

**Date :** April 28, 2022

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 22D27-PTH05


**Customer identification :** Kumquat - Brazil - K20104R

**Type :** Essential oil

**Source :** *Fortunella japonica*

**Customer :** Plant Therapy

*ANALYSIS*

**Method:** PC-MAT-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 :** Seydou Ka, Ph. D.

**Analysis date :** April 28, 2022

Checked and approved by :

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Alexis St-Gelais, Ph. D., Chimiste 2013-174

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Yellow liquid

**Refractive index:**  $1.4736 \pm 0.0003$  (20 °C; method PC-MAT-016)

*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
$\alpha$ -Thujene	0.07	Monoterpene
$\alpha$ -Pinene	0.67	Monoterpene
Camphene	0.01	Monoterpene
$\beta$ -Pinene	1.23	Monoterpene
Sabinene	0.44	Monoterpene
Myrcene	1.65	Monoterpene
Octanal	0.14	Aliphatic aldehyde
$\alpha$ -Phellandrene	0.03	Monoterpene
$\Delta^3$ -Carene	0.13	Monoterpene
$\alpha$ -Terpinene	0.02	Monoterpene
para-Cymene	0.25	Monoterpene
Limonene	90.05	Monoterpene
$\beta$ -Phellandrene	0.26	Monoterpene
(Z)- $\beta$ -Ocimene	0.01	Monoterpene
(E)- $\beta$ -Ocimene	0.03	Monoterpene
$\gamma$ -Terpinene	1.49	Monoterpene
cis-Sabinene hydrate	0.01	Monoterpenic alcohol
Octanol	0.06	Aliphatic alcohol
Terpinolene	0.08	Monoterpene
Linalool	0.44	Monoterpenic alcohol
Nonanal	0.03	Aliphatic aldehyde
(E)-4,8-Dimethylnona-1,3,7-triene	0.01	Terpene derivative
trans-para-Mentha-2,8-dien-1-ol	0.03	Monoterpenic alcohol
cis-Limonene oxide	0.06	Monoterpenic ether
trans-Limonene oxide	0.06	Monoterpenic ether
neo-Isopulegol	0.02	Monoterpenic alcohol
Citronellal	0.30	Monoterpenic aldehyde
Terpinen-4-ol	0.04	Monoterpenic alcohol
$\alpha$ -Terpineol	0.09	Monoterpenic alcohol
Unknown	0.02	Unknown
Decanal	0.17	Aliphatic aldehyde
trans-Carveol	0.05	Monoterpenic alcohol
Nerol	0.04	Monoterpenic alcohol
Citronellol	0.10	Monoterpenic alcohol
Neral	0.10	Monoterpenic aldehyde
Geraniol	0.16	Monoterpenic alcohol
Geranial	0.08	Monoterpenic aldehyde
Limonen-10-ol	0.02	Monoterpenic alcohol
Undecanal	0.01	Aliphatic aldehyde
Limonene cis-glycol	0.07	Monoterpenic alcohol
Citronellyl acetate	0.03	Monoterpenic ester
Neryl acetate	0.01	Monoterpenic ester
$\alpha$ -Copaene	0.03	Sesquiterpene
Geranyl acetate	0.03	Monoterpenic ester
$\beta$ -Cubebene	0.02	Sesquiterpene

β-Elemene	0.04	Sesquiterpene
Dodecanal	0.04	Aliphatic aldehyde
β-Caryophyllene	0.02	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
Germacrene D	0.03	Sesquiterpene
Valencene	0.10	Sesquiterpene
α-Muurolene	0.01	Sesquiterpene
γ-Cadinene	0.01	Sesquiterpene
δ-Cadinene	0.05	Sesquiterpene
α-Elemol	0.04	Sesquiterpenic alcohol
Germacrene D-4-ol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.01	Sesquiterpenic ether
β-Sinensal	0.03	Sesquiterpenic aldehyde
Nootkatone	0.01	Sesquiterpenic ketone
Tangeretin	0.02	Flavonoid
<b>Consolidated total</b>	<b>99.08%</b>	

