

Date : July 19, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 19G12-PTH13-1-SCC

**Customer identification :** Neroli Oil - Egypt - N1010794R

**Type :** Essential oil

**Source :** *Citrus aurantium* subsp. *amara*

**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 :** Benoit Roger, Ph. D.

**Analysis date :** July 18, 2019

Checked and approved by :

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

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#### PHYSICO-CHEMICAL DATA

**Physical aspect:** Yellow liquid

**Refractive index:** 1.4664 ± 0.0003 (20 °C)

#### ISO 3517:2012 - OIL OF NEROLI - EGYPT

Compound	Min. %	Max. %	Observed %	Complies?
Methyl anthranilate	0	1.0	0.2	Yes
Indole	0	0.5	0.1	Yes
Geraniol	1	5	3	Yes
Nerol	0.5	2.0	1.1	Yes
(2E,6E)-Farnesol	0.5	4.0	1.6	Yes
(E)-Nerolidol	0.5	5.0	1.4	Yes
Geranyl acetate	1	5	3	Yes
Neryl acetate	0	7	2	Yes
Linalyl acetate	3	20	14	Yes
α-Terpineol	2	8	5	Yes
Linalool	26	55	40	Yes
(E)-β-Ocimene	3	9	5	Yes
Limonene	7	17	7	Yes
Myrcene	1	4	2	Yes
β-Pinene	2	8	5	Yes
Sabinene	0	3	2	Yes
α-Pinene	0	2	0	Yes
<b>Refractive index</b>	1.4650	1.4720	1.4664	Yes

#### CONCLUSION

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

## ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Classe
(2E)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
$\alpha$ -Thujene	0.03	Monoterpene
$\alpha$ -Pinene	0.41	Monoterpene
Camphene	0.03	Monoterpene
Benzaldehyde	0.01	Simple phenolic
Sabinene	1.91	Monoterpene
$\beta$ -Pinene	5.40	Monoterpene
6-Methyl-5-hepten-2-one	0.02	Aliphatic ketone
Myrcene	2.12	Monoterpene
$\alpha$ -Phellandrene	0.02	Monoterpene
$\Delta^3$ -Carene	0.06	Monoterpene
$\alpha$ -Terpinene	0.14	Monoterpene
ortho-Cymene	0.01	Monoterpene
para-Cymene	0.05	Monoterpene
Limonene	6.84	Monoterpene
$\beta$ -Phellandrene	0.09*	Monoterpene
1,8-Cineole	[0.09]*	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.81	Monoterpene
(E)- $\beta$ -Ocimene	5.23	Monoterpene
$\gamma$ -Terpinene	0.25	Monoterpene
cis-Sabinene hydrate	0.02	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.10	Monoterpenic alcohol
trans-Linalool oxide (fur.)	0.05	Monoterpenic alcohol
Terpinolene	0.44	Monoterpene
Linalool	39.76	Monoterpenic alcohol
Phenylethyl alcohol	0.02	Simple phenolic
cis-para-Menth-2-en-1-ol	0.07	Monoterpenic alcohol
Benzeneacetonitrile	0.10	Simple phenolic
(Z)-Myroxide	0.01	Monoterpenic ether
(E)-Myroxide	0.01	Monoterpenic ether
Citronellal	0.01	Monoterpenic aldehyde
Borneol	0.01	Monoterpenic alcohol
Terpinen-4-ol	0.44	Monoterpenic alcohol
$\alpha$ -Terpineol	4.63	Monoterpenic alcohol
(3E,5E)-2,6-Dimethylocta-3,5,7-trien-2-ol	0.05	Monoterpenic alcohol
Nerol	1.12	Monoterpenic alcohol
Citronellol	0.02	Monoterpenic alcohol
Neral	0.04	Monoterpenic aldehyde
Geraniol	3.07	Monoterpenic alcohol
Linalyl acetate	14.37	Monoterpenic ester
Geranial	0.07	Monoterpenic aldehyde
Bornyl acetate	0.01	Monoterpenic ester
Indole	0.11	Indole
4-Vinylguaiacol	0.02	Simple phenolic
Methyl anthranilate	0.15	Phenolic ester
Linalyl propionate	0.03	Monoterpenic ester

