

Date : March 07, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19B27-PTH03-1-SCC

Customer identification : Lemongrass Organic - India - L90107811R

Type : Essential oil

Source : *Cymbopogon flexuosus*

Customer : Plant Therapy

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 : Lindsay Girard, B. Sc.

Analysis date : March 04, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Yellow liquid

Refractive index: 1.4835 ± 0.0003 (20 °C)

ISO 4718:2004 - OIL OF LEMONGRASS

Compound	Min. %	Max. %	Observed %	Complies?
Geraniol	1.5	8.0	6.8	Yes
Geranyl acetate	0.5	6.0	4.7	Yes
Geranial	35.0	47.0	38.4	Yes
Neral	25.0	35.0	29.7	Yes
β-Caryophyllene	0.2	3.5	2.0	Yes
6-Methyl-5-hepten-2-one	0.1	2.0	1.4	Yes
Limonene	0.5	3.5	0.2	No
Refractive index	1.4830	1.4890	1.4835	Yes

CONCLUSION

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

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
2-Methyl-3-buten-2-ol	0.03	0.03	Aliphatic alcohol
Isovaleral	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	0.01	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.01	0.01	Aliphatic alcohol
Hexanal	tr	0.01	Aliphatic aldehyde
(3Z)-Hexenol	0.01	0.01	Aliphatic alcohol
4-Heptanone	0.01	0.01*	Aliphatic ketone
Tricyclene	0.11	0.10	Monoterpene
α-Pinene	0.16	0.15	Monoterpene
Camphene	0.84	0.84	Monoterpene
Benzaldehyde	0.01	0.13*	Simple phenolic
Sabinene	0.02	[0.01]*	Monoterpene
β-Pinene	[0.02]	0.02	Monoterpene
6-Methyl-5-hepten-2-one	1.44	1.41	Aliphatic ketone
Myrcene	0.07	0.06	Monoterpene
6-Methyl-5-hepten-2-ol	0.05	0.27*	Aliphatic alcohol
Octanal	0.08	0.06	Aliphatic aldehyde
para-Cymene	0.02	0.01	Monoterpene
Limonene	0.24*	0.20	Monoterpene
1,8-Cineole	[0.24]*	0.03	Monoterpenic ether
Benzeneacetaldehyde	0.02	0.02	Simple phenolic
(Z)-β-Ocimene	0.28	0.25	Monoterpene
(E)-β-Ocimene	0.18	0.16	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.03	0.01	Aliphatic aldehyde
γ-Terpinene	0.01	0.01	Monoterpene
cis-Sabinene hydrate	0.01	0.02*	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.02	0.02	Monoterpenic alcohol
4-Nonanone	0.76	0.79	Aliphatic ketone
Camphenilone	0.01	0.01	Normonoterpenic ketone
Terpinolene	0.06*	0.04	Monoterpene
trans-Linalool oxide (fur.)	[0.06]*	[0.02]*	Monoterpenic alcohol
Rosefuran	0.20	0.19	Monoterpenic ether
Linalool	1.06*	1.01	Monoterpenic alcohol
Perillene	[1.06]*	0.06	Monoterpenic ether
cis-Chrysanthemal?	0.02	0.03	Monoterpenic aldehyde
(Z)-6-Methyl-3,5-heptadien-2-one	0.01	0.01	Aliphatic ketone
trans-para-Mentha-2,8-dien-1-ol	0.03*	0.02	Monoterpenic alcohol
Unknown	[0.03]*	0.02	Unknown
Unknown	0.14	0.15*	Unknown
Unknown	0.01	0.02*	Unknown
exo-Isocitral	0.02	[0.02]*	Monoterpenic aldehyde
trans-Chrysanthemal	0.30	0.29*	Monoterpenic aldehyde
Citronellal	0.29	[0.27]*	Monoterpenic aldehyde
Borneol	0.18	0.33*	Monoterpenic alcohol
Isoneral	0.64*	0.67	Monoterpenic aldehyde
α-Phellandren-8-ol	[0.64]*	38.73*	Monoterpenic alcohol
Rosefuran oxide	0.02	0.02	Monoterpenic ether
Terpinen-4-ol	0.20*	2.26*	Monoterpenic alcohol

