

Date : March 29, 2018

CERTIFICATE OF ANALYSIS - GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 18C20-ALZ2-1-CC

Customer identification : Citronella

Type : Essential oil

Source : *Cymbopogon winterianus*

Customer : Aliz Liu

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 : Sylvain Mercier, M. Sc., Chimiste

Analysis date : March 27, 2018

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid

Refractive index: 1.4728 ± 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	0.02	0.02	Aliphatic alcohol
3-Methylcyclopentene	0.02		Alkene
Isovaleral	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	0.01	Aliphatic aldehyde
2-Ethylfuran	0.01	0.01	Furan
Unknown	0.01	0.03*	Unknown
Unknown	0.01	[0.03]*	Unknown
α -Thujene	0.01	tr	Monoterpene
α -Pinene	0.01	0.01	Monoterpene
Sabinene	0.01	0.01	Monoterpene
6-Methyl-5-hepten-2-one	0.06	0.07	Aliphatic ketone
Myrcene	0.07	0.08	Monoterpene
α -Phellandrene	0.01	0.01	Monoterpene
Octanal	tr	tr	Aliphatic aldehyde
α -Terpinene	tr	0.01	Monoterpene
para-Cymene	0.01	0.02	Monoterpene
Limonene	3.95*	4.07	Monoterpene
1,8-Cineole	[3.95]*	tr	Monoterpenic ether
β -Phellandrene	[3.95]*	0.06	Monoterpene
(Z)- β -Ocimene	0.01	tr	Monoterpene
(E)- β -Ocimene	0.01	0.01	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.05	0.05	Aliphatic aldehyde
γ -Terpinene	0.01	0.02	Monoterpene
Terpinolene	0.06	0.06	Monoterpene
Linalool	0.86	0.91	Monoterpenic alcohol
cis-Rose oxide	0.03	0.02	Monoterpenic ether
Unknown	0.01	0.01	Oxygenated monoterpene
trans-Rose oxide	0.01	0.01	Monoterpenic ether
Isopulegol	1.57*	1.68*	Monoterpenic alcohol
neo-Isopulegol	[1.57]*	[1.68]*	Monoterpenic alcohol
Citronellal	28.00*	27.72	Monoterpenic aldehyde
iso-Isopulegol	[28.00]*	0.43	Monoterpenic alcohol
neoiso-Isopulegol	0.07	0.08	Monoterpenic alcohol
Terpinen-4-ol	0.03	0.04	Monoterpenic alcohol
α -Terpineol	0.20	2.83*	Monoterpenic alcohol
Decanal	0.08	0.07	Aliphatic aldehyde
Nerol	0.17	0.23	Monoterpenic alcohol
Citronellol	12.80	13.38*	Monoterpenic alcohol
Neral	0.41	3.92*	Monoterpenic aldehyde
Geraniol	21.14	21.74	Monoterpenic alcohol
Geranial	0.47	1.07*	Monoterpenic aldehyde
Citronellyl formate	0.02	0.01	Monoterpenic ester
Geranyl formate	0.03	0.08	Monoterpenic ester
δ -Elemene isomer	0.38*	0.04	Sesquiterpene
8-Hydroxy-neo-menthol	[0.38]*	0.19	Monoterpenic alcohol
Citronellic acid	[0.38]	0.14	Monoterpenic acid
Citronellyl acetate	4.92*	[3.92]*	Monoterpenic ester
Eugenol	[4.92]*	1.34	Phenylpropanoid

