Date : April 06, 2021

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 21C19-PTH03
Customer identification : Mandarin Green - Brazil - M1010494R
Type : Essential oil
Source : *Citrus reticulata* cv. Mandarine
Customer : Plant Therapy

Analysis

Method: PC-MAT-014 ISO - Analysis of the composition of an essential oil or other volatile liquid by FAST GC-FID (in French); identifications validated by GC-MS.
Analyst : Seydou Ka, M. Sc.
Analysis date : March 29, 2021

Checked and approved by :

Sylvain Mercier, M. Sc., chimiste 2014-005

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PHYSICOCHEMICAL DATA

Physical aspect: Yellow brownish liquid
Refractive index: 1.4754 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 3528:2012 - OIL OF MANDARIN, ITALIAN TYPE - GREEN

Compound	Min. %	Max. %	Observed %	Complies?
α-Pinene	1.6	2.7	1.9	Yes
β-Pinene	1.0	2.0	1.4	Yes
Myrcene	1.4	2.0	1.7	Yes
Octanal		0.14	0.11	Yes
γ-Terpinene	17.0	22.0	17.1	Yes
Limonene	65.0	74.0	69.5	Yes
Linalool	0.05	0.20	0.17	Yes
Decanal	0.04	0.14	0.10	Yes
Dimethyl anthranilate	0.4	0.7	0.5	Yes
α-Sinensal	0.2	0.5	0.4	Yes
Refractive index	1.4732	1.4758	1.4754	Yes

CONCLUSION

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

Analysis summary – Consolidated contents

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

Identification	%	Class
Octane	tr	Alkane
α-Thujene	0.67	Monoterpene
α-Pinene	1.85	Monoterpene
Camphene	0.02	Monoterpene
Sabinene	0.24	Monoterpene
β-Pinene	1.36	Monoterpene
Myrcene	1.70	Monoterpene
α-Phellandrene	0.06	Monoterpene
Octanal	0.11	Aliphatic aldehyde
α-Terpinene	0.36	Monoterpene
para-Cymene	0.67	Monoterpene
Limonene	69.54	Monoterpene
β-Phellandrene	0.25	Monoterpene
(*Z*)-β-Ocimene	0.01	Monoterpene
(*E*)-β-Ocimene	0.02	Monoterpene
γ-Terpinene	17.10	Monoterpene
cis-Sabinene hydrate	0.04	Monoterpenic alcohol
Octanol	0.02	Aliphatic alcohol
Terpinolene	0.78	Monoterpene
trans-Sabinene hydrate	0.07	Monoterpenic alcohol
Linalool	0.17	Monoterpenic alcohol
Nonanal	0.03	Aliphatic aldehyde
trans-para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
cis-Limonene oxide	0.02	Monoterpenic ether
trans-Limonene oxide	0.02	Monoterpenic ether
Epoxyterpinolene	0.03	Monoterpenic ether
Citronellal	0.03	Monoterpenic aldehyde
Borneol	tr	Monoterpenic alcohol
Unknown	0.02	Unknown
Terpinen-4-ol	0.06	Monoterpenic alcohol
para-Cymen-8-ol	0.02	Monoterpenic alcohol
α-Terpineol	0.23	Monoterpenic alcohol
Unknown	0.01	Unknown
Decanal	0.10	Aliphatic aldehyde
trans-Carveol	0.01	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
Citronellol	0.04	Monoterpenic alcohol
Thymol methyl ether	0.01	Monoterpenic ether
Neral	0.01	Monoterpenic aldehyde
Isopiperitenone	0.01	Monoterpenic ketone
Geranial	0.01	Monoterpenic aldehyde
trans-Ascaridole glycol?	0.01	Oxygenated monoterpene
Unknown	0.01	Unknown
Unknown	0.01	Oxygenated monoterpene
cis-Ascaridole glycol	0.01	Monoterpenic alcohol

