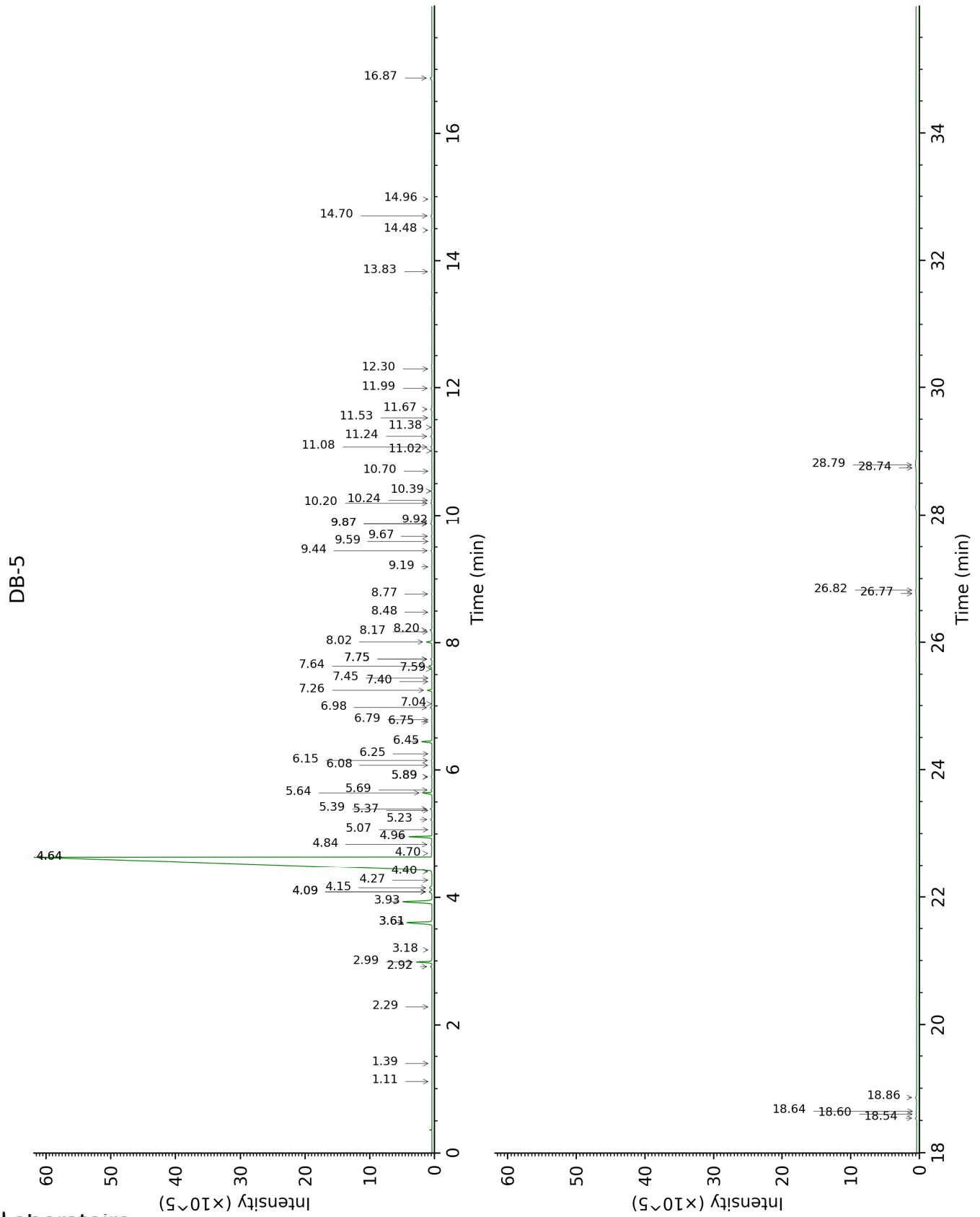
\*: Two or more compounds are coeluting on this column

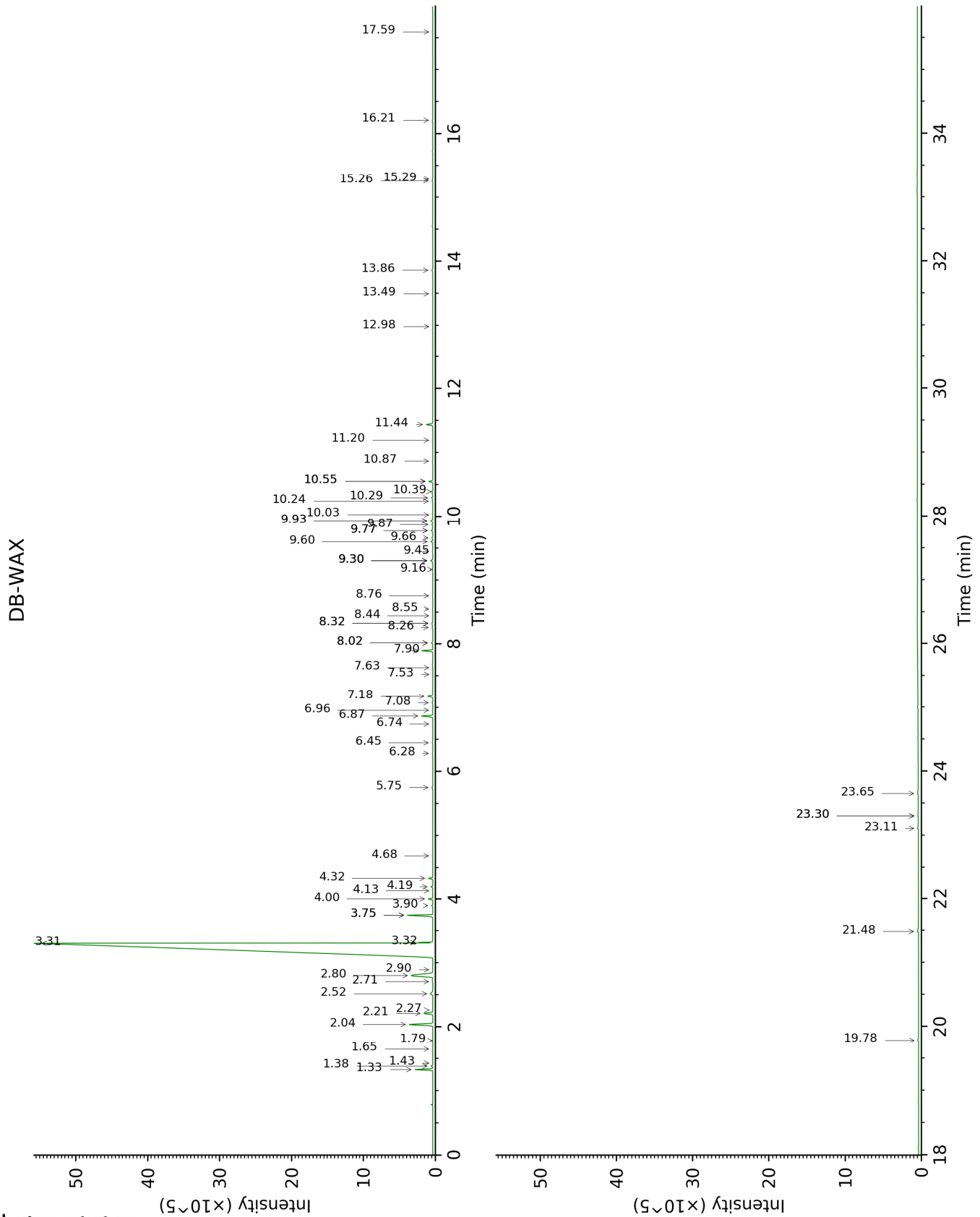
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Toluene	1.11	755	tr	1.43	1009	tr
Hexanal	1.39	796	tr	1.79	1045	tr
Isoamyl acetate	2.29	876	tr	2.27	1092	tr
$\alpha$ -Thujene	2.92	924	0.05	1.38	1003	0.06
$\alpha$ -Pinene	2.99	929	0.63	1.33	994	0.63
Camphene	3.18	942	0.01	1.65	1031	0.01
Sabinene	3.61*	970	1.51	2.21	1087	0.40
$\beta$ -Pinene	3.61*	970	[1.51]	2.04	1070	1.11
Myrcene	3.93	992	1.81	2.80	1138	1.82
Octanal	4.09*	1003	0.18	4.32	1253	0.15
$\alpha$ -Phellandrene	4.09*	1003	[0.18]	2.71	1130	0.04
$\Delta$ 3-Carene	4.15	1007	0.17	2.52	1116	0.17
$\alpha$ -Terpinene	4.27	1014	0.02	2.90	1145	0.02
para-Cymene	4.40†	1023	90.34	4.00	1230	0.15
Limonene	4.64*†	1038	[90.34]	3.31	1177	90.30
$\beta$ -Phellandrene	4.64*†	1038	[90.34]	3.32	1178	0.23
(Z)- $\beta$ -Ocimene	4.70	1041	0.06	3.75*	1211	0.96
(E)- $\beta$ -Ocimene	4.84	1050	0.05	3.90	1222	0.04
$\gamma$ -Terpinene	4.96	1058	0.92	3.75*	1211	[0.96]
cis-Sabinene hydrate	5.07	1065	0.01	6.74	1429	0.01
Octanol	5.23	1075	0.05	8.02*	1525	0.05
Isoterpinolene	5.37	1084	tr	4.13	1239	0.01
Terpinolene	5.39	1086	0.06	4.19	1243	0.06
Linalool	5.64	1101	0.39	7.90	1516	0.40
Nonanal	5.69	1104	0.04	5.75	1356	0.03
trans-para-Mentha-2,8-dien-1-ol	5.90*	1117	0.02	8.76	1583	0.01