α-Terpinyl acetate	0.09	Monoterpenic ester
Eugenol	0.02	Phenylpropanoid
Neryl acetate	1.68	Monoterpenic ester
Geranyl acetate	3.24	Monoterpenic ester
β-Elemene	0.09	Sesquiterpene
(Z)-Jasmone	0.02	Jasmonate
Dimethyl anthranilate	0.04	Phenolic ester
β-Caryophyllene	0.68	Sesquiterpene
α-Humulene	0.09	Sesquiterpene
(E)-β-Farnesene	0.13	Sesquiterpene
Germacrene D	0.08	Sesquiterpene
Bicyclogermacrene	0.25	Sesquiterpene
(3Z,6E)-α-Farnesene	0.07	Sesquiterpene
(3E,6E)-α-Farnesene	tr	Sesquiterpene
γ-Cadinene	0.08	Sesquiterpene
<i>trans</i> -Calamenene	0.01	Sesquiterpene
δ-Cadinene	0.04	Sesquiterpene
(E)-Nerolidol	1.38	Sesquiterpenic alcohol
Spathulenol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.02	Sesquiterpenic ether
α-Bisabolol	0.05	Sesquiterpenic alcohol
(2E,6Z)-Farnesol	0.04	Sesquiterpenic alcohol
(2E,6Z)-Farnesal	0.02	Sesquiterpenic aldehyde
(2E,6E)-Farnesol	1.56	Sesquiterpenic alcohol
(2E,6E)-Farnesal	0.04	Sesquiterpenic aldehyde
(2E,6E)-Farnesyl acetate	0.03	Sesquiterpenic ester
Nonadecane	0.02	Alkane
Phytol	0.04	Diterpenic alcohol
Tricosane	0.09	Alkane
Pentacosane	0.06	Alkane
<b>Consolidated total</b>	<b>98.20%</b>	

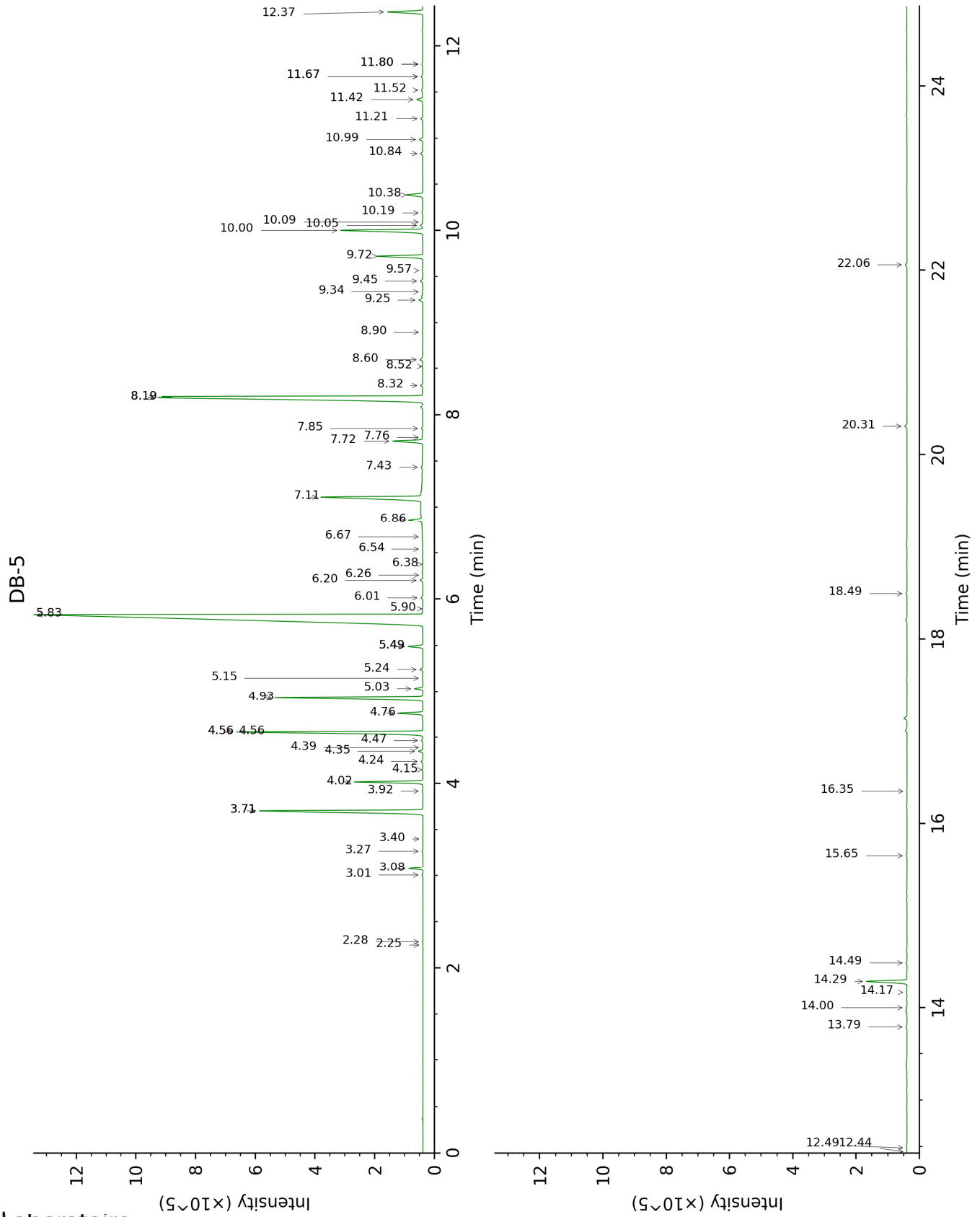
\*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered  
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

