

**Date :** February 18, 2020

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 20B14-PSC02

**Customer identification :** Lemongrass - Zambia - 02102020

**Type :** Essential oil

**Source :** *Cymbopogon flexuosus*

**Customer :** Pacha Soap Co.

*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 :** Benoit Roger, Ph. D.

**Analysis date :** February 17, 2020

Checked and approved by :

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

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#### PHYSICOCHEMICAL DATA

**Physical aspect:** Light yellow liquid  
**Refractive index:**  $1.4853 \pm 0.0003$  (20 °C)  
**Optical rotation:**  $-0.22^\circ$

#### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. However, there likely is a labelling issue. Indeed, the composition of this sample does not match with that of *C. flexuosus*, but *C. citratus*, as indicated by the high myrcene content that is characteristic of the latter species (also called lemongrass).

## ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Classe
Ethanol	0.08	Aliphatic alcohol
2-Methyl-3-buten-2-ol	0.03	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Hexanal	tr	Aliphatic aldehyde
Hashishene	0.05	Monoterpene
Tricyclene	0.01	Monoterpene
$\alpha$ -Pinene	0.07	Monoterpene
Camphene	0.03	Monoterpene
$\beta$ -Pinene	0.02	Monoterpene
Sabinene	0.01	Monoterpene
6-Methyl-5-hepten-2-one	2.69	Aliphatic ketone
Dehydro-1,8-cineole	0.07	Monoterpenic ether
Myrcene	16.30	Monoterpene
6-Methyl-5-hepten-2-ol	0.06	Aliphatic alcohol
Octan-3-ol	0.01	Aliphatic alcohol
$\Delta^3$ -Carene	0.01	Monoterpene
para-Cymene	0.12	Monoterpene
Limonene	0.06	Monoterpene
1,8-Cineole	0.06	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.51	Monoterpene
(E)- $\beta$ -Ocimene	0.36	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.05	Aliphatic aldehyde
$\gamma$ -Terpinene	0.04	Monoterpene
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
$\alpha$ -Pinene oxide analog	0.02	Monoterpenic ether
trans-Linalool oxide (fur.)	0.03	Monoterpenic alcohol
6,7-Epoxyterpinene	0.14	Monoterpenic ether
Rosefuran	0.27	Monoterpenic ether
Linalool	1.26	Monoterpenic alcohol
Unknown	0.26	Oxygenated monoterpene
cis-Chrysanthamal?	0.13	Monoterpenic aldehyde
Unknown	0.04	Oxygenated monoterpene
trans-para-Mentha-2,8-dien-1-ol	0.04	Monoterpenic alcohol
Unknown	tr	Unknown
cis-para-Mentha-2,8-dien-1-ol	0.26	Monoterpenic alcohol
trans-Chrysanthamal	0.37	Monoterpenic aldehyde
exo-Isocitral	0.09	Monoterpenic aldehyde
Citronellal	0.36	Monoterpenic aldehyde
Borneol	0.07	Monoterpenic alcohol
Isoneral	0.84	Monoterpenic aldehyde
$\alpha$ -Phellandren-8-ol	0.06	Monoterpenic alcohol
Rosefuran oxide	0.16*	Monoterpenic ether
Unknown	0.21	Oxygenated monoterpene
Terpinen-4-ol	[0.16]*	Monoterpenic alcohol
Isogeranial	1.37	Monoterpenic aldehyde
Unknown	0.04	Unknown

