Date : May 22, 2019

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 19E22-PTH04-1-SCC
Customer identification : Kumquat - K20102810R
Type : Essential oil
Source : *Fortunella japonica*
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 : Sylvain Mercier, M. Sc., Chimiste
Analysis date : May 22, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Bright yellow liquid
Refractive index: 1.4735 ± 0.0003 (20 °C)

CONCLUSION

No clear adulterant, contaminant or diluent has been detected using this method, based on the scarce reports from scientific literature.

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ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
α-Thujene	0.07	0.07	Monoterpene
α-Pinene	0.69	0.68	Monoterpene
Camphene	0.01	0.01	Monoterpene
β-Pinene	1.68*	1.27	Monoterpene
Sabinene	[1.68]*	0.42	Monoterpene
Myrcene	1.80	1.80	Monoterpene
α-Phellandrene	0.18*	0.04	Monoterpene
Octanal	[0.18]*	0.13	Aliphatic aldehyde
Δ3-Carene	0.14	0.14	Monoterpene
α-Terpinene	0.04	0.04	Monoterpene
para-Cymene	0.16	0.21	Monoterpene
Limonene	90.23*	90.39	Monoterpene
1,8-Cineole	[90.23]*	0.28	Monoterpenic ether
(*Z*)-β-Ocimene	0.01	1.52*	Monoterpene
(*E*)-β-Ocimene	0.03	0.03	Monoterpene
γ-Terpinene	1.49	[1.52]*	Monoterpene
cis-Sabinene hydrate	0.01	0.01	Monoterpenic alcohol
Octanol	0.05	0.06	Aliphatic alcohol
Terpinolene	0.10	0.10	Monoterpene
Linalool	0.40	0.42	Monoterpenic alcohol
Nonanal	0.03	0.03	Aliphatic aldehyde
(*E*)-4,8-Dimethylnona-1,3,7-triene	0.02	0.01	Terpene derivative
trans-para-Mentha-2,8-dien-1-ol	0.01	0.02	Monoterpenic alcohol
cis-Limonene oxide	0.03	0.03	Monoterpenic ether
cis-para-Mentha-2,8-dien-1-ol	0.01	0.01	Monoterpenic alcohol
trans-Limonene oxide	0.03	0.03	Monoterpenic ether
neo-Isopulegol	0.01	0.01	Monoterpenic alcohol
Citronellal	0.26	0.24	Monoterpenic aldehyde
Terpinen-4-ol	0.03	0.03	Monoterpenic alcohol
α-Terpineol	0.10	0.14*	Monoterpenic alcohol
Unknown	0.01	0.03*	Unknown
Decanal	0.18	0.17	Aliphatic aldehyde
trans-Carveol	0.03	0.02	Monoterpenic alcohol
Nerol	0.03	0.02	Monoterpenic alcohol
Citronellol	0.09	0.12*	Monoterpenic alcohol
Neral	0.07	0.08	Monoterpenic aldehyde
Geraniol	0.14	0.15	Monoterpenic alcohol
Perillaldehyde	0.01	[0.12]*	Monoterpenic aldehyde
Geranial	0.08	0.09	Monoterpenic aldehyde
Limonen-10-ol	0.02	0.02	Monoterpenic alcohol
Undecanal	0.01	0.02	Aliphatic aldehyde
Citronellyl acetate	0.02	0.02	Monoterpenic ester
Neryl acetate	0.02	0.02	Monoterpenic ester
α-Copaene	0.02	0.03	Sesquiterpene
Geranyl acetate	0.03	0.03	Monoterpenic ester
β-Cubebene	0.02	[0.03]*	Sesquiterpene
β-Elemene	0.03	0.08*	Sesquiterpene
Dodecanal	0.05	0.06	Aliphatic aldehyde

