CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 20I14-PTH06
Customer identification : Bergamot BF - B30109202R
Type : Essential oil
Source : *Citrus bergamia*
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 : Fanny Charlier, B. Sc., chimiste à l'entraînement
Analysis date : September 17, 2020

Checked and approved by :

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

Notes: This report may not be published, including online, without the written consent from Laboratoire PhytoChemia. This report is digitally signed, it is only considered valid if the digital signature is intact. The results only describe the samples that were submitted to the assays.

MÉTHODE CERTIFIÉE
✳ISO 17025:2017 CERTIFIED METHOD

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid
Refractive index: 1.4647 ± 0.0003 (20 °C; method PC-MAT-016)

NF T 75-215:2009 - OIL OF BERGAMOT - ITALY

Compound	Min. %	Max. %	Observed %	Complies?
β-Bisabolene	0.3	0.6	0.1	No
Geranial	0.25	0.50	0.32	Yes
Linalyl acetate	22	36	28	Yes
Linalool	3	15	11	Yes
γ-Terpinene	6	10	7	Yes
Limonene	30	45	38	Yes
β-Pinene	5.5	9.5	6.6	Yes
Refractive index	1.4650	1.4700	1.4647	No

CONCLUSION

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

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ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Class
Tricyclene	tr	Monoterpene
α-Thujene	0.17	Monoterpene
α-Pinene	1.08	Monoterpene
Camphene	0.03	Monoterpene
α-Fenchene	tr	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
β-Pinene	6.65	Monoterpene
Sabinene	1.00	Monoterpene
6-Methyl-5-hepten-2-one	0.01	Aliphatic ketone
Myrcene	1.16	Monoterpene
α-Phellandrene	0.03	Monoterpene
Pseudolimonene	0.02	Monoterpene
Octanal	0.06	Aliphatic aldehyde
Δ3-Carene	0.01	Monoterpene
α-Terpinene	0.15	Monoterpene
ortho-Cymene	tr	Monoterpene
para-Cymene	0.45	Monoterpene
Limonene	37.89	Monoterpene
1,8-Cineole	0.03	Monoterpenic ether
β-Phellandrene	0.14	Monoterpene
(*Z*)-β-Ocimene	0.08	Monoterpene
(*E*)-β-Ocimene	0.15	Monoterpene
γ-Terpinene	6.57	Monoterpene
cis-Sabinene hydrate	0.02	Monoterpenic alcohol
Terpinolene	0.34	Monoterpene
trans-Linalool oxide (fur.)	0.05	Monoterpenic alcohol
Linalool	11.08	Monoterpenic alcohol
cis-Limonene oxide	0.01	Monoterpenic ether
trans-Limonene oxide	tr	Monoterpenic ether
Camphor	0.01	Monoterpenic ketone
Citronellal	0.05	Monoterpenic aldehyde
Borneol	0.01	Monoterpenic alcohol
Terpinen-4-ol	0.03	Monoterpenic alcohol
α-Terpineol	0.07	Monoterpenic alcohol
Decanal	0.07	Aliphatic aldehyde
Octyl acetate	0.11	Aliphatic ester
Nerol	0.07	Monoterpenic alcohol
Citronellol	0.01	Monoterpenic alcohol
Neral	0.20	Monoterpenic aldehyde
(*cis*?)-Linalool oxide acetate (fur.)?	0.04	Monoterpenic ester
Geraniol	0.07	Monoterpenic alcohol
Linalyl acetate	27.55	Monoterpenic ester
(*trans*?)-Linalool oxide acetate (fur.)?	0.04	Monoterpenic ester
Geranial	0.32	Monoterpenic aldehyde
Bornyl acetate	0.02	Monoterpenic ester