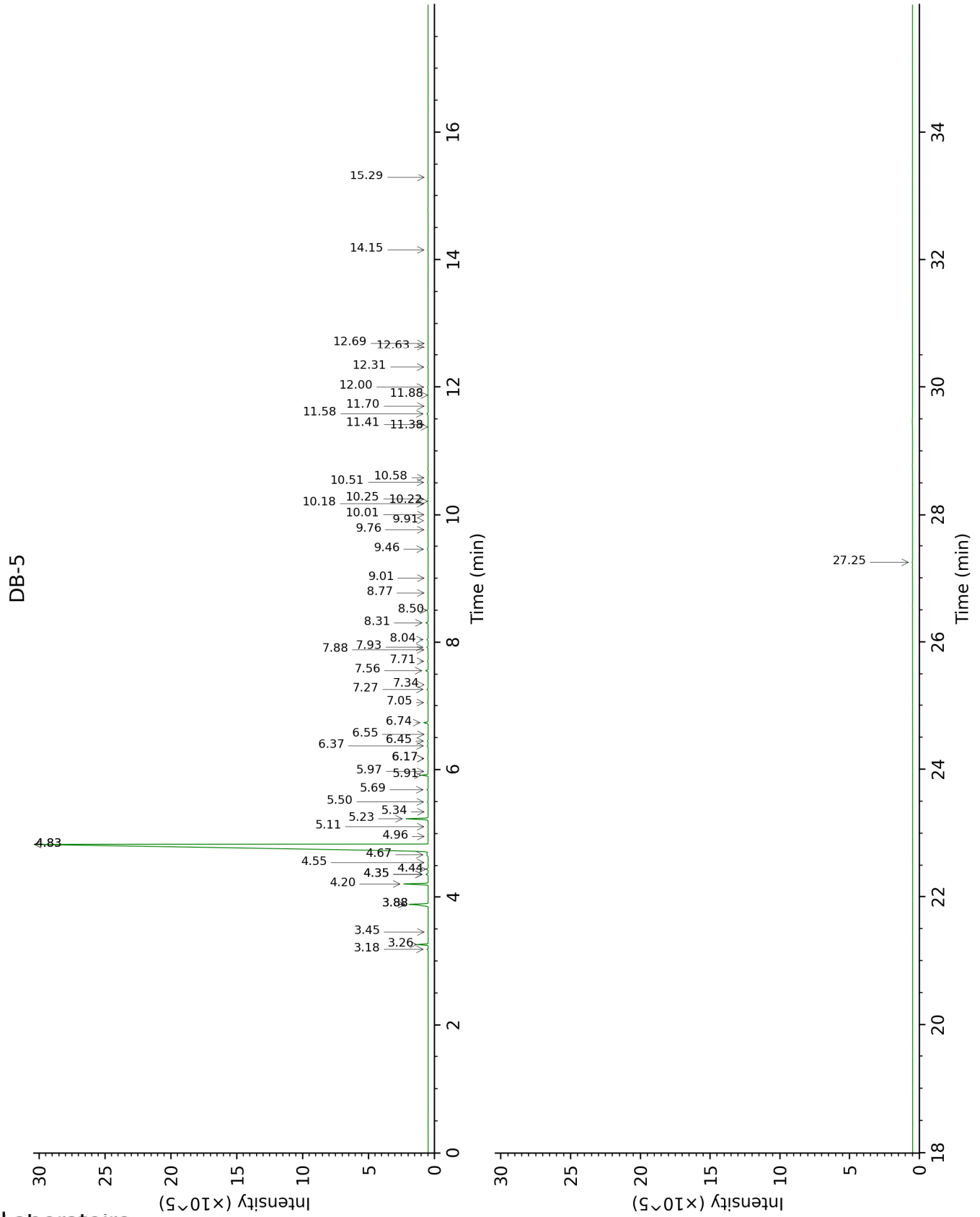
tr: The compound has been detected below 0.005% of total signal.

