



## GC/MS BATCH NUMBER: L60110

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**ESSENTIAL OIL:** LEMON

**BOTANICAL NAME:** CITRUS C LIMON

**ORIGIN:** ARGENTINA

KEY CONSTITUENTS PRESENT IN THIS BATCH OF LEMON OIL	%
LIMONENE	66.5
$\beta$ -PINENE	10.5
$\gamma$ -TERPINENE	9.6
GERANIAL	1.8
SABINENE	1.6
$\alpha$ -PINENE	1.4
MYRCENE	1.4
NERAL	1.1

Comments from Robert Tisserand: Fresh, intensely fruity citrus odor quality. All thirteen key ISO constituents are within range.

**Date :** September 19, 2018

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 18I12-PTH1-1-CC

**Customer identification :** Lemon - Argentina - L6011082R

**Type :** Essential oil

**Source :** *Citrus x limon*

**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 :** Lindsay Girard, B. Sc.

**Analysis date :** September 13, 2018

Checked and approved by :

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

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*This report is digitally signed, it is only considered valid if the digital signature is intact.*

*PHYSICOCHEMICAL DATA*

**Physical aspect:** Bright yellow liquid

**Refractive index:**  $1.4738 \pm 0.0003$  (20 °C)

*CONCLUSION*

No adulterant, contaminant or diluent has been detected using this method.

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Tricyclene	0.01	tr	Monoterpene
$\alpha$ -Thujene	0.28	0.29	Monoterpene
$\alpha$ -Pinene	1.42	1.42	Monoterpene
Camphene	0.06	0.05	Monoterpene
$\beta$ -Pinene	11.82*	10.45	Monoterpene
Sabinene	[11.82]*	1.57	Monoterpene
Myrcene	1.39	1.43	Monoterpene
$\alpha$ -Phellandrene	0.03	0.03	Monoterpene
Octanal	0.04	0.02	Aliphatic aldehyde
$\Delta$ 3-Carene	0.01	0.01	Monoterpene
$\alpha$ -Terpinene	0.13	0.15	Monoterpene
para-Cymene	0.12	0.12	Monoterpene
Limonene	66.57*	66.46	Monoterpene
$\beta$ -Phellandrene	[66.57]*	0.29*	Monoterpene
1,8-Cineole	[66.57]*	[0.29]*	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.13	9.65*	Monoterpene
(E)- $\beta$ -Ocimene	0.11	[9.65]*	Monoterpene
$\gamma$ -Terpinene	9.57	[9.65]*	Monoterpene
cis-Sabinene hydrate	[9.57]	0.02	Monoterpenic alcohol
Terpinolene	0.34	0.34	Monoterpene
trans-Sabinene hydrate	0.02	0.02	Monoterpenic alcohol
Linalool	0.06	0.06	Monoterpenic alcohol
Nonanal	0.04	0.04	Aliphatic aldehyde
trans-para-Mentha-2,8-dien-1-ol	0.01	tr	Monoterpenic alcohol
cis-Limonene oxide	0.01	0.01	Monoterpenic ether
trans-Limonene oxide	0.02	0.01	Monoterpenic ether
Camphor	0.01	0.01	Monoterpenic ketone
Citronellal	0.04	0.04	Monoterpenic aldehyde
Borneol	0.01	0.12*	Monoterpenic alcohol
Terpinen-4-ol	0.03	0.03	Monoterpenic alcohol
Isogeranial	0.01	0.01	Monoterpenic aldehyde
$\alpha$ -Terpineol	0.10	[0.12]*	Monoterpenic alcohol
Decanal	0.02	0.03	Aliphatic aldehyde
2,3-Epoxyneral?	tr		Monoterpenic aldehyde
Nerol	0.05	0.05*	Monoterpenic alcohol
2,3-Epoxygeranial?	0.03		Monoterpenic aldehyde
Neral	1.10	1.12*	Monoterpenic aldehyde
Geraniol	0.02	0.01	Monoterpenic alcohol
Geranial	1.78	1.83*	Monoterpenic aldehyde
Undecanal	0.01	0.01	Aliphatic aldehyde
Citronellyl acetate	0.02	[1.12]*	Monoterpenic ester
Neryl acetate	0.53	0.56	Monoterpenic ester
Geranyl acetate	0.39	0.41	Monoterpenic ester
Dodecanal	0.02	0.01	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.31*	0.28	Sesquiterpene
cis- $\alpha$ -Bergamotene	[0.31]*	0.04	Sesquiterpene
trans- $\alpha$ -Bergamotene	0.47	0.46	Sesquiterpene
Neryl propionate	0.03	[0.05]*	Monoterpenic ester