Unknown	[0.20]*	0.15	Oxygenated monoterpene
Isogeranial	0.90	0.84	Monoterpenic aldehyde
Unknown	0.03		Unknown
α -Terpineol	0.13	[0.33]*	Monoterpenic alcohol
γ -Terpineol	0.03	0.15*	Monoterpenic alcohol
<i>trans</i> -Isopiperitenol	0.02	1.14*	Monoterpenic alcohol
Unknown	0.04		Oxygenated monoterpene
Decanal	0.12	[0.13]*	Aliphatic aldehyde
<i>cis</i> -Isopiperitenol	0.03	0.06	Monoterpenic alcohol
2,3-Epoxyneral?	0.03		Monoterpenic aldehyde
Nerol	0.21	0.16	Monoterpenic alcohol
Citronellol	[29.97]	0.16	Monoterpenic alcohol
Neral	29.97*	29.82*	Monoterpenic aldehyde
Piperitone	[29.97]*	[0.15]*	Monoterpenic ketone
Geraniol	6.80	6.99	Monoterpenic alcohol
Geranial	38.44	[38.73]*	Monoterpenic aldehyde
Unknown	0.16	0.19	Oxygenated monoterpene
Geranyl formate	0.04	0.07*	Monoterpenic ester
Unknown	0.07	0.09*	Unknown
α -Cubebene	0.02	[0.15]*	Sesquiterpene
Citronellyl acetate	0.11	[29.82]*	Monoterpenic ester
Cyclosativene I	0.12	0.10	Sesquiterpene
Cyclosativene II	0.19	[0.27]*	Sesquiterpene
Neryl acetate	0.05	0.05	Monoterpenic ester
α -Copaene	0.10	[0.29]*	Sesquiterpene
β -Bourbonene	0.05	0.06	Sesquiterpene
Geranyl acetate	4.65	4.69	Monoterpenic ester
β -Elemene	0.13	[2.26]*	Sesquiterpene
β -Caryophyllene	2.02	[2.26]*	Sesquiterpene
β -Copaene	0.03	0.04*	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.03	[0.04]*	Sesquiterpene
α -Humulene	0.70*	0.26*	Sesquiterpene
(<i>E</i>)-Isoeugenol	[0.70]*	0.47	Phenylpropanoid
<i>cis</i> -Muurolo-4(15),5-diene	0.04	[0.26]*	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.04	0.04	Sesquiterpene
Germacrene D	0.33	0.38	Sesquiterpene
γ -Amorphene	0.03	[0.15]*	Sesquiterpene
epi-Cubebol	0.15	0.15	Sesquiterpenic alcohol
α -Muurolole	0.06	[0.07]*	Sesquiterpene
γ -Cadinene	1.15	[1.14]*	Sesquiterpene
Cubebol	0.27	0.34	Sesquiterpenic alcohol
δ -Cadinene	0.40	0.33*	Sesquiterpene
(<i>E</i>)- γ -Bisabolene	0.25	[0.33]*	Sesquiterpene
α -Elemol	0.09	0.08	Sesquiterpenic alcohol
Germacrene B	0.05	0.07	Sesquiterpene
Geranyl butyrate	0.01	0.02	Monoterpenic ester
Caryophyllene oxide	0.56*	0.50	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.56]*	[0.09]*	Sesquiterpenic ether
Humulene epoxide II	0.06	0.05	Sesquiterpenic ether
Selin-6-en-4 α -ol?	0.01	0.08	Sesquiterpenic alcohol
1-epi-Cubenol	0.02	0.02	Sesquiterpenic alcohol
Cubenol	0.04*	0.02	Sesquiterpenic alcohol

