

**Date :** September 26, 2019

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 19I13-PTH05-1-SCC

**Customer identification :** Lemon Organic - Spain - L7010795R

**Type :** Essential oil

**Source :** *Citrus x limon*

**Customer :** Plant Therapy

**ANALYSIS**

**Method:** PC-PA-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 :** Lindsay Girard, B. Sc.

**Analysis date :** September 24, 2019

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:** 1.4746 ± 0.0003 (20 °C)

*ISO 855:2004 - OIL OF LEMON, OBTAINED BY EXPRESSION - SPAIN*

<b>Compound</b>	<b>Min. %</b>	<b>Max. %</b>	<b>Observed %</b>	<b>Complies?</b>
Geranyl acetate	0.20	0.65	0.42	Yes
Neryl acetate	0.30	0.60	0.52	Yes
β-Bisabolene	0.45	0.90	0.68	Yes
Geranial	0.6	2.0	1.4	Yes
Neral	0.4	1.0	0.9	Yes
α-Terpineol	0.09	0.35	0.15	Yes
γ-Terpinene	8.0	12.0	8.9	Yes
Limonene	60.0	70.0	64.7	Yes
para-Cymene	tr	0.40	0.18	Yes
β-Pinene	10.0	16.5	11.9	Yes
Sabinene	1.5	3.0	1.9	Yes
α-Pinene	1.5	3.0	1.8	Yes
α-Thujene	0.2	0.5	0.4	Yes
<b>Refractive index</b>	1.4730	1.4760	1.4746	Yes

*CONCLUSION*

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for lemon oil from Spain.

## ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

New readers of similar reports are encouraged to read table footnotes at least once.

Identification	%	Classe
Tricyclene	0.01	Monoterpene
$\alpha$ -Thujene	0.41	Monoterpene
$\alpha$ -Pinene	1.85	Monoterpene
Camphene	0.06	Monoterpene
$\alpha$ -Fenchene	0.01	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
$\beta$ -Pinene	11.87	Monoterpene
Sabinene	1.92	Monoterpene
6-Methyl-5-hepten-2-one	0.01	Aliphatic ketone
Myrcene	1.49	Monoterpene
$\alpha$ -Phellandrene	0.04	Monoterpene
Octanal	0.11	Aliphatic aldehyde
$\alpha$ -Terpinene	0.19	Monoterpene
para-Cymene	0.18	Monoterpene
1,8-Cineole	64.71*	Monoterpenic ether
$\beta$ -Phellandrene	[64.71]*	Monoterpene
Limonene	[64.71]*	Monoterpene
(Z)- $\beta$ -Ocimene	0.04	Monoterpene
(E)- $\beta$ -Ocimene	0.09	Monoterpene
$\gamma$ -Terpinene	8.85	Monoterpene
<i>cis</i> -Sabinene hydrate	0.03	Monoterpenic alcohol
Terpinolene	0.37	Monoterpene
<i>trans</i> -Sabinene hydrate	0.02	Monoterpenic alcohol
Linalool	0.11	Monoterpenic alcohol
Nonanal	0.12	Aliphatic aldehyde
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
Camphor	0.01	Monoterpenic ketone
Citronellal	0.14	Monoterpenic aldehyde
Borneol	0.01	Monoterpenic alcohol
Terpinen-4-ol	0.06	Monoterpenic alcohol
Isogeranial	0.02	Monoterpenic aldehyde
$\alpha$ -Terpineol	0.15	Monoterpenic alcohol
Decanal	0.08	Aliphatic aldehyde
2,3-Epoxyneral?	0.01	Monoterpenic aldehyde
Nerol	0.04	Monoterpenic alcohol
Neral	0.86	Monoterpenic aldehyde
Geraniol	0.02	Monoterpenic alcohol
Geranial	1.44	Monoterpenic aldehyde
Undecanal	0.03	Aliphatic aldehyde
Citronellyl acetate	0.05	Monoterpenic ester
Neryl acetate	0.52	Monoterpenic ester
Geranyl acetate	0.42	Monoterpenic ester
Dodecanal	0.02	Aliphatic aldehyde
<i>cis</i> - $\alpha$ -Bergamotene	0.04	Sesquiterpene
$\beta$ -Caryophyllene	0.17	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.44	Sesquiterpene
$\alpha$ -Humulene	0.03	Sesquiterpene

