



## GC/MS BATCH NUMBER: K20100

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

KEY CONSTITUENTS PRESENT IN THIS BATCH OF KUMQUAT OIL	%
LIMONENE	91.2
MYRCENE	1.9
$\beta$ -PINENE	1.2

Comments from Robert Tisserand: Exquisite, green-citrus odor profile with hints of gardenia and white pepper. Constituents are in expected amounts.

**Date :** February 27, 2018

**CERTIFICATE OF ANALYSIS - GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 18B26-PTH1-1-CC

**Customer identification :** Kumquat Oil - Brazil - K2010078R

**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 :** Alexis St-Gelais, M. Sc., chimiste

**Analysis date :** February 27, 2018

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Bright yellow liquid

**Refractive index:**  $1.4718 \pm 0.0003$  (20 °C)

*CONCLUSION*

No clear adulterant, contaminant or diluent has been detected using this method, based on the 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	0.01	Aliphatic ester
$\alpha$ -Thujene	0.06	0.07	Monoterpene
$\alpha$ -Pinene	0.68	0.69	Monoterpene
Camphene	0.01	0.01	Monoterpene
Sabinene	1.60*	0.43	Monoterpene
$\beta$ -Pinene	[1.60]*	1.19	Monoterpene
Myrcene	1.87	1.88	Monoterpene
$\alpha$ -Phellandrene	0.04	0.04	Monoterpene
Octanal	0.15	0.15	Aliphatic aldehyde
$\Delta^3$ -Carene	0.18	0.17	Monoterpene
$\alpha$ -Terpinene	0.03	0.03	Monoterpene
Limonene	91.22*	91.20	Monoterpene
para-Cymene	[91.22]*	0.12	Monoterpene
$\beta$ -Phellandrene	[91.22]*	0.28	Monoterpene
(Z)- $\beta$ -Ocimene	tr	0.01	Monoterpene
(E)- $\beta$ -Ocimene	0.04	0.04	Monoterpene
$\gamma$ -Terpinene	0.97	0.99	Monoterpene
cis-Sabinene hydrate	0.01	0.01	Monoterpenic alcohol
Octanol	0.05	0.05	Aliphatic alcohol
Isoterpinolene	tr	tr	Monoterpene
Terpinolene	0.07	0.06	Monoterpene
Linalool	0.36	0.37	Monoterpenic alcohol
Nonanal	0.04	0.03	Aliphatic aldehyde
(E)-4,8-Dimethylnona-1,3,7-triene	0.01	0.01	Terpene derivative
trans-para-Mentha-2,8-dien-1-ol	tr	0.01	Monoterpenic alcohol
cis-Limonene oxide	0.01	0.01	Monoterpenic ether
trans-Limonene oxide	0.02	0.02	Monoterpenic ether
neo-Isopulegol	0.01	tr	Monoterpenic alcohol
Citronellal	0.27	0.26	Monoterpenic aldehyde
Terpinen-4-ol	0.01	0.01*	Monoterpenic alcohol
Nonanol	0.01	0.01	Aliphatic alcohol
$\alpha$ -Terpineol	0.06	0.07	Monoterpenic alcohol
Unknown	0.01		Unknown
Decanal	0.18	0.17	Aliphatic aldehyde
Octyl acetate	0.01	0.01	Aliphatic ester
trans-Carveol	0.01	0.01	Monoterpenic alcohol
Nerol	0.01	0.01	Monoterpenic alcohol
Citronellol	0.09	0.09*	Monoterpenic alcohol
Neral	0.05*	0.05	Monoterpenic aldehyde
Carvone	[0.05]*	0.01	Monoterpenic ketone
Geraniol	0.15	0.15	Monoterpenic alcohol
Perillaldehyde	0.02	[0.09]*	Monoterpenic aldehyde
Geranial	0.08	0.08*	Monoterpenic aldehyde
Limonen-10-ol	0.01	0.01	Monoterpenic alcohol
Undecanal	0.01	[0.01]*	Aliphatic aldehyde
Limonene glycol isomer I	0.01		Monoterpenic alcohol