$\beta$ -Santalene	0.01	0.01	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.06	0.05	Sesquiterpene
<i>trans</i> - $\beta$ -Bergamotene	0.03	0.03	Sesquiterpene
Valencene	0.02	0.02	Sesquiterpene
Bicyclogermacrene	0.06	[1.83]*	Sesquiterpene
( <i>Z</i> )- $\alpha$ -Bisabolene	0.01	0.01	Sesquiterpene
$\beta$ -Bisabolene	0.71	0.69	Sesquiterpene
( <i>E</i> )- $\alpha$ -Bisabolene	0.02	0.02	Sesquiterpene
Caryophyllene oxide isomer	0.03*	0.01	Sesquiterpenic ether
Caryophyllene oxide	[0.03]*	0.01	Sesquiterpenic ether
Unknown	0.02	0.02	Oxygenated sesquiterpene
Unknown	0.02	0.02	Oxygenated sesquiterpene
$\alpha$ -Bisabolol	0.03	0.04	Sesquiterpenic alcohol
Myristic acid	0.04		Aliphatic acid
Citropten	0.04	0.04	Furanocoumarin
Palmitic acid	0.12		Aliphatic acid
Bergapten	0.01		Furanocoumarin
Linoleic acid	0.03		Aliphatic acid
Oleic acid	0.04		Aliphatic acid
Stearic acid	0.08		Aliphatic acid
<b>Total identified</b>	<b>98.48%</b>	<b>98.39%</b>	