Neryl acetate	0.04	0.03	Monoterpenic ester
α -Copaene	tr	0.05	Sesquiterpene
β -Bourbonene	0.12	0.12	Sesquiterpene
<i>cis</i> - β -Elemene	0.07	0.06	Sesquiterpene
Geranyl acetate	3.07	3.16	Monoterpenic ester
β -Elemene	1.99	2.08*	Sesquiterpene
Methyleugenol	tr	0.01	Phenylpropanoid
Dodecanal	0.01	0.02	Aliphatic aldehyde
β -Caryophyllene	0.10	[2.08]*	Sesquiterpene
β -Copaene	0.04	0.04	Sesquiterpene
<i>trans</i> - α -Bergamotene	tr	[2.08]*	Sesquiterpene
α -Humulene	0.13	0.17	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.08	0.07	Sesquiterpene
γ -Murolene	0.21	0.29	Sesquiterpene
Germacrene D	2.79	[2.83]*	Sesquiterpene
β -Selinene	0.08	0.11	Sesquiterpene
α -Selinene	0.04	0.06	Sesquiterpene
epi-Cubebol	0.14	0.08	Sesquiterpenic alcohol
α -Murolene	0.67	[1.07]*	Sesquiterpene
Germacrene A	0.24	0.27	Sesquiterpene
γ -Cadinene	0.62	0.68	Sesquiterpene
Cubebol	0.07	0.08	Sesquiterpenic alcohol
δ -Cadinene	2.37*	2.39	Sesquiterpene
<i>trans</i> -Calamenene	[2.37]*	0.01	Sesquiterpene
Unknown	0.07	[13.38]*	Sesquiterpene
α -Cadinene	0.16	0.24	Sesquiterpene
α -Elemol	2.74	2.80	Sesquiterpenic alcohol
Geranyl butyrate	0.01	tr	Monoterpenic ester
Germacrene D-4-ol	0.59*	0.65	Sesquiterpenic alcohol
Caryophyllene oxide isomer	[0.59]*	0.01	Sesquiterpenic ether
10-epi-Cubebol	0.04		Sesquiterpenic alcohol
γ -Eudesmol	0.32	0.32	Sesquiterpenic alcohol
τ -Murolol	0.67*	0.36	Sesquiterpenic alcohol
τ -Cadinol	[0.67]*	0.32	Sesquiterpenic alcohol
α -Murolol	0.39*	0.10	Sesquiterpenic alcohol
β -Eudesmol	[0.39]*	0.31	Sesquiterpenic alcohol
α -Eudesmol	0.28	0.27	Sesquiterpenic alcohol
α -Cadinol	0.70	0.67	Sesquiterpenic alcohol
(2E,6Z)-Farnesal	0.01		Sesquiterpenic aldehyde
(2E,6E)-Farnesol	0.07	0.08	Sesquiterpenic alcohol
Cryptomeridiol	0.03		Sesquiterpenic alcohol
Unknown	0.02	0.03	Oxygenated diterpene
Unknown	1.32	1.34	Oxygenated diterpene
Total identified	94.44%	96.40%	

