

Date : August 23, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 21H09-PTH03


**Customer identification :** Lemon Steam Distilled - LI0107213R

**Type :** Essential oil

**Source :** *Citrus x limon* ct. Distilled

**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 :** Pamela Lavoie, M.Sc., Chimiste

**Analysis date :** August 13, 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:** Clear liquid

**Refractive index:**  $1.4737 \pm 0.0003$  (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
Octane	tr	Alkane
Nonane	tr	Alkane
Tricyclene	0.01	Monoterpene
$\alpha$ -Thujene	0.19	Monoterpene
$\alpha$ -Pinene	1.95	Monoterpene
Camphene	0.07	Monoterpene
$\alpha$ -Fenchene	0.01	Monoterpene
Sabinene	0.66	Monoterpene
$\beta$ -Pinene	10.63	Monoterpene
Myrcene	1.36	Monoterpene
$\alpha$ -Phellandrene	0.05	Monoterpene
Pseudolimonene	0.01	Monoterpene
Octanal	0.04	Aliphatic aldehyde
$\Delta^3$ -Carene	tr	Monoterpene
$\alpha$ -Terpinene	0.28	Monoterpene
$\beta$ -Phellandrene	0.41*	Monoterpene
1,8-Cineole	[0.41]*	Monoterpenic ether
Limonene	68.99	Monoterpene
para-Cymene	0.76	Monoterpene
(Z)- $\beta$ -Ocimene	0.05	Monoterpene
(E)- $\beta$ -Ocimene	0.10	Monoterpene
$\gamma$ -Terpinene	9.04	Monoterpene
<i>cis</i> -Sabinene hydrate	0.01	Monoterpenic alcohol
Octanol	0.02	Aliphatic alcohol
Terpinolene	0.60	Monoterpene
<i>trans</i> -Sabinene hydrate	0.01	Monoterpenic alcohol
Linalool	0.09	Monoterpenic alcohol
Nonanal	0.05	Aliphatic aldehyde
endo-Fenchol	0.04	Monoterpenic alcohol
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.02	Monoterpenic alcohol
<i>cis</i> -Limonene oxide	0.03	Monoterpenic ether
<i>cis</i> -para-Mentha-2,8-dien-1-ol	0.02	Monoterpenic alcohol
<i>trans</i> -Limonene oxide	0.01	Monoterpenic ether
Epoxyterpinolene	0.04	Monoterpenic ether
Citronellal	0.01	Monoterpenic aldehyde
Borneol	0.02	Monoterpenic alcohol
Terpinen-4-ol	0.45	Monoterpenic alcohol
Isogeranial	0.01	Monoterpenic aldehyde
$\alpha$ -Terpineol	0.53	Monoterpenic alcohol
<i>trans</i> -Isopiperitenol	tr	Monoterpenic alcohol
Decanal	0.03	Aliphatic aldehyde
<i>trans</i> -Carveol	0.01	Monoterpenic alcohol
Nerol	0.04	Monoterpenic alcohol
2,3-Epoxygeranial?	0.01	Monoterpenic aldehyde
Neral	0.62	Monoterpenic aldehyde

Geraniol	0.04	Monoterpenic alcohol
Geranial	0.99	Monoterpenic aldehyde
Undecanal	0.01	Aliphatic aldehyde
Citronellyl acetate	0.02	Monoterpenic ester
Neryl acetate	0.26	Monoterpenic ester
Geranyl acetate	0.11	Monoterpenic ester
Dodecanal	0.01	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.13	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.22	Sesquiterpene
$\alpha$ -Humulene	0.01	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.02	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
<i>trans</i> - $\beta$ -Bergamotene	0.01	Sesquiterpene
Valencene	0.02	Sesquiterpene
$\alpha$ -Selinene	0.01	Sesquiterpene
$\beta$ -Bisabolene	0.34	Sesquiterpene
( <i>E</i> )- $\alpha$ -Bisabolene	0.01	Sesquiterpene
Caryophyllene oxide	0.01	Sesquiterpenic ether
Globulol	tr	Sesquiterpenic alcohol
Viridiflorol	tr	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
Unknown	0.01	Oxygenated sesquiterpene
$\alpha$ -Bisabolol	0.01	Sesquiterpenic alcohol
meta-Camphorene	tr	Diterpene
<b>Consolidated total</b>	<b>99.56%</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