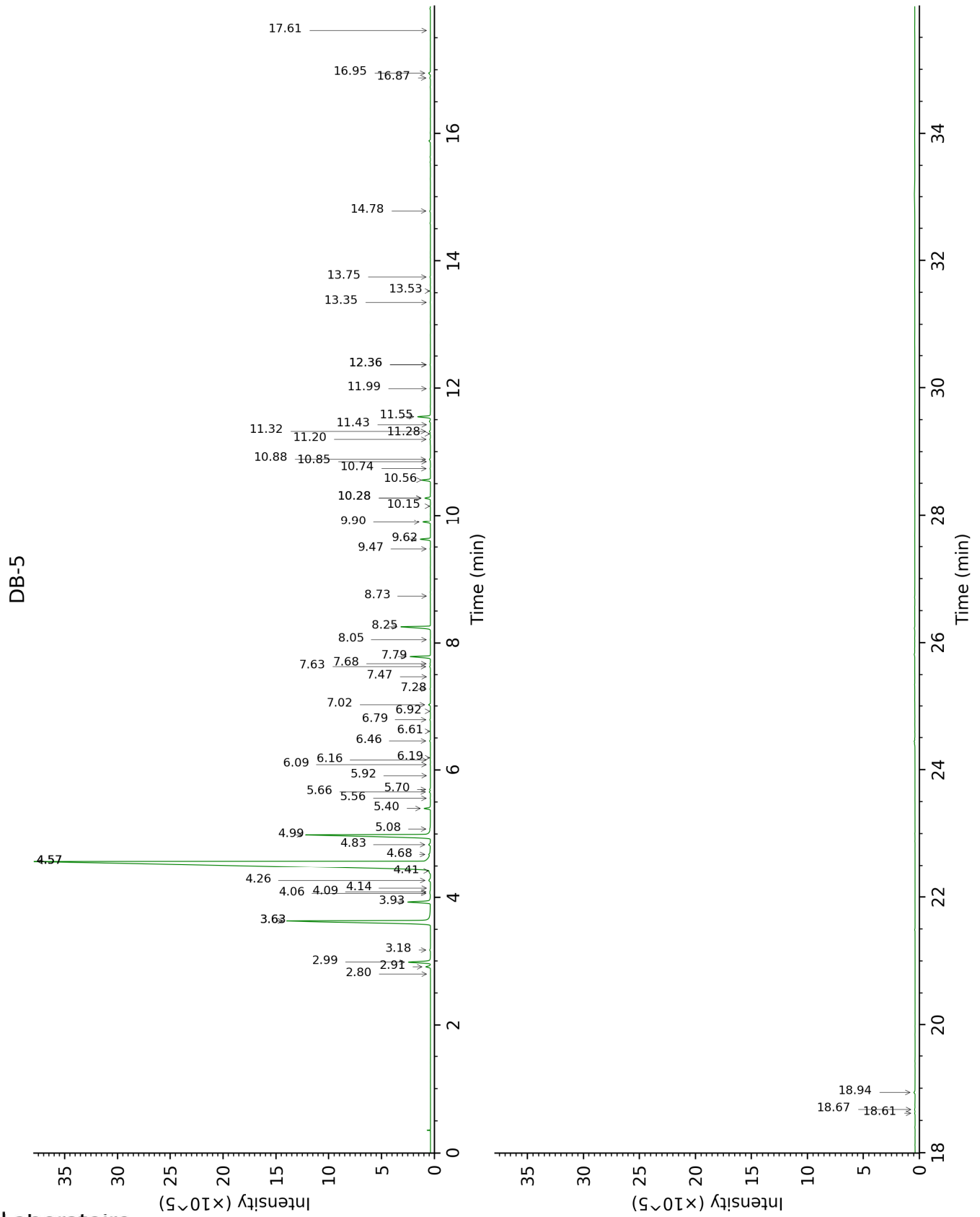
\*: Two or more compounds are coeluting on this column