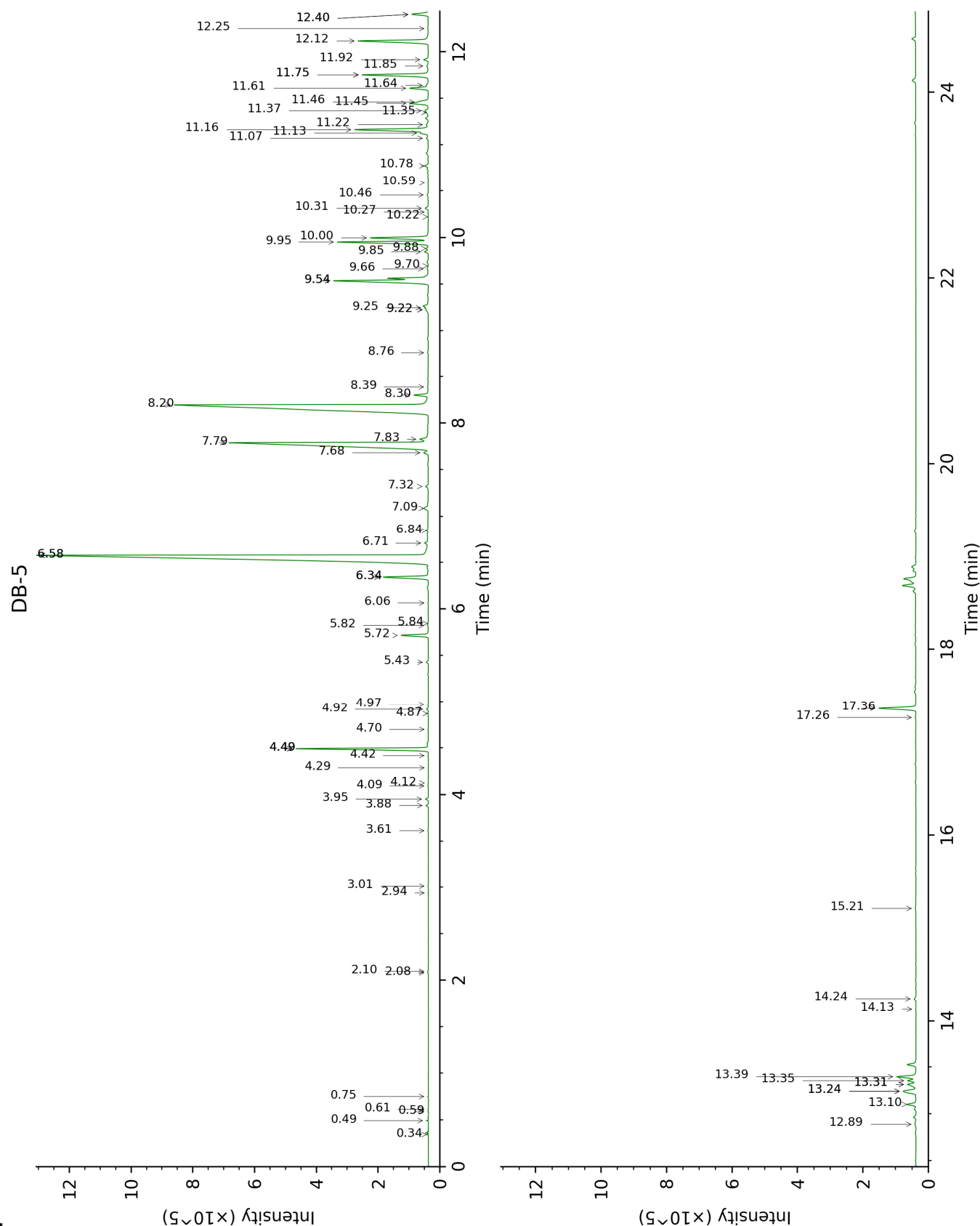
*: Two or more compounds are coeluting on this column