α-Terpineol	0.07	Monoterpenic alcohol
Unknown	0.12	Unknown
<i>trans</i> -Isopiperitenol	0.04	Monoterpenic alcohol
Unknown	0.07	Oxygenated monoterpene
Decanal	0.02	Aliphatic aldehyde
2,3-Epoxyneral?	0.04	Monoterpenic aldehyde
Nerol	0.18	Monoterpenic alcohol
Citronellol	0.30	Monoterpenic alcohol
Neral	29.35	Monoterpenic aldehyde
Piperitone	0.05	Monoterpenic ketone
Unknown	0.03	Unknown
Geraniol	2.06	Monoterpenic alcohol
Geranial	36.61	Monoterpenic aldehyde
Unknown	0.06	Oxygenated monoterpene
2-Undecanone	0.42	Aliphatic ketone
Geranyl formate	0.07	Monoterpenic ester
Methyl nerate?	0.01	Monoterpenic ester
Methyl geranate	0.01	Monoterpenic ester
Unknown	0.04	Unknown
Unknown	0.04	Unknown
Geranic acid	0.18	Aliphatic acid
Unknown	0.04	Unknown
Geranyl acetate	0.35	Monoterpenic ester
β-Elemene	0.03	Sesquiterpene
Unknown	0.01	Unknown
β-Caryophyllene	0.26	Sesquiterpene
<i>cis</i> -α-Bergamotene	0.04	Sesquiterpene
β-Copaene	0.01	Sesquiterpene
α-Guaiene	0.21*	Sesquiterpene
<i>trans</i> -α-Bergamotene	[0.21]*	Sesquiterpene
<i>cis</i> -β-Bergamotene?	0.03	Sesquiterpene
α-Humulene	0.07	Sesquiterpene
Selina-4,11-diene	0.01	Sesquiterpene
Germacrene D	0.04	Sesquiterpene
δ-Selinene	0.04	Sesquiterpene
(3 <i>Z</i> ,6 <i>E</i> )-α-Farnesene	0.24	Sesquiterpene
γ-Cadinene	0.10	Sesquiterpene
Cubebol	0.01	Sesquiterpenic alcohol
δ-Cadinene	0.05	Sesquiterpene
Neryl butyrate	0.02	Monoterpenic ester
( <i>E</i> )-Nerolidol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	tr	Sesquiterpenic ether
Caryophyllene oxide isomer	0.03	Sesquiterpenic ether
Selin-6-en-4α-ol isomer	0.07	Sesquiterpenic alcohol
Unknown	0.02	Oxygenated sesquiterpene
α-Cadinol	0.01	Sesquiterpenic alcohol
Juniper camphor	0.01	Sesquiterpenic alcohol
Geranyl caprylate	0.23	Monoterpenic ester
meta-Camphorene	0.01	Diterpene
para-Camphorene	0.11	Diterpene
Unknown	0.01	Unknown
Unknown	0.03	Unknown

<b>Consolidated total</b>	<b>98.53%</b>	
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\*: 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