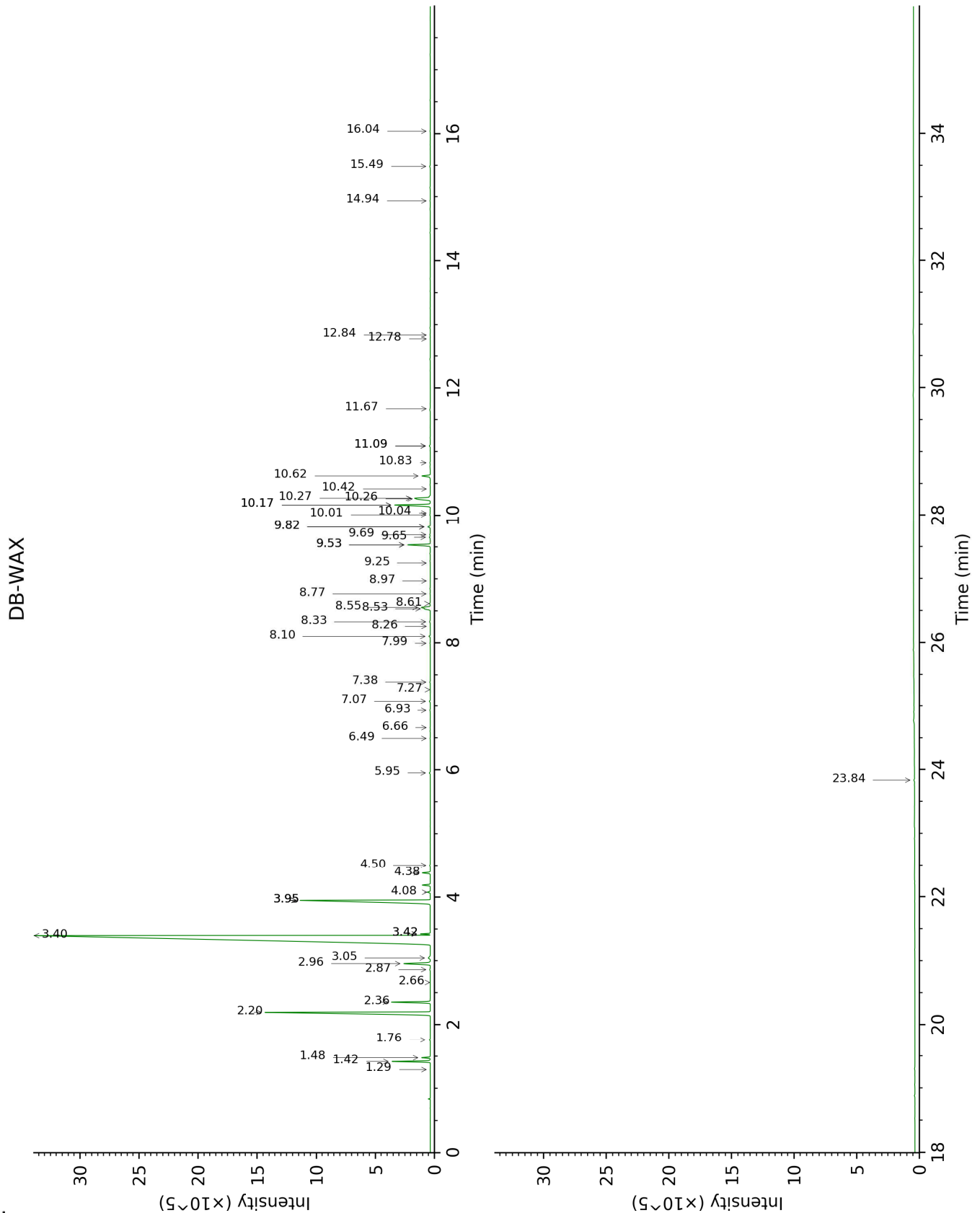
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Tricyclene	2.80	916	0.01	1.29	976	tr
α-Thujene	2.91	923	0.28	1.48	1002	0.29
α-Pinene	2.99	928	1.42	1.42	996	1.42
Camphene	3.18	941	0.06	1.76	1030	0.05
β-Pinene	3.63*	972	11.82	2.20	1073	10.45
Sabinene	3.63*	972	[11.82]	2.36	1089	1.57
Myrcene	3.93	992	1.39	2.96	1139	1.43
α-Phellandrene	4.06	1001	0.03	2.86	1132	0.03
Octanal	4.09	1002	0.04	4.50	1253	0.02
Δ <sup>3</sup> -Carene	4.14	1006	0.01	2.66	1116	0.01
α-Terpinene	4.26	1013	0.13	3.05	1146	0.15
para-Cymene	4.41	1023	0.12	4.08	1223	0.12
Limonene	4.57*†	1033	66.57	3.40	1173	66.46
β-Phellandrene	4.57*†	1033	[66.57]	3.42*	1175	0.29
1,8-Cineole	4.57*†	1033	[66.57]	3.42*	1175	[0.29]
(Z)-β-Ocimene	4.68	1040	0.13	3.95*	1214	9.65
(E)-β-Ocimene	4.84	1049	0.11	3.95*	1214	[9.65]
γ-Terpinene	4.99†	1059	9.57	3.95*	1214	[9.65]
cis-Sabinene hydrate	5.08†	1065	[9.57]	6.93	1428	0.02
Terpinolene	5.40	1085	0.34	4.38	1245	0.34
trans-Sabinene hydrate	5.56	1095	0.02	7.99	1506	0.02
Linalool	5.66	1101	0.06	8.10	1514	0.06
Nonanal	5.70	1104	0.04	5.95	1357	0.04
trans-para-Mentha-2,8-dien-1-ol	5.92	1118	0.01	8.97	1581	tr
cis-Limonene oxide	6.09	1129	0.01	6.49	1395	0.01
trans-Limonene oxide	6.16	1134	0.02	6.66	1408	0.01
Camphor	6.19	1136	0.01	7.27	1452	0.01
Citronellal	6.46	1153	0.04	7.07	1438	0.04
Borneol	6.61	1162	0.01	9.82*	1649	0.12
Terpinen-4-ol	6.79	1174	0.03	8.61	1554	0.03
Isogeranial	6.92	1182	0.01	8.26	1527	0.01
α-Terpineol	7.02	1189	0.10	9.82*	1649	[0.12]
Decanal	7.28	1206	0.02	7.38	1461	0.03
2,3-Epoxyneral?	7.47	1218	tr			
Nerol	7.63	1229	0.05	11.09*	1755	0.05
2,3-Epoxygeranial?	7.68	1232	0.03			
Neral	7.79	1240	1.10	9.53*	1626	1.12
Geraniol	8.05	1257	0.02	11.67	1805	0.01
Geranial	8.25	1271	1.78	10.17*	1678	1.83
Undecanal	8.74	1303	0.01	8.77	1566	0.01
Citronellyl acetate	9.47	1355	0.02	9.53*	1626	[1.12]
Neryl acetate	9.62	1366	0.53	10.26	1686	0.56

