

Date : 2023-07-13

CERTIFICATE OF ANALYSIS - GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 23G04-NPA01

Customer Identification : RM - EO - Lemongrass - AF - Zambia - NPS00081 - NP0184

Type : Essential Oil

Source : *Cymbopogon citratus*

Customer : Nature Packaged

Checked and approved by:

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

Notes: 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.

This report is an update from the first version issued on July 11, 2023, to format it for online publication.

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 : Amélie Simard, Analyste

Date : 2023-07-10

PHYSICOCHEMICAL DATA

Physical aspect : Light yellow liquid

Analyst : Cindy Caron B. Sc.

Date : 2023-07-05

Refractive index : 1.4874 ± 0.0003 (20 °C)

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

Analyst : Cindy Caron B. Sc.

Date : 2023-07-05

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
Isobutyral	tr	Aliphatic aldehyde
2-Methyl-3-buten-2-ol	0.05	Aliphatic alcohol
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Isoamyl alcohol	tr	Aliphatic alcohol
Unknown	0.01	Unknown
Unknown	tr	Unknown
(E)-2,4-Dimethyl-2,4-heptadiene	0.04	Alkene
Tricyclene	0.01	Monoterpene
α -Pinene	0.03	Monoterpene
Camphene	0.02	Monoterpene
Sabinene	0.02	Monoterpene
β -Pinene	tr	Monoterpene
Myrcene	11.21	Monoterpene
6-Methyl-5-hepten-2-one	1.60	Aliphatic ketone
6-Methyl-5-hepten-2-ol	0.01	Aliphatic alcohol
Octanal	0.01	Aliphatic aldehyde
α -Phellandrene	tr	Monoterpene
Δ^3 -Carene	0.01	Monoterpene
α -Terpinene	0.01	Monoterpene
<i>para</i> -Cymene	0.02	Monoterpene
Limonene	0.03	Monoterpene
1,8-Cineole	0.02	Monoterpenic ether
(Z)- β -Ocimene	0.39	Monoterpene
(E)- β -Ocimene	0.28	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.04	Aliphatic aldehyde
γ -Terpinene	0.01	Monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Camphenilone	0.01	Normonoterpenic ketone
Terpinolene	0.03	Monoterpene
4-Nonanol	0.10	Aliphatic alcohol
Rosefuran	0.19	Monoterpenic ether
Perillene	0.25	Monoterpenic ether
Linalool	0.96	Monoterpenic alcohol
<i>cis</i> -Chrysanthemal?	0.10	Monoterpenic aldehyde
<i>trans-para</i> -Mentha-2,8-dien-1-ol	0.05	Monoterpenic alcohol
Unknown	0.20	Unknown
Unknown	0.01	Unknown
<i>trans</i> -Chrysanthemal	0.29	Monoterpenic aldehyde
exo-Isocitral	0.10	Monoterpenic aldehyde

