

Date : January 23, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19A10-ORA05-1-CC

Customer identification : Citronella

Type : Essential oil

Source : *Cymbopogon winterianus*

Customer : Organic Aromas Inc.

ANALYSIS

Method: PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID (in French); identifications validated by GC-MS.

Analyst : Alexis St-Gelais, M. Sc., chimiste

Analysis date : January 22, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow liquid

Refractive index: 1.4700 ± 0.0003 (20 °C)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method.

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Ethanol	0.09	0.10	Aliphatic alcohol
3-Methylcyclopentene	0.02	0.02	Alkene
Methylcyclopentane	0.01	0.01	Alkane
Isovaleral	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	0.01	Aliphatic aldehyde
Valeral	tr	tr	Aliphatic aldehyde
2-Ethylfuran	0.01	0.01	Furan
Isoamyl alcohol	0.08	0.10*	Aliphatic alcohol
2-Methylbutanol	0.01	[0.10]*	Aliphatic alcohol
Unknown	0.01	0.03*	Unknown
Unknown	0.01	[0.03]*	Unknown
α -Thujene	0.03	0.03	Monoterpene
α -Pinene	0.39	0.39	Monoterpene
Camphene	0.05*	0.05	Monoterpene
α -Fenchene	[0.05]*	0.01	Monoterpene
Sabinene	0.19	0.17	Monoterpene
β -Pinene	0.10	0.11	Monoterpene
6-Methyl-5-hepten-2-one	0.09	0.09	Aliphatic ketone
Myrcene	0.07	0.07	Monoterpene
α -Phellandrene	0.03	0.03	Monoterpene
Octanal	0.02	0.01	Aliphatic aldehyde
α -Terpinene	0.01	0.02	Monoterpene
para-Cymene	0.04	0.04	Monoterpene
β -Phellandrene	3.88*	0.10*	Monoterpene
1,8-Cineole	[3.88]*	[0.10]*	Monoterpenic ether
Limonene	[3.88]*	3.67	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.02	0.02	Aliphatic aldehyde
γ -Terpinene	0.04	0.04	Monoterpene
cis-Sabinene hydrate	0.01	0.01	Monoterpenic alcohol
Octanol	0.02	1.32*	Aliphatic alcohol
Terpinolene	0.06	0.06	Monoterpene
trans-Sabinene hydrate	0.01	0.01	Monoterpenic alcohol
Linalool	0.83	0.84	Monoterpenic alcohol
Nonanal	0.02	0.01	Aliphatic aldehyde
Unknown	0.02	0.02	Oxygenated monoterpene
cis-Rose oxide	0.01	0.01	Monoterpenic ether
trans-Rose oxide	0.01	0.01	Monoterpenic ether
Unknown	0.07	0.08	Oxygenated normonoterpene
Isopulegol	1.29*	[1.32]*	Monoterpenic alcohol
neo-Isopulegol	[1.29]*	0.06	Monoterpenic alcohol
Menthone	0.02	0.04	Monoterpenic ketone
Citronellal	34.44	33.76*	Monoterpenic aldehyde
Isomenthone	0.01	[33.76]*	Monoterpenic ketone
Borneol	0.02	1.82*	Monoterpenic alcohol
neoiso-Isopulegol	0.07	0.08	Monoterpenic alcohol
Isopulegol isomer	0.03	0.03	Monoterpenic alcohol
Terpinen-4-ol	0.05	0.07*	Monoterpenic alcohol
α -Terpineol	0.07	0.07	Monoterpenic alcohol