Geranyl acetate	9.90	1385	0.39	10.62	1715	0.41
Dodecanal	10.15	1403	0.02	10.04	1667	0.01
$\beta$ -Caryophyllene	10.28*	1412	0.31	8.53	1548	0.28
<i>cis</i> - $\alpha$ -Bergamotene	10.28*	1412	[0.31]	8.33	1532	0.04
<i>trans</i> - $\alpha$ -Bergamotene	10.56	1434	0.47	8.55	1549	0.46
Neryl propionate	10.74	1447	0.03	11.09*	1755	[0.05]
$\beta$ -Santalene	10.85	1455	0.01	9.25	1603	0.01
( <i>E</i> )- $\beta$ -Farnesene	10.88	1458	0.06	9.65	1636	0.05
<i>trans</i> - $\beta$ -Bergamotene	11.20	1481	0.03	9.69	1639	0.03
Valencene	11.28	1488	0.02	10.01	1665	0.02
Bicyclogermacrene	11.32	1490	0.06	10.17*	1678	[1.83]
( <i>Z</i> )- $\alpha$ -Bisabolene	11.43	1498	0.01	10.42	1698	0.01
$\beta$ -Bisabolene	11.55	1508	0.71	10.27	1686	0.69
( <i>E</i> )- $\alpha$ -Bisabolene	11.99	1542	0.02	10.83	1733	0.02
Caryophyllene oxide isomer	12.36*	1572	0.03	12.78	1903	0.01
Caryophyllene oxide	12.36*	1572	[0.03]	12.84	1908	0.01
Unknown [m/z 94, 43 (89), 41 (67), 122 (46), 69 (41)...222]	13.35	1652	0.02	14.94	2107	0.02
Unknown [m/z 69, 95 (100), 41 (89), 109 (68), 67 (61)...222]	13.53	1666	0.02	16.04	2219	0.02
$\alpha$ -Bisabolol	13.75	1684	0.03	15.49	2163	0.04
Myristic acid	14.78	1773	0.04			
Citropten	16.87	1965	0.04	23.84	3162	0.04
Palmitic acid	16.95	1972	0.12			
Bergapten	17.61	2037	0.01			
Linoleic acid	18.62	2138	0.03			
Oleic acid	18.67	2144	0.04			
Stearic acid	18.94	2171	0.08			
<b>Total identified</b>		<b>98.48%</b>			<b>98.39%</b>	
<b>Total reported</b>		<b>98.52%</b>			<b>98.42%</b>	

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

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