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

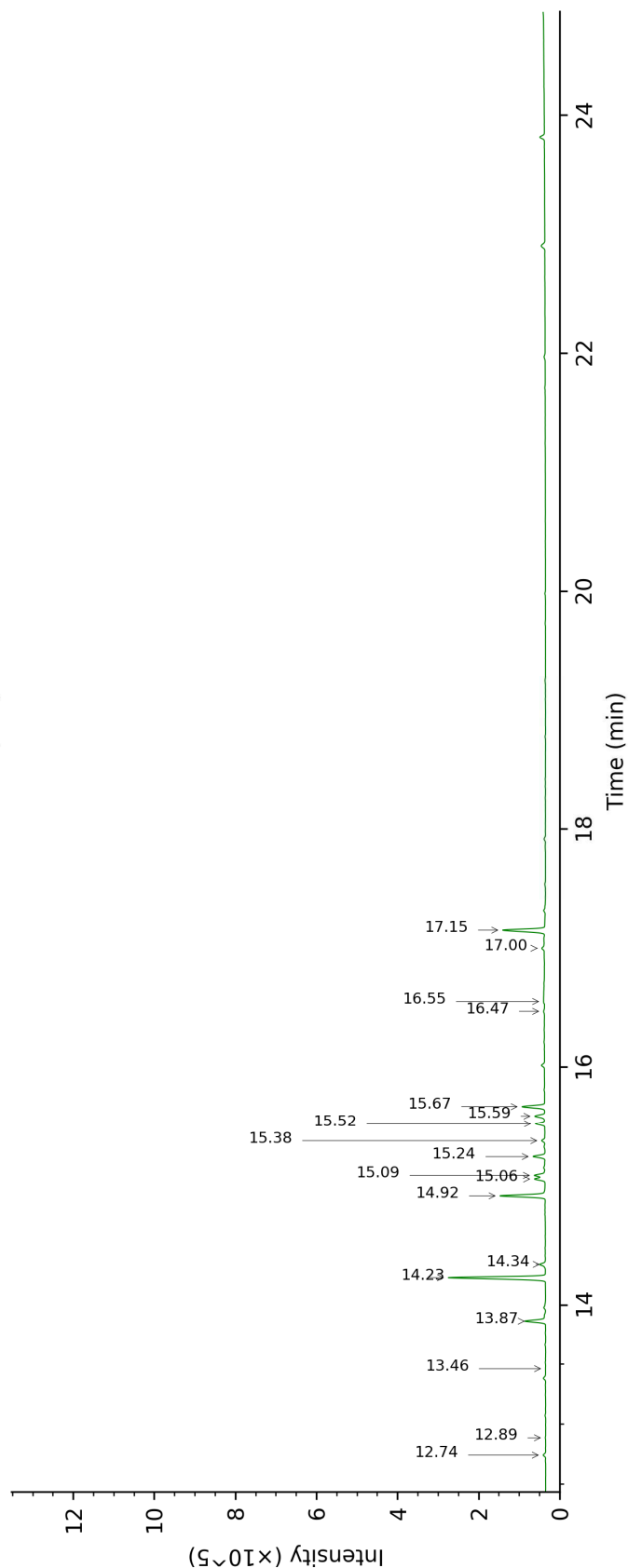
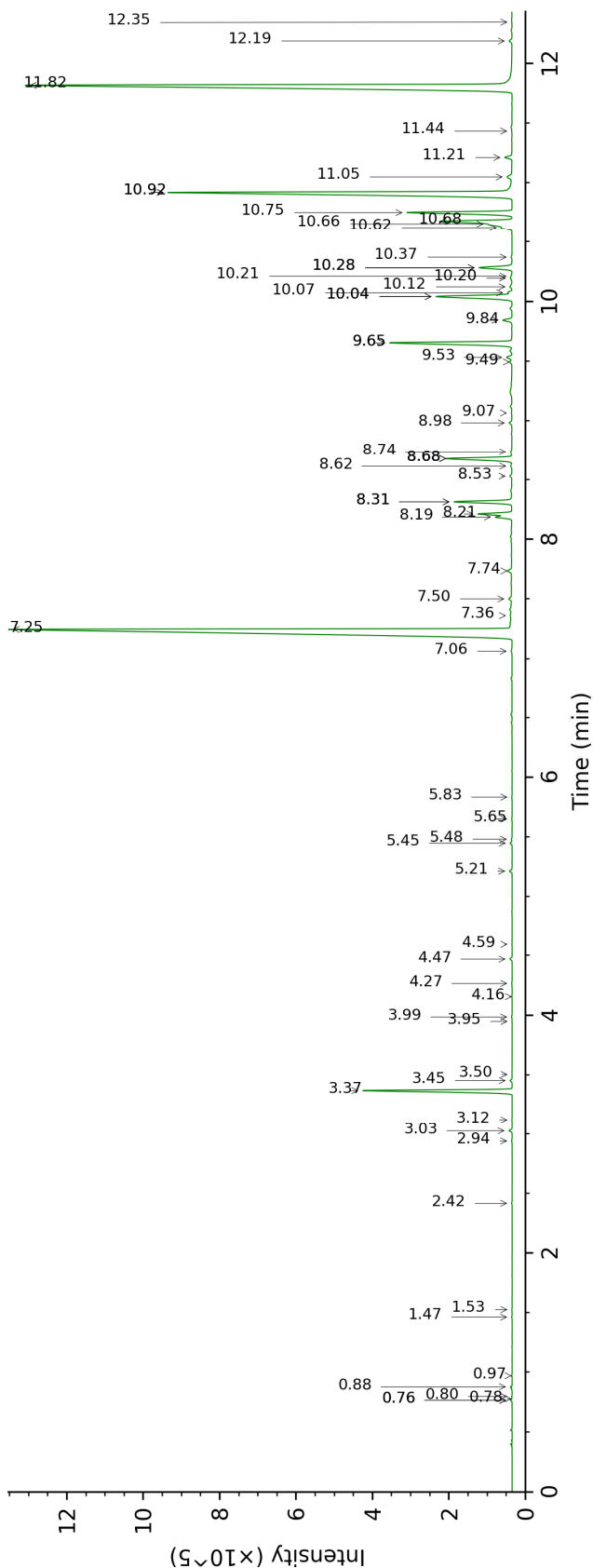
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