Citronellal	0.29	Monoterpenic aldehyde
Borneol	0.05	Monoterpenic alcohol
α -Phellandren-8-ol	0.08	Monoterpenic alcohol
Isoneral	0.82	Monoterpenic aldehyde
Rosefuran oxide	0.08	Monoterpenic ether
Unknown	0.17	Oxygenated monoterpene
Isogeranial	1.47	Monoterpenic aldehyde
α -Terpineol	0.02	Monoterpenic alcohol
Unknown	0.16	Unknown
<i>trans</i> -Isopiperitenol	0.05	Monoterpenic alcohol
Unknown	0.09	Oxygenated monoterpene
Decanal	0.02	Aliphatic aldehyde
<i>cis</i> -Isopiperitenol	0.04	Monoterpenic alcohol
2,3-Epoxyneral?	0.05	Monoterpenic aldehyde
Nerol	0.17	Monoterpenic alcohol
Citronellol	0.30	Monoterpenic alcohol
Neral	32.51	Monoterpenic aldehyde
Piperitone	0.04	Monoterpenic ketone
Geraniol	1.96	Monoterpenic alcohol
Geranial	41.61	Monoterpenic aldehyde
Unknown	0.17	Oxygenated monoterpene
2-Undecanone	0.35	Aliphatic ketone
Geranyl formate	0.07	Monoterpenic ester
Unknown	0.05	Unknown
Citronellyl acetate	0.07	Monoterpenic ester
Geranic acid	0.15	Aliphatic acid
α -Copaene	0.15	Sesquiterpene
β -Bourbonene	0.02	Sesquiterpene
Geranyl acetate	0.25	Monoterpenic ester
β -Elemene	0.03	Sesquiterpene
Longifolene	0.03	Sesquiterpene
β -Caryophyllene	0.15	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.13	Sesquiterpene
α -Humulene	0.02	Sesquiterpene
<i>cis</i> -Muurolo-4(15),5-diene	0.04	Sesquiterpene
Germacrene D	0.02	Sesquiterpene
α -Muurolole	0.27	Sesquiterpene
γ -Cadinene	0.02	Sesquiterpene
δ -Cadinene	0.02	Sesquiterpene
(<i>E</i>)- γ -Bisabolene	0.01	Sesquiterpene
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Caryophyllene oxide	0.03	Sesquiterpenic ether
Humulene epoxide II	0.02	Sesquiterpenic ether
Selin-6-en-4 α -ol isomer	0.02	Sesquiterpenic alcohol
Unknown	0.03	Oxygenated sesquiterpene

(2Z,6Z)-Farnesol	0.02	Sesquiterpenic alcohol
(2E,6E)-Farnesal	0.02	Sesquiterpenic aldehyde
Phytone	0.02	Terpenic ketone
<i>meta</i> -Camphorene	0.18	Diterpene
<i>para</i> -Camphorene	0.09	Diterpene
Unknown	0.01	Unknown
Unknown	0.02	Unknown
Unknown	0.02	Unknown
Unknown	0.02	Unknown
Dicitral	0.03	Diterpenic aldehyde
Unknown	0.03	Unknown
Phytol isomer I	0.02	Diterpenic alcohol
Unknown	0.02	Unknown
Consolidated total	98.79	