β-Caryophyllene	0.04	[0.08]*	Sesquiterpene
β-Copaene	0.03	0.04	Sesquiterpene
α-Humulene	0.01	0.01	Sesquiterpene
γ-Muurolene	0.01	0.01	Sesquiterpene
Germacrene D	0.04	[0.14]*	Sesquiterpene
Valencene	0.08	0.08	Sesquiterpene
α-Muurolene	0.03	0.02	Sesquiterpene
γ-Cadinene	0.04	0.03	Sesquiterpene
δ-Cadinene	0.05	0.05	Sesquiterpene
α-Elemol	0.03	0.03	Sesquiterpenic alcohol
Germacrene D-4-ol	0.01	0.01	Sesquiterpenic alcohol
β-Sinensal	0.03	0.03	Sesquiterpenic aldehyde
α-Sinensal	0.02	0.02	Sesquiterpenic aldehyde
Myristic acid	0.02		Aliphatic acid
Nootkatone	0.01	0.02	Sesquiterpenic ketone
Palmitic acid	0.05		Aliphatic acid
Linoleic acid	0.02		Aliphatic acid
Oleic acid	0.02		Aliphatic acid
Stearic acid	0.04		Aliphatic acid
Tetramethoxyflavone isomer	0.02		Flavonoid
Tangeretin	0.03		Flavonoid
Total identified	**99.10%**	**99.49%**	

*: Two or more compounds are coeluting on this column
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