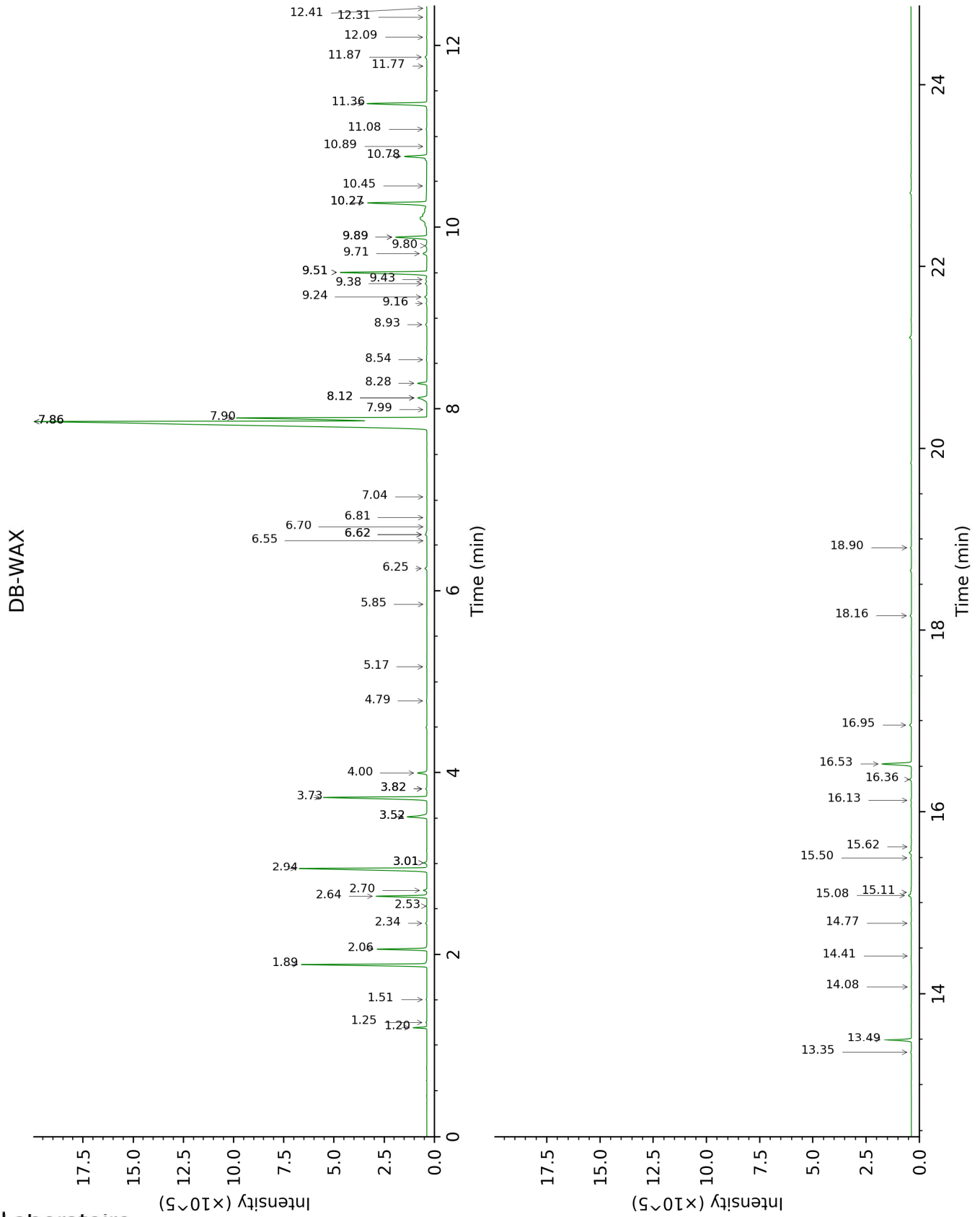
Note: no correction factor was applied

**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.

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	%
(2E)-Hexenol	2.25	868	0.01	5.85	1375	0.01
Hexanol	2.28	871	0.01	5.17	1326	0.02
$\alpha$ -Thujene	3.01	925	0.03	1.26	999	0.03
$\alpha$ -Pinene	3.08	930	0.41	1.20	991	0.42
Camphene	3.27	942	0.03	1.51	1026	0.03
Benzaldehyde	3.40	951	0.01	7.04	1462	0.01
Sabinene	3.71*	971	7.22	2.06	1084	1.91
$\beta$ -Pinene	3.71*	971	[7.22]	1.89	1066	5.40
6-Methyl-5-hepten-2-one	3.92	985	0.02	4.79	1300	0.02
Myrcene	4.02	992	2.12	2.64	1134	2.13
$\alpha$ -Phellandrene	4.15	1000	0.02	2.53	1125	0.01
$\Delta^3$ -Carene	4.24	1006	0.06	2.34	1110	0.05
$\alpha$ -Terpinene	4.35	1013	0.14	2.70	1139	0.14
ortho-Cymene	4.39	1016	0.01	3.82*	1228	0.05
para-Cymene	4.47	1020	0.05	3.82*	1228	[0.05]
Limonene	4.56*	1026	6.93	2.94	1159	6.84
$\beta$ -Phellandrene	4.56*	1026	[6.93]	3.01*	1164	0.14
1,8-Cineole	4.56*	1026	[6.93]	3.01*	1164	[0.14]
(Z)- $\beta$ -Ocimene	4.76	1039	0.81	3.52*	1205	1.08