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DB-WAX



FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.34	496	0.02	0.88	905	0.02
3-Methylcyclopentene	0.49	606	0.02			
Isovaleral	0.59	639	0.01	0.80	885	0.01
2-Methylbutyral	0.61	648	tr	0.78	878	0.01
2-Ethylfuran	0.75	696	0.01	0.97	919	0.01
Unknown [m/z 55, 83 (89), 82 (70), 67 (66), 41 (55), 69 (46), 111 (37)... 126 (2)]	2.08	855	0.01	0.76*	874	0.03
Unknown [m/z 55, 83 (79), 67 (65), 41 (63), 82 (60), 69 (58)... 111 (27), 126 (9)]	2.10	856	0.01	0.76*	874	[0.03]
α -Thujene	2.94	922	0.01	1.53	1002	tr
α -Pinene	3.01	927	0.01	1.46	995	0.01
Sabinene	3.61	967	0.01	2.42	1087	0.01
6-Methyl-5-hepten-2-one	3.88	985	0.06	5.22	1296	0.07
Myrcene	3.95	990	0.07	3.03	1136	0.08
α -Phellandrene	4.09	999	0.01	2.94	1129	0.01
Octanal	4.12	1001	tr	4.60	1252	tr
α -Terpinene	4.29	1012	tr	3.12	1143	0.01
para-Cymene	4.42	1020	0.01	4.27	1228	0.02
Limonene	4.49*	1025	3.95	3.37	1162	4.07
1,8-Cineole	4.49*	1025	[3.95]	3.50	1172	tr
β -Phellandrene	4.49*	1025	[3.95]	3.45	1168	0.06
(Z)- β -Ocimene	4.70	1038	0.01	3.95	1206	tr
(E)- β -Ocimene	4.87	1048	0.01	4.16	1220	0.01
2,6-Dimethyl-5-heptenal (melonal)	4.92	1051	0.05	5.45	1313	0.05
γ -Terpinene	4.97	1055	0.01	3.99	1208	0.02
Terpinolene	5.43	1084	0.06	4.47	1243	0.06
Linalool	5.72	1102	0.86	8.21	1515	0.91
cis-Rose oxide	5.82	1108	0.03	5.48	1315	0.02
Unknown [m/z 111, 69 (70), 41 (68), 55 (53), 43 (51)... 154 (7)]	5.84	1110	0.01	5.84	1340	0.01
trans-Rose oxide	6.06	1124	0.01	5.65	1327	0.01
Isopulegol	6.34*	1142	1.57	8.32*	1523	1.68
neo-Isopulegol	6.34*	1142	[1.57]	8.32*	1523	[1.68]
Citronellal	6.58*	1156	28.00	7.25	1443	27.72
iso-Isopulegol	6.58*	1156	[28.00]	8.19	1513	0.43
neoiso-Isopulegol	6.71	1165	0.07	8.98	1574	0.08
Terpinen-4-ol	6.84	1174	0.03	8.74	1556	0.04
α -Terpineol	7.09	1189	0.20	10.04*	1659	2.83