τ-Cadinol	[0.04]*	0.02	Sesquiterpenic alcohol
τ-Muurolol	0.04	0.02	Sesquiterpenic alcohol
β-Eudesmol	0.07	0.07	Sesquiterpenic alcohol
Unknown	0.04	0.03	Oxygenated sesquiterpene
(2Z,6Z)-Farnesol	0.01	0.05	Sesquiterpenic alcohol
Farnesal isomer	0.02		Sesquiterpenic aldehyde
(2E,6Z)-Farnesal	0.02		Sesquiterpenic aldehyde
(2E,6E)-Farnesal	0.02	0.06	Sesquiterpenic aldehyde
Neophytadiene	0.01	0.05	Diterpene
Octadecanal	0.01	0.02	Aliphatic aldehyde
Unknown	0.05		Unknown
Dicitral	0.08	0.03	Diterpenic aldehyde
Unknown	0.09		Unknown
Phytol isomer	0.02		Diterpenic alcohol
Unknown	0.57		Unknown
Unknown	0.02		Unknown
Unknown	0.02		Unknown
Unknown	0.04		Unknown
Total identified	96.26%	96.03%	

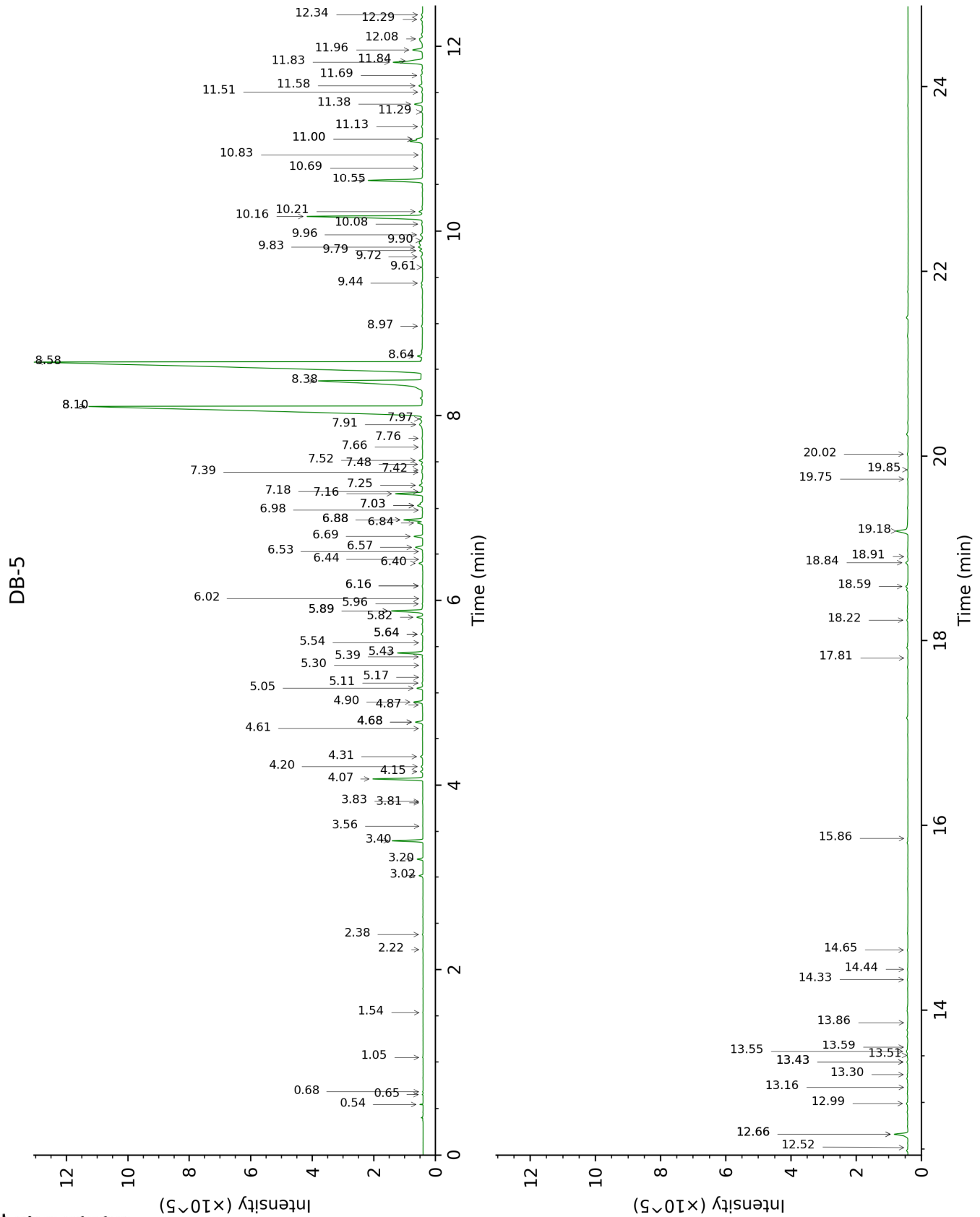
*: Two or more compounds are coeluting on this column

