

**Date :** February 22, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 21B15-PTH16


**Customer identification :** Mandarin Green ORGANIC - MI01042011R

**Type :** Essential oil

**Source :** *Citrus reticulata* cv. Mandarine

**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 :** Sylvain Mercier, M. Sc., Chimiste

**Analysis date :** February 18, 2021

Checked and approved by :

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

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#### PHYSICOCHEMICAL DATA

**Physical aspect:** Green brownish liquid

**Refractive index:** 1.4761 ± 0.0003 (20 °C; method PC-MAT-016)

#### ISO 3528:2012 - OIL OF MANDARIN, ITALIAN TYPE - GREEN

Compound	Min. %	Max. %	Observed %	Complies?
α-Pinene	1.6	2.7	2.2	Yes
β-Pinene	1.0	2.0	1.7	Yes
Myrcene	1.4	2.0	1.6	Yes
Octanal		0.14	0.08	Yes
γ-Terpinene	17.0	22.0	19.2	Yes
Limonene	65.0	74.0	65.4	Yes
Linalool	0.05	0.20	0.14	Yes
Decanal	0.04	0.14	0.06	Yes
Dimethyl anthranilate	0.4	0.7	0.6	Yes
α-Sinensal	0.2	0.5	0.2	Yes
<b>Refractive index</b>	1.4732	1.4758	1.4761	No

#### 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
Octane	tr	Alkane
Nonane	0.01	Alkane
$\alpha$ -Thujene	0.82	Monoterpene
$\alpha$ -Pinene	2.25	Monoterpene
Camphene	0.03	Monoterpene
Thuja-2,4(10)-diene	0.03	Monoterpene
Sabinene	0.21	Monoterpene
$\beta$ -Pinene	1.70	Monoterpene
Myrcene	1.56	Monoterpene
$\alpha$ -Phellandrene	0.07	Monoterpene
Octanal	0.08	Aliphatic aldehyde
$\alpha$ -Terpinene	0.34	Monoterpene
ortho-Cymene	0.02	Monoterpene
para-Cymene	0.93	Monoterpene
Limonene	65.42	Monoterpene
$\beta$ -Phellandrene	0.21	Monoterpene
( <i>E</i> )- $\beta$ -Ocimene	0.02	Monoterpene
$\gamma$ -Terpinene	19.22	Monoterpene
<i>cis</i> -Sabinene hydrate	0.06	Monoterpenic alcohol
Octanol	0.05	Aliphatic alcohol
Terpinolene	0.80	Monoterpene
<i>trans</i> -Sabinene hydrate	0.10	Monoterpenic alcohol
Linalool	0.14	Monoterpenic alcohol
Nonanal	0.03	Aliphatic aldehyde
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
<i>cis</i> -Limonene oxide	0.02	Monoterpenic ether
<i>cis</i> -para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
<i>trans</i> -Limonene oxide	0.04	Monoterpenic ether
Epoxyterpinolene	0.03	Monoterpenic ether
Citronellal	0.02	Monoterpenic aldehyde
Unknown	0.02	Unknown
Terpinen-4-ol	0.08	Monoterpenic alcohol
para-Cymen-8-ol	0.01	Monoterpenic alcohol
$\alpha$ -Terpineol	0.28	Monoterpenic alcohol
Unknown	0.02	Unknown
Decanal	0.06	Aliphatic aldehyde
<i>trans</i> -Carveol	0.01	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
Citronellol	0.03	Monoterpenic alcohol
Carvone	0.01	Monoterpenic ketone
Neral	0.01	Monoterpenic aldehyde
Piperitone	0.01	Monoterpenic ketone
<i>trans</i> -Ascaridole glycol	0.01	Monoterpenic alcohol
Geranial	0.06	Monoterpenic aldehyde
Unknown	0.01	Oxygenated monoterpene