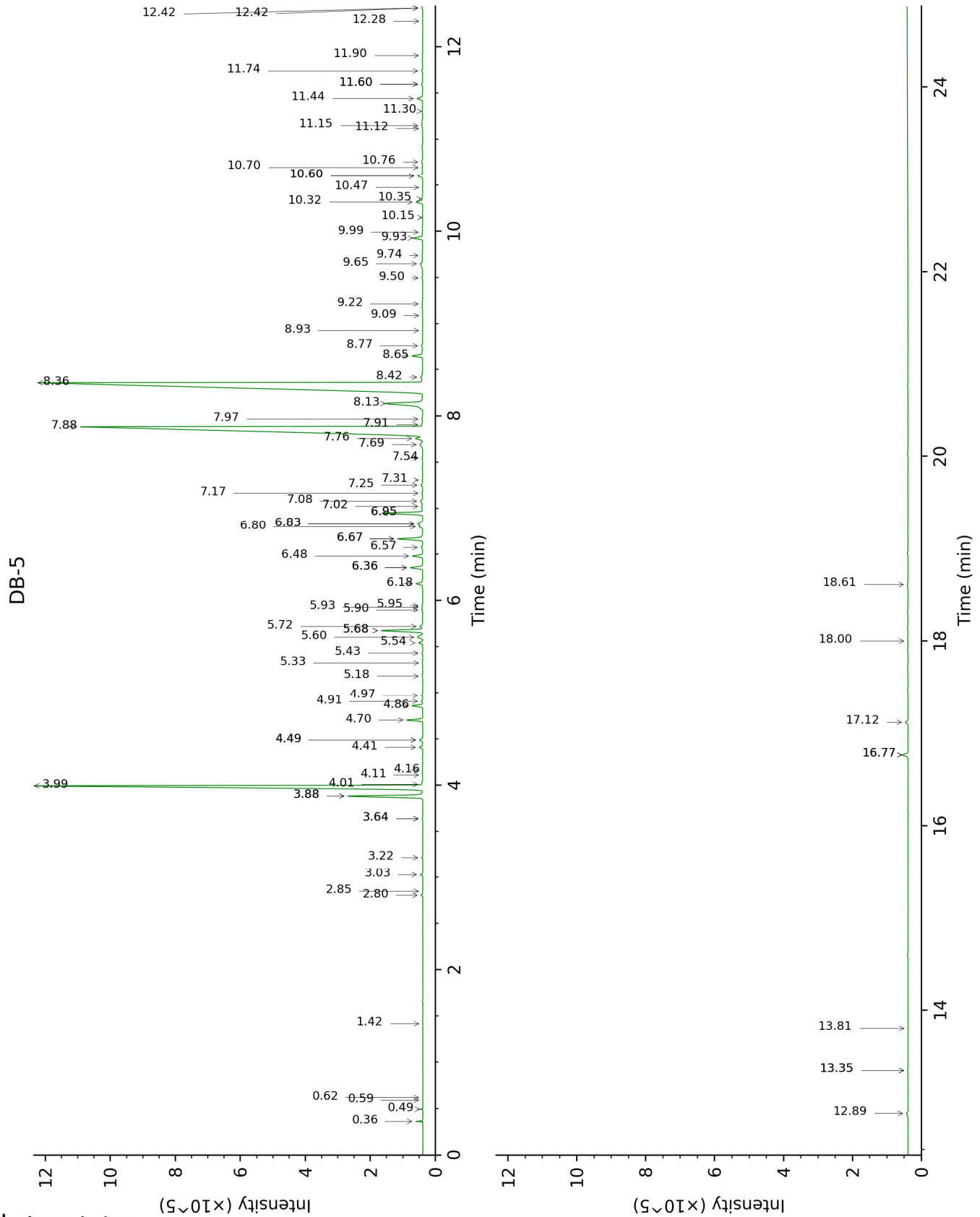
tr: The compound has been detected below 0.005% of total signal.