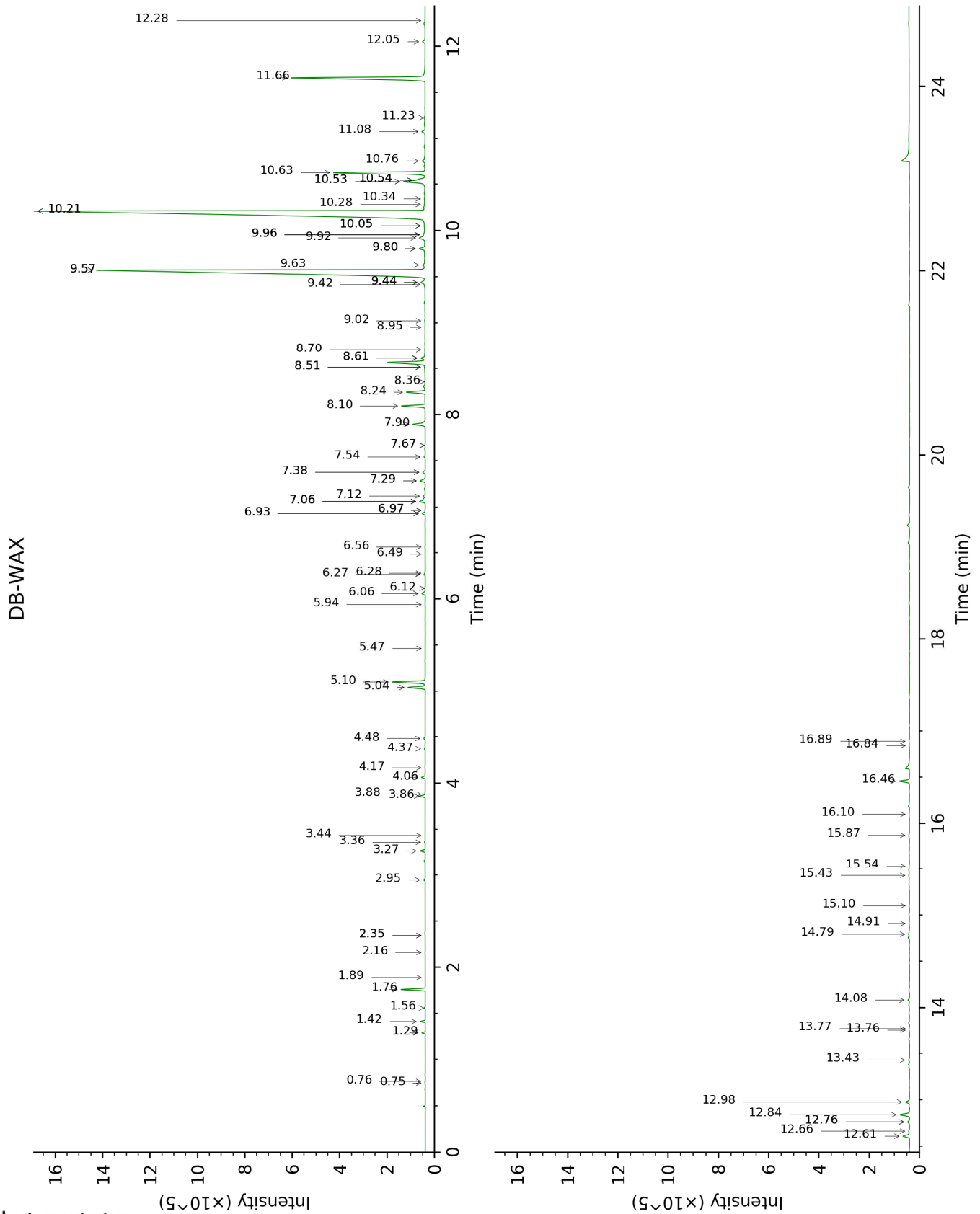
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
2-Methyl-3-buten-2-ol	0.54	605	0.03	1.56	1010	0.03
Isovaleral	0.65	640	0.01	0.76	886	0.01
2-Methylbutyral	0.68	649	0.01	0.75	880	0.01
Isoamyl alcohol	1.05	731	0.01	3.44	1172	0.01
Hexanal	1.54	796	tr	1.89	1041	0.01
(3Z)-Hexenol	2.22	855	0.01	5.94	1348	0.01
4-Heptanone	2.38	868	0.01	2.34*	1084	0.01
Tricyclene	3.02	916	0.11	1.29	975	0.10
α-Pinene	3.20	928	0.16	1.42	993	0.15
Camphene	3.40	941	0.84	1.76	1028	0.84
Benzaldehyde	3.56	952	0.01	7.38*	1456	0.13
Sabinene	3.81†	968	0.02	2.34*	1084	[0.01]
β-Pinene	3.82†	969	[0.02]	2.16	1066	0.02
6-Methyl-5-hepten-2-one	4.07	985	1.44	5.10	1303	1.41
Myrcene	4.15	990	0.07	2.95	1133	0.06
6-Methyl-5-hepten-2-ol	4.20	994	0.05	7.06*	1432	0.27
Octanal	4.31	1001	0.08	4.48	1254	0.06
para-Cymene	4.61	1020	0.02	4.17	1230	0.01
Limonene	4.68*	1024	0.24	3.27	1159	0.20
1,8-Cineole	4.68*	1024	[0.24]	3.36	1166	0.03