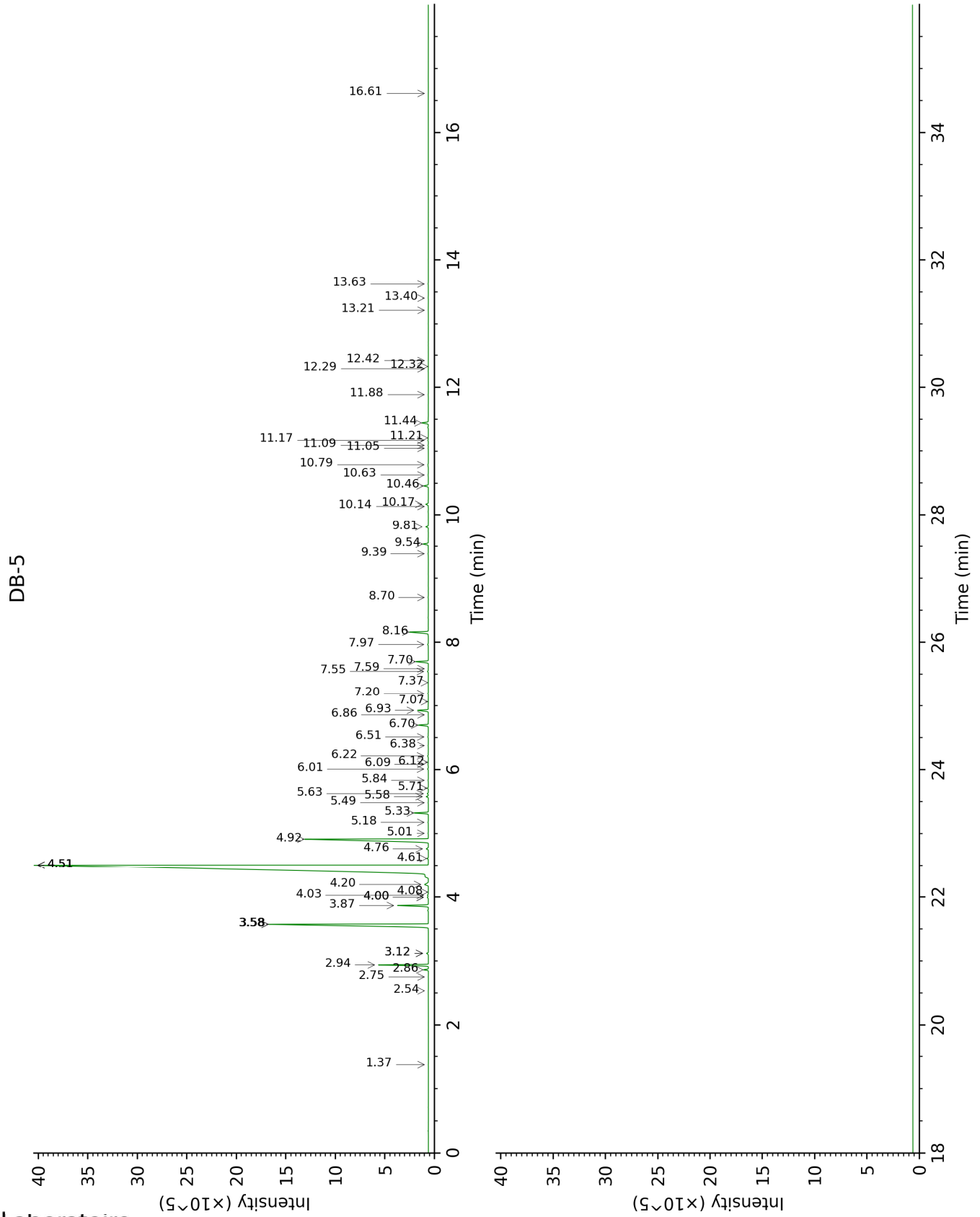
tr: The compound has been detected below 0.005% of total signal.