Decanal	0.11	0.11	Aliphatic aldehyde
Nerol	0.17	0.21	Monoterpenic alcohol
Citronellol	12.34	12.48	Monoterpenic alcohol
Neral	0.26	2.84*	Monoterpenic aldehyde
Geraniol	20.14	20.22	Monoterpenic alcohol
Geranial	0.46	0.47	Monoterpenic aldehyde
Citronellyl formate	0.02	0.06	Monoterpenic ester
Geranyl formate	0.03	0.04	Monoterpenic ester
Unknown	0.06	0.06	Norsesquiterpene
Citronellic acid	0.27	0.33	Monoterpenic acid
8-Hydroxy-neo-menthol	0.21*	0.12	Monoterpenic alcohol
δ -Elemene isomer	[0.21]*	0.03	Sesquiterpene
Eugenol	3.58	1.11	Phenylpropanoid
Citronellyl acetate	[3.58]	[2.84]*	Monoterpenic ester
Neryl acetate	0.02	0.02	Monoterpenic ester
α -Copaene	0.04	0.05	Sesquiterpene
β -Bourbonene	0.13	0.12	Sesquiterpene
<i>cis</i> - β -Elemene	0.07	0.08	Sesquiterpene
Geranyl acetate	2.30	2.31	Monoterpenic ester
β -Elemene	1.86	1.99*	Sesquiterpene
β -Caryophyllene	0.14	[1.99]*	Sesquiterpene
β -Copaene	0.04	0.04	Sesquiterpene
Aromadendrene	0.02	[0.07]*	Sesquiterpene
α -Humulene	0.12	0.12	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.06	0.06	Sesquiterpene
γ -Muurolole	0.25	0.28	Sesquiterpene
Germacrene D	1.80	[1.82]*	Sesquiterpene
β -Selinene	0.06	0.13	Sesquiterpene
epi-Cubebol	0.18*	0.09	Sesquiterpenic alcohol
α -Selinene	[0.18]*	0.06	Sesquiterpene
α -Muurolole	0.61	0.58	Sesquiterpene
Germacrene A	0.49	0.59	Sesquiterpene
γ -Cadinene	0.67	0.59	Sesquiterpene
<i>trans</i> -Calamenene	0.04	0.04	Sesquiterpene
δ -Cadinene	2.17	2.17	Sesquiterpene
Unknown	0.04		Unknown
α -Cadinene	0.15	0.19	Sesquiterpene
α -Elemol	2.57	2.65	Sesquiterpenic alcohol
Geranyl butyrate	0.01	0.01	Monoterpenic ester
Germacrene D-4-ol	0.53	0.58	Sesquiterpenic alcohol
10-epi-Cubebol	0.03	0.03	Sesquiterpenic alcohol
γ -Eudesmol	0.31	0.30	Sesquiterpenic alcohol
Cubebol	0.02	0.02	Sesquiterpenic alcohol
τ -Muurolol	0.61*	0.32	Sesquiterpenic alcohol
τ -Cadinol	[0.61]*	0.30	Sesquiterpenic alcohol
α -Muurolol	0.39*	0.10	Sesquiterpenic alcohol
β -Eudesmol	[0.39]*	0.33	Sesquiterpenic alcohol
α -Eudesmol	0.29	0.27	Sesquiterpenic alcohol
α -Cadinol	0.61	0.59	Sesquiterpenic alcohol
7-epi- γ -Eudesmol	0.47		Sesquiterpenic alcohol
(2 <i>E</i> ,6 <i>Z</i>)-Farnesal	0.02		Sesquiterpenic aldehyde
(2 <i>E</i> ,6 <i>E</i>)-Farnesol	0.07	0.14*	Sesquiterpenic alcohol

(2E,6E)-Farnesal	0.02		Sesquiterpenic aldehyde
Cryptomeridiol	0.03	0.03	Sesquiterpenic alcohol
Unknown	0.17	[0.14]*	Oxygenated diterpene
Unknown	0.03		Unknown
Citronellyl citronellate	0.01	0.01	Monoterpenic ester
Unknown	0.02		Unknown
Unknown	0.05		Unknown
Total identified	96.96%	96.50%	