<i>cis</i> -Ascaridole glycol	0.02	Monoterpenic alcohol
Perilla alcohol	0.01	Monoterpenic alcohol
Thymol	0.14	Monoterpenic alcohol
Undecanal	0.01	Aliphatic aldehyde
Unknown	0.01	Monoterpenic alcohol
<i>trans</i> - <i>para</i> -Mentha-2,8-diene-1-hydroperoxide	0.01	Monoterpenic peroxide
<i>para</i> -Mentha-1,8-diene-4-hydroperoxide	0.02	Monoterpenic peroxide
$\alpha$ -Copaene	0.02	Sesquiterpene
$\beta$ -Cubebene	0.01	Sesquiterpene
$\beta$ -Elemene	0.01	Sesquiterpene
Dimethyl anthranilate	0.57	Phenolic ester
Dodecanal	0.02	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.14	Sesquiterpene
$\alpha$ -Humulene	0.02	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.01	Sesquiterpene
(2 <i>E</i> )-Dodecenal	0.04	Aliphatic aldehyde
Germacrene D	0.01	Sesquiterpene
$\alpha$ -Selinene	0.08	Sesquiterpene
Bicyclogermacrene	0.01	Sesquiterpene
$\gamma$ -Cadinene	0.06	Sesquiterpene
(3 <i>E</i> ,6 <i>E</i> )- $\alpha$ -Farnesene	0.29	Sesquiterpene
$\delta$ -Cadinene	0.03	Sesquiterpene
$\alpha$ -Elemol	0.01	Sesquiterpenic alcohol
Spathulenol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.02	Sesquiterpenic ether
$\beta$ -Sinensal	0.04	Sesquiterpenic aldehyde
Pentadecanal	0.09	Aliphatic aldehyde
$\alpha$ -Sinensal	0.24	Sesquiterpenic aldehyde
Myristic acid	0.04	Aliphatic acid
meta-Camphorene	0.01	Diterpene
Palmitic acid	0.13	Aliphatic acid
<i>para</i> -Camphorene	0.03	Diterpene
Linoleic acid	0.02	Aliphatic acid
Oleic acid	0.03	Aliphatic acid
<i>cis</i> -Vaccenic acid?	0.03	Aliphatic acid
Stearic acid	0.40	Aliphatic acid
Tangeretin	0.31	Flavonoid
<b>Consolidated total</b>	<b>97.76%</b>	

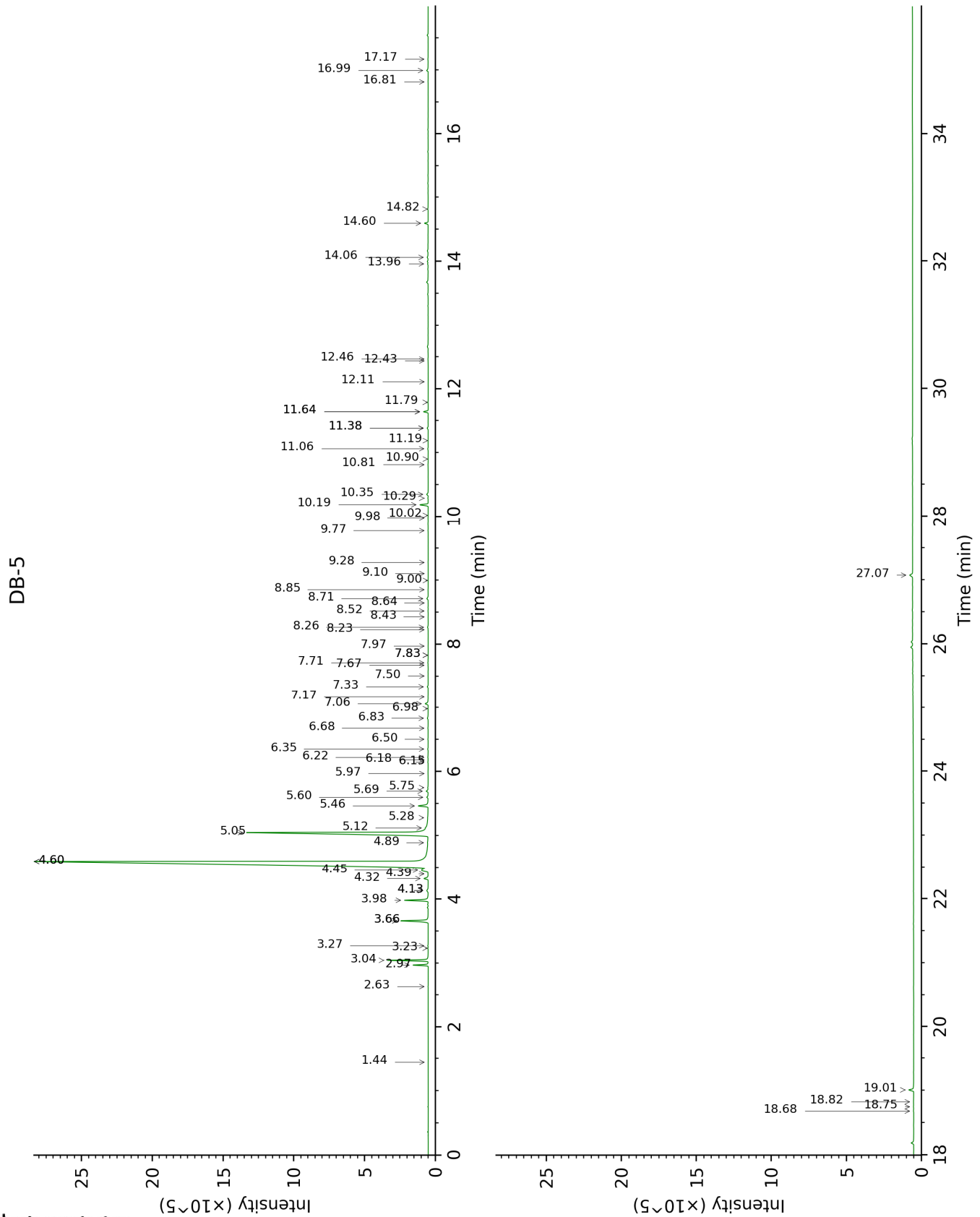
tr: The compound has been detected below 0.005% of total signal.

