

Date : 2023-12-20

CERTIFICATE OF ANALYSIS - GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 23L06-NSO02

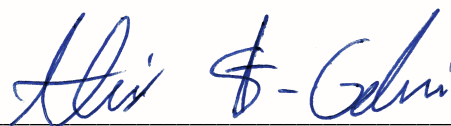
**Customer Identification :** Bergamot - Lot: B123011

**Type :** Essential Oil

**Source :** *Citrus bergamia* [syn. *Citrus aurantium* var. *bergamia*]

**Customer :** Natural Sourcing LLC

Checked and approved by:



Alexis St-Gelais, Ph. D., Chimiste 2013-174

*Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia. This report is digitally signed, it is only considered valid if the digital signature is intact. The results only describe the samples that were submitted to the assays.*

## GAS CHROMATOGRAPHIC ANALYSIS

**Method :** PC-MAT-014 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID

**\*ISO**

**Results :** See analysis summary (next page)

**Analyst :** Sylvain Mercier, M. Sc., Chimiste 2014-005

**Date :** 2023-12-18

## PHYSICOCHEMICAL DATA

**Refractive index :**  $1.4645 \pm 0.0003$  (20 °C)

**Method :** PC-MAT-016 - Measure of the refractive index of a liquid.

**Analyst :** Cindy Caron B. Sc.

**Date :** 2023-12-06

## 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
Nonane	0.01	Alkane
$\alpha$ -Thujene	0.20	Monoterpene
$\alpha$ -Pinene	0.92	Monoterpene
Camphene	0.03	Monoterpene
$\beta$ -Pinene	6.74	Monoterpene
Sabinene	0.80	Monoterpene
6-Methyl-5-hepten-2-one	0.02	Aliphatic ketone
Myrcene	0.94	Monoterpene
Pseudolimonene	0.02	Monoterpene
$\alpha$ -Phellandrene	0.02	Monoterpene
Octanal	0.05	Aliphatic aldehyde
$\Delta^3$ -Carene	0.01	Monoterpene
$\alpha$ -Terpinene	0.05	Monoterpene
<i>para</i> -Cymene	2.15	Monoterpene
Limonene	40.09	Monoterpene
$\beta$ -Phellandrene	0.13	Monoterpene
1,8-Cineole	0.02	Monoterpenic ether
( <i>Z</i> )- $\beta$ -Ocimene	0.02	Monoterpene
( <i>E</i> )- $\beta$ -Ocimene	0.12	Monoterpene
$\gamma$ -Terpinene	4.51	Monoterpene
<i>cis</i> -Sabinene hydrate	0.03	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.03	Monoterpenic alcohol
Octanol	0.02	Aliphatic alcohol
<i>trans</i> -Linalool oxide (fur.)	0.03	Monoterpenic alcohol
Terpinolene	0.22	Monoterpene
Nonanal	0.02	Aliphatic aldehyde
Linalool	11.85	Monoterpenic alcohol
<i>trans-para</i> -Mentha-2,8-dien-1-ol	0.02	Monoterpenic alcohol
<i>cis</i> -Limonene oxide	0.05	Monoterpenic ether
<i>cis-para</i> -Mentha-2,8-dien-1-ol	0.05	Monoterpenic alcohol
<i>trans</i> -Limonene oxide	0.03	Monoterpenic ether
Epoxyterpinolene	0.02	Monoterpenic ether
Citronellal	0.02	Monoterpenic aldehyde
Terpinen-4-ol	0.03	Monoterpenic alcohol
$\alpha$ -Terpineol	0.13	Monoterpenic alcohol
Hodiendiol (2,6-dimethylocta-3,7-diene-2,6-diol)	0.02	Monoterpenic alcohol
Decanal	0.04	Aliphatic aldehyde
Octyl acetate	0.12	Aliphatic ester
Nerol	0.07	Monoterpenic alcohol