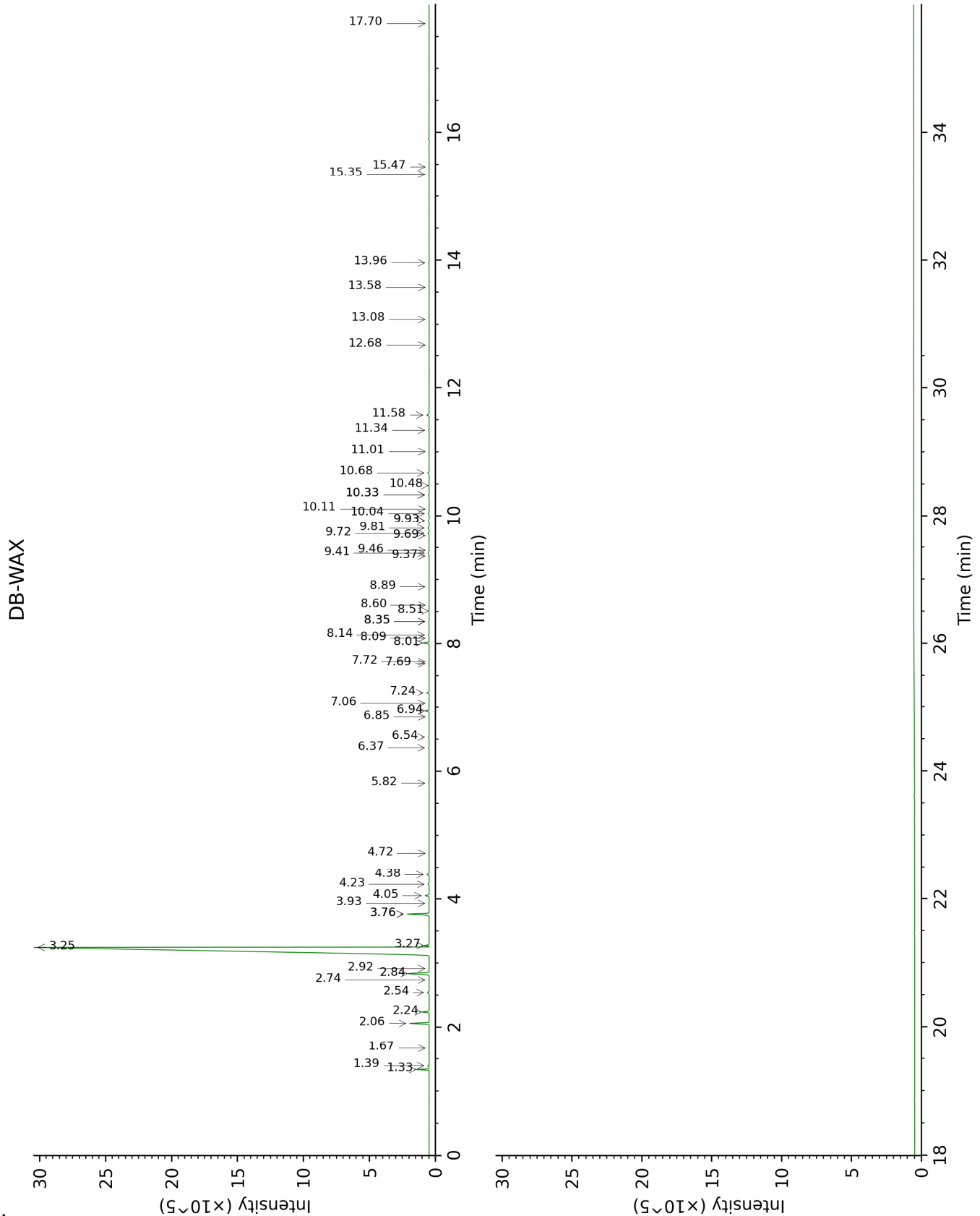
Note: no correction factor was applied

**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.

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
$\alpha$ -Thujene	3.18	925	0.07	1.39	999	0.07
$\alpha$ -Pinene	3.26	930	0.67	1.33	991	0.66
Camphene	3.45	943	0.01	1.67	1027	0.01
$\beta$ -Pinene	3.88*	971	1.68	2.06	1066	1.23
Sabinene	3.88*	971	[1.68]	2.24	1084	0.44
Myrcene	4.20	992	1.65	2.84	1134	1.65
Octanal	4.35*	1002	0.16	4.38	1253	0.14
$\alpha$ -Phellandrene	4.35*	1002	[0.16]	2.74	1126	0.03
$\Delta^3$ -Carene	4.44	1007	0.13	2.54	1111	0.13
$\alpha$ -Terpinene	4.55	1014	0.02	2.92	1141	0.02
para-Cymene	4.67	1022	0.25	4.05	1228	0.27
Limonene	4.83*	1032	90.67	3.24	1167	90.05
$\beta$ -Phellandrene	4.83*	1032	[90.67]	3.28	1169	0.26
(Z)- $\beta$ -Ocimene	4.96	1040	0.01	3.76*	1207	1.49
(E)- $\beta$ -Ocimene	5.11	1050	0.03	3.93	1220	0.03
$\gamma$ -Terpinene	5.23	1058	1.49	3.76*	1207	[1.49]
<i>cis</i> -Sabinene hydrate	5.34	1064	0.01	6.85	1431	0.01
Octanol	5.50	1074	0.06	8.14	1528	0.06
Terpinolene	5.69	1086	0.08	4.23	1242	0.09
Linalool	5.91	1101	0.44	8.01	1518	0.44
Nonanal	5.97	1104	0.03	5.82	1356	0.03
(E)-4,8-Dimethylnona-1,3,7-triene	6.18*	1117	0.04	4.72	1278	0.01
<i>trans</i> -para-Mentha-2,8-dien-1-ol	6.18*	1117	[0.04]	8.89	1586	0.03
<i>cis</i> -Limonene oxide	6.37	1130	0.06	6.37	1395	0.06
<i>trans</i> -Limonene oxide	6.45	1135	0.06	6.54	1408	0.06
neo-Isopulegol	6.55	1142	0.02	8.09	1524	0.01
Citronellal	6.74	1154	0.30	6.94	1438	0.30
Terpinen-4-ol	7.05	1174	0.04	8.51	1556	0.03
$\alpha$ -Terpineol	7.27	1188	0.09	9.72	1653	0.09