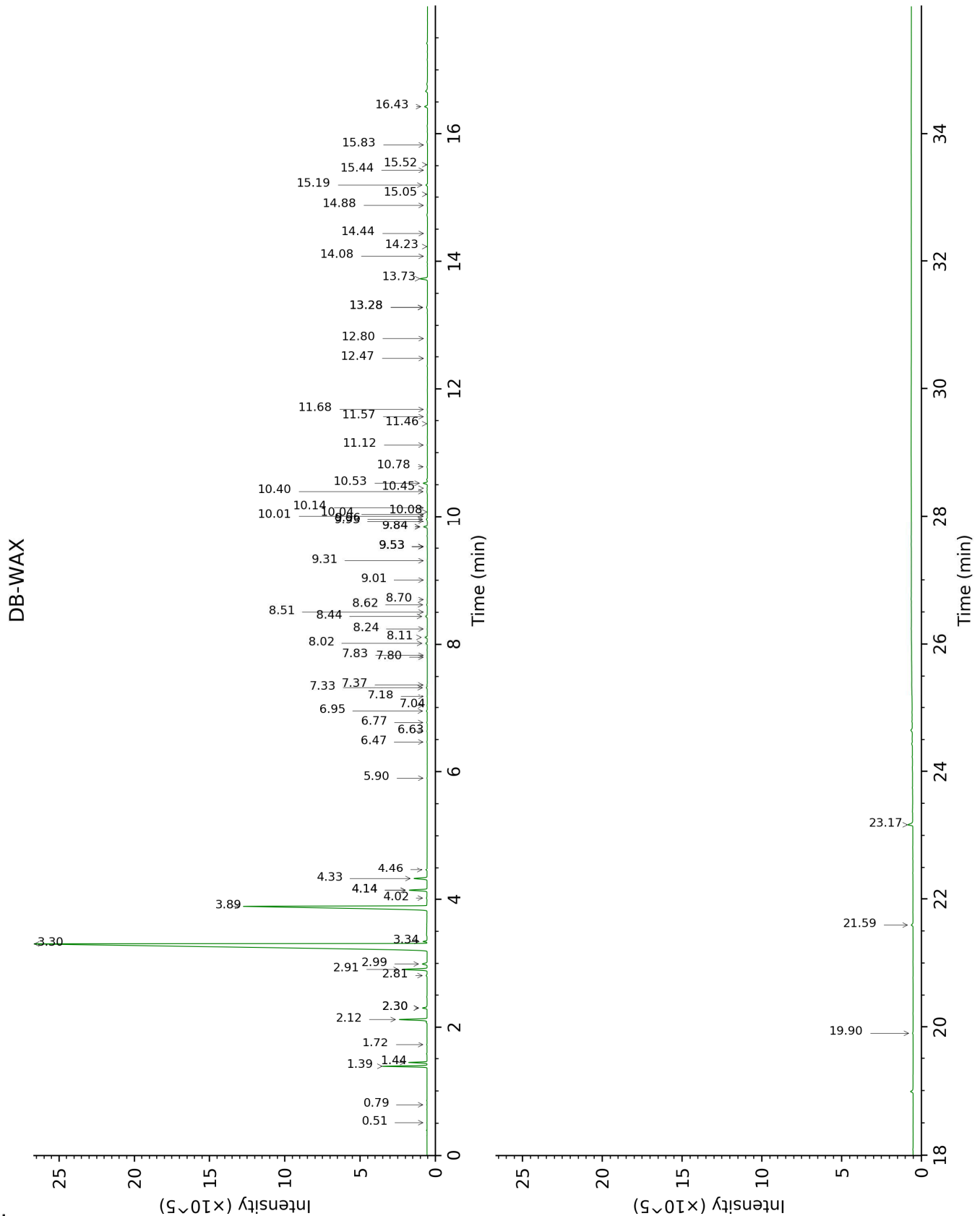
Note: no correction factor was applied

**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.

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





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Octane	1.44	806	tr	0.51	784	tr
Nonane	2.63	904	0.01	0.79	892	0.01
$\alpha$ -Thujene	2.97	926	0.82	1.44	999	0.86
$\alpha$ -Pinene	3.04	931	2.25	1.39	993	2.28
Camphene	3.23	943	0.03	1.72	1027	0.02
Thuja-2,4(10)-diene	3.27	946	0.03	2.30*	1085	0.27
Sabinene	3.66*	971	1.91	2.30*	1085	[0.27]
$\beta$ -Pinene	3.66*	971	[1.91]	2.12	1067	1.70
Myrcene	3.98	992	1.56	2.91	1134	1.58
$\alpha$ -Phellandrene	4.13*	1002	0.16	2.81	1127	0.07
Octanal	4.13*	1002	[0.16]	4.46	1252	0.08
$\alpha$ -Terpinene	4.32	1014	0.34	2.99	1141	0.36
ortho-Cymene	4.39	1019	0.02	4.14*	1228	1.09
para-Cymene	4.45	1022	0.93	4.14*	1228	[1.09]
Limonene	4.60*†	1031	65.63	3.30	1166	65.42
$\beta$ -Phellandrene	4.60*†	1031	[65.63]	3.34	1169	0.21
( <i>E</i> )- $\beta$ -Ocimene	4.89†	1050	[65.63]	4.02	1220	0.02