Note: no correction factor was applied

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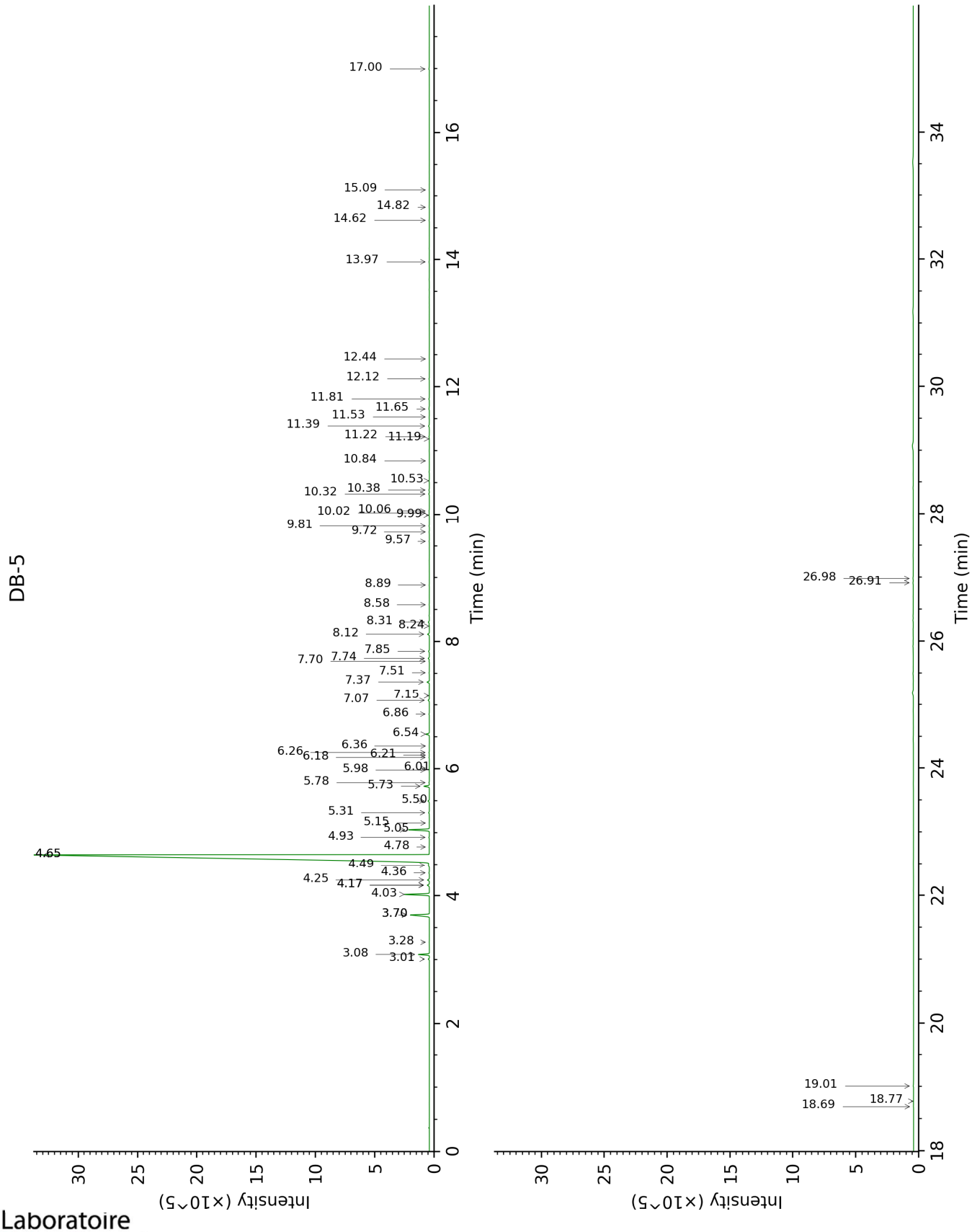
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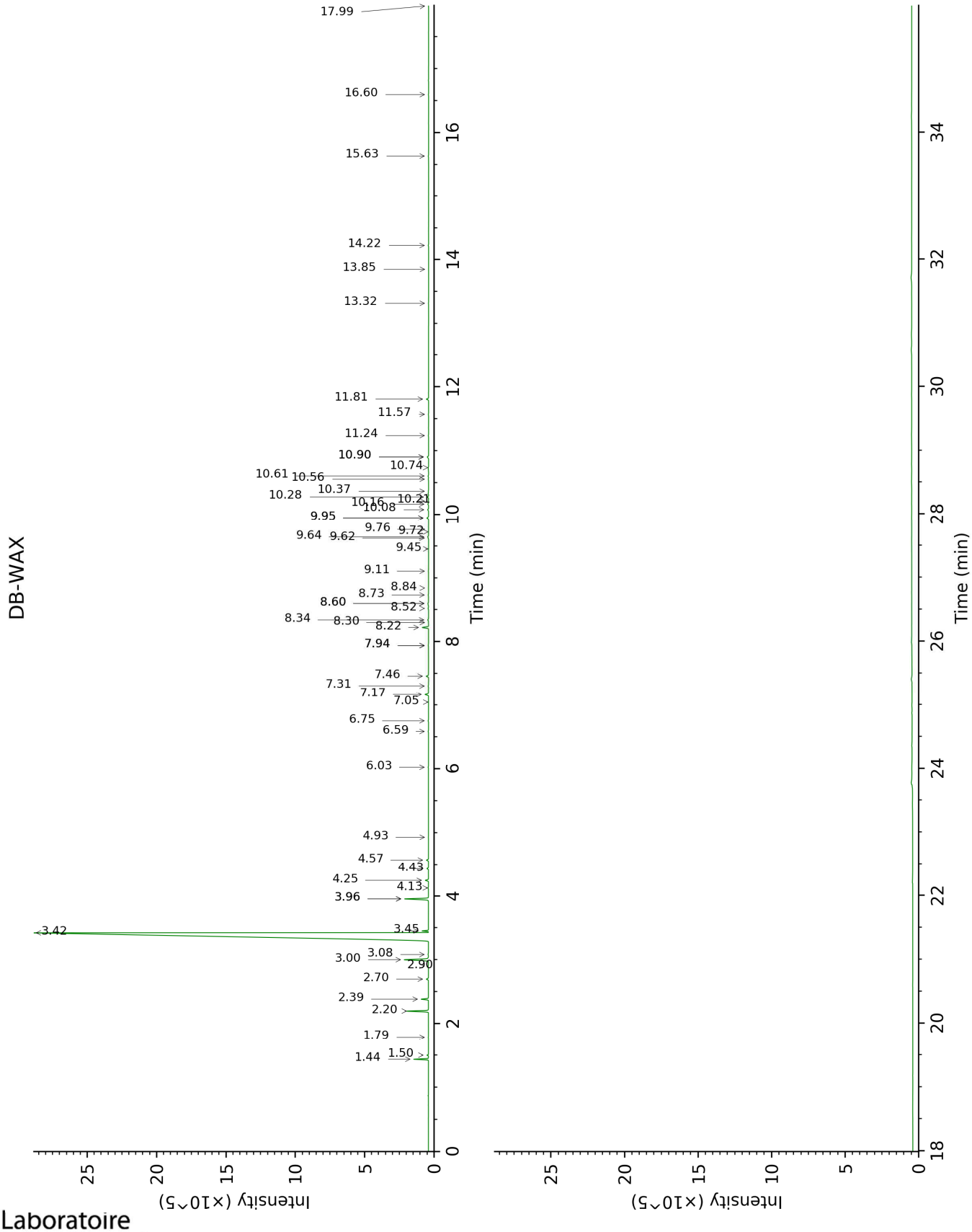
15.09
14.82
14.62
13.97
12.44
12.12
11.81
11.65
11.53
11.39
11.22
11.19
10.84
10.53
10.38
10.32
10.06
10.02
9.99
9.81
9.72
9.57
8.89
8.58
8.31
8.24
8.12
7.85
7.74
7.70
7.51
7.37
7.15
7.07
6.86
6.54
6.36
6.26
6.21
6.18
6.01
5.98
5.78
5.73
5.50
5.31
5.15
5.05
4.93
4.78
4.65
4.49
4.36
4.25
4.17
4.03
3.70
3.28
3.08
3.01
Time (min)
Intensity (×10^5)
26.98
26.91
19.01
18.77
18.69
Time (min)
Intensity (×10^5)