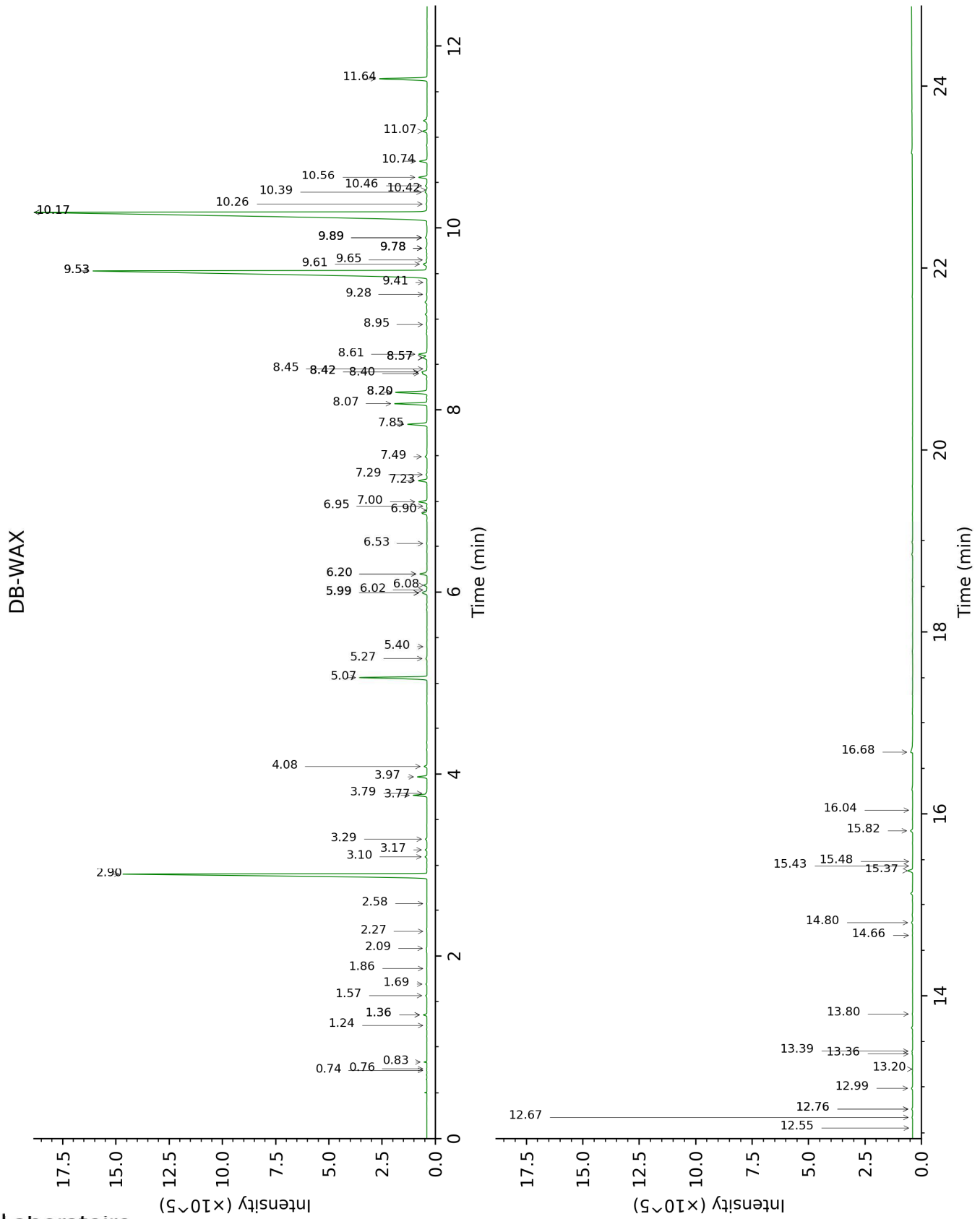
Note: no correction factor was applied

**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	0.36	518	0.08	0.84	903	0.05
2-Methyl-3-buten-2-ol	0.49	586	0.03	1.57	1013	0.04
Isovaleral	0.59	639	tr	0.76	884	tr
2-Methylbutyral	0.62	650	tr	0.74	877	tr
Hexanal	1.42	801	tr	1.86	1043	0.01
Hashishene	2.80	915	0.05	1.36*	989	0.11
Tricyclene	2.85	918	0.01	1.24	970	tr
$\alpha$ -Pinene	3.03	930	0.07	1.36*	989	[0.11]
Camphene	3.22	942	0.03	1.69	1026	0.03
$\beta$ -Pinene	3.64*	970	0.02	2.09	1064	0.02
Sabinene	3.64*	970	[0.02]	2.27	1083	0.01
6-Methyl-5-hepten-2-one	3.88*	986	2.74	5.06	1295	2.69
Dehydro-1,8-cineole	3.88*	986	[2.74]	3.10	1150	0.07
Myrcene	3.99	994	16.30	2.90	1135	16.33
6-Methyl-5-hepten-2-ol	4.01	995	0.06	6.95	1432	0.02
Octan-3-ol	4.11	1001	0.01	6.02	1364	0.01
$\Delta$ 3-Carene	4.16	1005	0.01	2.58	1110	0.01
para-Cymene	4.41	1020	0.12	4.08	1225	0.11
Limonene	4.49*	1025	0.13	3.17	1156	0.06
1,8-Cineole	4.49*	1025	[0.13]	3.29	1165	0.06
(Z)- $\beta$ -Ocimene	4.70	1039	0.51	3.77	1202	0.52
(E)- $\beta$ -Ocimene	4.86	1049	0.36	3.97	1216	0.36
2,6-Dimethyl-5-heptenal (melonal)	4.91	1052	0.05	5.27	1310	0.05
$\gamma$ -Terpinene	4.97	1056	0.04	3.79	1204	0.04
cis-Linalool oxide (fur.)	5.18	1069	0.02	6.53	1401	0.02
$\alpha$ -Pinene oxide analog	5.33	1078	0.02	5.40	1320	0.01
trans-Linalool oxide (fur.)	5.43	1085	0.03	6.90	1428	0.02
6,7-Epoxy-myrcene	5.54	1092	0.14	6.08	1368	0.13
Rosefuran	5.60	1096	0.27	5.99*	1362	0.27
Linalool	5.68*	1101	1.52	8.07	1516	1.26
Unknown [m/z 41, 81 (97), 69 (91), 55 (68), 123 (65), 83 (64), 109 (56)... 152 (3)]	5.68*	1101	[1.52]	5.99*	1362	[0.27]
cis-Chrysanthemal?	5.72	1104	0.13	5.99*	1362	[0.27]