Benzeneacetaldehyde	4.86	1035	0.02	8.95	1579	0.02
(Z)-β-Ocimene	4.90	1037	0.28	3.86	1206	0.25
(E)-β-Ocimene	5.05	1047	0.18	4.06	1222	0.16
2,6-Dimethyl-5-heptenal (melonal)	5.11	1051	0.03	5.47	1314	0.01
γ-Terpinene	5.17	1054	0.01	3.88	1208	0.01
cis-Sabinene hydrate	5.30	1063	0.01	6.97*	1425	0.02
cis-Linalool oxide (fur.)	5.39	1068	0.02	6.56	1394	0.02
4-Nonanone	5.43	1071	0.76	5.04	1298	0.79
Camphenilone	5.54	1078	0.01	6.49	1389	0.01
Terpinolene	5.64*	1084	0.06	4.37	1246	0.04
trans-Linalool oxide (fur.)	5.64*	1084	[0.06]	6.97*	1425	[0.02]
Rosefuran	5.82	1095	0.20	6.06	1357	0.19
Linalool	5.89*	1099	1.06	8.10	1511	1.01
Perillene	5.89*	1099	[1.06]	6.27	1373	0.06
cis-Chrysanthemal?	5.96	1104	0.02	6.12	1361	0.03
(Z)-6-Methyl-3,5-heptadien-2-one	6.02	1108	0.01	8.36	1532	0.01
trans-para-Mentha-2,8-dien-1-ol	6.16*	1117	0.03	9.02	1584	0.02
Unknown [m/z 81, 79 (19), 41 (12), 92 (8), 77 (8)...]	6.16*	1117	[0.03]	6.28	1374	0.02