$\gamma$ -Terpinene	5.05†	1060	19.21	3.89	1210	19.22
<i>cis</i> -Sabinene hydrate	5.12†	1064	[19.21]	6.95	1432	0.06
Octanol	5.28	1074	0.05	8.24	1529	0.02
Terpinolene	5.46	1086	0.80	4.32	1242	0.83
<i>trans</i> -Sabinene hydrate	5.60	1094	0.10	8.02	1511	0.11
Linalool	5.69	1101	0.14	8.11	1519	0.15
Nonanal	5.75	1104	0.03	5.90	1355	0.02
<i>trans</i> -para-Mentha-2,8-dien-1-ol	5.97	1118	0.01	9.00	1588	0.01
<i>cis</i> -Limonene oxide	6.15	1130	0.02	6.47	1396	0.03
<i>cis</i> -para-Mentha-2,8-dien-1-ol	6.18	1132	0.01	9.53*	1630	0.03
<i>trans</i> -Limonene oxide	6.22	1135	0.04	6.63	1408	0.02
Epoxyterpinolene	6.35	1143	0.03	6.77	1418	0.04
Citronellal	6.50	1153	0.02	7.04	1438	0.02
Unknown [m/z 43, 109 (68), 67 (62), 81 (36), 41 (31), 137 (29), 79 (26)...]	6.68	1164	0.02	7.37	1462	0.02
Terpinen-4-ol	6.83	1175	0.08	8.62	1558	0.06
para-Cymen-8-ol	6.98	1184	0.01	11.57	1799	0.02
$\alpha$ -Terpineol	7.06	1189	0.28	9.84*	1654	0.28
Unknown [m/z 121, 79 (98), 93	7.17	1197	0.02	7.80	1495	0.01