Citronellol	0.04	Monoterpenic alcohol
Neral	0.23	Monoterpenic aldehyde
Geraniol	0.04	Monoterpenic alcohol
Linalyl acetate	26.84	Monoterpenic ester
( <i>trans</i> ?) - Linalool oxide acetate (fur.)?	0.04	Monoterpenic ester
Geranial	0.29	Monoterpenic aldehyde
Unknown	0.01	Unknown
Bornyl acetate	0.03	Monoterpenic ester
Unknown	0.01	Unknown
<i>cis-para</i> -Mentha-2,8-diene-1-hydroperoxide	0.01	Monoterpenic peroxide
Linalyl propionate	0.02	Monoterpenic ester
Hodiendiol derivative	0.03	Oxygenated monoterpene
$\alpha$ -Terpinyl acetate	0.14	Monoterpenic ester
Unknown	0.04	Monoterpenic ester
Unknown	0.07	Oxygenated monoterpene
Neryl acetate	0.36	Monoterpenic ester
Geranyl acetate	0.33	Monoterpenic ester
Dodecanal	0.01	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.36	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.23	Sesquiterpene
$\alpha$ -Humulene	0.02	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.03	Sesquiterpene
Germacrene D	0.01	Sesquiterpene
$\beta$ -Bisabolene	0.24	Sesquiterpene
( <i>E</i> )- $\alpha$ -Bisabolene	0.01	Sesquiterpene
Caryophyllene oxide	0.05	Sesquiterpenic ether
Caryophyllene oxide isomer	0.02	Sesquiterpenic ether
<b>Consolidated total</b>	<b>99.17</b>	