Decanal	7.32	1204	0.08	7.50	1462	0.07
Nerol	7.68	1229	0.17	11.21	1756	0.23
Citronellol	7.79	1236	12.80	10.92*	1732	13.38
Neral	7.83	1238	0.41	9.65*	1628	3.92
Geraniol	8.20	1263	21.14	11.82	1808	21.74
Geranial	8.30	1270	0.47	10.28*	1678	1.07
Citronellyl formate	8.39	1276	0.02	9.07	1581	0.01
Geranyl formate	8.76	1301	0.03	10.12	1666	0.08
δ-Elemene isomer	9.22*†	1334	0.38	7.06	1429	0.04
8-Hydroxy-neo-menthol	9.22*†	1334	[0.38]	14.34	2039	0.19
Citronellic acid	9.25†	1335	[0.38]	16.55	2260	0.14
Citronellyl acetate	9.54*	1355	4.92	9.65*	1628	[3.92]
Eugenol	9.54*	1355	[4.92]	14.92	2094	1.34
Neryl acetate	9.66	1364	0.04	10.37	1686	0.03
α-Copaene	9.70	1367	tr	7.36	1451	0.05
β-Bourbonene	9.85	1377	0.12	7.74	1479	0.12
cis-β-Elemene	9.88	1380	0.07	8.53	1540	0.06
Geranyl acetate	9.95	1385	3.07	10.75	1717	3.16
β-Elemene	10.00	1388	1.99	8.68*	1551	2.08
Methyleugenol	10.22	1404	tr	13.46	1956	0.01
Dodecanal	10.27	1408	0.01	10.21	1673	0.02
β-Caryophyllene	10.31	1411	0.10	8.68*	1551	[2.08]
β-Copaene	10.46	1421	0.04	8.62	1546	0.04
trans-α-Bergamotene	10.59	1431	tr	8.68*	1551	[2.08]
α-Humulene	10.78	1445	0.13	9.53	1618	0.17
trans-Cadina-1(6),4-diene	11.07	1467	0.08	9.49	1615	0.07
γ-Murolene	11.13	1471	0.21	9.84	1643	0.29
Germacrene D	11.16	1474	2.79	10.04*	1659	[2.83]
β-Selinene	11.22	1478	0.08	10.07	1662	0.11
α-Selinene	11.35	1488	0.04	10.20	1671	0.06
epi-Cubebol	11.37	1489	0.14	12.19	1841	0.08
α-Murolene	11.45	1495	0.67	10.28*	1678	[1.07]
Germacrene A	11.46	1496	0.24	10.62	1706	0.27
γ-Cadinene	11.61	1507	0.62	10.66	1709	0.68
Cubebol	11.64	1510	0.07	12.74	1890	0.08
δ-Cadinene	11.75*	1519	2.37	10.68	1711	2.39
trans-Calamenene	11.75*	1519	[2.37]	11.44	1775	0.01
Unknown [m/z 119, 105 (53), 161 (33), 93 (28), 91 (25), 40 (20)...204]	11.85	1526	0.07	10.92*	1732	[13.38]
α-Cadinene	11.92	1532	0.16	11.05	1743	0.24
α-Elemol	12.12	1547	2.74	14.23	2028	2.80
Geranyl butyrate	12.25	1558	0.01	12.35	1855	tr
Germacrene D-4-ol	12.40*	1570	0.59	13.87	1993	0.65
Caryophyllene oxide isomer	12.40*	1570	[0.59]	12.89	1903	0.01
10-epi-Cubenol	12.89	1608	0.04			
γ-Eudesmol	13.10	1626	0.32	15.09	2111	0.32

τ-Muurolol	13.24*	1637	0.67	15.24	2127	0.36
τ-Cadinol	13.24*	1637	[0.67]	15.06	2108	0.32
α-Muurolol	13.31*	1643	0.39	15.38	2140	0.10
β-Eudesmol	13.31*	1643	[0.39]	15.59	2161	0.31
α-Eudesmol	13.35	1646	0.28	15.52	2155	0.27
α-Cadinol	13.40	1650	0.70	15.67	2169	0.67
(2E,6Z)-Farnesal	14.13	1710	0.01			
(2E,6E)-Farnesol	14.24	1720	0.07	17.00	2307	0.08
Cryptomeridiol	15.21	1804	0.03			
Unknown [m/z 81, 137 (70), 95 (46), 69 (45), 41 (39), 55 (29)...]	17.26	1995	0.02	16.47	2251	0.03
Unknown [m/z 41, 69 (98), 55 (55), 81 (46), 109 (46)... 290 (8)]	17.36	2005	1.32	17.15	2323	1.34
Total identified		94.44%			96.40%	
Total reported		95.89%			97.77%	

*: 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