Unknown [m/z 41, 67 (75), 69 (59), 79 (55), 81 (44), 71 (41)... 150 (5)]	5.90	1115	0.04	6.20*	1377	0.33
<i>trans</i> -para-Mentha-2,8-dien-1-ol	5.93†	1117	0.05	8.94	1583	0.04
Unknown [m/z 81, 79 (19), 41 (12), 92 (8), 77 (8)...]	5.95†	1118	[0.05]	6.20*	1377	[0.33]
<i>cis</i> -para-Mentha-2,8-dien-1-ol	6.18	1134	0.26	9.53*	1630	29.23
<i>trans</i> -Chrysanthemal	6.36*	1145	0.46	7.23	1452	0.37
exo-Isocitral	6.36*	1145	[0.46]	7.49	1472	0.09
Citronellal	6.48	1153	0.36	7.00	1435	0.35
Borneol	6.57	1159	0.07	9.78*	1650	0.08
Isoneral	6.67*	1165	0.94	7.85	1498	0.84
α-Phellandren-8-ol	6.67*	1165	[0.94]	10.26	1689	0.06
Rosefuran oxide	6.80†	1174	0.37	8.57*	1554	0.22
Unknown [m/z 84, 83 (74), 137 (56), 41 (47), 93 (43), 108 (40)... 152 (2)]	6.83*†	1176	[0.37]	9.61	1636	0.21
Terpinen-4-ol	6.83*†	1176	[0.37]	8.57*	1554	[0.22]
Isogeranial	6.95*	1184	1.41	8.20*	1525	1.41
Unknown [m/z 69, 41 (65), 109 (36), 67 (16), 84 (11), 43 (10), 55 (9)...]	6.95*	1184	[1.41]			
α-Terpineol	7.02	1189	0.07	9.90*	1659	0.10
Unknown [m/z 43, 81 (47), 67 (45), 69 944), 41 (42), 59 (40), 55 (39)...]	7.08	1192	0.12			
<i>trans</i> -Isopiperitenol	7.17	1198	0.04	10.42	1702	0.04
Unknown [m/z 84, 41 (83), 83 (79), 91 (76), 93 (67), 119 (64), 137 (63), 109 (54), 108 (54)... 152 (4)]	7.25	1204	0.07			
Decanal	7.31	1208	0.02	7.29	1457	0.04