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

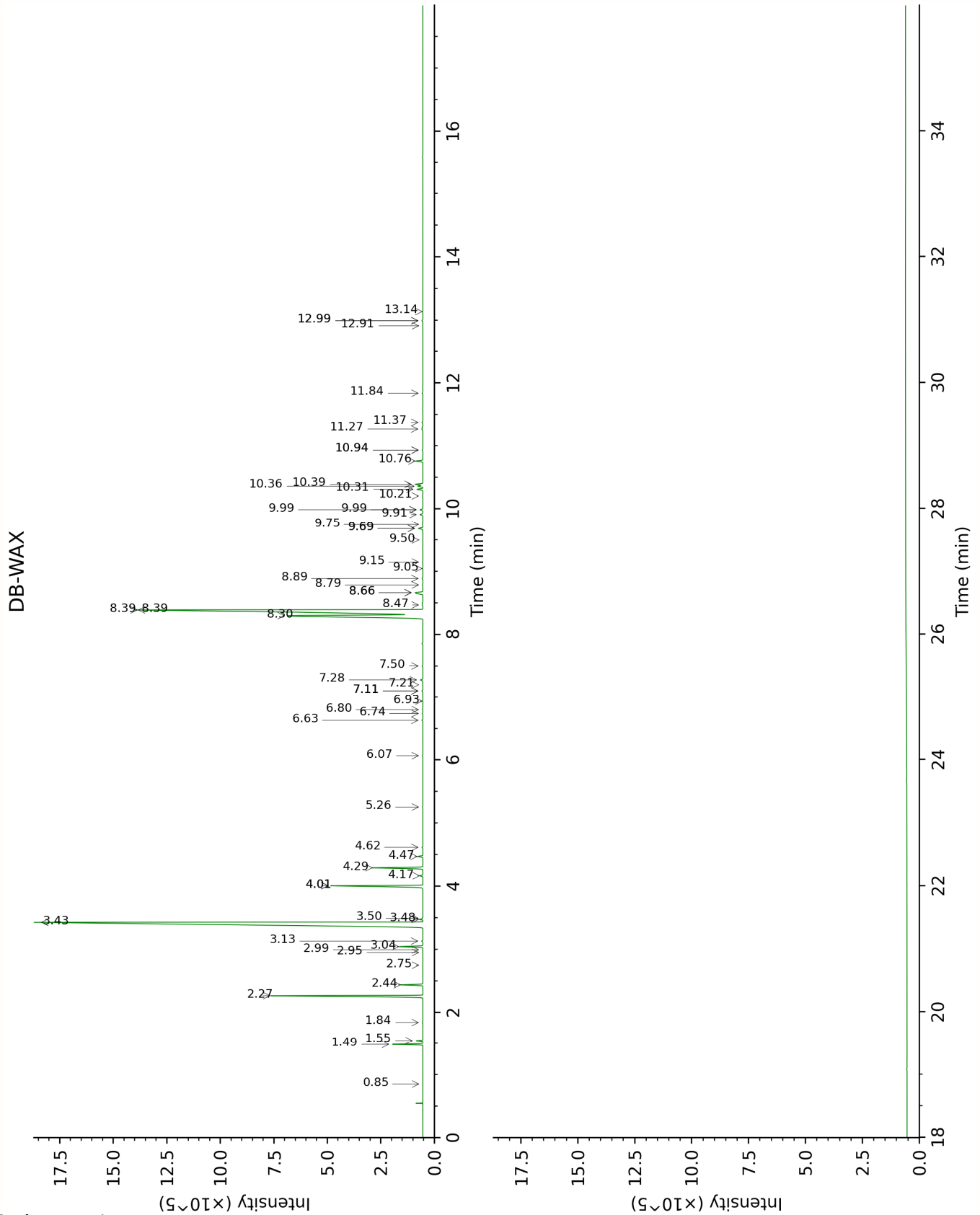
Note: no correction factor was applied

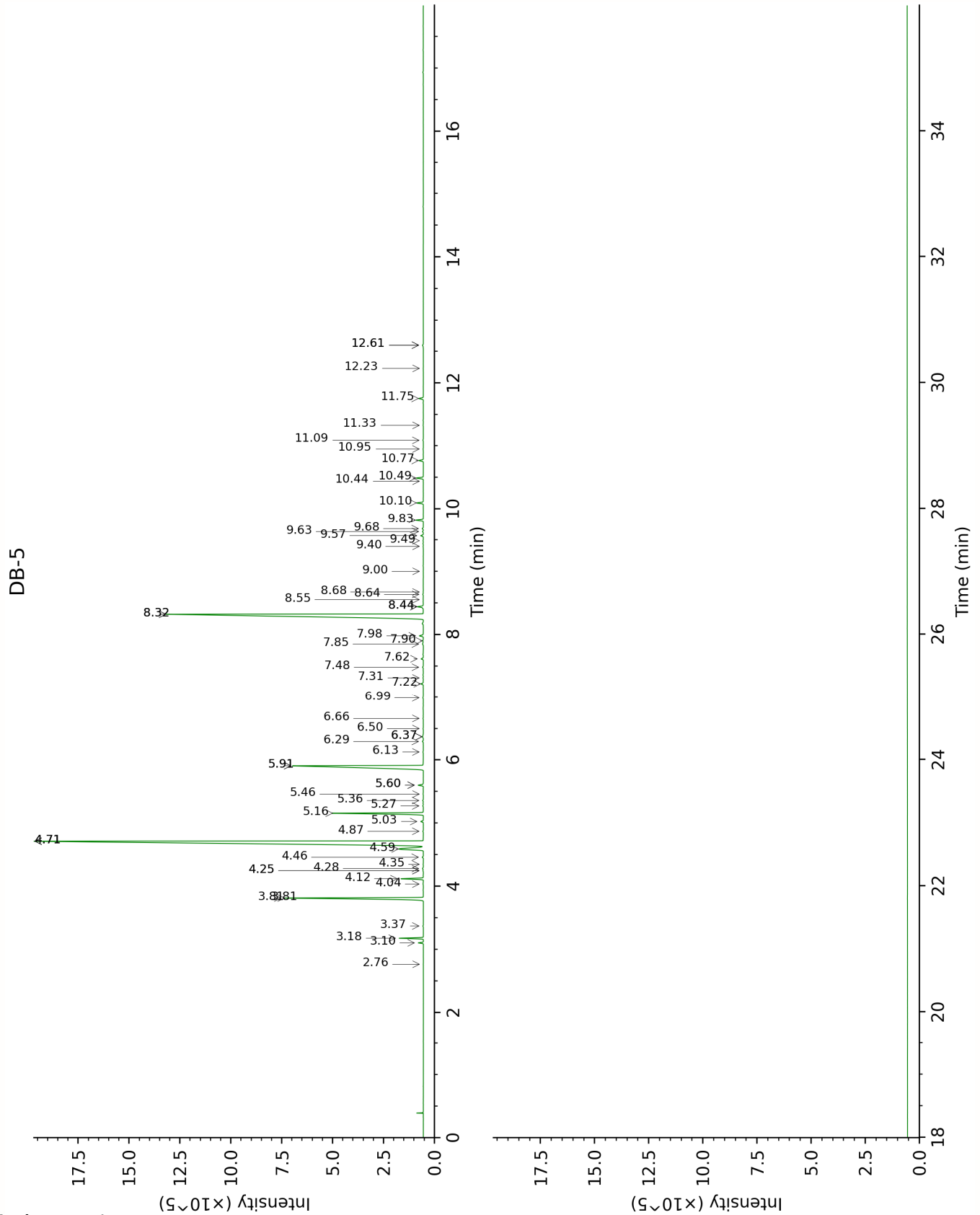
**About "consolidated" data:** The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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.