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

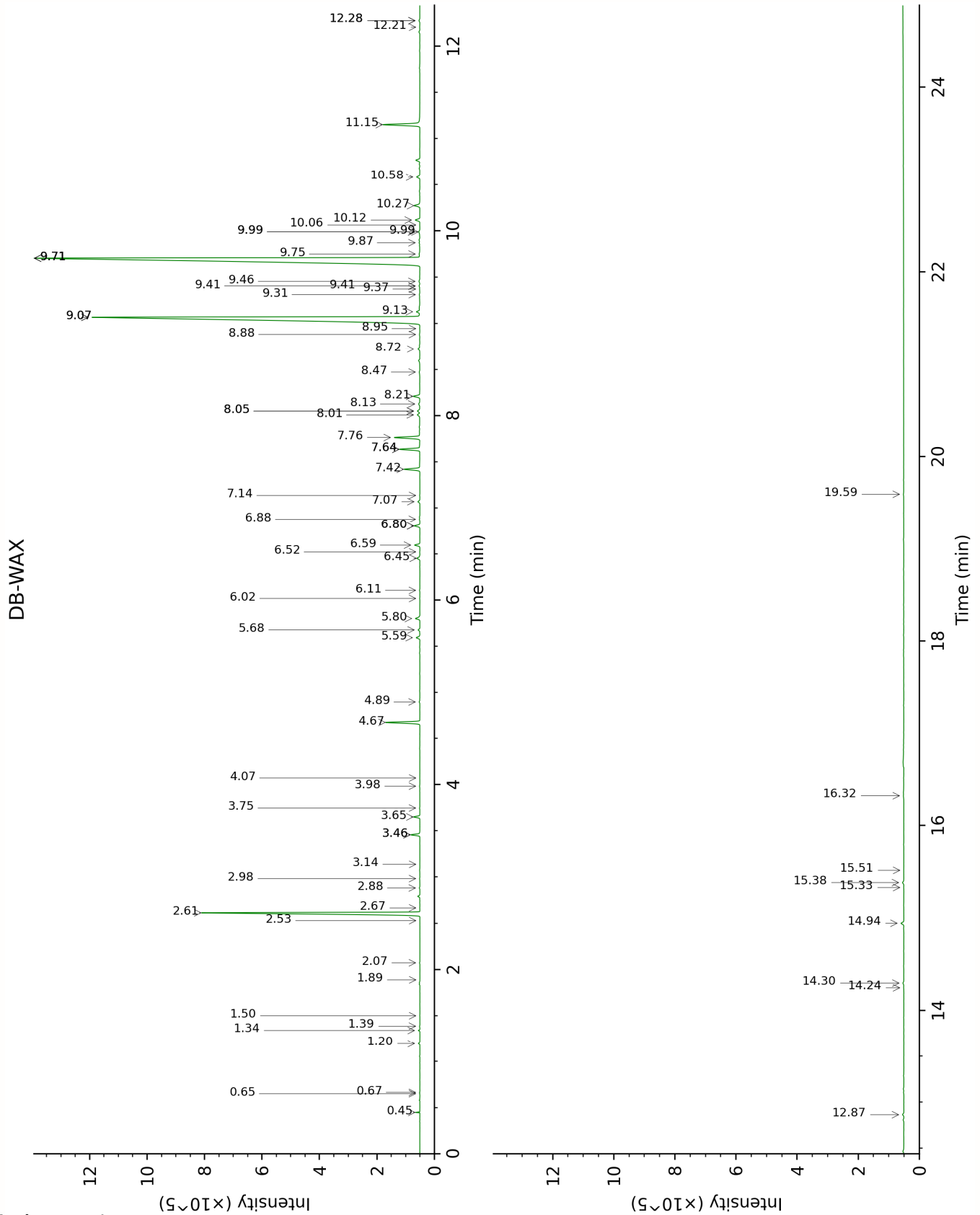
Note: no correction factor was applied

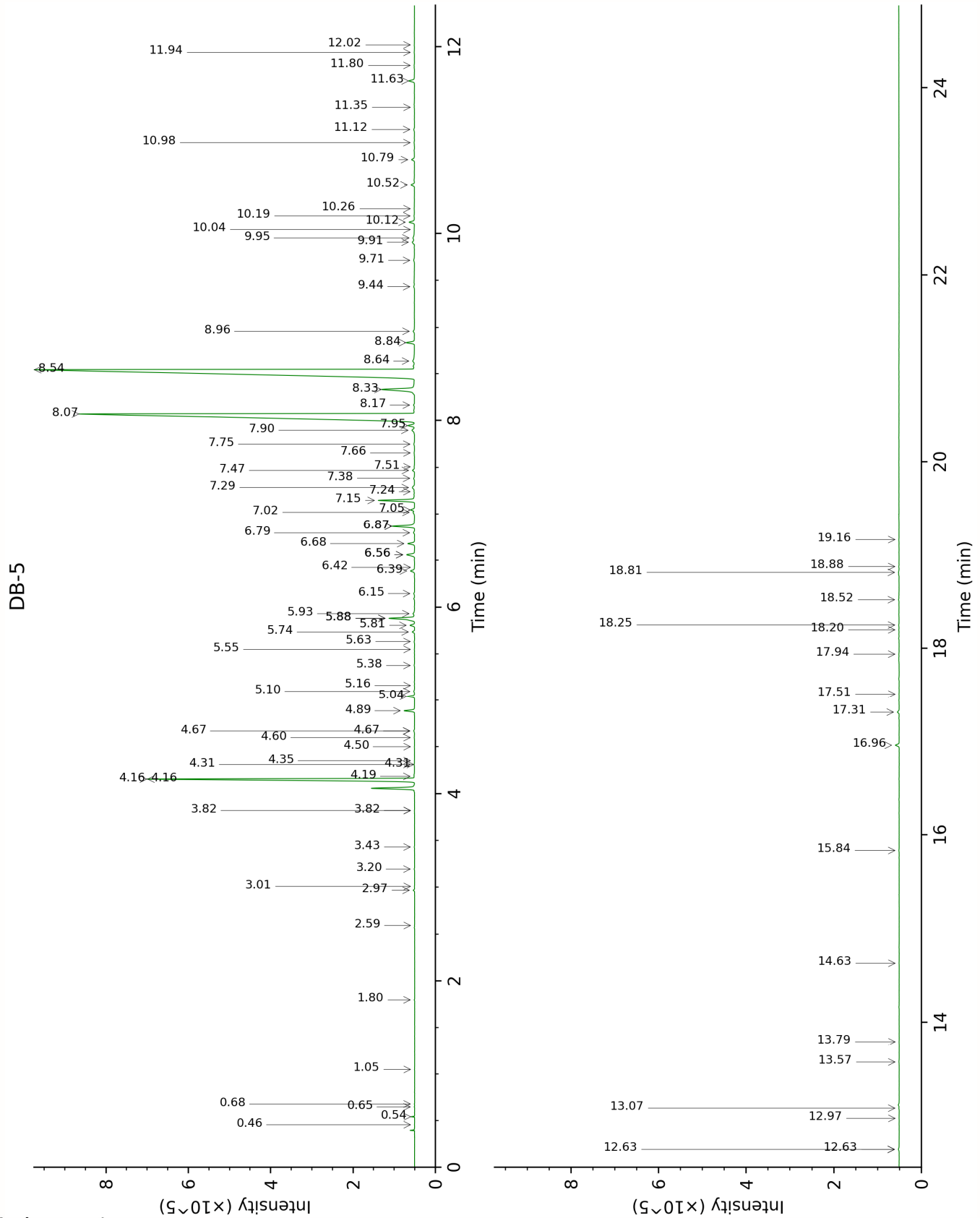
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm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