β-Santalene	0.01	Sesquiterpene
(E)-β-Farnesene	0.06	Sesquiterpene
trans-β-Bergamotene	0.03	Sesquiterpene
Valencene	0.10	Sesquiterpene
Bicyclogermacrene	0.07	Sesquiterpene
(Z)-α-Bisabolene	0.01	Sesquiterpene
β-Bisabolene	0.68	Sesquiterpene
(E)-α-Bisabolene	0.02	Sesquiterpene
Unknown	0.04	Oxygenated sesquiterpene
Unknown	0.03	Oxygenated sesquiterpene
α-Bisabolol	0.04	Sesquiterpenic alcohol
Myristic acid	0.05	Aliphatic acid
Citropten	0.07	Furanocoumarin
Palmitic acid	0.11	Aliphatic acid
Linoleic acid	0.03	Aliphatic acid
Oleic acid	0.03	Aliphatic acid
Stearic acid	0.14	Aliphatic acid
<b>Consolidated total</b>	<b>98.60%</b>	

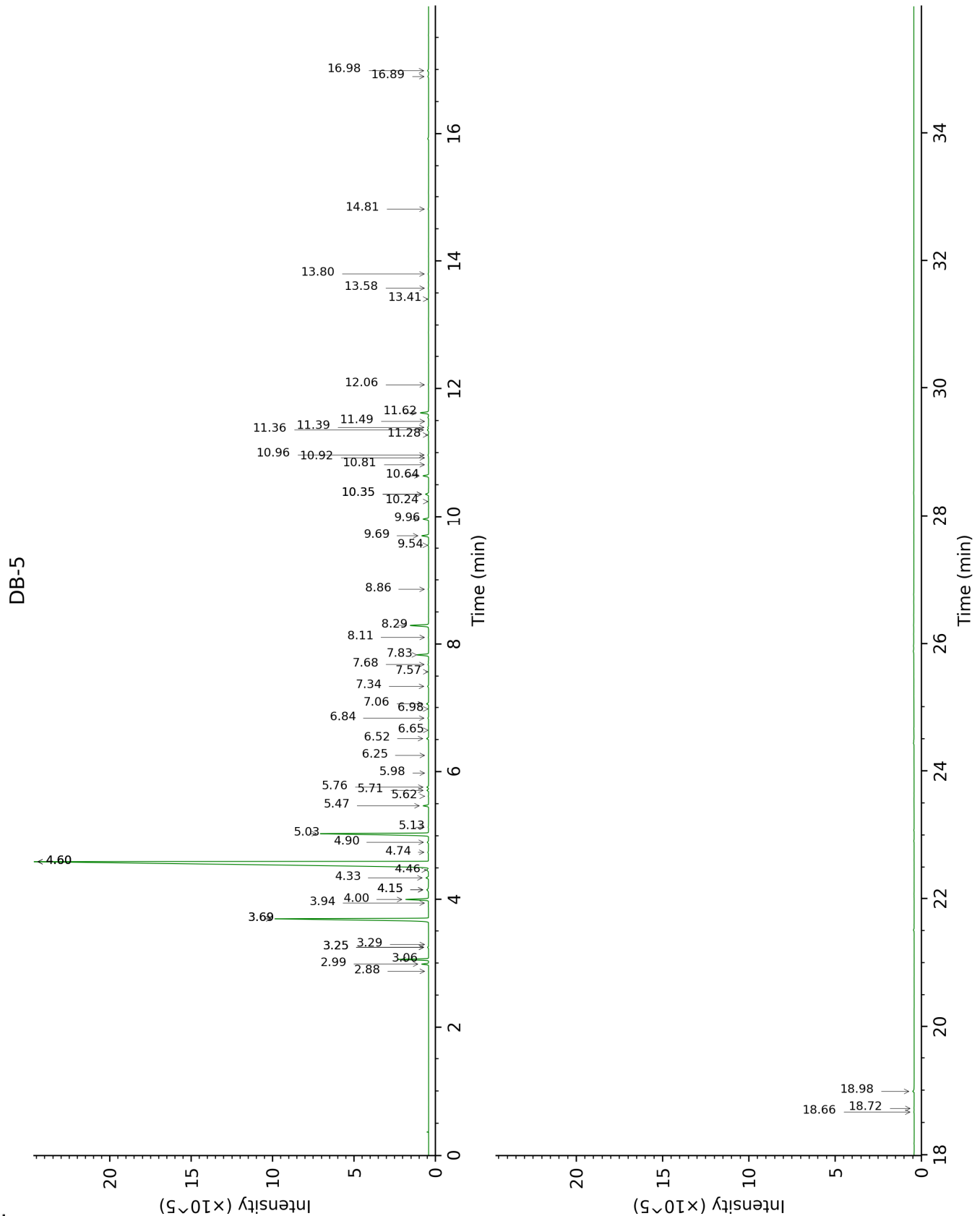
\*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered [xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

