

Date : April 06, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19J18-PTH18-1-CC

Customer identification : Citronella Organic - China - CD010497R

Type : Essential oil

Source : *Cymbopogon winterianus*

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 : Lindsay Girard, B. Sc.

Analysis date : October 21, 2019

Checked and approved by :

Sylvain Mercier, M. Sc., chimiste 2014-005

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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.

This report is an update of the version first issued on October 21, 2019 to indicatively present comparison to a standard.

PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid

Refractive index: 1.4702 ± 0.0003 (20 °C)

ISO 3848:2016 - ESSENTIAL OIL OF CITRONELLA, JAVA TYPE

Compound	Min. %	Max. %	Observed %	Complies?
Eugenol	0.5	1.0	0.3	No
α-Elemol	1.3	4.8	2.9	Yes
Geraniol	20.0	25.0	20.7	Yes
Citronellol	8.5	14.0	10.4	Yes
δ-Cadinene	1.5	2.5	2.1	Yes
Geranyl acetate	2.5	5.5	3.1	Yes
Geranial	0.3	1.0	0.5	Yes
Germacrene D	1.5	3.0	2.5	Yes
Citronellyl acetate	2.0	4.0	2.7	Yes
β-Elemene	0.7	2.5	2.0	Yes
Isopulegol	0.5	1.7	0.3	No
Linalool	0.5	1.5	0.9	Yes
Citronellal	31.0	40.0	33.9	Yes
Limonene	2.0	5.0	4.1	Yes
Refractive index	1.4663	1.4770	1.4702	Yes

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	%	Classe
Ethanol	0.01	Aliphatic alcohol
1,4-Hexadiene?	0.01	Alkene
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Methylbutanol	0.01	Aliphatic alcohol
α -Thujene	0.01	Monoterpene
α -Pinene	0.16	Monoterpene
Camphene	0.01	Monoterpene
Sabinene	0.03	Monoterpene
β -Pinene	0.03	Monoterpene
6-Methyl-5-hepten-2-one	0.12	Aliphatic ketone
Myrcene	0.13	Monoterpene
α -Phellandrene	0.11	Monoterpene
Octanal	0.01	Aliphatic aldehyde
Δ^3 -Carene	0.11	Monoterpene
α -Terpinene	0.04	Monoterpene
para-Cymene	0.04	Monoterpene
Limonene	4.09	Monoterpene
1,8-Cineole	0.22*	Monoterpenic ether
β -Phellandrene	[0.22]*	Monoterpene
(Z)- β -Ocimene	0.02	Monoterpene
(E)- β -Ocimene	0.03	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.06	Aliphatic aldehyde
γ -Terpinene	0.06	Monoterpene
Octanol	0.02	Aliphatic alcohol
Terpinolene	0.10	Monoterpene
Linalool	0.95	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
cis-Rose oxide	0.02	Monoterpenic ether
trans-Rose oxide	0.01	Monoterpenic ether
Isopulegol	0.31	Monoterpenic alcohol
neo-Isopulegol	0.10	Monoterpenic alcohol
Citronellal	33.89	Monoterpenic aldehyde
Borneol	0.01	Monoterpenic alcohol
neiso-Isopulegol	0.08	Monoterpenic alcohol
Isopulegol isomer	0.02	Monoterpenic alcohol
Terpinen-4-ol	0.04	Monoterpenic alcohol
α -Terpineol	0.07	Monoterpenic alcohol
(4Z)-Decenal	0.06	Aliphatic aldehyde
Decanal	0.09	Aliphatic aldehyde
Nerol	0.17	Monoterpenic alcohol
Citronellol	10.42	Monoterpenic alcohol
Neral	0.34	Monoterpenic aldehyde
Geraniol	20.66	Monoterpenic alcohol
Geranial	0.49	Monoterpenic aldehyde
Citronellyl formate	0.04	Monoterpenic ester
Geranyl formate	0.02	Monoterpenic ester