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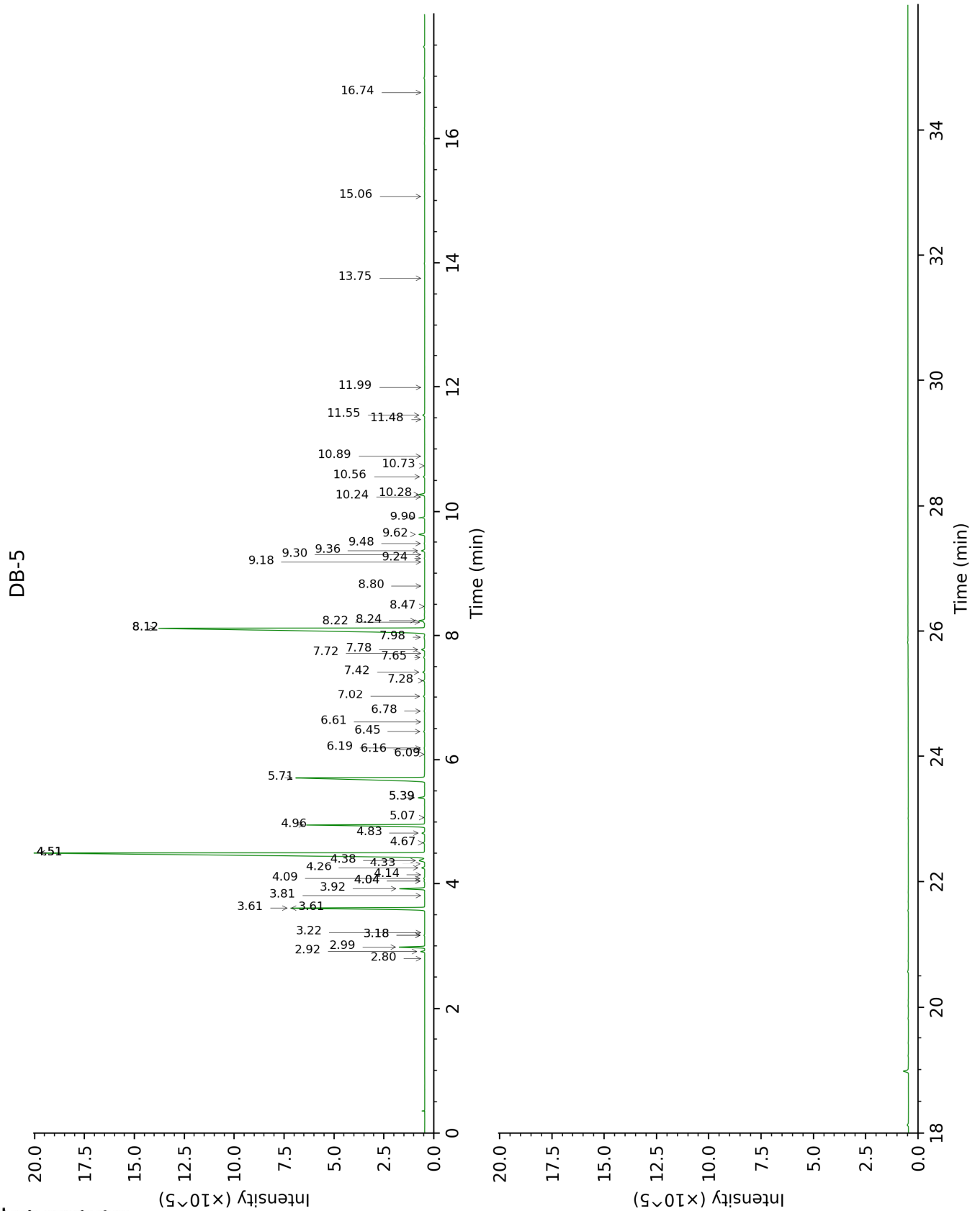|		
cis-para-Mentha-2,8-diene-1-hydroperoxide?	0.01	Monoterpenic peroxide
para-Mentha-1,8-diene-4-hydroperoxide	0.01	Monoterpenic peroxide
Linalyl propionate	0.02	Monoterpenic ester
Hodiendiol derivative	0.01	Oxygenated monoterpene
α-Terpinyl acetate	0.18	Monoterpenic ester
Unknown	0.03	Monoterpenic ester
Neryl acetate	0.33	Monoterpenic ester
Geranyl acetate	0.34	Monoterpenic ester
Dodecanal	0.01	Aliphatic aldehyde
β-Caryophyllene	0.34	Sesquiterpene
trans-α-Bergamotene	0.09	Sesquiterpene
α-Humulene	0.01	Sesquiterpene
(*E*)-β-Farnesene	0.02	Sesquiterpene
(*Z*)-α-Bisabolene	0.02	Sesquiterpene
β-Bisabolene	0.12	Sesquiterpene
(*E*)-α-Bisabolene	0.01	Sesquiterpene
α-Bisabolol	0.01	Sesquiterpenic alcohol
Nootkatone	0.02	Sesquiterpenic ketone
meta-Camphorene	0.01	Diterpene
Consolidated total	**97.44%**	