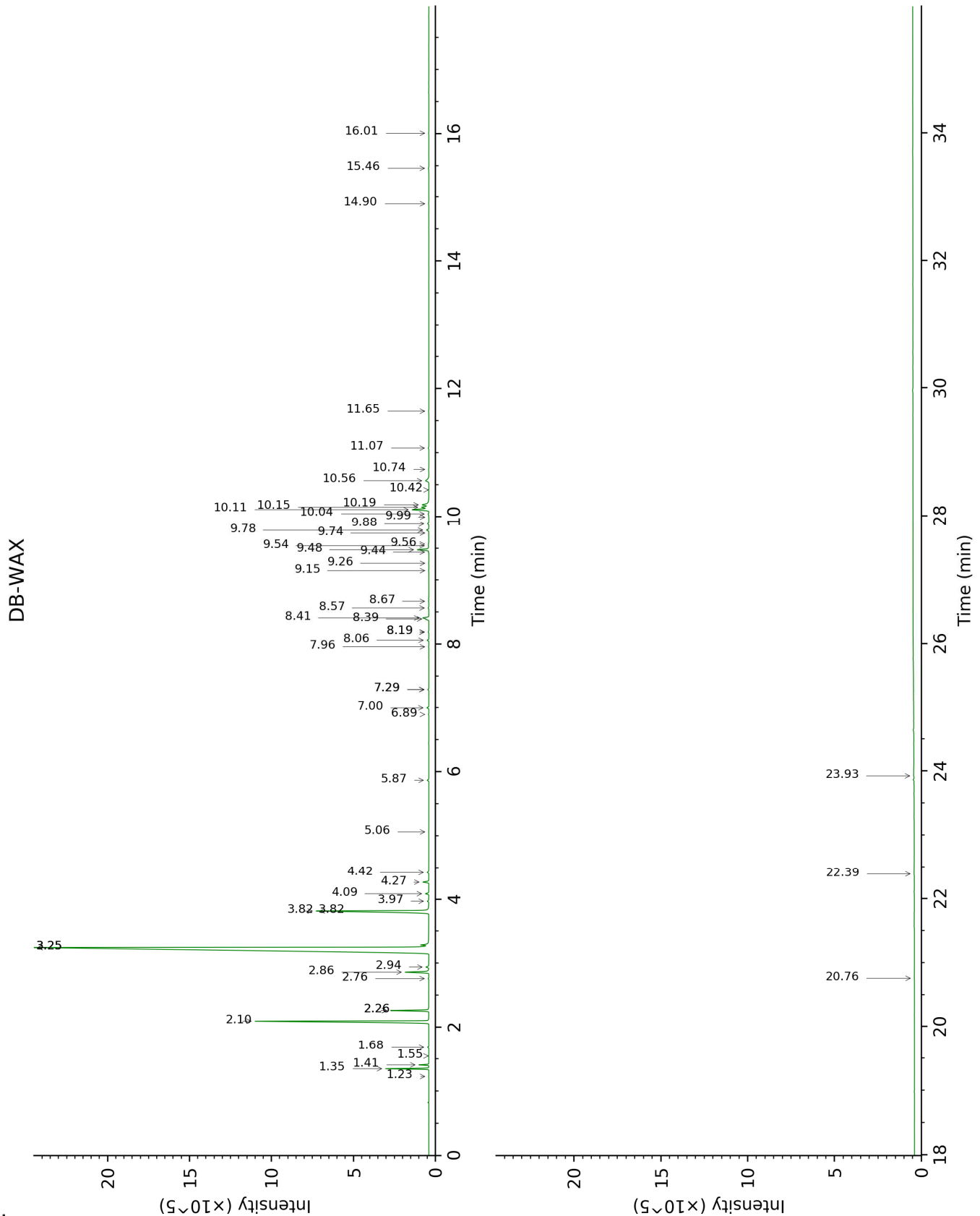
Note: no correction factor was applied

**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	%
Tricyclene	2.88	917	0.01	1.23	973	0.01
$\alpha$ -Thujene	2.99	924	0.41	1.41	1001	0.40
$\alpha$ -Pinene	3.06	929	1.85	1.35	992	1.84
Camphene	3.25*	942	0.06	1.68	1028	0.06
$\alpha$ -Fenchene	3.25*	942	[0.06]	1.55	1015	0.01
Thuja-2,4(10)-diene	3.29	944	0.01	2.26*	1085	1.93
$\beta$ -Pinene	3.69*	971	13.81	2.10	1068	11.87
Sabinene	3.69*	971	[13.81]	2.26*	1085	[1.93]
6-Methyl-5-hepten-2-one	3.94	987	0.01	5.06	1298	0.01
Myrcene	4.00	991	1.49	2.86	1134	1.48
$\alpha$ -Phellandrene	4.15*	1001	0.15	2.76	1126	0.04
Octanal	4.15*	1001	[0.15]	4.42	1251	0.11
$\alpha$ -Terpinene	4.33	1013	0.19	2.94	1140	0.22
para-Cymene	4.46	1020	0.18	4.09	1227	0.21
1,8-Cineole	4.60*	1029	64.71	3.25*†	1164	64.94
$\beta$ -Phellandrene	4.60*	1029	[64.71]	3.25*†	1164	[64.94]
Limonene	4.60*	1029	[64.71]	3.25*†	1164	[64.94]
(Z)- $\beta$ -Ocimene	4.74	1039	0.04	3.82*	1208	8.92
(E)- $\beta$ -Ocimene	4.90	1049	0.09	3.97	1219	0.10
$\gamma$ -Terpinene	5.03	1057	8.85	3.82*	1208	[8.92]
cis-Sabinene hydrate	5.14	1064	0.03	6.90	1431	0.03
Terpinolene	5.47	1085	0.37	4.27	1240	0.38
trans-Sabinene hydrate	5.62	1094	0.02	7.96	1510	0.02
Linalool	5.71	1100	0.11	8.06	1518	0.11
Nonanal	5.76	1103	0.12	5.87	1357	0.11
trans-para-Mentha-2,8-dien-1-ol	5.98	1118	0.01			
Camphor	6.26	1136	0.01	7.29*	1461	0.07
Citronellal	6.52	1153	0.14	7.00	1439	0.14
Borneol	6.65	1162	0.01	9.74	1650	0.02
Terpinen-4-ol	6.84	1174	0.06	8.57	1557	0.05
Isogeranial	6.98	1183	0.02	8.19*	1528	0.05
$\alpha$ -Terpineol	7.06	1189	0.15	9.78	1653	0.18
Decanal	7.34	1208	0.08	7.29*	1461	[0.07]
2,3-Epoxyneral?	7.57	1223	0.01			
Nerol	7.68	1231	0.04	11.07	1760	0.05