(E)- $\beta$ -Ocimene	4.93	1050	5.23	3.73	1221	5.25
$\gamma$ -Terpinene	5.03	1056	0.25	3.52*	1205	[1.08]
<i>cis</i> -Sabinene hydrate	5.15	1063	0.02	6.62*	1431	0.09
<i>cis</i> -Linalool oxide (fur.)	5.24	1069	0.10	6.24	1404	0.10
<i>trans</i> -Linalool oxide (fur.)	5.49*	1085	0.49	6.62*	1431	[0.09]
Terpinolene	5.49*	1085	[0.49]	4.00	1241	0.44
Linalool	5.83	1107	39.76	7.86*†	1525	[54.20]
Phenylethyl alcohol	5.90	1111	0.02	11.77	1848	0.01
<i>cis</i> -para-Menth-2-en-1-ol	6.02	1119	0.07	7.86*†	1525	[54.20]
Benzeneacetonitrile	6.20	1131	0.10	11.87	1856	0.10
(Z)-Myroxide	6.26	1135	0.01	6.55	1426	0.01
(E)-Myroxide	6.38	1142	0.01	6.81	1446	0.01
Citronellal	6.54	1153	0.01	6.70	1438	0.02
Borneol	6.68	1162	0.01	9.51*	1655	4.72
Terpinen-4-ol	6.86	1174	0.44	8.28	1558	0.45
$\alpha$ -Terpineol	7.11	1190	4.63	9.51*	1655	[4.72]
(3E,5E)-2,6-Dimethylocta-3,5,7-trien-2-ol	7.43	1212	0.05	11.08	1787	0.04
Nerol	7.72	1231	1.12	10.78	1762	1.14
Citronellol	7.76	1234	0.02	10.45	1733	0.01
Neral	7.85	1241	0.04	9.16	1627	0.06
Geraniol	8.19*	1264	17.92	11.36	1811	3.07
Linalyl acetate	8.19*	1264	[17.92]	7.90†	1528	54.20



