

**Date :** January 11, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 19L18-PTH11

**Customer identification :** Citronella - Indonesia - CE010593R

**Type :** Essential oil

**Source :** *Cymbopogon winterianus*

**Customer :** Plant Therapy

*ANALYSIS*

**Method:** PC-MAT-007 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID (in French); identifications validated by GC-MS.

**Analyst :** Sarah-Eve Tremblay, M. Sc. A., Chimiste

**Analysis date :** December 18, 2019

Checked and approved by :

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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*Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia.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 December 19, 2019 to indicatively present comparison to a standard.*

### PHYSICOCHEMICAL DATA

**Physical aspect:** Faintly yellow liquid

**Refractive index:** 1.4701 ± 0.0003 (20 °C)

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

Compound	Min. %	Max. %	Observed %	Complies?
Eugenol	0.5	1.0	0.5	Yes
α-Elemol	1.3	4.8	1.7	Yes
Geraniol	20.0	25.0	23.4	Yes
Citronellol	8.5	14.0	8.9	Yes
δ-Cadinene	1.5	2.5	1.3	No
Geranyl acetate	2.5	5.5	4.0	Yes
Geranial	0.3	1.0	0.8	Yes
Germacrene D	1.5	3.0	1.6	Yes
Citronellyl acetate	2.0	4.0	2.4	Yes
β-Elemene	0.7	2.5	1.0	Yes
Isopulegol	0.5	1.7	1.3	Yes
Linalool	0.5	1.5	0.8	Yes
Citronellal	31.0	40.0	35.4	Yes
Limonene	2.0	5.0	2.5	Yes
<b>Refractive index</b>	1.4663	1.4770	1.4701	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
3-Methylcyclopentane	tr	Alkane
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Tricyclene	0.02	Monoterpene
$\alpha$ -Thujene	tr	Monoterpene
$\alpha$ -Pinene	0.08	Monoterpene
Camphene	0.06	Monoterpene
$\alpha$ -Fenchene	tr	Monoterpene
Sabinene	0.01	Monoterpene
$\beta$ -Pinene	tr	Monoterpene
6-Methyl-5-hepten-2-one	0.06	Aliphatic ketone
Myrcene	0.06	Monoterpene
$\alpha$ -Phellandrene	0.01	Monoterpene
Octanal	0.01	Aliphatic aldehyde
$\alpha$ -Terpinene	tr	Monoterpene
para-Cymene	0.01	Monoterpene
Limonene	2.51	Monoterpene
1,8-Cineole	0.02*	Monoterpenic ether
$\beta$ -Phellandrene	[0.02]*	Monoterpene
Unknown	0.04	Unknown
(Z)- $\beta$ -Ocimene	0.50	Monoterpene
(E)- $\beta$ -Ocimene	0.26	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.12	Aliphatic aldehyde
$\gamma$ -Terpinene	0.01	Monoterpene
cis-Sabinene hydrate	tr	Monoterpenic alcohol
Octanol	0.02	Aliphatic alcohol
Terpinolene	0.06	Monoterpene
trans-Sabinene hydrate	0.02	Monoterpenic alcohol
Linalool	0.76	Monoterpenic alcohol
Nonanal	0.02	Aliphatic aldehyde
Unknown	0.01	Oxygenated monoterpene
cis-Rose oxide	0.01	Monoterpenic ether
trans-Rose oxide	0.01	Monoterpenic ether
Melonol ?	0.01	Normonoterpene
Unknown	tr	Oxygenated normonoterpene
neo-Isopulegol	1.29*	Monoterpenic alcohol
Isopulegol	[1.29]*	Monoterpenic alcohol
Menthone	0.03	Monoterpenic ketone
Citronellal	35.36	Monoterpenic aldehyde
iso-Isopulegol	0.47	Monoterpenic alcohol
Isomenthone	0.05	Monoterpenic ketone
Borneol	0.02	Monoterpenic alcohol
neoiso-Isopulegol	0.07	Monoterpenic alcohol
Terpinen-4-ol	0.03	Monoterpenic alcohol
$\alpha$ -Terpineol	0.06	Monoterpenic alcohol