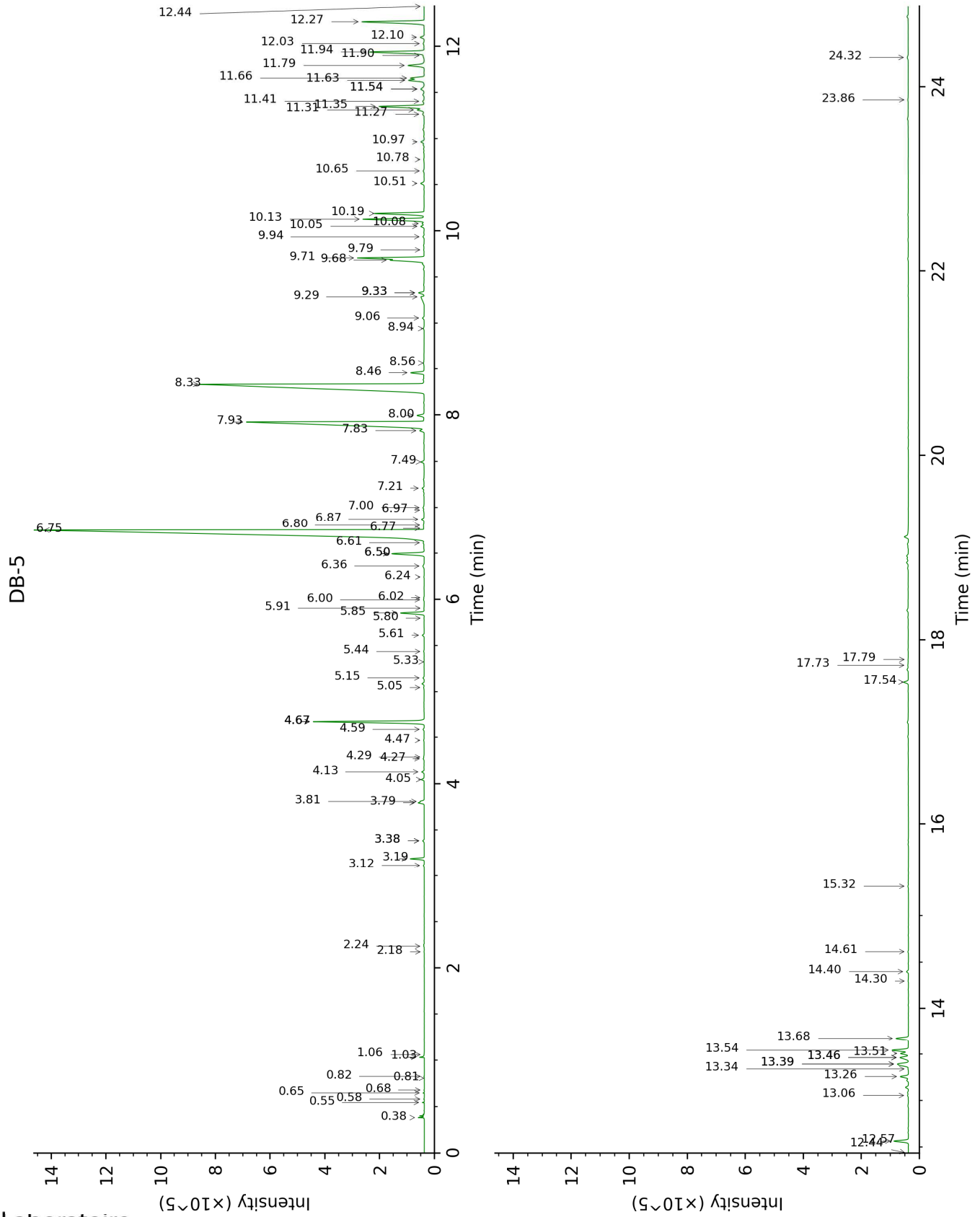
*: Two or more compounds are coeluting on this column