Isobutyral	Column DB-WAX			Column DB-5		
	0.45	781.6	0.07	0.46	538.8	tr
2-Methyl-3-buten-2-ol	1.34	1011.2	0.05	0.54	605.7	0.05
Isovaleral	0.67	884.0	0.01	0.65	640.5	0.01
2-Methylbutyral	0.65	878.5	tr	0.68	651.1	tr
Isoamyl alcohol	3.14	1177.4	0.01	1.05	732.8	tr
Unknown PEGR III [m/z 81, 69 (80), 41 (65), 83 (52), 109 (48), 55 (47)...]				1.80	822.9	0.01
Unknown CULE I [m/z 69, 41 (57), 81 (57), 80 (18), 79 (18), 67 (17)...]				2.59	887.8	tr
(E)-2,4-Dimethyl-2,4-heptadiene	1.39	1016.0	0.02	2.97	915.8	0.04
Tricyclene				3.01	918.5	0.01
α -Pinene	1.20	989.3	0.06	3.20	930.7	0.03
Camphene	1.50	1027.4	tr	3.43	946.2	0.02
Sabinene	2.07	1086.4	0.02	3.82*	971.7	[0.02]
β -Pinene	1.89	1067.3	tr	3.82*	971.7	[0.02]
Myrcene	2.61	1134.5	11.21	4.16*	993.8	[12.95]
6-Methyl-5-hepten-2-one	4.67	1297.8	1.60	4.16*	993.8	[12.95]
6-Methyl-5-hepten-2-ol	6.52	1428.7	0.01	4.19	995.7	0.01
Octanal	4.07	1251.2	0.01	4.31*	1004.0	[0.03]
α -Phellandrene	2.53	1127.7	tr	4.31*	1004.0	[0.03]
Δ^3 -Carene				4.35	1006.6	0.01
α -Terpinene	2.67	1138.9	0.01	4.50	1015.9	0.01
<i>para</i> -Cymene	3.75	1226.3	0.02	4.60	1022.0	0.02
Limonene	2.88	1156.4	0.03	4.67*	1026.5	[0.05]
1,8-Cineole	2.98	1164.8	0.02	4.67*	1026.5	[0.05]
(Z)- β -Ocimene	3.46*	1203.8	[0.41]	4.89	1040.0	0.39
(E)- β -Ocimene	3.65	1218.9	0.28	5.04	1049.8	0.28
2,6-Dimethyl-5-heptenal (melonal)	4.89	1309.2	0.04	5.10	1053.2	0.04
γ -Terpinene	3.46*	1203.8	[0.41]	5.16	1057.2	0.01
<i>cis</i> -Linalool oxide (fur.)	6.11	1397.7	0.02	5.38	1070.6	0.02
Camphenilone	6.02	1391.3	0.01	5.55	1081.4	0.01