Unknown [m/z 121, 79 (98), 93 (87), 94 (73), 91 (63), 105 (45)...]	7.34	1193	0.02	7.69	1493	0.02
Decanal	7.56	1207	0.17	7.24	1459	0.17
<i>trans</i> -Carveol	7.71	1218	0.05	11.34	1788	0.04
Nerol	7.88	1230	0.04	11.01	1760	0.02
Citronellol	7.93	1232	0.10	10.68	1731	0.12
Neral	8.04	1241	0.10	9.41	1628	0.09
Geraniol	8.31	1259	0.16	11.58	1808	0.17
Geranial	8.50	1272	0.08	10.04	1678	0.08
Limonen-10-ol	8.77	1290	0.02	13.08	1944	0.02



Undecanal	9.00	1306	0.01	8.60	1564	0.01
Limonene <i>cis</i> -glycol	9.46	1334	0.07	15.47	2174	0.01
Citronellyl acetate	9.76	1355	0.03	9.37	1624	0.02
Neryl acetate	9.91	1366	0.01	10.11	1684	tr
$\alpha$ -Copaene	10.01	1372	0.03	7.06	1446	0.02
Geranyl acetate	10.18	1385	0.03	10.48	1715	0.06
$\beta$ -Cubebene	10.22	1387	0.02	7.72	1495	0.03
$\beta$ -Elemene	10.25	1390	0.04	8.35*	1544	0.04
Dodecanal	10.51	1408	0.04	9.93*	1669	0.10
$\beta$ -Caryophyllene	10.58	1414	0.02	8.35*	1544	[0.04]
$\gamma$ -Murolene	11.38	1473	0.01	9.46	1631	0.01
Germacrene D	11.42	1476	0.03	9.69	1650	0.02
Valencene	11.58	1488	0.10	9.81	1660	0.10
$\alpha$ -Murolene	11.70	1497	0.01	9.93*	1669	[0.10]
$\gamma$ -Cadinene	11.88	1510	0.01	10.33*	1702	0.05
$\delta$ -Cadinene	12.00	1520	0.05	10.33*	1702	[0.05]
$\alpha$ -Elemol	12.31	1545	0.04	13.96	2026	0.04
Germacrene D-4-ol	12.63	1570	0.01	13.58	1990	0.01
Caryophyllene oxide	12.69	1575	0.01	12.68	1906	0.01
$\beta$ -Sinensal	14.16	1694	0.03	15.35	2163	0.03
Nootkatone	15.29	1792	0.01	17.70	2412	0.01
Tangeretin	27.25	3130	0.02			
<b>Total identified</b>		<b>99.42%</b>			<b>99.00%</b>	
<b>Total reported</b>		<b>99.44%</b>			<b>99.02%</b>	

\*: 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