Thymol	0.10	Monoterpenic alcohol
Perilla alcohol	tr	Monoterpenic alcohol
Unknown	0.01	Unknown
Undecanal	0.01	Aliphatic aldehyde
Carvacrol	0.01	Monoterpenic alcohol
Unknown	0.01	Monoterpenic alcohol
trans-para-Mentha-2,8-diene-1-hydroperoxide	0.01	Monoterpenic peroxide
Unknown	0.01	Sesquiterpene
Neryl acetate	tr	Monoterpenic ester
α-Copaene	0.01	Sesquiterpene
Geranyl acetate	0.01	Monoterpenic ester
Dimethyl anthranilate	0.52	Phenolic ester
Dodecanal	0.03	Aliphatic aldehyde
β-Caryophyllene	0.11	Sesquiterpene
α-Humulene	0.01	Sesquiterpene
(2*E*)-Dodecenal	0.02	Aliphatic aldehyde
Germacrene D	0.01	Sesquiterpene
α-Selinene	0.05	Sesquiterpene
Bicyclogermacrene	tr	Sesquiterpene
(3*E*,6*E*)-α-Farnesene	0.44	Sesquiterpene
δ-Cadinene	0.02	Sesquiterpene
Spathulenol	0.01	Sesquiterpenic alcohol
Germacrene D-4-ol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.01	Sesquiterpenic ether
α-Sinensal	0.39	Sesquiterpenic aldehyde
Myristic acid	0.02	Aliphatic acid
Palmitic acid	0.07	Aliphatic acid
para-Camphorene	0.07	Diterpene
Linoleic acid	0.03	Aliphatic acid
Oleic acid	0.04	Aliphatic acid
Stearic acid	0.02	Aliphatic acid
Tetramethoxyflavone isomer	tr	Flavonoid
Tangeretin	0.21	Flavonoid
3,3',4',5,6,7,8-Heptamethoxyflavone	0.03	Flavonoid
Nobiletin	0.08	Flavonoid
Consolidated total	**98.15%**	

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.