Citronellyl acetate	0.03	0.02	Monoterpenic ester
Neryl acetate	0.01	0.01	Monoterpenic ester
$\alpha$ -Copaene	0.03	0.03	Sesquiterpene
Geranyl acetate	0.05	0.05	Monoterpenic ester
$\beta$ -Cubebene	0.02*	0.02	Sesquiterpene
$\beta$ -Elemene	[0.02]*	0.04*	Sesquiterpene
Dodecanal	0.04	0.04	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.03	[0.04]*	Sesquiterpene
$\beta$ -Copaene	0.03	0.02	Sesquiterpene
$\alpha$ -Humulene	0.01	0.01	Sesquiterpene
$\gamma$ -Murolene	0.01	0.01	Sesquiterpene
Germacrene D	0.05	0.02	Sesquiterpene
Valencene	0.05	0.05	Sesquiterpene
$\alpha$ -Murolene	0.02	[0.08]*	Sesquiterpene
$\gamma$ -Cadinene	0.02	0.02	Sesquiterpene
$\delta$ -Cadinene	0.04	0.04	Sesquiterpene
$\alpha$ -Elemol	0.02	0.02	Sesquiterpenic alcohol
Germacrene D-4-ol	0.01	0.01	Sesquiterpenic alcohol
$\beta$ -Sinensal	0.02	0.02	Sesquiterpenic aldehyde
$\alpha$ -Sinensal	0.02	0.02	Sesquiterpenic aldehyde
Myristic acid	0.04	0.04	Aliphatic acid
Nootkatone	0.01	0.01	Sesquiterpenic ketone
Palmitic acid	0.07	0.07	Aliphatic acid
Linoleic acid	0.05		Aliphatic acid
Oleic acid	0.03	0.05	Aliphatic acid
<i>cis</i> -Vaccenic acid?	0.01		Aliphatic acid
Stearic acid	0.02	0.03	Aliphatic acid
Tetramethoxyflavone isomer	0.04		Flavonoid
Tangeretin	0.05		Flavonoid
3,3',4',5,6,7,8-Heptamethoxyflavone	0.08		Flavonoid
Nobiletin	0.07		Flavonoid
<b>Total identified</b>	<b>99.42%</b>	<b>99.51%</b>	