(4Z)-Decenal	0.01	Aliphatic aldehyde
Decanal	0.12	Aliphatic aldehyde
Nerol	0.18	Monoterpenic alcohol
Citronellol	8.92	Monoterpenic alcohol
Neral	0.57	Monoterpenic aldehyde
Geraniol	23.37	Monoterpenic alcohol
Geranial	0.79	Monoterpenic aldehyde
Citronellyl formate	0.06	Monoterpenic ester
Geranyl formate	0.03	Monoterpenic ester
Unknown	0.03	Norsesquiterpene
Citronellic acid	0.18	Monoterpenic acid
8-Hydroxy-neo-menthol	0.16	Monoterpenic alcohol
Eugenol	0.51	Phenylpropanoid
Citronellyl acetate	2.44	Monoterpenic ester
Neryl acetate	0.06	Monoterpenic ester
$\alpha$ -Copaene	0.03	Sesquiterpene
$\beta$ -Bourbonene	0.09	Sesquiterpene
<i>cis</i> - $\beta$ -Elemene	0.04	Sesquiterpene
Geranyl acetate	3.98	Monoterpenic ester
$\beta$ -Cubebene	0.03	Sesquiterpene
$\beta$ -Elemene	0.95	Sesquiterpene
Methyleugenol	0.08	Phenylpropanoid
Dodecanal	0.03	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.76	Sesquiterpene
$\beta$ -Copaene	0.04	Sesquiterpene
Aromadendrene	0.05	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.03	Sesquiterpene
$\alpha$ -Humulene	0.08	Sesquiterpene
( <i>E</i> )-Isoeugenol	0.04	Phenylpropanoid
<i>trans</i> -Cadina-1(6),4-diene	0.07	Sesquiterpene
$\gamma$ -Murolene	0.10	Sesquiterpene
Germacrene D	1.63	Sesquiterpene
$\beta$ -Selinene	0.03	Sesquiterpene
epi-Cubebol	0.14	Sesquiterpenic alcohol
$\alpha$ -Selinene	0.06	Sesquiterpene
$\alpha$ -Murolene	0.28	Sesquiterpene
Germacrene A	0.60	Sesquiterpene
Methyl ( <i>E</i> )-isoeugenol	0.52	Phenylpropanoid
Cubebol	0.23	Sesquiterpenic alcohol
$\gamma$ -Cadinene	0.49	Sesquiterpene
<i>trans</i> -Calamenene	0.02	Sesquiterpene
$\delta$ -Cadinene	1.29	Sesquiterpene
Unknown	0.04	Sesquiterpene
Unknown	0.10	Unknown
$\alpha$ -Cadinene	0.09	Sesquiterpene
$\alpha$ -Elemol	1.71	Sesquiterpenic alcohol
Geranyl butyrate	0.37	Monoterpenic ester
Germacrene D-4-ol	0.84	Sesquiterpenic alcohol
Caryophyllene oxide	0.05	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
10-epi-Cubebol	0.08	Sesquiterpenic alcohol
$\gamma$ -Eudesmol	0.17	Sesquiterpenic alcohol

τ-Cadinol	0.15	Sesquiterpenic alcohol
τ-Muurolol	0.23	Sesquiterpenic alcohol
Cubenol	0.08	Sesquiterpenic alcohol
β-Eudesmol	0.20	Sesquiterpenic alcohol
α-Muurolol	0.08	Sesquiterpenic alcohol
α-Eudesmol	0.16	Sesquiterpenic alcohol
α-Cadinol	0.48	Sesquiterpenic alcohol
7-epi-γ-Eudesmol	0.83	Sesquiterpenic alcohol
(2E,6Z)-Farnesal	0.03	Sesquiterpenic aldehyde
(2E,6E)-Farnesol	0.07	Sesquiterpenic alcohol
(2E,6E)-Farnesal	0.02	Sesquiterpenic aldehyde
Cryptomeridiol	tr	Sesquiterpenic alcohol
Unknown	tr	Oxygenated diterpene
Unknown	0.06	Oxygenated diterpene
Unknown	0.01	Unknown
Citronellyl citronellate	tr	Monoterpenic ester
Unknown	0.01	Unknown
<b>Consolidated total</b>	<b>97.15%</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