8-Hydroxy-neo-menthol	0.31	Monoterpenic alcohol
Citronellic acid	0.03	Monoterpenic acid
Methyl geranate	0.10	Monoterpenic ester
Eugenol	0.31	Phenylpropanoid
Citronellyl acetate	2.66	Monoterpenic ester
Neryl acetate	0.02	Monoterpenic ester
α -Copaene	0.04	Sesquiterpene
β -Bourbonene	0.10	Sesquiterpene
Geranyl acetate	3.07	Monoterpenic ester
β -Elemene	2.00	Sesquiterpene
Dodecanal	0.04	Aliphatic aldehyde
β -Caryophyllene	0.20	Sesquiterpene
β -Copaene	0.16	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.02	Sesquiterpene
α -Humulene	0.16	Sesquiterpene
(<i>E</i>)-Isoeugenol	tr	Phenylpropanoid
<i>trans</i> -Cadina-1(6),4-diene	0.09	Sesquiterpene
γ -Muurolene	0.22	Sesquiterpene
Germacrene D	2.49	Sesquiterpene
β -Selinene	0.07	Sesquiterpene
α -Selinene	0.14	Sesquiterpene
epi-Cubebol	0.06	Sesquiterpenic alcohol
α -Muurolene	0.59	Sesquiterpene
Germacrene A	0.67	Sesquiterpene
γ -Cadinene	0.49	Sesquiterpene
Cubebol	0.04	Sesquiterpenic alcohol
<i>trans</i> -Calamenene	0.01	Sesquiterpene
δ -Cadinene	2.13	Sesquiterpene
Unknown	0.06	Sesquiterpene