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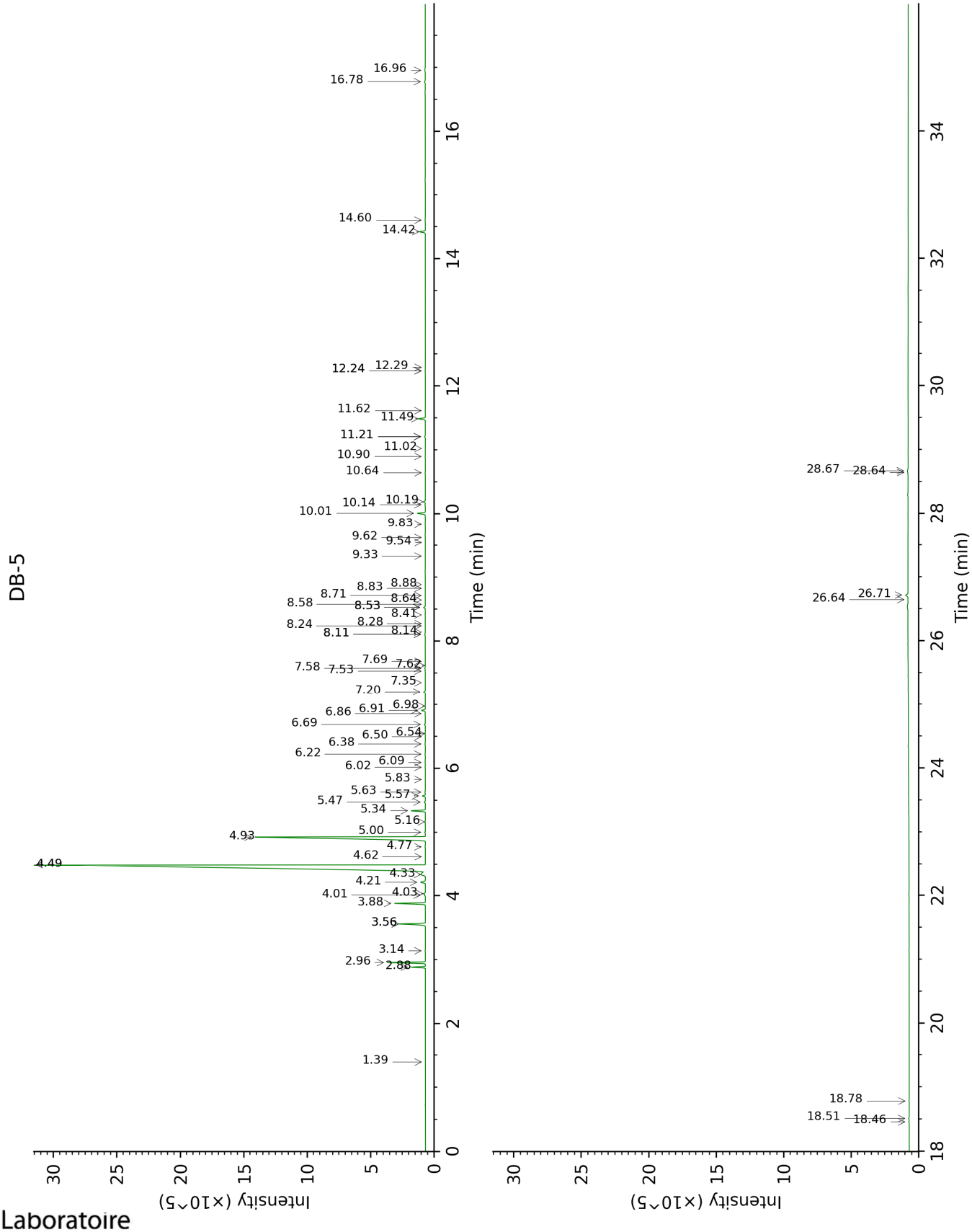
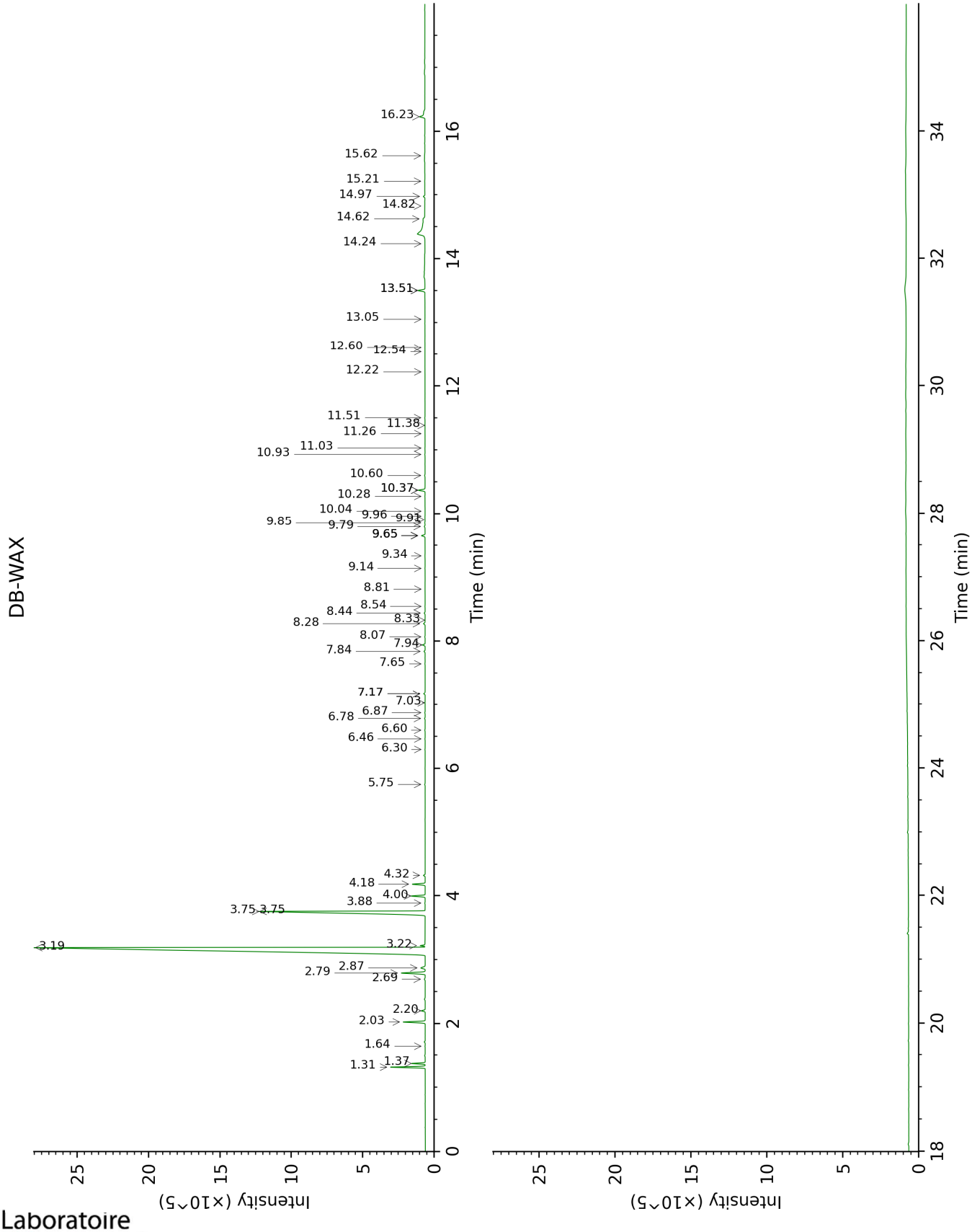