Terpinolene	3.98	1244.4	0.02	5.63	1086.6	0.03
4-Nonanol				5.74	1093.0	0.10
Rosefuran	5.60	1360.4	0.20	5.81	1097.5	0.19
Perillene	5.80	1375.5	0.25	5.88*	1102.1	[1.21]
Linalool	7.64*	1512.7	[1.03]	5.88*	1102.1	[1.21]
<i>cis</i> - Chrysanthemal?	5.68	1366.5	0.08	5.93	1105.2	0.10
<i>trans-para</i> - Mentha-2,8- dien-1-ol	8.47	1578.4	0.05	6.15	1118.9	0.05
Unknown CYFL III [m/z 81, 70 (98), 67 (63), 82 (53), 41 (46), 69 (46), 109 (43)...]	6.45	1423.4	0.18	6.39	1134.3	0.20
Unknown CYFL IV [m/z 95, 67 (86), 41 (68), 82 (64), 123 (62)...]				6.42	1136.7	0.01
<i>trans</i> - Chrysanthemal	6.80*	1449.8	[0.29]	6.56*	1145.3	[0.40]
exo-Isocitral	7.07	1470.0	0.10	6.56*	1145.3	[0.40]
Citronellal	6.60	1434.1	0.27	6.68	1152.9	0.29
Borneol	9.31	1646.3	0.04	6.80	1160.2	0.05
α -Phellandren-8- ol	9.75	1682.3	0.08	6.87*	1164.8	[0.95]
Isoneral	7.42	1496.3	0.82	6.87*	1164.8	[0.95]
Rosefuran oxide	8.13	1551.2	0.09	7.02	1174.6	0.08
Unknown CYFL V [m/z 84, 83 (74), 137 (56), 41 (47), 93 (43), 108 (40)... 152 (2)]	9.13	1631.1	0.20	7.05	1176.2	0.17
Isogeranial	7.76	1522.7	1.34	7.15	1182.7	1.47
α -Terpineol	9.37	1651.2	0.03	7.24	1188.7	0.02
Unknown DRMO III [m/z 43, 81 (47), 67 (45), 69 (944), 41 (42), 59 (40), 55 (39)...]	8.72	1598.2	0.14	7.28	1191.4	0.16
<i>trans</i> - Isopiperitenol	9.99*	1702.0	[0.10]	7.38	1197.8	0.05
Unknown CYFL VI [m/z 84, 41 (83), 83 (79), 91	9.71*	1678.6	[41.27]	7.47	1203.1	0.09