(E)-4,8-Dimethylnona-1,3,7-triene	5.90*	1117	[0.02]	4.68	1279	0.01
cis-Limonene oxide	6.08	1129	0.02	6.28	1395	0.02
trans-Limonene oxide	6.15	1134	0.02	6.45	1407	0.02
neo-Isopulegol	6.25	1140	0.01	8.02*	1525	[0.05]
Citronellal	6.45	1153	0.44	6.87	1438	0.43
Nonanol	6.76	1173	0.01	9.30*	1627	0.09
Terpinen-4-ol	6.79	1175	0.01	8.44	1558	tr
$\alpha$ -Terpineol	6.98	1187	0.07	9.60	1651	0.07
Unknown [m/z 121, 79 (98), 93 (87), 94 (73), 91 (63), 105 (45)...]	7.04	1191	0.01	7.53	1488	tr
Decanal	7.26	1205	0.19	7.18	1462	0.19
Octyl acetate	7.40	1214	0.01	6.96	1445	0.01
trans-Carveol	7.45	1218	0.01	11.20	1785	0.01
Nerol	7.59	1228	0.02	10.87	1757	0.02
Citronellol	7.64	1231	0.15	10.55*	1730	0.15
Neral	7.75*	1238	0.06	9.30*	1627	[0.09]
Carvone	7.75*	1238	[0.06]	9.87	1673	0.04
Geraniol	8.02	1256	0.25	11.44	1806	0.25

Perillaldehyde	8.17	1267	0.02	10.55*	1730	[0.15]
Geranial	8.20	1269	0.08	9.93*	1678	0.09
Limonen-10-ol	8.48	1287	0.01	12.98	1945	tr
Undecanal	8.77	1307	0.02	8.55	1567	0.01
Limonene glycol isomer I	9.19	1337	0.01	15.29	2169	0.01
Citronellyl acetate	9.44	1355	0.05	9.30*	1627	[0.09]
Neryl acetate	9.59	1365	0.01	10.03	1686	0.01
$\alpha$ -Copaene	9.67	1371	0.03	7.08	1454	0.03
Geranyl acetate	9.87*	1384	0.07	10.39	1716	0.05
$\beta$ -Cubebene	9.87*	1384	[0.07]	7.63	1496	0.01
$\beta$ -Elemene	9.92	1388	0.03	8.32*	1549	0.06