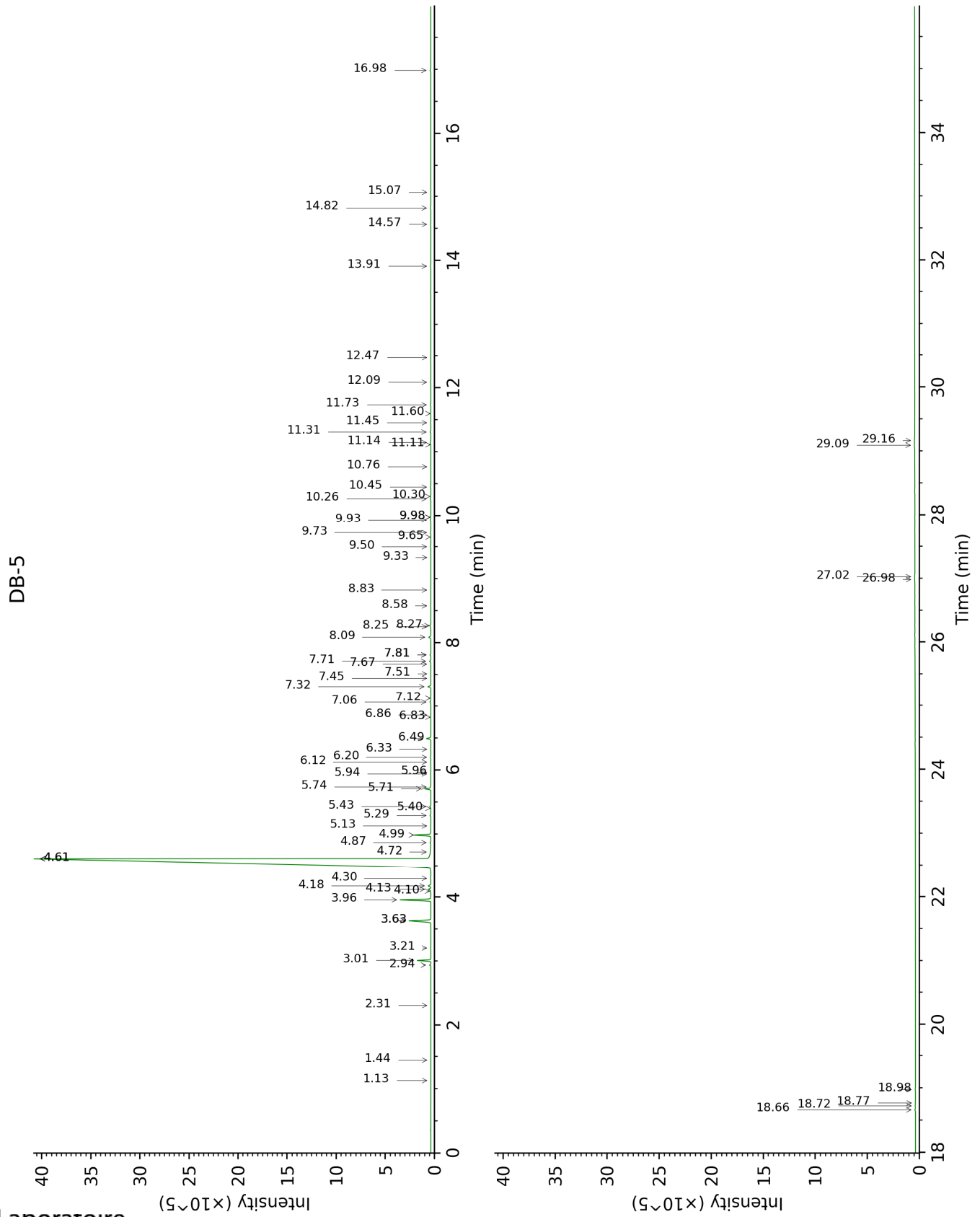
\*: Two or more compounds are coeluting on this column