(76), 93 (67), 119 (64), 137 (63), 109 (54), 108 (54)... 152 (4)]						
Decanal	6.88	1455.6	0.02	7.51	1205.6	0.02
<i>cis</i> - Isopiperitenol	9.87	1692.3	0.04	7.66	1215.5	0.04
2,3-Epoxyneral?				7.75	1221.7	0.05
Nerol	10.58	1752.6	0.19	7.90	1231.6	0.17
Citronellol	10.27	1726.0	0.34	7.95	1235.0	0.30
Neral	9.07*	1626.2	[32.17]	8.07	1243.2	32.51
Piperitone	9.41*	1653.9	[0.05]	8.17	1249.6	0.04
Geraniol	11.15	1802.0	2.07	8.33	1260.7	1.96
Geranial	9.71*	1678.6	[41.27]	8.54	1274.8	41.61
Unknown CYFL VII [m/z 43, 69 (77), 41 (70), 109 (54)... 152 (6)]				8.64	1281.0	0.17
2-Undecanone	8.21	1557.7	0.38	8.84	1294.6	0.35
Geranyl formate	9.46	1658.0	0.07	8.96	1302.7	0.07
Unknown CYFL VIII [m/z 82, 59 (44), 41 (43), 95 (31), 43 (29), 81 (24)...]	12.28*	1903.0	[0.06]	9.44	1336.0	0.05
Citronellyl acetate	9.07*	1626.2	[32.17]	9.72	1355.7	0.07
Geranic acid				9.91	1369.3	0.15
α -Copaene	6.80*	1449.8	[0.29]	9.95	1372.5	0.15
β -Bourbonene	7.14	1475.0	0.02	10.04	1378.8	0.02
Geranyl acetate	10.12	1712.6	0.25	10.12	1384.3	0.25
β -Elemene	8.05*	1545.2	[0.16]	10.19	1389.0	0.03
Longifolene	7.64*	1512.7	[1.03]	10.26	1394.4	0.03
β -Caryophyllene	8.01	1542.0	0.17	10.52	1412.6	0.15
<i>trans</i> - α - Bergamotene	8.05*	1545.2	[0.16]	10.79	1433.2	0.13
α -Humulene	8.88	1610.9	0.03	10.98	1446.8	0.02
<i>cis</i> -Muurolo- 4(15),5-diene	8.95	1616.1	0.02	11.12	1457.2	0.04
Germacrene D	9.41*	1653.9	[0.05]	11.35	1474.8	0.02
α -Muurolene	9.71*	1678.6	[41.27]	11.64	1495.8	0.27
γ -Cadinene	9.99*	1702.0	[0.10]	11.80	1508.3	0.02
δ -Cadinene	9.99*	1702.0	[0.10]	11.94	1519.2	0.02
(<i>E</i>)- γ -Bisabolene	10.06	1708.1	0.01	12.02	1525.5	0.01
Caryophyllene	12.21	1896.6	0.01	12.63*	1573.7	[0.05]

oxide isomer						
Caryophyllene oxide	12.28*	1903.0	[0.06]	12.63*	1573.7	[0.05]
Humulene epoxide II	12.86	1958.2	0.07	12.97	1599.8	0.02
Selin-6-en-4 α -ol isomer	14.30	2096.7	0.06	13.08	1608.4	0.02
Unknown JUVI XVI [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79 (58)... 204 (48), 220 (2)]				13.57	1649.2	0.03
(2Z,6Z)-Farnesol	15.51	2221.5	0.01	13.79	1667.5	0.02
(2E,6E)-Farnesol	15.33	2202.1	0.01	14.63	1738.4	0.02
Phytone	14.24	2091.7	0.02	15.84	1844.6	0.02
<i>meta</i> -Camphorene	14.94	2162.4	0.16	16.96	1948.6	0.18
<i>para</i> -Camphorene	15.38	2207.6	0.08	17.31	1982.3	0.09
Unknown LICU V [m/z 41, 69 (95), 109 (41), 95 (39), 55 (36), 121 (36)...]				17.51	2001.1	0.01
Unknown LICU VII [m/z 69, 41 (94), 81 (42), 109 (39), 107 (33), 43 (31)...]				17.94	2043.4	0.02
Unknown CYFL IX [m/z 93, 69 (95), 135 (76), 107 (53), 41 (53), 109 (50)... 235 (10)...]				18.20	2069.2	0.02
Unknown LIMU XXI [m/z 57, 85 (55), 163 (47), 41 (44), 120 (35), 202 (30), 145 (25)... 219 (17), 304 (t)]				18.25	2074.2	0.02
Dicital	16.32	2307.7	0.05	18.52	2101.1	0.03
Unknown LICU II	19.59	2689.2	0.03	18.81	2131.1	0.03

[m/z 69, 41 (38), 151 (36), 123 (34), 82 (24), 43 (23), 109 (21)...]				
Phytol isomer I		18.88	2137.5	0.02
Unknown CYFL XIII [m/z 94, 43 (85), 93 (81), 69 (76), 137 (76), 95 (60), 134 (51)...]		19.16	2167.4	0.02
Total reported	97.07%		98.99%	

*: 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