DB-5
16.96
16.78
14.60
14.42
12.24
12.29
11.62
11.49
11.21
11.02
10.90
10.64
10.14
10.19
10.01
9.83
9.62
9.54
9.33
8.83
8.88
8.71
8.64
8.58
8.53
8.41
8.24
8.28
8.11
8.14
7.69
7.62
7.58
7.53
7.35
7.20
6.98
6.91
6.86
6.69
6.54
6.50
6.38
6.22
6.09
6.02
5.83
5.63
5.57
5.47
5.34
5.16
5.00
4.93
4.77
4.62
4.49
4.33
4.21
4.03
4.01
3.88
3.56
3.14
2.96
2.88
1.39
Time (min)
Intensity (×10^5)
28.67
28.64
26.64
26.71
18.78
18.51
18.46
Time (min)
Intensity (×10^5)


DB-WAX
Intensity (×10^5)
Time (min)
16.23
15.62
15.21
14.97
14.82
14.62
14.24
13.51
13.05
12.60
12.54
12.22
11.51
11.38
11.26
11.03
10.93
10.60
10.37
10.28
10.04
9.96
9.91
9.85
9.79
9.65
9.34
9.14
8.81
8.54
8.44
8.33
8.28
8.07
7.94
7.84
7.65
7.17
7.03
6.87
6.78
6.60
6.46
6.30
5.75
4.32
4.18
4.00
3.88
3.75
3.75
3.22
3.19
2.87
2.79
2.69
2.20
2.03
1.64
1.37
1.31

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Octane	1.39	803	tr			
α-Thujene	2.88	926	0.67	1.37	1002	0.67
α-Pinene	2.96	931	1.85	1.31	993	1.87
Camphene	3.14	944	0.02	1.64	1029	0.02
Sabinene	3.56*	972	1.60	2.20	1086	0.24
β-Pinene	3.56*	972	[1.60]	2.03	1068	1.36
Myrcene	3.88	994	1.70	2.79	1135	1.67
α-Phellandrene	4.01	1002	0.06	2.70	1128	0.06
Octanal	4.03	1004	0.11	4.32	1251	0.10
α-Terpinene	4.21	1015	0.36	2.87	1142	0.36
para-Cymene	4.33	1023	0.67	4.00	1228	0.82
Limonene	4.49*	1033	70.74	3.19	1166	69.54
β-Phellandrene	4.49*	1033	[70.74]	3.22	1169	0.25
(*Z*)-β-Ocimene	4.62	1041	0.01	3.75*	1210	16.84
(*E*)-β-Ocimene	4.77	1051	0.02	3.88	1220	0.02
γ-Terpinene	4.93	1061	17.10	3.75*	1210	[16.84]
cis-Sabinene hydrate	5.00	1066	0.04	6.78	1431	0.04
Octanol	5.16	1076	0.02	8.07	1528	0.02
Terpinolene	5.34	1087	0.78	4.18	1241	0.77
trans-Sabinene hydrate	5.47	1096	0.07	7.84	1510	0.07
Linalool	5.57	1102	0.17	7.94	1518	0.17
Nonanal	5.63	1105	0.03	5.75	1355	0.03
trans-para-Mentha-2,8-dien-1-ol	5.83	1118	0.01	8.81	1586	0.01
cis-Limonene oxide	6.02	1130	0.02	6.30	1395	0.01
trans-Limonene oxide	6.09	1135	0.02	6.46	1407	0.02
Epoxyterpinolene	6.22	1144	0.03	6.60	1417	0.03
Citronellal	6.38	1154	0.03	6.87	1437	0.02
Borneol	6.50	1161	tr	9.65*	1654	0.24
Unknown [m/z 43, 109 (68), 67 (62), 81 (36), 41 (31), 137 (29), 79 (26)...]	6.54	1164	0.02	7.17*	1460	0.10
Terpinen-4-ol	6.69	1173	0.06	8.44	1557	0.06
para-Cymen-8-ol	6.86	1184	0.02	11.38	1800	tr
α-Terpineol	6.91	1188	0.23	9.65*	1654	[0.24]
Unknown [m/z 121, 79 (98), 93 (87), 94 (73), 91 (63), 105 (45)...]	6.98	1192	0.01	7.65	1495	0.02
Decanal	7.20	1207	0.10	7.17*	1460	[0.10]
trans-Carveol	7.35	1216	0.01	11.26	1789	0.01
Nerol	7.53	1229	0.02	10.93	1761	0.02
Citronellol	7.58	1232	0.04	10.60	1733	0.03
Thymol methyl ether	7.62	1235	0.01	8.33	1548	tr
Neral	7.69	1239	0.01	9.34	1628	0.01
Isopiperitenone	8.11*	1267	0.04	11.03	1770	0.01