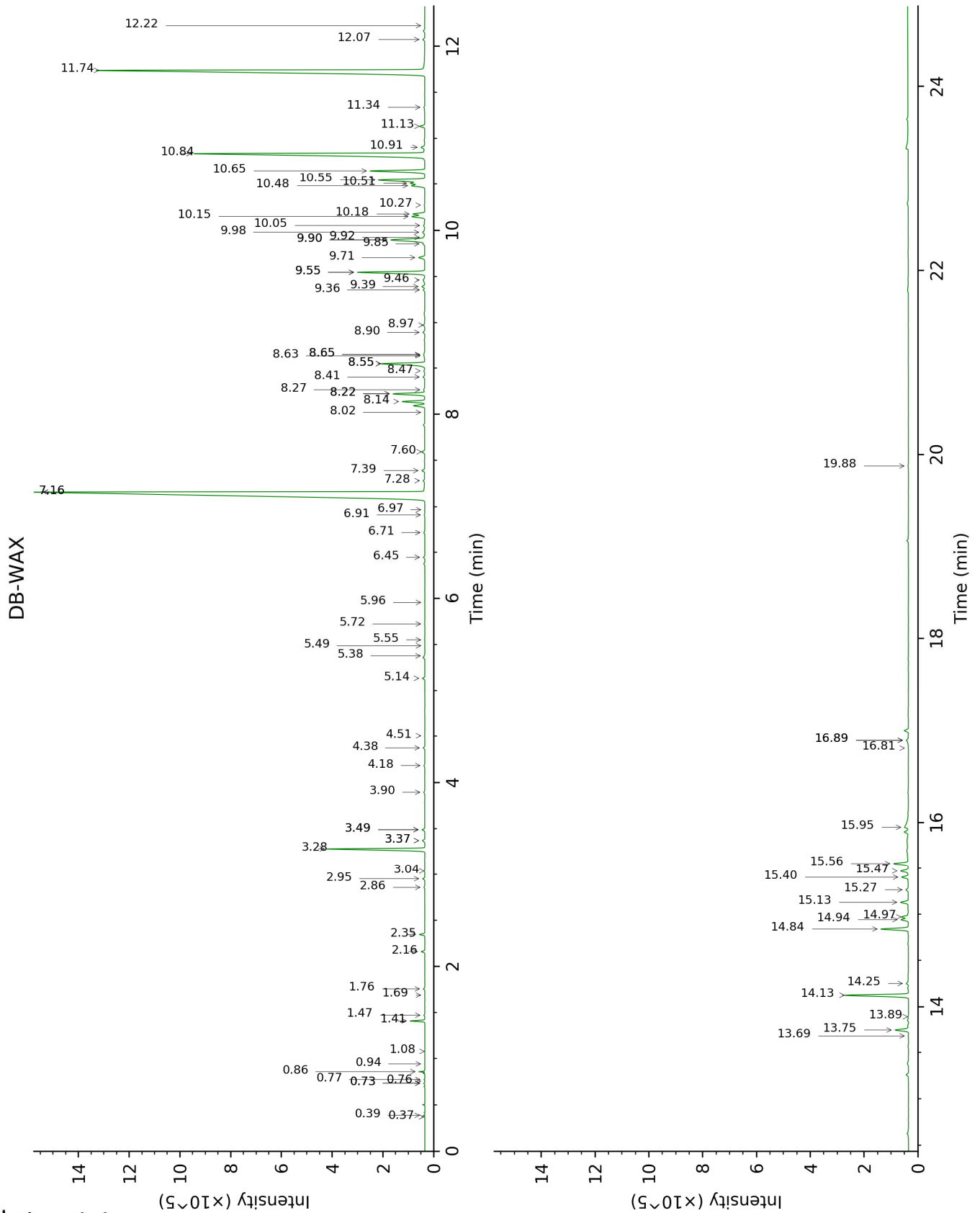
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.38	513	0.09	0.86	913	0.10
3-Methylcyclopentene	0.54	605	0.02	0.39	679	0.02
Methylcyclopentane	0.58	620	0.01	0.37	659	0.01
Isovaleral	0.65	639	0.01	0.77	888	0.01
2-Methylbutyral	0.68	648	tr	0.76	883	0.01
Valeral	0.81	686	tr	1.08	944	tr
2-Ethylfuran	0.82	692	0.01	0.94	925	0.01
Isoamyl alcohol	1.03	729	0.08	3.49*	1178	0.10
2-Methylbutanol	1.06	733	0.01	3.49*	1178	[0.10]
Unknown [m/z 55, 83 (89), 82 (70), 67 (66), 41 (55), 69 (46), 111 (37)... 126 (2)]	2.18	852	0.01	0.73*	876	0.03
Unknown [m/z 55, 83 (79), 67 (65), 41 (63), 82 (60), 69 (58)... 111 (27), 126 (9)]	2.24	857	0.01	0.73*	876	[0.03]
α-Thujene	3.12	924	0.03	1.47	1002	0.03
α-Pinene	3.19	929	0.39	1.41	993	0.39
Camphene	3.38*	942	0.05	1.76	1029	0.05
α-Fenchene	3.38*	942	[0.05]	1.69	1023	0.01
Sabinene	3.80	969	0.19	2.35	1085	0.17
β-Pinene	3.81	970	0.10	2.16	1067	0.11
6-Methyl-5-hepten-2-one	4.05	985	0.09	5.14	1305	0.09
Myrcene	4.13	991	0.07	2.95	1135	0.07
α-Phellandrene	4.27	1000	0.03	2.86	1128	0.03
Octanal	4.29	1002	0.02	4.51	1256	0.01
α-Terpinene	4.47	1013	0.01	3.04	1142	0.02
para-Cymene	4.59	1020	0.04	4.18	1232	0.04
β-Phellandrene	4.67*	1026	3.88	3.37*	1168	0.10
1,8-Cineole	4.67*	1026	[3.88]	3.37*	1168	[0.10]
Limonene	4.67*	1026	[3.88]	3.28	1161	3.67
2,6-Dimethyl-5-heptenal (melonal)	5.05	1049	0.02	5.38	1312	0.02
γ-Terpinene	5.15	1056	0.04	3.90	1210	0.04
cis-Sabinene hydrate	5.32	1067	0.01	6.97	1429	0.01
Octanol	5.44	1074	0.02	8.22*	1524	1.32
Terpinolene	5.61	1085	0.06	4.38	1246	0.06
trans-Sabinene hydrate	5.80	1096	0.01	8.02	1508	0.01
Linalool	5.85	1100	0.83	8.14	1517	0.84
Nonanal	5.91	1103	0.02	5.96	1354	0.01
Unknown [m/z 111, 69 (70), 41 (68), 55]	6.00	1109	0.02	5.72	1337	0.02