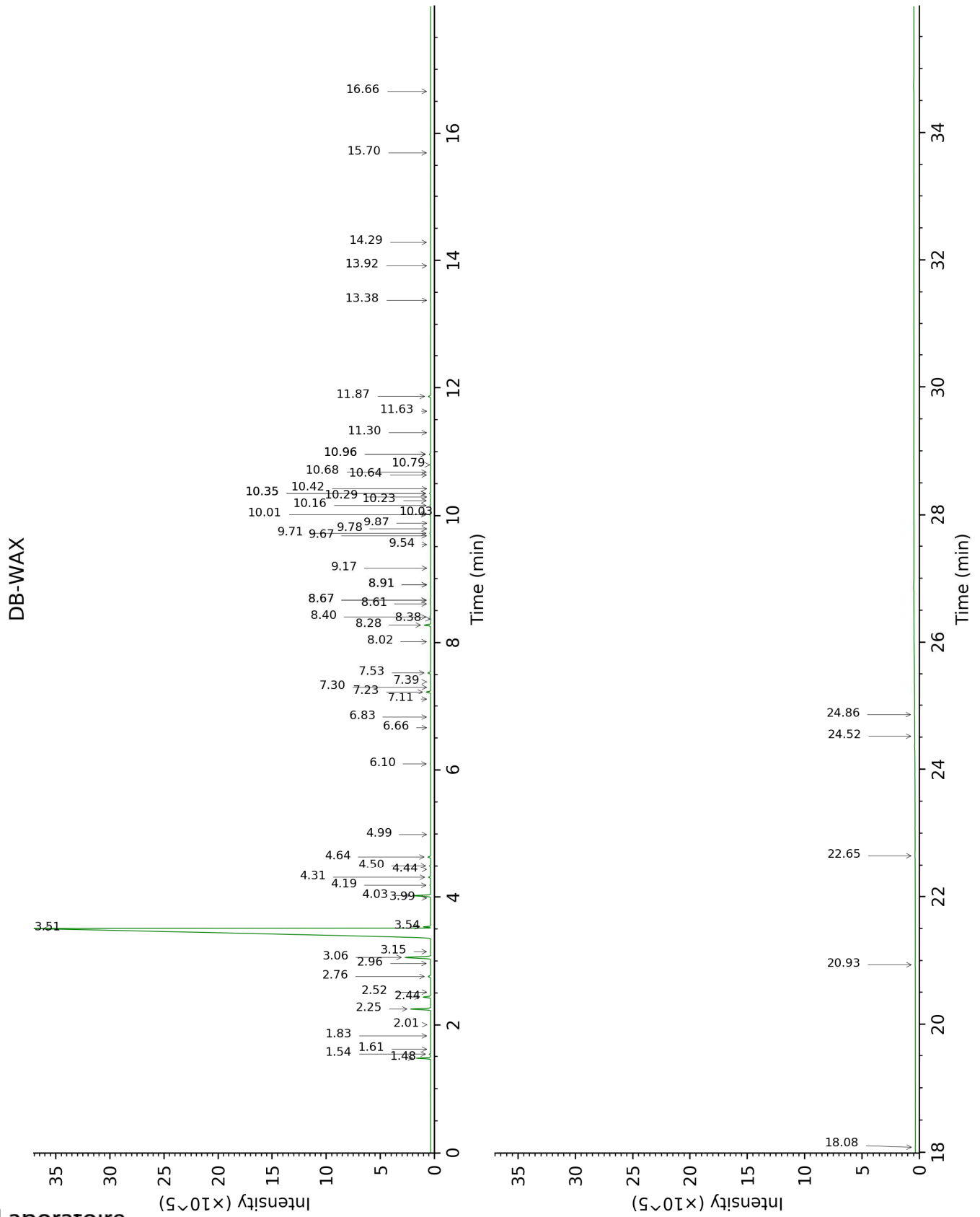
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	1.13	753	tr	1.61	1009	tr
Hexanal	1.44	799	tr	2.01	1046	tr
Isoamyl acetate	2.31	872	tr	2.52	1094	0.01
$\alpha$ -Thujene	2.94	920	0.06	1.54	1002	0.07
$\alpha$ -Pinene	3.01	925	0.68	1.48	995	0.69
Camphene	3.21	938	0.01	1.83	1030	0.01
Sabinene	3.63*	966	1.60	2.44	1086	0.43
$\beta$ -Pinene	3.63*	966	[1.60]	2.25	1069	1.19
Myrcene	3.96	988	1.87	3.06	1135	1.88
$\alpha$ -Phellandrene	4.10	997	0.04	2.96	1128	0.04
Octanal	4.13	999	0.15	4.64	1251	0.15
$\Delta$ 3-Carene	4.18	1003	0.18	2.76	1112	0.17
$\alpha$ -Terpinene	4.30	1010	0.03	3.15	1142	0.03
Limonene	4.61*	1030	91.22	3.51	1169	91.20
para-Cymene	4.61*	1030	[91.22]	4.31	1228	0.12
$\beta$ -Phellandrene	4.61*	1030	[91.22]	3.54	1171	0.28
(Z)- $\beta$ -Ocimene	4.72	1036	tr	3.99	1205	0.01
(E)- $\beta$ -Ocimene	4.87	1046	0.04	4.19	1219	0.04
$\gamma$ -Terpinene	4.98	1053	0.97	4.03	1207	0.99
cis-Sabinene hydrate	5.13	1062	0.01	7.11	1428	0.01
Octanol	5.29	1072	0.05	8.40	1525	0.05
Isoterpinolene	5.40	1079	tr	4.44	1236	tr
Terpinolene	5.43	1081	0.07	4.50	1241	0.06
Linalool	5.71	1099	0.36	8.28	1515	0.37
Nonanal	5.74	1100	0.04	6.10	1354	0.03
(E)-4,8-Dimethylnona-1,3,7-triene	5.94	1113	0.01	4.99	1276	0.01
trans-para-Mentha-2,8-dien-1-ol	5.96	1115	tr	9.17	1583	0.01
cis-Limonene oxide	6.12	1125	0.01	6.66	1395	0.01
trans-Limonene oxide	6.20	1130	0.02	6.83	1407	0.02
neo-Isopulegol	6.32	1138	0.01	8.38	1522	tr
Citronellal	6.49	1149	0.27	7.23	1437	0.26
Terpinen-4-ol	6.83	1170	0.01	8.91*	1564	0.01
Nonanol	6.86	1172	0.01	9.78	1632	0.01
$\alpha$ -Terpineol	7.06	1185	0.06	10.01	1651	0.07
Unknown [m/z 121, 79 (98), 93 (87), 94 (73), 91 (63), 105 (45)...]	7.12	1189	0.01			
Decanal	7.32	1201	0.18	7.53	1459	0.17
Octyl acetate	7.45	1210	0.01	7.30	1442	0.01
trans-Carveol	7.52	1214	0.01	11.63	1786	0.01
Nerol	7.67	1225	0.01	11.30	1757	0.01
Citronellol	7.71	1228	0.09	10.96*	1729	0.09
Neral	7.81*	1234	0.05	9.71	1627	0.05
Carvone	7.81*	1234	[0.05]	10.29	1674	0.01
Geraniol	8.09	1253	0.15	11.86	1806	0.15