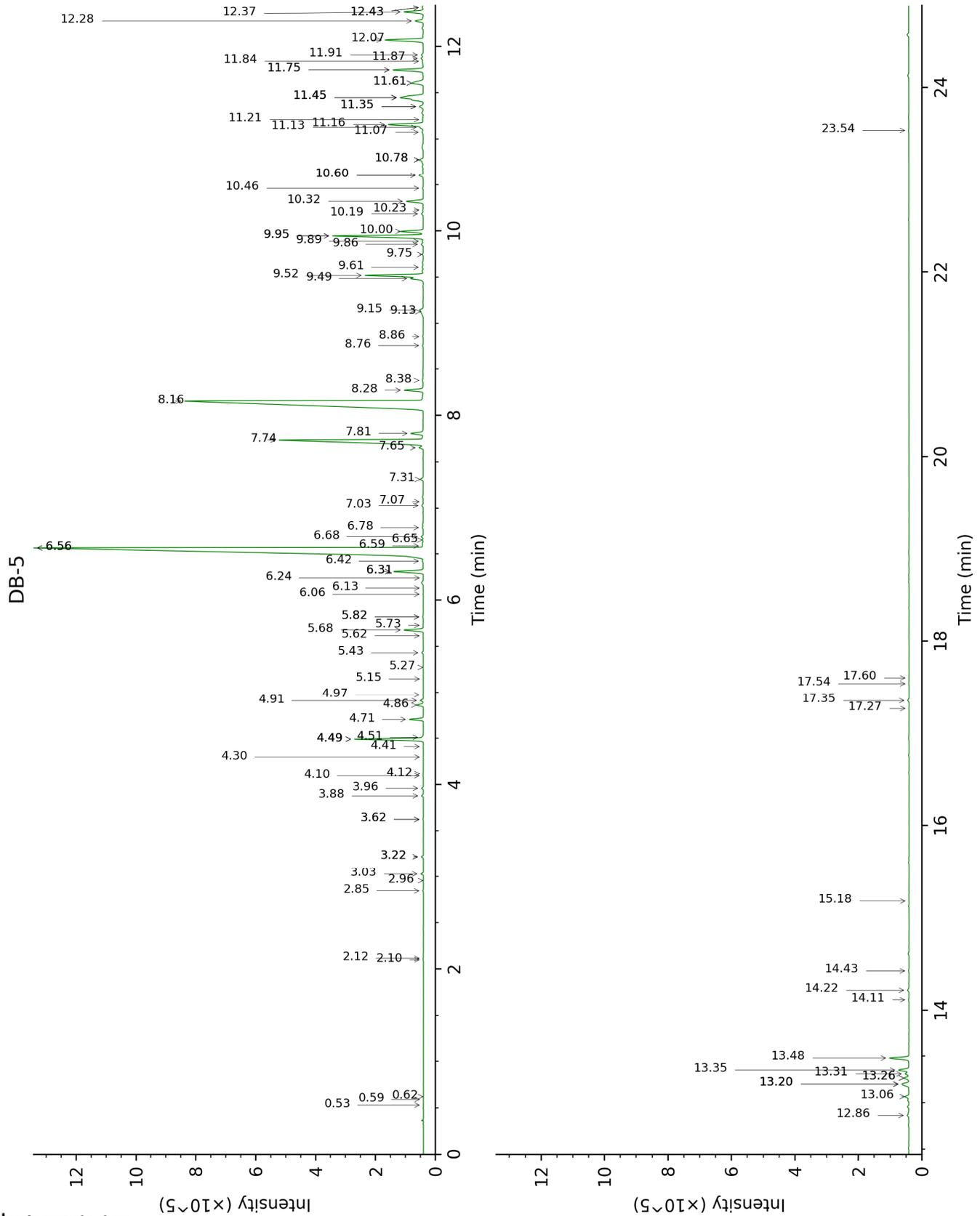
tr: The compound has been detected below 0.005% of total signal.