Unknown [m/z 81, 70 (98), 67 (63), 82 (53), 41 (46), 69 (46), 109 (43)...]	6.40	1132	0.14	6.93*	1422	0.15
Unknown [m/z 95, 67 (86), 41 (68), 82 (64), 123 (62)...]	6.44	1135	0.01	7.67*	1478	0.02
exo-Isocitral	6.53	1140	0.02	7.67*	1478	[0.02]
trans-Chrysanthemal	6.57	1143	0.30	7.29*	1449	0.29
Citronellal	6.69	1151	0.29	7.06*	1432	[0.27]
Borneol	6.84	1160	0.18	9.80*	1648	0.33
Isoneral	6.88*	1163	0.64	7.90	1496	0.67
α-Phellandren-8-ol	6.88*	1163	[0.64]	10.21*	1682	38.73
Rosefuran oxide	6.98	1170	0.02	8.70	1559	0.02
Terpinen-4-ol	7.03*	1173	0.20	8.61*†	1552	2.26
Unknown [m/z 84, 83 (74), 137 (56), 41 (47), 93 (43), 108 (40)... 152 (2)]	7.03*	1173	[0.20]	9.63	1634	0.15
Isogeranial	7.16	1181	0.90	8.24	1523	0.84
Unknown [m/z 69, 41 (65), 109 (36), 67 (16), 84 (11), 43 (10), 55 (9)...]	7.18	1182	0.03			
α-Terpineol	7.25	1187	0.13	9.80*	1648	[0.33]
γ-Terpineol	7.39	1196	0.03	9.96*	1660	0.15
trans-Isopiperitenol	7.42	1197	0.02	10.53*	1708	1.14
Unknown [m/z 84, 41 (83), 83 (79), 91 (76), 93 (67), 119 (64), 137 (63), 109 (54), 108 (54)... 152 (4)]	7.48	1201	0.04			
Decanal	7.52	1204	0.12	7.38*	1456	[0.13]
cis-Isopiperitenol	7.66	1214	0.03	10.34	1692	0.06
2,3-Epoxyneral?	7.76	1220	0.03			
Nerol	7.90	1230	0.21	11.08	1755	0.16
Citronellol	7.97†	1234	[29.97]	10.76	1728	0.16
Neral	8.10*†	1244	29.97	9.57*	1629	29.82
Piperitone	8.10*†	1244	[29.97]	9.96*	1660	[0.15]
Geraniol	8.38	1262	6.80	11.66	1805	6.99
Geranial	8.58	1276	38.44	10.21*	1682	[38.73]
Unknown [m/z 43, 69 (77), 41 (70), 109 (54)... 152 (6)]	8.64	1280	0.16	12.98	1924	0.19
Geranyl formate	8.98	1303	0.04	10.05*	1668	0.07
Unknown [m/z 82, 59 (44), 41 (43), 95 (31), 43 (29), 81 (24)...]	9.44	1332	0.07	12.76*	1904	0.09
α-Cubebene	9.61	1344	0.02	6.93*	1422	[0.15]
Citronellyl acetate	9.72	1352	0.11	9.57*	1629	[29.82]
Cyclosativene I	9.79	1356	0.12	7.12	1437	0.10
Cyclosativene II	9.83	1359	0.19	7.06*	1432	[0.27]