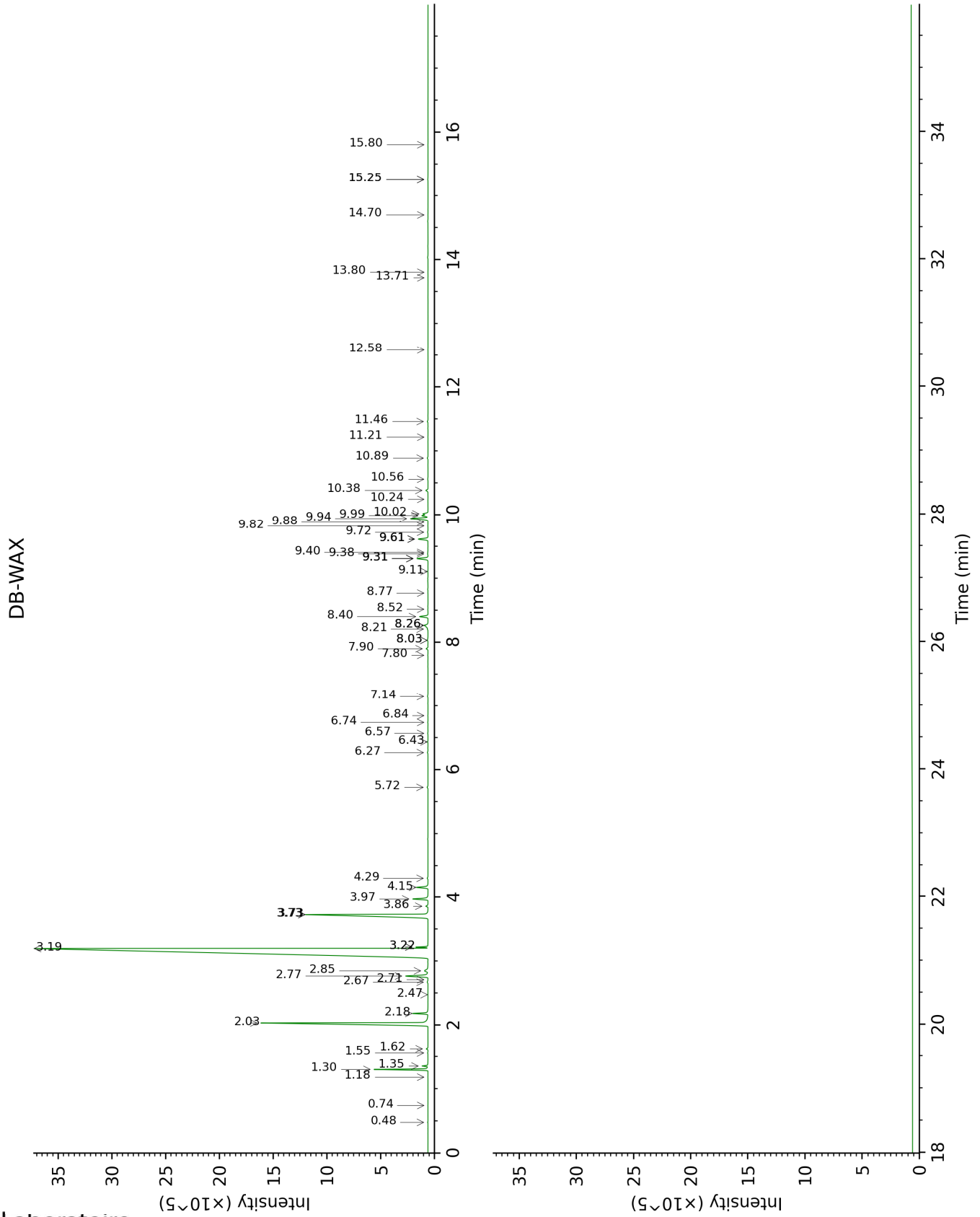
Note: no correction factor was applied

**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	1.37	802	tr	0.48	783	tr
Nonane	2.54	904	tr	0.74	894	tr
Tricyclene	2.75	918	0.01	1.18	972	tr
α-Thujene	2.86	926	0.19	1.35	1000	0.22
α-Pinene	2.94	931	1.95	1.30	992	1.92
Camphene	3.12*	943	0.08	1.62	1027	0.07
α-Fenchene	3.12*	943	[0.08]	1.55	1020	0.01
Sabinene	3.58*	974	11.29	2.18	1084	0.66
β-Pinene	3.58*	974	[11.29]	2.03	1069	10.63
Myrcene	3.87	994	1.36	2.76	1134	1.34
α-Phellandrene	4.00*	1002	0.05	2.67	1126	0.05
Pseudolimonene	4.00*	1002	[0.05]	2.71	1130	0.01
Octanal	4.03	1004	0.04	4.29	1254	0.04
Δ <sup>3</sup> -Carene	4.08	1008	tr	2.47	1111	tr
α-Terpinene	4.20	1015	0.28	2.85	1141	0.31
β-Phellandrene	4.51*	1035	70.16	3.22*	1171	0.36
1,8-Cineole	4.51*	1035	[70.16]	3.22*	1171	[0.36]
Limonene	4.51*	1035	[70.16]	3.20	1169	68.99
para-Cymene	4.51*	1035	[70.16]	3.97	1229	0.76
(Z)-β-Ocimene	4.61	1042	0.05	3.72*	1211	9.09
(E)-β-Ocimene	4.76	1051	0.10	3.86	1221	0.10
γ-Terpinene	4.92	1061	9.04	3.72*	1211	[9.09]
cis-Sabinene hydrate	5.01	1066	0.01	6.74	1428	0.01
Octanol	5.18	1077	0.02	8.03*	1526	0.05
Terpinolene	5.33	1086	0.60	4.15	1243	0.60
trans-Sabinene hydrate	5.49	1097	0.01	7.80	1507	0.01
Linalool	5.58	1103	0.09	7.90	1515	0.10
Nonanal	5.63	1106	0.05	5.72	1353	0.05
endo-Fenchol	5.71	1111	0.04	8.21	1539	0.03
trans-para-Mentha-2,8-dien-1-ol	5.84	1119	0.02	8.77	1583	0.01
cis-Limonene oxide	6.01	1130	0.03	6.27	1393	0.03
cis-para-Mentha-2,8-dien-1-ol	6.09	1135	0.02	9.31*	1626	0.63
trans-Limonene oxide	6.12	1137	0.01	6.43	1405	0.02
Epoxyterpinolene	6.22	1144	0.04	6.57	1415	0.01
Citronellal	6.38	1154	0.01	6.84	1436	0.01
Borneol	6.51	1163	0.02	9.61*	1651	0.55
Terpinen-4-ol	6.70	1174	0.45	8.40	1554	0.46