(53), 43 (51)... 154 (7)]						
<i>cis</i> -Rose oxide	6.02	1111	0.01	5.49	1320	0.01
<i>trans</i> -Rose oxide	6.24	1125	0.01	5.55	1325	0.01
Unknown [m/z 41, 69 (87), 82 (66), 67 (55), 109 (46)... 142 (18)]	6.36	1133	0.07	9.46	1622	0.08
Isopulegol	6.50*	1141	1.29	8.22*	1524	[1.32]
neo-Isopulegol	6.50*	1141	[1.29]	8.27	1527	0.06
Menthone	6.61	1149	0.02	6.71	1410	0.04
Citronellal	6.75	1158	34.44	7.16*	1443	33.76
Isomenthone	6.77	1159	0.01	7.16*	1443	[33.76]
Borneol	6.80	1162	0.02	9.90*	1657	1.82
neoiso-Isopulegol	6.87	1166	0.07	8.90	1576	0.08
Isopulegol isomer	6.97	1172	0.03	8.64	1556	0.03
Terpinen-4-ol	7.00	1174	0.05	8.65*	1557	0.07
α -Terpineol	7.21	1188	0.07	9.85	1654	0.07
Decanal	7.49	1206	0.11	7.39	1461	0.11
Nerol	7.83	1229	0.17	11.14	1761	0.21
Citronellol	7.93	1236	12.34	10.84	1736	12.48
Neral	8.00	1241	0.26	9.55*	1628	2.84
Geraniol	8.33	1264	20.14	11.74	1813	20.22
Geranial	8.46	1272	0.46	10.18	1680	0.47
Citronellyl formate	8.56	1280	0.02	8.98	1583	0.06
Geranyl formate	8.94	1306	0.03	9.92	1659	0.04
Unknown [m/z 135, 121 (81), 177 (78), 107 (60), 192 (42), 149 (35)]	9.06	1310	0.06	6.45	1390	0.06
Citronellic acid	9.29	1326	0.27	15.95	2214	0.33
8-Hydroxy-neo-menthol	9.33*	1329	0.21	14.25	2045	0.12
δ -Elemene isomer	9.33*	1329	[0.21]	6.91	1425	0.03
Eugenol	9.68†	1354	3.58	14.84	2102	1.11
Citronellyl acetate	9.71†	1356	[3.58]	9.55*	1628	[2.84]
Neryl acetate	9.79	1362	0.02	10.27	1688	0.02
α -Copaene	9.94	1372	0.04	7.28	1452	0.05
β -Bourbonene	10.05	1380	0.13	7.60	1476	0.12
<i>cis</i> - β -Elemene	10.08	1382	0.07	8.41	1538	0.08
Geranyl acetate	10.13	1386	2.30	10.65	1720	2.31
β -Elemene	10.19	1390	1.86	8.55*	1549	1.99
β -Caryophyllene	10.51	1414	0.14	8.55*	1549	[1.99]
β -Copaene	10.66	1424	0.04	8.47	1543	0.04
Aromadendrene	10.78	1434	0.02	8.65*	1557	[0.07]
α -Humulene	10.97	1448	0.12	9.39	1616	0.12
<i>trans</i> -Cadina-1(6),4-diene	11.27	1470	0.06	9.36	1613	0.06
γ -Murolene	11.32	1474	0.25	9.71	1642	0.28
Germacrene D	11.35	1477	1.80	9.90*	1657	[1.82]
β -Selinene	11.41	1481	0.06	9.98	1664	0.13
epi-Cubebol	11.54*	1491	0.18	12.07	1843	0.09