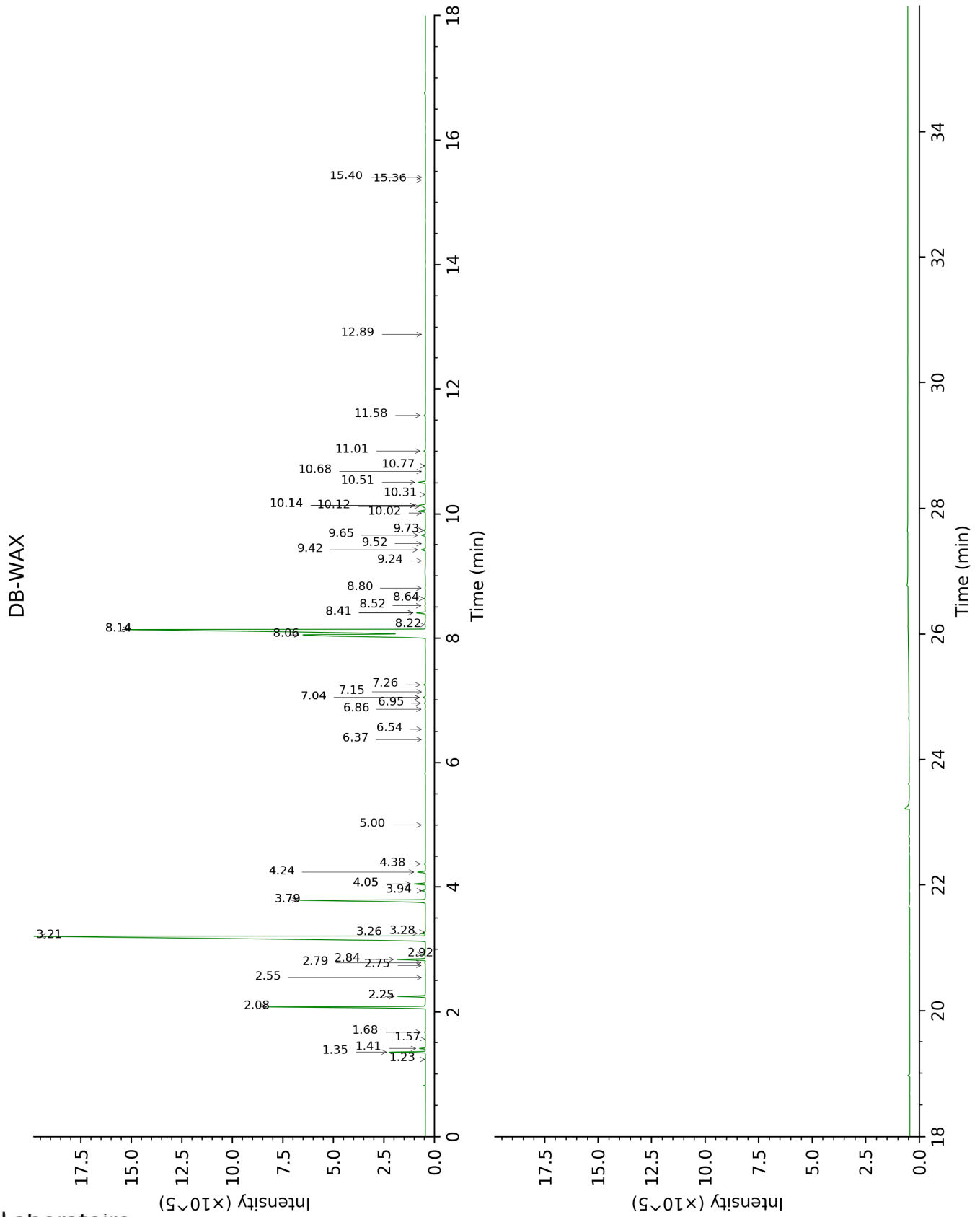tr: The compound has been detected below 0.005% of total signal.

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

16.74

15.06

13.75

11.99

11.55   11.48

10.89   10.73
10.56   10.28
10.24

9.90
9.62
9.48
9.18   9.30   9.36   9.24

8.80
8.47
8.22   8.24
8.12   7.98
7.72   7.78   7.65
7.42   7.28

7.02
6.78
6.61   6.45
6.19   6.16   6.09

5.71

5.39
5.07
4.96   4.83
4.67
4.51   4.38   4.33
4.26   4.14
4.09   4.04
3.81   3.92
3.61   3.61

3.22   3.18
2.92   2.99
2.80

Time (min)

Intensity (×10^5)

Time (min)

Intensity (×10^5)