α -Cadinene	0.14	Sesquiterpene
α -Elemol	2.89	Sesquiterpenic alcohol
Geranyl butyrate	0.01	Monoterpenic ester
Germacrene D-4-ol	0.47	Sesquiterpenic alcohol
Caryophyllene oxide	0.02	Sesquiterpenic ether
10-epi-Cubebol	0.04	Sesquiterpenic alcohol
τ -Cadinol	0.38	Sesquiterpenic alcohol
τ -Muurolol	0.15	Sesquiterpenic alcohol
α -Muurolol	0.29	Sesquiterpenic alcohol
β -Eudesmol	0.48	Sesquiterpenic alcohol
α -Eudesmol	0.60	Sesquiterpenic alcohol
α -Cadinol	0.06	Sesquiterpenic alcohol
(2 <i>E</i> ,6 <i>Z</i>)-Farnesal	0.02	Sesquiterpenic aldehyde
(2 <i>E</i> ,6 <i>E</i>)-Farnesol	0.10	Sesquiterpenic alcohol
(2 <i>E</i> ,6 <i>E</i>)-Farnesal	0.03	Sesquiterpenic aldehyde
Cryptomeridiol	0.03	Sesquiterpenic alcohol
Unknown	0.02	Oxygenated diterpene
Unknown	0.14	Oxygenated diterpene
Unknown	0.03	Unknown
Citronellyl citronellate	0.02	Monoterpenic ester
Consolidated total	95.47%	

*: 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

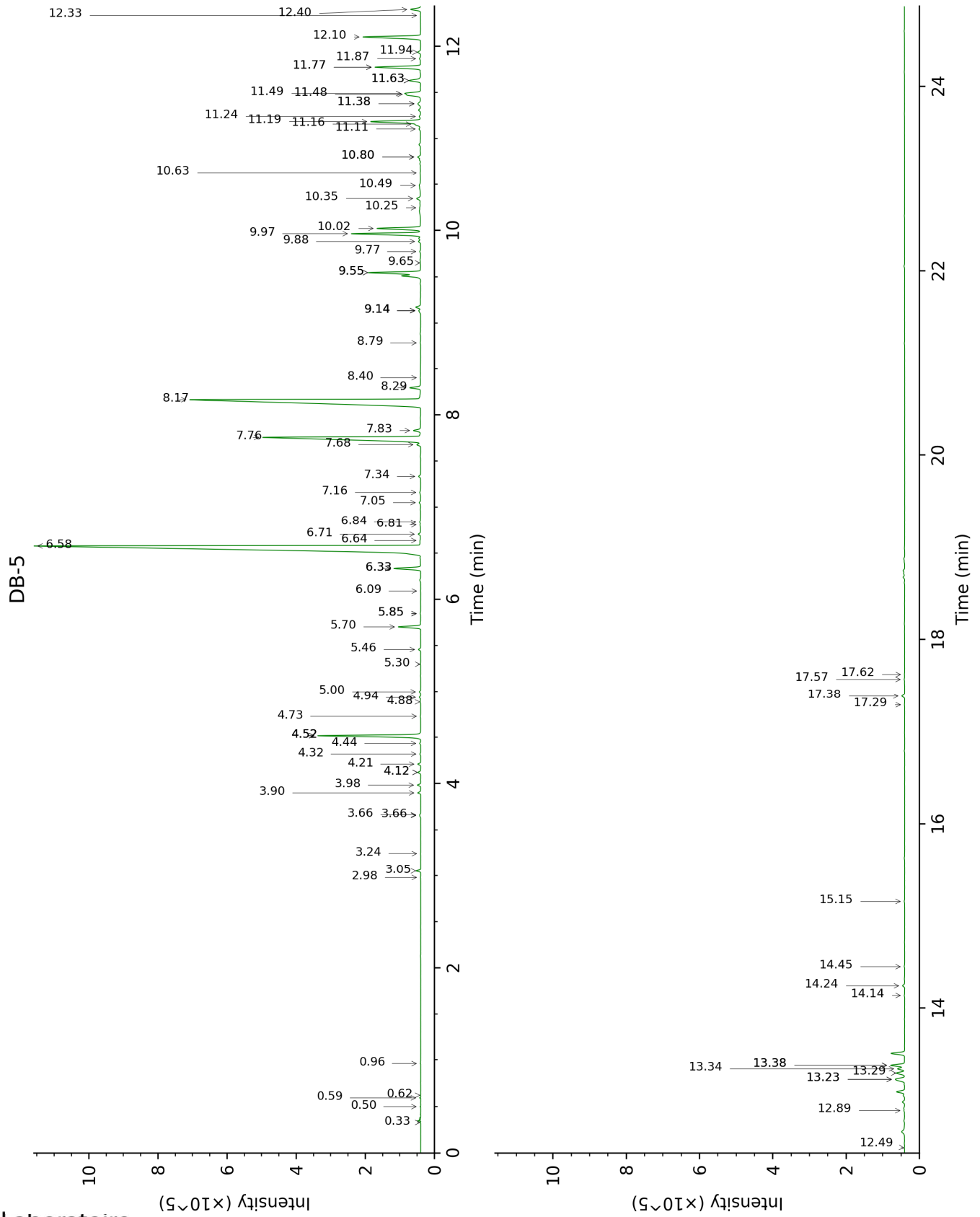
tr: The compound has been detected below 0.005% of total signal.