Perillaldehyde	8.25	1264	0.02	10.96*	1729	[0.09]
Geranial	8.27	1265	0.08	10.35*	1678	0.08
Limonen-10-ol	8.58	1286	0.01	13.38	1941	0.01
Undecanal	8.83	1302	0.01	8.91*	1564	[0.01]
Limonene glycol isomer I	9.33	1338	0.01			
Citronellyl acetate	9.50	1350	0.03	9.67	1624	0.02
Neryl acetate	9.65	1360	0.01	10.42	1684	0.01
$\alpha$ -Copaene	9.73	1365	0.03	7.39	1449	0.03
Geranyl acetate	9.93	1380	0.05	10.79	1715	0.05
$\beta$ -Cubebene	9.98*	1383	0.02	8.02	1495	0.02
$\beta$ -Elemene	9.98*	1383	[0.02]	8.67*	1545	0.04
Dodecanal	10.26	1403	0.04	10.24	1669	0.04
$\beta$ -Caryophyllene	10.30	1406	0.03	8.67*	1545	[0.04]
$\beta$ -Copaene	10.45	1417	0.03	8.61	1540	0.02
$\alpha$ -Humulene	10.76	1441	0.01	9.54	1613	0.01
$\gamma$ -Murolene	11.11	1466	0.01	9.87	1640	0.01
Germacrene D	11.14	1469	0.05	10.03	1653	0.02
Valencene	11.31	1481	0.05	10.16	1663	0.05
$\alpha$ -Murolene	11.45	1492	0.02	10.35*	1678	[0.08]
$\gamma$ -Cadinene	11.60	1502	0.02	10.64	1702	0.02
$\delta$ -Cadinene	11.73	1513	0.04	10.68	1706	0.04
$\alpha$ -Elemol	12.09	1541	0.02	14.28	2026	0.02
Germacrene D-4-ol	12.47	1571	0.01	13.92	1991	0.01
$\beta$ -Sinensal	13.91	1688	0.02	15.70	2164	0.02
$\alpha$ -Sinensal	14.57	1744	0.02	16.66	2263	0.02
Myristic acid	14.82	1766	0.04	20.93	2751	0.04
Nootkatone	15.07	1787	0.01	18.08	2416	0.01
Palmitic acid	16.98	1963	0.07	22.65	2971	0.07
Linoleic acid	18.66	2129	0.05			
Oleic acid	18.72	2135	0.03	24.86	3278	0.05
<i>cis</i> -Vaccenic acid?	18.77	2140	0.01			
Stearic acid	18.98	2161	0.02	24.52	3230	0.03
Tetramethoxyflavone isomer	26.98	3130	0.04			
Tangeretin	27.02	3134	0.05			
3,3',4',5,6,7,8-Heptamethoxyflavone	29.09	3317	0.08			
Nobiletin	29.16	3322	0.07			
<b>Total identified</b>		<b>99.42%</b>			<b>99.51%</b>	
<b>Total reported</b>		<b>99.44%</b>			<b>99.51%</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

R.T.: Retention time (minutes)

R.I.: Retention index