**Bracketed value ([xx]):** A bracketed percent value indicate that two or more compound percentage could not be solved due to coelution.

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





## FULL ANALYSIS DATA

Nonane	Column DB-WAX			Column DB-5		
	0.85	892.7	tr	2.76	903.8	0.01
$\alpha$ -Thujene	1.55	1001.1	0.19	3.10	926.4	0.20
$\alpha$ -Pinene	1.49	992.5	0.92	3.18	931.2	0.92
Camphene	1.84	1028.5	0.02	3.37	944.0	0.03
$\beta$ -Pinene	2.27	1068.7	6.74	3.81*	973.1	[7.56]
Sabinene	2.44	1085.0	0.80	3.81*	973.1	[7.56]
6-Methyl-5-hepten-2-one	5.26	1295.0	0.02	4.04	987.7	0.02
Myrcene	3.04	1133.7	0.95	4.12	993.3	0.94
Pseudolimonene	2.99	1129.9	0.02	4.25*	1001.6	[0.03]
$\alpha$ -Phellandrene	2.95	1126.6	0.02	4.25*	1001.6	[0.03]
Octanal	4.62	1249.6	0.04	4.28	1003.8	0.05
$\Delta^3$ -Carene	2.75	1111.3	0.01	4.35	1008.1	0.01
$\alpha$ -Terpinene	3.13	1140.3	0.06	4.46	1015.1	0.05
<i>para</i> -Cymene	4.29	1226.6	2.17	4.59	1023.3	2.15
Limonene	3.43	1162.9	40.09	4.71*	1031.0	[40.34]
$\beta$ -Phellandrene	3.48	1166.4	0.13	4.71*	1031.0	[40.34]
1,8-Cineole	3.50	1167.9	0.02	4.71*	1031.0	[40.34]
( <i>Z</i> )- $\beta$ -Ocimene	4.01*	1206.3	[4.53]	4.87	1040.8	0.02
( <i>E</i> )- $\beta$ -Ocimene	4.17	1217.5	0.12	5.03	1050.5	0.12
$\gamma$ -Terpinene	4.01*	1206.3	[4.53]	5.16	1058.7	4.51
<i>cis</i> -Sabinene hydrate	7.11*	1429.7	[0.06]	5.27	1065.9	0.03
<i>cis</i> -Linalool oxide (fur.)	6.74	1402.5	0.03	5.36	1071.3	0.03
Octanol	8.39*†	1525.8	[26.68]	5.46	1077.6	0.02
<i>trans</i> -Linalool oxide (fur.)	7.11*	1429.7	[0.06]	5.60*	1086.5	[0.26]
Terpinolene	4.47	1239.3	0.22	5.60*	1086.5	[0.26]
Nonanal	6.07	1354.6	0.02	5.91*	1105.7	[11.88]
Linalool	8.30*†	1518.7	[11.97]	5.91*	1105.7	[11.88]
<i>trans-para</i> -Mentha-2,8-dien-1-ol	9.15	1584.2	0.02	6.13	1119.6	0.02
<i>cis</i> -Limonene oxide	6.63	1394.7	0.05	6.30	1130.3	0.05
<i>cis-para</i> -Mentha-2,8-dien-1-ol	9.68*	1626.9	[0.22]	6.37*	1135.1	[0.08]
<i>trans</i> -Limonene oxide	6.80	1407.0	0.03	6.37*	1135.1	[0.08]
Epoxyterpinolene	6.94	1417.1	0.01	6.50	1143.3	0.02
Citronellal	7.20	1437.0	0.02	6.66	1153.6	0.02
Terpinen-4-ol	8.79	1556.3	0.02	6.99	1174.5	0.03