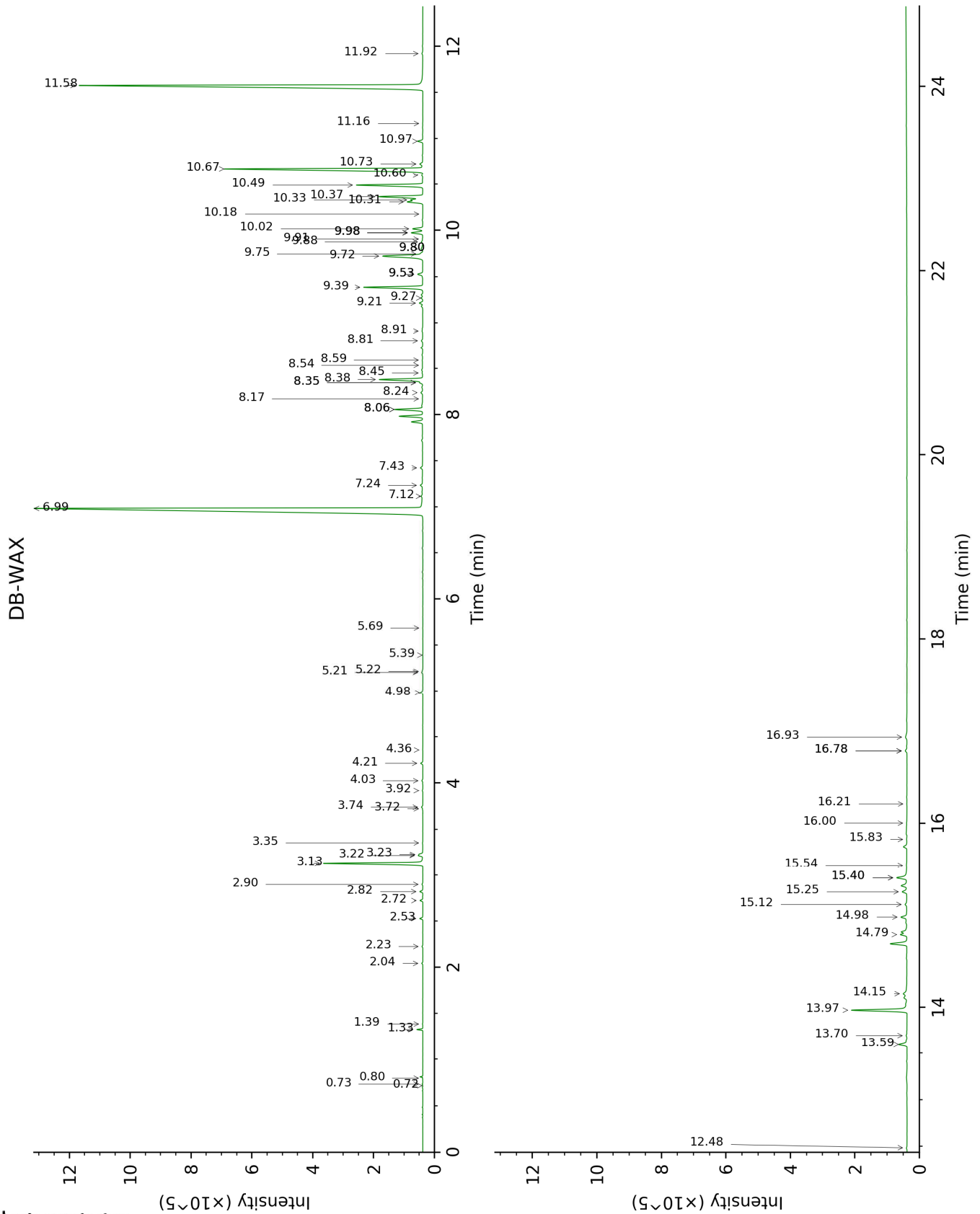
Note: no correction factor was applied

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	%
Ethanol	0.33	522	0.01	0.80	904	0.01
1,4-Hexadiene?	0.50	594	0.01			
Isovaleral	0.59	640	0.01	0.73	883	0.01
2-Methylbutyral	0.62	651	0.01	0.72	877	tr
2-Methylbutanol	0.96	735	0.01	3.35	1172	0.02
α-Thujene	2.98	924	0.01	1.39	999	0.01
α-Pinene	3.05	929	0.16	1.33	989	0.16
Camphene	3.24	941	0.01			
Sabinene	3.66	968	0.03	2.23	1081	0.03
β-Pinene	3.66	969	0.03	2.04	1063	0.04
6-Methyl-5-hepten-2-one	3.90	985	0.12	4.98	1292	0.12
Myrcene	3.98	990	0.13	2.82	1131	0.13
α-Phellandrene	4.12*	999	0.13	2.72	1123	0.11
Octanal	4.12*	999	[0.13]	4.36	1247	0.01
Δ3-Carene	4.21	1005	0.11	2.53	1108	0.12
α-Terpinene	4.32	1012	0.04	2.90	1137	0.04
para-Cymene	4.44	1019	0.04	4.03	1223	0.05
Limonene	4.52*	1024	4.31	3.13	1155	4.09
1,8-Cineole	4.52*	1024	[4.31]	3.23†	1162	[0.32]
β-Phellandrene	4.52*	1024	[4.31]	3.22†	1162	0.32
(Z)-β-Ocimene	4.73	1038	0.02	3.72	1201	0.01
(E)-β-Ocimene	4.88	1048	0.03	3.92	1215	0.03
2,6-Dimethyl-5-heptenal (melonal)	4.94	1051	0.06	5.20	1308	0.05
γ-Terpinene	5.00	1055	0.06	3.74	1202	0.06
Octanol	5.30	1074	0.02	8.17	1527	0.02
Terpinolene	5.46	1084	0.10	4.22	1236	0.10
Linalool	5.70	1100	0.95	8.06*	1518	1.25
Unknown [m/z 111, 69 (70), 41 (68), 55 (53), 43 (51)... 154 (7)]	5.85*	1109	0.03	5.69	1343	0.01
cis-Rose oxide	5.85*	1109	[0.03]	5.22	1309	0.02
trans-Rose oxide	6.09	1125	0.01	5.39	1322	0.01
Isopulegol	6.33*	1141	1.20	8.06*	1518	[1.25]
neo-Isopulegol	6.33*	1141	[1.20]	8.24	1532	0.10
Citronellal	6.58	1157	33.89	6.99	1438	33.44
Borneol	6.64	1161	0.01	9.80*	1655	0.15
neoiso-Isopulegol	6.70	1165	0.08	8.81	1576	0.07
Isopulegol isomer	6.81	1172	0.02	8.54	1555	0.02
Terpinen-4-ol	6.84	1174	0.04	8.59	1559	0.03
α-Terpineol	7.05	1188	0.07	9.80*	1655	[0.15]