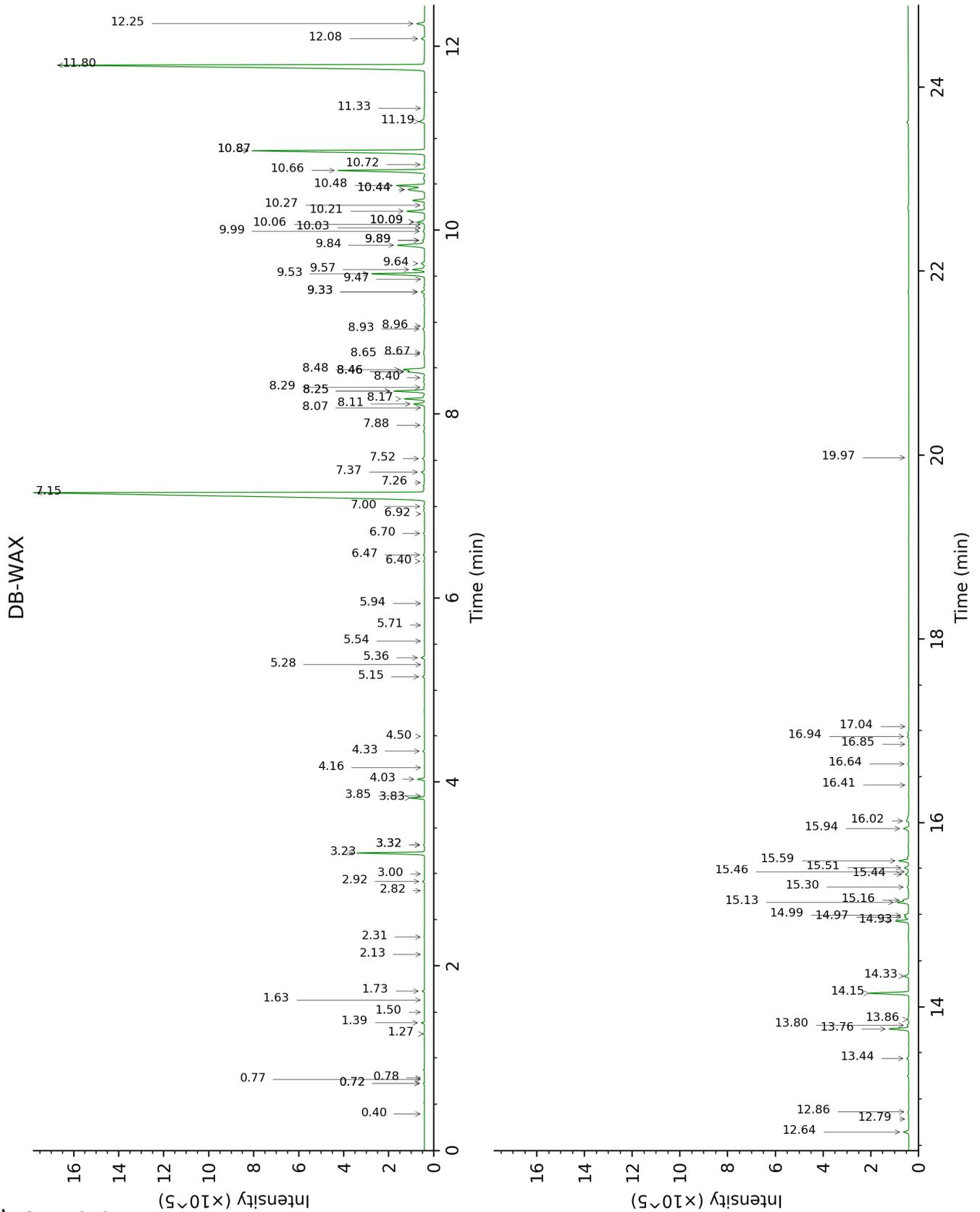
Note: no correction factor was applied

**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	%
3-Methylcyclopentane	0.53	616	tr	0.40	643	tr
Isovaleral	0.59	640	tr	0.78	887	tr
2-Methylbutyral	0.62	652	tr	0.77	881	tr
Unknown [m/z 55, 83 (89), 82 (70), 67 (66), 41 (55), 69 (46), 111 (37)... 126 (2)]	2.10	858	0.01	0.72*	865	0.02
Unknown [m/z 55, 83 (79), 67 (65), 41 (63), 82 (60), 69 (58)... 111 (27), 126 (9)]	2.12	860	0.01	0.72*	865	[0.02]
Tricyclene	2.85	916	0.02	1.27	970	0.02
$\alpha$ -Thujene	2.96	924	tr	1.50	1002	tr
$\alpha$ -Pinene	3.03	928	0.08	1.39	989	0.08
Camphene	3.22*	941	0.07	1.73	1025	0.06
$\alpha$ -Fenchene	3.22*	941	[0.07]	1.63	1015	tr
Sabinene	3.62*	968	0.02	2.31	1083	0.01
$\beta$ -Pinene	3.62*	968	[0.02]	2.13	1064	tr
6-Methyl-5-hepten-2-one	3.88	985	0.06	5.15	1297	0.08
Myrcene	3.96	990	0.06	2.92	1132	0.07
$\alpha$ -Phellandrene	4.10	1000	0.01	2.82	1124	0.01
Octanal	4.12	1001	0.01	4.50	1251	0.01
$\alpha$ -Terpinene	4.30	1012	tr	3.00	1139	0.01
para-Cymene	4.41	1020	0.01	4.16	1227	0.01
Limonene	4.49*	1025	2.53	3.23	1157	2.51
1,8-Cineole	4.49*	1025	[2.53]	3.32*	1164	0.04
$\beta$ -Phellandrene	4.49*	1025	[2.53]	3.32*	1164	[0.04]
Unknown [m/z 59, 43 (12), 109 (11), 41 (10), 127 (8)...]	4.51	1026	0.04	6.40	1387	0.04
(Z)- $\beta$ -Ocimene	4.70	1038	0.50	3.83	1203	0.52
(E)- $\beta$ -Ocimene	4.86	1048	0.26	4.03	1218	0.25
2,6-Dimethyl-5-heptenal (melonal)	4.91	1051	0.12	5.36	1312	0.14
$\gamma$ -Terpinene	4.98	1055	0.01	3.85	1205	0.01
cis-Sabinene hydrate	5.15	1066	tr	6.92	1425	tr
Octanol	5.27	1074	0.02	8.29	1528	0.03
Terpinolene	5.43	1085	0.06	4.34	1240	0.06
trans-Sabinene hydrate	5.62	1096	0.02	8.07	1511	tr
Linalool	5.68	1100	0.76	8.17	1519	0.78
Nonanal	5.73	1104	0.02	5.94	1354	0.01
Unknown [m/z 111, 69 (70), 41 (68), 55]	5.82*	1110	0.03	5.71	1337	0.01