Isogeranial	6.86	1185	0.01	8.03*	1526	[0.05]
α-Terpineol	6.93	1189	0.53	9.61*	1651	[0.55]
trans-Isopiperitenol	7.07	1198	tr	10.24	1703	0.01



Decanal	7.20	1207	0.03	7.14	1458	0.03
<i>trans</i> -Carveol	7.37	1218	0.01	11.22	1785	0.01
Nerol	7.55	1230	0.04	10.89	1757	0.04
2,3-Epoxygeranial?	7.59	1233	0.01			
Neral	7.70	1240	0.62	9.31*	1626	[0.63]
Geraniol	7.97	1258	0.04	11.46	1806	0.04
Geranial	8.16	1271	0.99	9.94	1678	0.99
Undecanal	8.70	1308	0.01	8.52	1563	0.01
Citronellyl acetate	9.39	1356	0.02	9.31*	1626	[0.63]
Neryl acetate	9.54	1367	0.26	10.02	1684	0.28
Geranyl acetate	9.81	1386	0.11	10.38	1714	0.12
Dodecanal	10.14	1410	0.01	9.88	1673	0.01
$\beta$ -Caryophyllene	10.17	1412	0.13	8.26*	1544	0.24
<i>trans</i> - $\alpha$ -Bergamotene	10.46	1434	0.22	8.26*	1544	[0.24]
$\alpha$ -Humulene	10.63	1446	0.01	9.10	1610	0.01
( <i>E</i> )- $\beta$ -Farnesene	10.79	1458	0.02	9.38	1632	0.02
Germacrene D	11.05	1477	0.01	9.61*	1651	[0.55]
<i>trans</i> - $\beta$ -Bergamotene	11.09	1481	0.01	9.40	1634	0.01
Valencene	11.17	1487	0.02	9.72	1660	0.03
$\alpha$ -Selinene	11.21	1490	0.01	9.82	1668	0.01
$\beta$ -Bisabolene	11.44	1507	0.34	9.99	1682	0.33
( <i>E</i> )- $\alpha$ -Bisabolene	11.88	1542	0.01	10.56	1729	0.02
Caryophyllene oxide	12.29	1574	0.01	12.58	1906	0.01
Globulol	12.32	1576	tr	13.72	2012	tr
Viridiflorol	12.42	1584	tr	13.80	2020	0.01
Unknown [m/z 94, 43 (89), 41 (67), 122 (46), 69 (41)...222]	13.21	1649	0.01	14.70	2107	tr
Unknown [m/z 69, 95 (100), 41 (89), 109 (68), 67 (61)...222]	13.40	1664	0.01	15.80	2218	tr
$\alpha$ -Bisabolol	13.63	1683	0.01	15.25*	2162	0.02
meta-Camphorene	16.61	1950	tr	15.25*	2162	[0.02]
<b>Total identified</b>		<b>99.55%</b>			<b>99.39%</b>	
<b>Total reported</b>		<b>99.56%</b>			<b>99.40%</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