DB-WAX
17.99
16.60
15.63
14.22
13.85
13.32
11.81
11.57
11.24
10.90
10.74
10.61
10.56
10.37
10.28
10.21
10.16
10.08
9.95
9.76
9.72
9.64
9.62
9.45
9.11
8.84
8.73
8.60
8.52
8.34
8.30
8.22
7.94
7.46
7.31
7.17
7.05
6.75
6.59
6.03
4.93
4.57
4.43
4.25
4.13
3.96
3.45
3.42
3.08
3.00
2.90
2.70
2.39
2.20
1.79
1.50
1.44
Time (min)
Intensity (×10^5)
Time (min)
Intensity (×10^5)

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
α-Thujene	3.01	925	0.07	1.50	998	0.07
α-Pinene	3.08	930	0.69	1.44	990	0.68
Camphene	3.28	942	0.01	1.79	1026	0.01
β-Pinene	3.70*	971	1.68	2.20	1065	1.27
Sabinene	3.70*	971	[1.68]	2.39	1083	0.42
Myrcene	4.02	992	1.80	3.00	1132	1.80
α-Phellandrene	4.17*	1002	0.18	2.90	1125	0.04
Octanal	4.17*	1002	[0.18]	4.57	1248	0.13
Δ3-Carene	4.25	1007	0.14	2.70	1109	0.14
α-Terpinene	4.36	1014	0.04	3.08	1139	0.04
para-Cymene	4.49	1022	0.16	4.25	1225	0.21
Limonene	4.65*	1032	90.23	3.42	1165	90.39
1,8-Cineole	4.65*	1032	[90.23]	3.45	1167	0.28
(*Z*)-β-Ocimene	4.78	1040	0.01	3.96*	1204	1.52
(*E*)-β-Ocimene	4.93	1050	0.03	4.13	1217	0.03
γ-Terpinene	5.05	1057	1.49	3.96*	1204	[1.52]
cis-Sabinene hydrate	5.15	1064	0.01	7.05	1426	0.01
Octanol	5.31	1074	0.05	8.34	1523	0.06
Terpinolene	5.50	1086	0.10	4.43	1238	0.10
Linalool	5.73	1100	0.40	8.22	1514	0.42
Nonanal	5.78	1104	0.03	6.03	1352	0.03
(*E*)-4,8-Dimethylnona-1,3,7-triene	5.98	1117	0.02	4.93	1274	0.01
trans-para-Mentha-2,8-dien-1-ol	6.01	1119	0.01	9.10	1581	0.02
cis-Limonene oxide	6.18	1130	0.03	6.59	1392	0.03
cis-para-Mentha-2,8-dien-1-ol	6.21	1132	0.01	9.72	1630	0.01
trans-Limonene oxide	6.26	1135	0.03	6.75	1404	0.03
neo-Isopulegol	6.36	1141	0.01	8.30	1520	0.01
Citronellal	6.54	1154	0.26	7.17	1435	0.24
Terpinen-4-ol	6.86	1174	0.03	8.73	1552	0.03
α-Terpineol	7.07	1188	0.10	9.95*	1648	0.14
Unknown [m/z 121, 79 (98), 93 (87), 94 (73), 91 (63), 105 (45)...]	7.15	1193	0.01	7.94*	1492	0.03
Decanal	7.37	1208	0.18	7.46	1456	0.17
trans-Carveol	7.52	1218	0.03	11.57	1783	0.02
Nerol	7.70	1231	0.03	11.24	1755	0.02
Citronellol	7.74	1234	0.09	10.90*	1727	0.12
Neral	7.85	1242	0.07	9.64	1624	0.08
Geraniol	8.12	1260	0.14	11.81	1804	0.15
Perillaldehyde	8.24	1269	0.01	10.90*	1727	[0.12]
Geranial	8.31	1273	0.08	10.28	1675	0.09
Limonen-10-ol	8.58	1292	0.02	13.32	1939	0.02

Undecanal	8.89	1308	0.01	8.84	1561	0.02
Citronellyl acetate	9.57	1356	0.02	9.62	1622	0.02
Neryl acetate	9.72	1366	0.02	10.37	1682	0.02
α-Copaene	9.82	1373	0.02	7.31	1445	0.03
Geranyl acetate	9.99	1386	0.03	10.74	1713	0.03
β-Cubebene	10.02	1388	0.02	7.94*	1492	[0.03]
β-Elemene	10.06	1390	0.03	8.60*†	1542	0.08
Dodecanal	10.32	1410	0.05	10.16	1666	0.06
β-Caryophyllene	10.38	1414	0.04	8.60*†	1542	[0.08]
β-Copaene	10.53	1425	0.03	8.52	1536	0.04
α-Humulene	10.84	1448	0.01	9.45	1609	0.01
γ-Muurolene	11.18	1474	0.01	9.76	1634	0.01
Germacrene D	11.22	1477	0.04	9.95*	1648	[0.14]
Valencene	11.39	1489	0.08	10.08	1659	0.08
α-Muurolene	11.53	1500	0.03	10.21	1670	0.02
γ-Cadinene	11.65	1509	0.04	10.56	1698	0.03
δ-Cadinene	11.81	1522	0.05	10.61	1702	0.05
α-Elemol	12.12	1546	0.03	14.22	2023	0.03
Germacrene D-4-ol	12.44	1571	0.01	13.85	1987	0.01
β-Sinensal	13.97	1696	0.03	15.63	2161	0.03
α-Sinensal	14.62	1752	0.02	16.60	2259	0.02
Myristic acid	14.82	1770	0.02			
Nootkatone	15.09	1793	0.01	17.99	2408	0.02
Palmitic acid	17.00	1968	0.05			
Linoleic acid	18.69	2136	0.02			
Oleic acid	18.78	2144	0.02			
Stearic acid	19.01	2169	0.04			
Tetramethoxyflavone isomer	26.92	3123	0.02			
Tangeretin	26.98	3130	0.03			
Total identified		**99.10%**			**99.49%**	
Total reported		**99.11%**			**99.49%**	

*: 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

Note: no correction factor was applied
R.T.: Retention time (minutes)
R.I.: Retention index