(53), 43 (51)... 154 (7)]						
<i>cis</i> -Rose oxide	5.82*	1110	[0.03]	5.28	1307	0.01
<i>trans</i> -Rose oxide	6.06	1126	0.01	5.54	1325	0.01
Melonol ?	6.13	1130	0.01			
Unknown [m/z 41, 69 (87), 82 (66), 67 (55), 109 (46)... 142 (18)]	6.24	1138	tr	9.47	1620	0.01
neo-Isopulegol	6.31*	1142	1.29	8.25*	1525	1.31
Isopulegol	6.31*	1142	[1.29]	8.25*	1525	[1.31]
Menthone	6.42	1150	0.03	6.70	1409	0.05
Citronellal	6.56*	1159	36.17	7.15	1442	35.36
iso-Isopulegol	6.56*	1159	[36.17]	8.11	1514	0.47
Isomenthone	6.59	1160	0.05	7.00	1431	0.05
Borneol	6.65	1165	0.02	9.89*	1654	0.08
neoiso-Isopulegol	6.68	1167	0.07	8.93	1578	0.08
Terpinen-4-ol	6.78	1174	0.03	8.65	1556	0.03
$\alpha$ -Terpineol	7.03	1190	0.06	9.89*	1654	[0.08]
(4Z)-Decenal	7.07	1193	0.01			
Decanal	7.31	1209	0.12	7.37	1459	0.13
Nerol	7.65	1233	0.18	11.18	1761	0.33
Citronellol	7.74	1235	8.92	10.87*	1735	9.05
Neral	7.81	1240	0.57	9.58	1629	0.55
Geraniol	8.16	1263	23.37	11.80	1814	23.67
Geranial	8.28	1271	0.79	10.21	1680	0.77
Citronellyl formate	8.38	1278	0.06	8.96	1580	0.02
Geranyl formate	8.76	1303	0.03	9.99	1662	0.07
Unknown [m/z 135, 121 (81), 177 (78), 107 (60), 192 (42), 149 (35)]	8.86	1310	0.03	6.47	1392	0.05
Citronellic acid	9.13	1329	0.18	16.02	2212	0.20
8-Hydroxy-neo-menthol	9.15	1330	0.16	14.33	2045	0.21
Eugenol	9.49	1354	0.51	14.93	2103	0.58
Citronellyl acetate	9.52	1356	2.44	9.53	1625	2.44
Neryl acetate	9.61	1362	0.06	10.27	1685	0.04
$\alpha$ -Copaene	9.75	1372	0.03	7.26	1450	0.02
$\beta$ -Bourbonene	9.86	1380	0.09	7.52	1470	0.09
<i>cis</i> - $\beta$ -Elemene	9.89	1382	0.04	8.40	1536	0.04
Geranyl acetate	9.95*	1386	4.02	10.66	1717	3.98
$\beta$ -Cubebene	9.95*	1386	[4.02]	7.88	1497	0.03
$\beta$ -Elemene	10.00	1390	0.95	8.48†	1543	[1.78]
Methyleugenol	10.19	1403	0.08	13.44	1961	0.10
Dodecanal	10.23	1406	0.03	10.06	1668	0.01
$\beta$ -Caryophyllene	10.32	1413	0.76	8.46*†	1541	1.78
$\beta$ -Copaene	10.46	1423	0.04	8.46*†	1541	[1.78]
Aromadendrene	10.60*	1434	0.20	8.67	1557	0.05
<i>trans</i> - $\alpha$ -Bergamotene	10.60*	1434	[0.20]	8.46*†	1541	[1.78]
$\alpha$ -Humulene	10.78*	1447	0.18	9.33*	1609	0.15