(87), 94 (73), 91 (63), 105 (45)...						
Decanal	7.34	1208	0.06	7.32	1459	0.06
<i>trans</i> -Carveol	7.50	1219	0.01	11.46	1789	0.01
Nerol	7.67	1231	0.02	11.12	1761	0.02
Citronellol	7.71	1234	0.03	10.78	1733	0.03
Carvone	7.83*	1242	0.01	10.04	1671	0.01
Neral	7.83*	1242	[0.01]	9.53*	1630	[0.03]
Piperitone	7.97	1252	0.01	9.93	1662	0.01
<i>trans</i> -Ascaridole glycol	8.23	1269	0.01	14.23	2042	0.02
Geranial	8.26	1272	0.06	10.14	1679	0.01
Unknown [m/z 95, 67 (45), 41 (42), 110 (42), 43 (41), 59 (36)]	8.43	1283	0.01	12.48	1879	0.01
<i>cis</i> -Ascaridole glycol	8.52	1290	0.02	14.88	2104	0.03
Perilla alcohol	8.64	1298	0.01	13.28*	1952	0.13
Thymol	8.71	1303	0.14	15.19	2135	0.12
Undecanal	8.85	1307	0.01	8.70	1564	0.02
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	9.00	1317	0.01	15.05	2121	0.01
<i>trans</i> -para- Mentha-2,8-diene- 1-hydroperoxide	9.10	1325	0.01			
para-Mentha-1,8- diene-4- hydroperoxide	9.28	1337	0.02			
α-Copaene	9.77	1372	0.02	7.18	1448	0.02
β-Cubebene	9.98	1387	0.01	7.83	1497	0.01
β-Elemene	10.02	1390	0.01	8.51	1549	0.01
Dimethyl anthranilate	10.19	1401	0.57	13.73	1994	0.56
Dodecanal	10.29	1409	0.02	10.01	1669	0.02
β-Caryophyllene	10.35	1413	0.14	8.44	1544	0.13
α-Humulene	10.81	1448	0.02	9.31	1612	0.01
( <i>E</i> )-β-Farnesene	10.90	1454	0.01	9.53*	1630	[0.03]
(2 <i>E</i> )-Dodecenal	11.06	1466	0.04	11.68	1809	0.02
Germacrene D	11.19	1476	0.01	9.84*	1654	[0.28]
α-Selinene	11.38*	1490	0.08	9.96	1665	0.08
Bicyclogermacrene	11.38*	1490	[0.08]	10.08	1674	0.01
γ-Cadinene	11.64*	1509	0.31	10.40	1700	0.06
(3 <i>E</i> ,6 <i>E</i> )-α- Farnesene	11.64*	1509	[0.31]	10.53	1711	0.29
δ-Cadinene	11.79	1521	0.03	10.45	1705	0.03
α-Elemol	12.11	1546	0.01	14.08	2027	0.02
Spathulenol	12.43	1572	0.01	14.44	2061	0.01
Caryophyllene oxide	12.46	1574	0.02	12.80	1908	0.01

β-Sinensal	13.96	1696	0.04	15.52	2168	0.01
Pentadecanal	14.06	1704	0.09	13.28*	1952	[0.13]
α-Sinensal	14.60	1750	0.24	16.43	2260	0.22
Myristic acid	14.82	1769	0.04	19.90	2647	0.04
meta-Camphorene	16.81	1951	0.01	15.44	2159	0.02
Palmitic acid	16.99	1968	0.13	21.59	2854	0.14
para-Camphorene	17.17	1985	0.03	15.83	2199	0.01
Linoleic acid	18.68	2135	0.02			
Oleic acid	18.75	2142	0.03			
cis-Vaccenic acid?	18.82	2150	0.03			
Stearic acid	19.01	2169	0.40	23.17	3061	0.44
Tangeretin	27.07	3146	0.31			
<b>Total identified</b>		<b>97.60%</b>			<b>97.50%</b>	
<b>Total reported</b>		<b>97.66%</b>			<b>97.56%</b>	

\*: 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

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