Geranial	8.11*	1267	[0.04]	9.96	1680	0.01
trans-Ascaridole glycol?	8.14	1270	0.01			
Unknown [m/z 43, 79 (78), 128 (46), 58 (42), 127 (42)...]	8.24	1276	0.01	12.54	1903	tr
Unknown [m/z 95, 67 (45), 41 (42), 110 (42), 43 (41), 59 (36)]	8.28	1279	0.01	12.22	1874	tr
cis-Ascaridole glycol	8.41	1288	0.01	14.62	2101	0.19
Thymol	8.53*	1296	0.11	14.98	2136	0.10
Perilla alcohol	8.53*	1296	[0.11]	13.05	1951	tr
Unknown [m/z 112, 97 (93), 83 (60), 43 (46), 41 (20), 69 (19)...]	8.58	1299	0.01			
Undecanal	8.64	1303	0.01	8.54	1565	0.01
Carvacrol	8.71	1308	0.01	15.21	2160	0.02
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.83	1316	0.01	14.82	2121	0.01
trans-para-Mentha-2,8-diene-1-hydroperoxide	8.88	1320	0.01			
Unknown [m/z 43, 81 (96), 95 (85), 67 (74), 69 (68), 41 (66)...204 (1)]	9.33	1352	0.01			
Neryl acetate	9.54	1367	tr	10.04	1686	tr
α-Copaene	9.62	1373	0.01	7.03	1449	0.01
Geranyl acetate	9.83	1387	0.01	10.37*	1713	0.47
Dimethyl anthranilate	10.01	1400	0.52	13.50*	1993	0.51
Dodecanal	10.14	1410	0.03	9.85	1670	0.03
β-Caryophyllene	10.19	1413	0.11	8.28	1544	0.11
α-Humulene	10.64	1447	0.01	9.14	1612	0.01
(2*E*)-Dodecenal	10.90	1466	0.02	11.50	1811	0.02
Germacrene D	11.02	1476	0.01	9.65*	1654	[0.24]
α-Selinene	11.21*	1489	0.06	9.79	1666	0.05
Bicyclogermacrene	11.21*	1489	[0.06]	9.91	1675	tr
(3*E*,6*E*)-α-Farnesene	11.49	1511	0.44	10.37*	1713	[0.47]
δ-Cadinene	11.62	1521	0.02	10.28	1705	0.02
Spathulenol	12.24*	1570	0.02	14.24	2063	0.01
Germacrene D-4-ol	12.24*	1570	[0.02]	13.50*	1993	[0.51]
Caryophyllene oxide	12.29	1574	0.01	12.60	1909	tr
α-Sinensal	14.42	1751	0.39	16.23	2265	0.58
Myristic acid	14.60	1767	0.02			
Palmitic acid	16.78	1966	0.07			
para-Camphorene	16.96	1983	0.07	15.62	2201	0.04
Linoleic acid	18.46	2133	0.03			
Oleic acid	18.51	2138	0.04			
Stearic acid	18.78	2166	0.02			
Tetramethoxyflavone isomer	26.64	3133	tr			

Tangeretin	26.72	3141	0.21	
3,3',4',5,6,7,8-Heptamethoxyflavone	28.64	3328	0.03	
Nobiletin	28.67	3330	0.08	
Total identified		**99.07%**		**97.68%**
Total reported		**99.14%**		**97.71%**

*: Two or more compounds are coeluting on this column
[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
R.T.: Retention time (minutes)
R.I.: Retention index