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DB-WAX

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Tricyclene	2.80	917	tr	1.23	971	tr
α-Thujene	2.92	925	0.17	1.41	999	0.17
α-Pinene	2.99	930	1.08	1.35	990	1.07
Camphene	3.18*	942	0.03	1.68	1026	0.03
α-Fenchene	3.18*	942	[0.03]	1.57	1015	tr
Thuja-2,4(10)-diene	3.22	945	0.01	2.25*	1083	1.01
β-Pinene	3.61*	971	7.74	2.08	1066	6.65
Sabinene	3.61*	971	[7.74]	2.25*	1083	[1.01]
6-Methyl-5-hepten-2-one	3.81	985	0.01	5.00	1293	0.01
Myrcene	3.92	992	1.16	2.84	1132	1.15
α-Phellandrene	4.04*	1000	0.05	2.79	1128	0.03
Pseudolimonene	4.04*	1000	[0.05]	2.75	1124	0.02
Octanal	4.09	1003	0.06	4.38	1248	0.05
Δ3-Carene	4.14	1007	0.01	2.55	1109	0.01
α-Terpinene	4.26	1014	0.15	2.92	1138	0.15
ortho-Cymene	4.32	1018	tr	4.05*	1224	0.48
para-Cymene	4.38	1022	0.45	4.05*	1224	[0.48]
Limonene	4.51*	1029	38.49	3.21	1161	37.89
1,8-Cineole	4.51*	1029	[38.49]	3.28	1166	0.03
β-Phellandrene	4.51*	1029	[38.49]	3.26	1164	0.14
(Z)-β-Ocimene	4.67	1040	0.08	3.79*	1205	6.60
(E)-β-Ocimene	4.82	1049	0.15	3.94	1216	0.15
γ-Terpinene	4.96	1058	6.57	3.79*	1205	[6.60]
cis-Sabinene hydrate	5.07	1065	0.02	6.86	1425	0.02
Terpinolene	5.39*	1085	0.34	4.24	1238	0.34
trans-Linalool oxide (fur.)	5.39*	1085	[0.34]	6.95	1432	0.05
Linalool	5.71	1105	11.08	8.06	1516	11.45
cis-Limonene oxide	6.09	1129	0.01	6.37	1389	0.01
trans-Limonene oxide	6.16†	1134	0.04	6.54	1401	tr
Camphor	6.19†	1135	[0.04]	7.15	1447	0.01
Citronellal	6.45	1152	0.05	7.04*	1439	0.11
Borneol	6.61	1162	0.01	9.73*	1648	0.08
Terpinen-4-ol	6.78	1173	0.03	8.52	1552	0.03
α-Terpineol	7.02	1188	0.07	9.73*	1648	[0.08]
Decanal	7.28	1205	0.07	7.26	1455	0.07
Octyl acetate	7.42	1214	0.11	7.04*	1439	[0.11]
Nerol	7.65	1230	0.07	11.01	1754	0.08
Citronellol	7.72	1234	0.01	10.68	1727	0.01
Neral	7.78	1238	0.20	9.42	1623	0.21
(cis?)-Linalool oxide acetate (fur.)?	7.98	1251	0.04	8.14*	1522	27.59

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Geraniol	8.12*	1261	27.84	11.58	1803	0.07
Linalyl acetate	8.12*	1261	[27.84]	8.14*	1522	[27.59]
(*trans*?)-Linalool oxide acetate (fur.)?	8.22	1267	0.04	8.64	1561	0.06
Geranial	8.24	1269	0.32	10.14*	1681	0.36
Bornyl acetate	8.47	1284	0.02	8.22	1528	0.02
cis-para-Mentha-2,8-diene-1-hydroperoxide?	8.80	1305	0.01			
para-Mentha-1,8-diene-4-hydroperoxide	9.18	1332	0.01			
Linalyl propionate	9.24	1337	0.02	8.80	1574	0.02
Hodiendiol derivative	9.30	1341	0.01	12.89	1920	0.01
α-Terpinyl acetate	9.36	1345	0.18	9.65	1642	0.19
Unknown [m/z 43, 121 (52), 93 (48), 79 (33), 41 (30), 136 (26), 81 (25)...]	9.48	1353	0.03			
Neryl acetate	9.62	1364	0.33	10.14*	1681	[0.36]
Geranyl acetate	9.90	1383	0.34	10.51	1712	0.34
Dodecanal	10.24	1407	0.01	10.02	1671	0.01
β-Caryophyllene	10.28	1410	0.34	8.41*	1543	0.40
trans-α-Bergamotene	10.56	1431	0.09	8.41*	1543	[0.40]
α-Humulene	10.74	1444	0.01	9.24	1608	0.02
(*E*)-β-Farnesene	10.89	1456	0.02	9.52	1631	0.01
(*Z*)-α-Bisabolene	11.48	1500	0.02	10.31	1695	0.02
β-Bisabolene	11.55	1505	0.12	10.12	1680	0.09
(*E*)-α-Bisabolene	11.99	1540	0.01	10.77	1734	0.01
α-Bisabolol	13.75	1682	0.01	15.40	2160	0.01
Nootkatone	15.06	1796	0.02			
meta-Camphorene	16.74	1951	0.01	15.36	2156	0.01
Total identified		**98.12%**			**97.33%**	
Total reported		**98.15%**			**97.33%**	

*: Two or more compounds are coeluting on this column

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

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