Dodecanal	10.20	1408	0.04	9.77*	1665	0.06
$\beta$ -Caryophyllene	10.24	1412	0.03	8.32*	1549	[0.06]
$\beta$ -Copaene	10.39	1422	0.03	8.26	1544	0.03
$\alpha$ -Humulene	10.70	1446	0.01	9.16	1615	0.01
$\gamma$ -Murolene	11.02	1469	0.01	9.44	1638	0.02
Germacrene D	11.08	1474	0.05	9.66	1656	0.05
Valencene	11.24	1486	0.06	9.77*	1665	[0.06]
$\alpha$ -Murolene	11.38	1497	0.03	9.93*	1678	[0.09]
$\gamma$ -Cadinene	11.53	1508	0.02	10.24	1704	0.03
$\delta$ -Cadinene	11.67	1519	0.05	10.30	1708	0.05
$\alpha$ -Elemol	11.99	1545	0.04	13.86	2028	0.04
Germacrene D-4-ol	12.30	1569	0.02	13.49	1993	0.02
$\beta$ -Sinensal	13.83	1694	0.03	15.26	2166	0.03
$\alpha$ -Sinensal	14.48	1750	0.02	16.21	2265	0.02
Myristic acid	14.70	1769	0.06	19.78	2669	0.06
Nootkatone	14.96	1792	0.01	17.59	2414	0.01
Palmitic acid	16.87	1968	0.10	21.48	2883	0.10
Linoleic acid	18.54	2134	0.07	23.65	3177	0.07
Oleic acid	18.60	2140	0.04	23.30*	3128	0.07
<i>cis</i> -Vaccenic acid?	18.64	2145	0.03	23.30*	3128	[0.07]
Stearic acid	18.86	2167	0.06	23.11	3101	0.07
Tetramethoxyflavone isomer	26.77	3138	0.03			
Tangeretin	26.82	3144	0.04			
3,3',4',5,6,7,8-Heptamethoxyflavone	28.74	3326	0.02			
Nobiletin	28.79	3330	0.08			
<b>Total identified</b>		<b>98.88%</b>			<b>98.99%</b>	
<b>Total reported</b>		<b>98.88%</b>			<b>98.99%</b>	

\*: 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