Neral	7.84	1242	0.86	9.48	1628	0.85
Geraniol	8.11	1260	0.02	11.65	1809	0.03
Geranial	8.30	1272	1.44	10.11	1680	1.30
Undecanal	8.86	1309	0.03	8.67	1565	0.03
Citronellyl acetate	9.54	1357	0.05	9.44	1625	0.03
Neryl acetate	9.69	1368	0.52	10.19	1686	0.73
Geranyl acetate	9.96	1386	0.42	10.56	1717	0.45



Dodecanal	10.24	1406	0.02	9.99	1670	0.01
<i>cis</i> - $\alpha$ -Bergamotene	10.35*	1414	0.25	8.19*	1528	[0.05]
$\beta$ -Caryophyllene	10.35*	1414	[0.25]	8.40†	1544	[0.61]
<i>trans</i> - $\alpha$ -Bergamotene	10.64	1435	0.44	8.41†	1545	0.61
$\alpha$ -Humulene	10.81	1448	0.03	9.26	1611	0.02
$\beta$ -Santalene	10.92	1456	0.01	9.15	1602	0.02
( <i>E</i> )- $\beta$ -Farnesene	10.96	1459	0.06	9.56	1636	0.05
<i>trans</i> - $\beta$ -Bergamotene	11.28	1482	0.03	9.54	1634	0.04
Valencene	11.36	1488	0.10	9.88	1661	0.10
Bicyclogermacrene	11.40	1491	0.07	10.04	1674	0.07
( <i>Z</i> )- $\alpha$ -Bisabolene	11.49	1498	0.01	10.42	1705	0.01
$\beta$ -Bisabolene	11.62	1508	0.68	10.15	1683	0.61
( <i>E</i> )- $\alpha$ -Bisabolene	12.06	1542	0.02	10.74	1732	0.03
Unknown [m/z 94, 43 (89), 41 (67), 122 (46), 69 (41)...222]	13.41	1650	0.04	14.90	2110	0.02
Unknown [m/z 69, 95 (100), 41 (89), 109 (68), 67 (61)...222]	13.58	1664	0.03	16.01	2222	0.03
$\alpha$ -Bisabolol	13.80	1682	0.04	15.46	2166	0.04
Myristic acid	14.81	1768	0.05	20.76	2761	0.04
Citropten	16.89	1959	0.07			
Palmitic acid	16.98	1967	0.11	22.39	2972	0.10
Linoleic acid	18.66	2135	0.03			
Oleic acid	18.72	2141	0.03			
Stearic acid	18.98	2169	0.14	23.92	3183	0.16
<b>Total identified</b>		<b>98.59%</b>			<b>98.71%</b>	
<b>Total reported</b>		<b>98.66%</b>			<b>98.76%</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

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