α-Selinene	11.54*	1491	[0.18]	10.05	1670	0.06
α-Muurolene	11.64	1498	0.61	10.15	1678	0.58
Germacrene A	11.66	1500	0.49	10.51	1708	0.59
γ-Cadinene	11.80	1510	0.67	10.48	1705	0.59
<i>trans</i> -Calamenene	11.90	1519	0.04	11.34	1778	0.04
δ-Cadinene	11.94	1522	2.17	10.55	1711	2.17
Unknown [m/z 93, 107 (82), 108 (53), 119 (45), 43 (44), 135 (40)...222]	12.03	1529	0.04			
α-Cadinene	12.10	1534	0.15	10.91	1742	0.19
α-Elemol	12.27	1547	2.57	14.13	2032	2.65
Geranyl butyrate	12.44	1561	0.01	12.22	1856	0.01
Germacrene D-4-ol	12.57	1571	0.53	13.75	1996	0.58
10-epi-Cubenol	13.06	1610	0.03	13.89	2010	0.03
γ-Eudesmol	13.26	1627	0.31	14.94	2112	0.30
Cubenol	13.34	1633	0.02	13.68	1990	0.02
τ-Muurolol	13.39*	1638	0.61	15.13	2131	0.32
τ-Cadinol	13.39*	1638	[0.61]	14.97	2115	0.30
α-Muurolol	13.46*	1644	0.39	15.27	2144	0.10
β-Eudesmol	13.46*	1644	[0.39]	15.47	2165	0.33
α-Eudesmol	13.51	1647	0.29	15.40	2158	0.27
α-Cadinol	13.54	1650	0.61	15.56	2174	0.59
7-epi-γ-Eudesmol	13.68	1661	0.47			
(2 <i>E</i> ,6 <i>Z</i>)-Farnesal	14.30	1713	0.02			
(2 <i>E</i> ,6 <i>E</i>)-Farnesol	14.40	1722	0.07	16.89*	2312	0.14
(2 <i>E</i> ,6 <i>E</i>)-Farnesal	14.61	1740	0.02			
Cryptomeridiol	15.32	1802	0.03	19.88	2651	0.03
Unknown [m/z 41, 69 (98), 55 (55), 81 (46), 109 (46)... 290 (8)]	17.54	2009	0.17	16.89*	2312	[0.14]
Unknown [m/z 69, 41 (96), 55 (53), 109 (48), 95 (43), 67 (35)...]	17.72	2027	0.03			
Citronellyl citronellate	17.79	2033	0.01	16.81	2303	0.01
Unknown [m/z 69, 81 (79), 81 (70), 137 (53), 139 (35), 95 (30)...]	23.86	2712	0.02			
Unknown [m/z 69, 81 (84), 137 (53), 83 (30), 95 (27), 41 (19)...]	24.32	2771	0.05			
Total identified		96.96%			96.50%	
Total reported		97.46%			96.66%	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken account in the identified 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