Geranial	8.32	1273	0.07	9.80	1678	0.07
Bornyl acetate	8.52	1287	0.01	7.99	1535	0.02
Indole	8.60	1292	0.11	16.95	2357	0.11
4-Vinylguaiacol	8.90	1308	0.02	14.77	2130	0.03
Methyl anthranilate	9.25	1333	0.15	15.08	2160	0.20
Linalyl propionate	9.34	1339	0.03	8.54	1578	0.03
$\alpha$ -Terpinyl acetate	9.45	1347	0.09	9.38	1645	0.10
Eugenol	9.57	1355	0.02	14.42	2094	0.02
Neryl acetate	9.72	1366	1.68	9.89*	1686	1.66
Geranyl acetate	10.00	1386	3.24	10.27*	1718	3.24
$\beta$ -Elemene	10.05	1390	0.09	8.12*	1545	0.72
(Z)-Jasmone	10.09	1393	0.02	12.09	1876	0.03
Dimethyl anthranilate	10.19	1400	0.04	13.35	1992	0.05
$\beta$ -Caryophyllene	10.38	1414	0.68	8.12*	1545	[0.72]
$\alpha$ -Humulene	10.84	1448	0.09	8.93	1608	0.07
(E)- $\beta$ -Farnesene	10.99	1459	0.13	9.24	1633	0.13
Germacrene D	11.22	1476	0.08	9.43	1648	0.08
Bicyclogermacrene	11.42	1491	0.25	9.71	1672	0.23
(3Z,6E)- $\alpha$ -Farnesene	11.52	1499	0.07	9.89*	1686	[1.66]
(3E,6E)- $\alpha$ -Farnesene	11.67*	1510	0.08	10.27*	1718	[3.24]
$\gamma$ -Cadinene	11.67*	1510	[0.08]			
<i>trans</i> -Calamenene	11.80*	1521	0.06	10.89	1771	0.01
$\delta$ -Cadinene	11.80*	1521	[0.06]			
(E)-Nerolidol	12.37	1565	1.38	13.49	2005	1.36
Spathulenol	12.44	1571	0.02	14.08	2061	0.01
Caryophyllene oxide	12.49	1575	0.02	12.41	1904	0.02
$\alpha$ -Bisabolol	13.79	1681	0.05	15.11	2164	0.06
(2E,6Z)-Farnesol	14.00	1698	0.04	16.13	2269	0.04
(2E,6Z)-Farnesal	14.17	1712	0.02			
(2E,6E)-Farnesol	14.29	1723	1.56	16.53	2311	1.56
(2E,6E)-Farnesal	14.49	1740	0.04	15.50	2203	0.05
(2E,6E)-Farnesyl acetate	15.65	1843	0.03	15.62	2216	0.03
Nonadecane	16.35	1906	0.02	12.31	1895	0.02
Phytol	18.49	2115	0.04	18.90	2578	0.05
Tricosane	20.31	2307	0.09	16.36	2292	0.09
Pentacosane	22.06	2506	0.06	18.16	2491	0.07
<b>Total identified</b>		<b>98.58%</b>			<b>98.17%</b>	
<b>Total reported</b>		<b>98.58%</b>			<b>98.17%</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