(4Z)-Decenal	7.16	1196	0.06			
Decanal	7.34	1207	0.09	7.24	1456	0.09
Nerol	7.68	1231	0.17	10.97	1752	0.23
Citronellol	7.76	1236	10.42	10.67	1726	10.60
Neral	7.83	1241	0.34	9.53*	1633	0.27
Geraniol	8.17	1263	20.66	11.58	1803	21.36
Geranial	8.30	1272	0.49	10.02	1672	0.48
Citronellyl formate	8.40	1279	0.04	8.91	1584	0.04
Geranyl formate	8.79	1304	0.02	9.91	1663	0.03
8-Hydroxy-neomenthol	9.14*†	1328	0.36	14.15	2038	0.31
Citronellic acid	9.14*†	1328	[0.36]	16.00	2221	0.03
Methyl geranate	9.14*†	1328	[0.36]	9.75	1650	0.10
Eugenol	9.55*	1357	2.36	14.79	2099	0.31
Citronellyl acetate	9.55*	1357	[2.36]	9.39	1621	2.66
Neryl acetate	9.65	1365	0.02	10.18	1685	0.01
α-Copaene	9.77	1373	0.04	7.12	1448	0.04
β-Bourbonene	9.88	1381	0.10	7.43	1470	0.10
Geranyl acetate	9.97	1387	3.07	10.49	1711	3.11
β-Elemene	10.02	1391	2.00	8.38	1543	2.06
Dodecanal	10.25	1406	0.04	9.98*	1669	0.56
β-Caryophyllene	10.35	1414	0.20	8.35*	1540	0.12
β-Copaene	10.49	1424	0.16	8.35*	1540	[0.12]
trans-α-Bergamotene	10.63	1434	0.02	8.45	1548	0.03
α-Humulene	10.80*	1447	0.13	9.22	1607	0.16
(E)-Isoeugenol	10.80*	1447	[0.13]			
trans-Cadina-1(6),4-diene	11.11	1470	0.09	9.27	1612	0.07
γ-Murolene	11.16	1474	0.22	9.53*	1633	[0.27]
Germacrene D	11.19	1476	2.49	9.72	1648	2.54
β-Selinene	11.24	1480	0.07	9.88	1661	0.08
α-Selinene	11.38*	1490	0.20	9.98*	1669	[0.56]
epi-Cubebol	11.38*	1490	[0.20]	11.92	1833	0.06
α-Murolene	11.48	1497	0.59	9.98*	1669	[0.56]
Germacrene A	11.49	1498	0.67	10.31	1696	0.78
γ-Cadinene	11.63*	1508	0.59	10.33	1698	0.49
Cubebol	11.63*	1508	[0.59]	12.48	1883	0.04
trans-Calamenene	11.77*	1520	2.14	11.16	1768	0.01
δ-Cadinene	11.77*	1520	[2.14]	10.37	1700	2.13
Unknown [m/z 119, 105 (53), 161 (33), 93 (28), 91 (25), 40 (20)...204]	11.87	1527	0.06	10.60	1720	0.06
α-Cadinene	11.94	1532	0.14	10.73	1731	0.20

α-Elemol	12.10	1545	2.89	13.97	2020	2.76
Geranyl butyrate	12.33	1563	0.01			
Germacrene D-4-ol	12.40	1569	0.47	13.59	1984	0.49
Caryophyllene oxide	12.49	1576	0.02			
10-epi-Cubanol	12.89	1607	0.04	13.70	1994	0.05
τ-Cadinol	13.23*	1635	0.63	14.98	2118	0.38
τ-Muurolol	13.23*	1635	[0.63]	15.12	2132	0.15
α-Muurolol	13.29†	1640	0.77	15.25	2145	0.29
β-Eudesmol	13.34†	1644	[0.77]	15.40*	2161	0.71
α-Eudesmol	13.38*	1647	0.66	15.40*	2161	[0.71]
α-Cadinol	13.38*	1647	[0.66]	15.54	2174	0.06
(2E,6Z)-Farnesol	14.14	1710	0.02			
(2E,6E)-Farnesol	14.24	1719	0.10	16.78*	2303	0.12
(2E,6E)-Farnesol	14.45	1737	0.03	15.83	2203	0.03
Cryptomeridiol	15.15	1798	0.03			
Unknown [m/z 81, 137 (70), 95 (46), 69 (45), 41 (39), 55 (29)...]	17.29	1997	0.02	16.21	2243	0.01
Unknown [m/z 41, 69 (98), 55 (55), 81 (46), 109 (46)... 290 (8)]	17.38	2006	0.14	16.93	2319	0.17
Unknown [m/z 69, 41 (96), 55 (53), 109 (48), 95 (43), 67 (35)...]	17.57	2024	0.03			
Citronellyl citronellate	17.62	2030	0.02	16.78*	2303	[0.12]
Total identified		95.44%			94.79%	
Total reported		95.70%			95.05%	

*: 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

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