(E)-Isoeugenol	10.78*	1447	[0.18]	16.64	2275	0.04
<i>trans</i> -Cadina-1(6),4-diene	11.07	1469	0.07	9.33*	1609	[0.15]
γ-Murolene	11.13	1473	0.10	9.64	1634	0.16
Germacrene D	11.16	1475	1.63	9.84	1650	1.63
β-Selinene	11.21	1479	0.03	10.03	1665	0.01
epi-Cubebol	11.35*	1489	0.20	12.08	1839	0.14
α-Selinene	11.35*	1489	[0.20]	10.09*	1670	0.34
α-Murolene	11.45*	1496	1.92	10.09*	1670	[0.34]
Germacrene A	11.45*	1496	[1.92]	10.44*	1699	1.09
Methyl (E)-isoeugenol	11.45*	1496	[1.92]	15.13	2123	0.52
Cubebol	11.60*	1508	0.71	12.64	1888	0.23
γ-Cadinene	11.60*	1508	[0.71]	10.44*	1699	[1.09]
<i>trans</i> -Calamenene	11.75*	1519	1.32	11.33	1774	0.02
δ-Cadinene	11.75*	1519	[1.32]	10.48	1703	1.29
Unknown [m/z 119, 105 (53), 161 (33), 93 (28), 91 (25), 40 (20)...204]	11.84	1527	0.04	10.72	1722	0.03
Unknown [m/z 93, 107 (82), 108 (53), 119 (45), 43 (44), 135 (40)...222]	11.87	1529	0.10			
α-Cadinene	11.91	1532	0.09	10.87*	1735	[9.05]
α-Elemol	12.07	1545	1.71	14.15	2027	1.68
Geranyl butyrate	12.28	1561	0.37	12.25	1853	0.38
Germacrene D-4-ol	12.37	1568	0.84	13.76	1991	0.88
Caryophyllene oxide	12.43*	1573	0.05	12.86	1908	0.05
Caryophyllene oxide isomer	12.43*	1573	[0.05]	12.78	1901	0.01
10-epi-Cubebol	12.86	1607	0.08	13.80	1994	0.07
γ-Eudesmol	13.06	1624	0.17	15.00	2109	0.19
τ-Cadinol	13.20*	1635	0.42	14.97	2107	0.15
τ-Murolol	13.20*	1635	[0.42]	15.16	2125	0.23
Cubebol	13.20*	1635	[0.42]	13.86	2000	0.08
β-Eudesmol	13.26*	1640	0.23	15.51	2160	0.20
α-Murolol	13.26*	1640	[0.23]	15.30	2139	0.08
α-Eudesmol	13.31	1644	0.16	15.44	2153	0.15
α-Cadinol	13.35	1647	0.48	15.59	2168	0.44
7-epi-γ-Eudesmol	13.48	1658	0.83			
(2E,6Z)-Farnesal	14.11	1710	0.03	15.46	2155	0.01
(2E,6E)-Farnesol	14.22	1720	0.07	16.94	2306	0.07
(2E,6E)-Farnesal	14.43	1738	0.02	15.94	2203	0.26
Cryptomeridiol	15.18	1803	tr	19.97	2646	0.01
Unknown [m/z 81, 137 (70), 95 (46), 69 (45), 41 (39), 55 (29)...]	17.27	1998	tr	16.41	2251	0.01
Unknown [m/z 41, 69 (98), 55 (55), 81	17.35	2007	0.06	17.04	2318	tr

(46), 109 (46)... 290 (8)]						
Unknown [m/z 69, 41 (96), 55 (53), 109 (48), 95 (43), 67 (35)...]	17.54	2025	0.01			
Citronellyl citronellate	17.60	2032	tr	16.85	2297	0.02
Unknown [m/z 69, 81 (79), 81 (70), 137 (53), 139 (35), 95 (30)...]	23.54	2707	0.01			
<b>Total identified</b>		<b>97.84%</b>			<b>96.96%</b>	
<b>Total reported</b>		<b>98.15%</b>			<b>97.12%</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

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