2,3-Epoxyneral?	7.54	1224	0.04			
Nerol	7.69	1234	0.18	11.07	1757	0.19
Citronellol	7.76	1238	0.30	10.74	1729	0.33
Neral	7.88	1247	29.35	9.53*	1630	[29.23]
Piperitone	7.91	1249	0.05	9.90*	1659	[0.10]
Unknown [m/z 81, 43 (83), 139 (66), 59 (49), 97 (37), 41 (36)...]	7.97	1253	0.03			
Geraniol	8.13	1265	2.06	11.64	1806	2.10
Geranial	8.36†	1280	37.07	10.17*	1682	36.85
Unknown [m/z 43, 69 (77), 41 (70), 109 (54)... 152 (6)]	8.42†	1284	[37.07]	12.99	1926	0.06
2-Undecanone	8.65	1300	0.42	8.61	1558	0.38
Geranyl formate	8.76	1309	0.07	9.90*	1659	[0.10]
Methyl nerate?	8.93	1314	0.01			
Methyl geranate	9.09	1326	0.01	9.78*	1650	[0.08]
Unknown [m/z 82, 59 (44), 41 (43), 95 (31), 43 (29), 81 (24)...]	9.22	1335	0.04	12.76*	1905	0.04
Unknown [m/z 110, 95 (98), 109 (40), 43 (35), 111 (32)... 153 (13)...]	9.50	1355	0.04	13.36	1960	0.03
Geranic acid	9.65	1366	0.18	16.68	2287	0.18
Unknown [m/z 81, 59 (94), 41 (74), 85 (40), 43 (55)...]	9.74	1372	0.04	13.39	1963	0.03
Geranyl acetate	9.93	1385	0.35	10.56	1714	0.36
β-Elemene	9.99	1390	0.03	8.45	1545	0.01
Unknown [m/z 150, 91 (93), 107 (74), 135 (68), 79 (57), 77 (44)...]	10.15	1401	0.01	13.20	1945	0.01
β- Caryophyllene	10.32	1413	0.26	8.42*†	1542	[0.42]
cis-α- Bergamotene	10.35	1416	0.04	8.20*	1525	[1.41]
β-Copaene	10.47	1425	0.01	8.42*†	1542	[0.42]
α-Guaiene	10.60*	1434	0.21	8.42*†	1542	[0.42]
trans-α- Bergamotene	10.60*	1434	[0.21]	8.40†	1541	0.42
cis-β- Bergamotene?	10.70	1441	0.03			

α-Humulene	10.76	1446	0.07	9.28	1609	0.03
Selina-4,11-diene	11.12	1473	0.01	9.41	1620	0.01
Germacrene D	11.15	1475	0.04	9.78*	1650	[0.08]
δ-Selinene	11.30	1487	0.04	9.65	1640	0.05
(3Z,6E)-α-Farnesene	11.44	1497	0.24	10.17*	1682	[36.85]
γ-Cadinene	11.60*	1509	0.07	10.39	1700	0.10
Cubebol	11.60*	1509	[0.07]	12.56	1886	0.01
δ-Cadinene	11.74	1520	0.05	10.46	1706	0.08
Neryl butyrate	11.90	1533	0.02			
(E)-Nerolidol	12.28	1562	0.01	13.80	2001	0.02
Caryophyllene oxide	12.42*	1573	0.04	12.76*	1905	[0.04]
Caryophyllene oxide isomer	12.42*	1573	[0.04]	12.67	1896	0.03
Selin-6-en-4α-ol isomer	12.89	1610	0.07	14.80	2097	0.05
Unknown [m/z 161, 59 (67), 95 (45), 93 (40), 105 (40), 149 (39), 81 (39), 43 (38), 204 (37)... 220 (5)]	13.35*	1648	0.02	14.66	2084	0.02
α-Cadinol	13.35*	1648	[0.02]	15.48	2164	0.01
Juniper camphor	13.81	1686	0.01	16.04	2222	0.01
Geranyl caprylate	16.76*	1950	0.23	15.37	2154	0.23
meta-Camphorene	16.76*	1950	[0.23]	15.43	2160	0.01
para-Camphorene	17.12	1983	0.11	15.82	2198	0.11
Unknown [m/z 93, 69 (95), 135 (76), 107 (53), 41 (53), 109 (50)... 235 (10)...]	18.00	2070	0.01			
Unknown [m/z 69, 41 (38), 151 (36), 123 (34), 82 (24), 43 (23), 109 (21)...]	18.61	2131	0.03			
<b>Total identified</b>		<b>98.48%</b>			<b>97.15%</b>	
<b>Total reported</b>		<b>98.91%</b>			<b>97.50%</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