Laboratoire  
**Phyto**Chemia

Plus que des analyses... des conseils



$\alpha$ -Terpineol	9.99*	1651.4	[0.14]	7.22	1189.2	0.13
Hodiendiol (2,6-dimethylocta-3,7-diene-2,6-diol)	13.00*	1908.3	[0.06]	7.31	1195.2	0.02
Decanal	7.50	1459.0	0.04	7.48	1206.0	0.04
Octyl acetate	7.28	1442.7	0.11	7.62	1215.0	0.12
Nerol	11.27	1757.4	0.06	7.85	1230.6	0.07
Citronellol	10.94*	1729.2	[0.04]	7.90	1234.1	0.04
Neral	9.68*	1626.9	[0.22]	7.98	1239.3	0.23
Geraniol	11.84	1805.6	0.04	8.32*	1262.2	[26.89]
Linalyl acetate	8.39*†	1525.8	[26.68]	8.32*	1262.2	[26.89]
( <i>trans</i> ?) - Linalool oxide acetate (fur.)?	8.89	1564.2	0.04	8.44*	1270.2	[0.34]
Geranial	10.31	1677.7	0.29	8.44*	1270.2	[0.34]
Unknown MISC CCLXXIV [m/z 43, 121 (79), 136 (42), 107 (37), 68 (35), 95 (27), 93 (24)...]				8.55	1277.7	0.01
Bornyl acetate	8.47	1531.8	0.03	8.64	1283.2	0.03
Unknown MISC VI [m/z 43, 121 (74), 93 (42), 95 (38), 107 (29), 41 (29), 136 (28)...]				8.68	1285.7	0.01
<i>cis</i> - <i>para</i> -Mentha-2,8-diene-1-hydroperoxide				9.00	1307.8	0.01
Linalyl propionate	9.05	1576.3	0.02	9.40	1335.7	0.02
Hodiendiol derivative	13.14	1921.6	0.02	9.49	1342.0	0.03
$\alpha$ -Terpinyl acetate	9.91	1645.2	0.15	9.57	1347.6	0.14
Unknown MISC VII [m/z 43, 121 (52), 93 (48), 79 (33), 41 (30), 136 (26), 81 (25)...]				9.63	1352.2	0.04
Unknown SASC III [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	11.37	1766.2	0.05	9.68	1355.5	0.07

Neryl acetate	10.39	1684.1	0.37	9.83	1365.8	0.36
Geranyl acetate	10.76	1714.6	0.34	10.10	1385.0	0.33
Dodecanal	10.21	1669.1	0.04	10.44	1409.4	0.01
$\beta$ -Caryophyllene	8.66*	1546.9	[0.57]	10.49	1413.2	0.36
<i>trans</i> - $\alpha$ - Bergamotene	8.66*	1546.9	[0.57]	10.77	1433.8	0.23
$\alpha$ -Humulene	9.50	1612.0	0.02	10.95	1447.4	0.02
( <i>E</i> )- $\beta$ -Farnesene	9.75	1631.9	0.03	11.09	1457.6	0.03
Germacrene D	9.99*	1651.4	[0.14]	11.33	1475.3	0.01
$\beta$ -Bisabolene	10.36	1681.6	0.24	11.75	1507.1	0.24
( <i>E</i> )- $\alpha$ -Bisabolene	10.94*	1729.2	[0.04]	12.23	1544.4	0.01
Caryophyllene oxide	13.00*	1908.3	[0.06]	12.61*	1574.2	[0.06]
Caryophyllene oxide isomer	12.92	1901.0	0.02	12.61*	1574.2	[0.06]
Total reported		98.93%			99.29%	

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

[xx]: Duplicate percentage due to coelutions, only the first one is 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