Neryl acetate	9.90	1364	0.05	10.28	1687	0.05
α-Copaene	9.96	1368	0.10	7.29*	1449	[0.29]
β-Bourbonene	10.08	1377	0.05	7.54	1469	0.06
Geranyl acetate	10.16	1382	4.65	10.64	1717	4.69
β-Elementene	10.21	1386	0.13	8.61*†	1552	[2.26]
β-Caryophyllene	10.55	1410	2.02	8.61*†	1552	[2.26]
β-Copaene	10.69	1421	0.03	8.51*	1544	0.04
trans-α-Bergamotene	10.83	1431	0.03	8.51*	1544	[0.04]
α-Humulene	11.00*†	1444	0.70	9.44*	1618	0.26
(E)-Isoeugenol	11.00*†	1444	[0.70]	16.46	2266	0.47
cis-Muurolo-4(15),5-diene	11.14	1454	0.04	9.44*	1618	[0.26]
trans-Cadina-1(6),4-diene	11.29	1466	0.04	9.42	1616	0.04
Germacrene D	11.38	1472	0.33	9.92	1658	0.38
γ-Amorphene	11.51	1482	0.03	9.96*	1660	[0.15]
epi-Cubebol	11.58	1487	0.15	12.05	1840	0.15
α-Muurolole	11.69	1495	0.06	10.05*	1668	[0.07]
γ-Cadinene	11.83	1506	1.15	10.53*	1708	[1.14]
Cubebol	11.84	1507	0.27	12.61	1890	0.34
δ-Cadinene	11.96	1516	0.40	10.54*	1709	0.33
(E)-γ-Bisabolene	12.08	1526	0.25	10.54*	1709	[0.33]
α-Elemol	12.29	1542	0.09	14.08	2028	0.08
Germacrene B	12.34	1546	0.05	11.23	1768	0.07
Geranyl butyrate	12.52	1560	0.01	12.28	1861	0.02
Caryophyllene oxide	12.66*	1571	0.56	12.84	1911	0.50
Caryophyllene oxide isomer	12.66*	1571	[0.56]	12.76*	1904	[0.09]
Humulene epoxide II	12.99	1597	0.06	13.43	1966	0.05
Selin-6-en-4α-ol?	13.16	1611	0.01	14.79	2097	0.08
1-epi-Cubenol	13.30	1622	0.02	13.76	1997	0.02
Cubenol	13.43*	1634	0.04	13.77	1998	0.02
τ-Cadinol	13.43*	1634	[0.04]	14.91	2108	0.02
τ-Muurolol	13.50	1639	0.04	15.10	2128	0.02
β-Eudesmol	13.55	1643	0.07	15.43	2161	0.07
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79 (58)... 204 (48), 220 (2)]	13.59	1647	0.04	15.54	2171	0.03
(2Z,6Z)-Farnesol	13.86	1669	0.01	16.10	2228	0.05
Farnesal isomer	14.33	1708	0.02			
(2E,6Z)-Farnesal	14.44	1717	0.02			
(2E,6E)-Farnesal	14.65	1735	0.02	15.87	2205	0.06
Neophytadiene	15.86	1842	0.01	12.66	1895	0.05
Octadecanal	17.81	2026	0.01	16.84	2306	0.02
Unknown [m/z 93, 69 (95), 135 (76), 107 (53), 41 (53), 109 (50)... 235 (10)...]	18.22	2066	0.05			
Dicital	18.59	2102	0.08	16.89	2311	0.03
Unknown [m/z 69, 41 (38), 151 (36), 123	18.84	2129	0.09			

(34), 82 (24), 43 (23), 109 (21)...				
Phytol isomer	18.91	2136	0.02	
Unknown [m/z 94, 43 (85), 93 (81), 69 (76), 137 (76), 95 (60), 134 (51)...	19.18	2164	0.57	
Unknown [m/z 94, 43 (56), 123 (55), 69 (53), 95 (42), 79 (39)...	19.75	2224	0.02	
Unknown [m/z 93, 69 (79), 43 (70), 137 (53), 41 (41), 119 (37)... 289 (33)...	19.85	2235	0.02	
Unknown [m/z 123, 94 (100), 43 (86), 69 (75), 95 (47), 41 (47), 93 (45)...	20.02	2253	0.04	
Total identified		96.26%		96.03%
Total reported		97.54%		96.42%

*: 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