

Date : August 30, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21H17-ORA01

Customer identification : Organic Bergamot - Italy - 3 years - OIL-ORGANIC-4

Type : Essential oil

Source : *Citrus bergamia*

Customer : Organic Aromas Inc.

ANALYSIS

Method: PC-MAT-014  - Analysis of the composition of an essential oil or other volatile liquid by FAST GC-FID (in French); identifications validated by GC-MS.

Analyst : Pamela Lavoie, M.Sc., Chimiste

Analysis date : August 26, 2021

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Brown-greenish liquid

Refractive index: 1.4683 ± 0.0003 (20 °C; method PC-MAT-016)

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
Nonane	tr	Alkane
Tricyclene	tr	Monoterpene
α -Thujene	0.22	Monoterpene
α -Pinene	0.84	Monoterpene
Camphene	0.02	Monoterpene
β -Pinene	4.24	Monoterpene
Sabinene	0.82	Monoterpene
6-Methyl-5-hepten-2-one	0.02	Aliphatic ketone
Myrcene	0.94	Monoterpene
α -Phellandrene	0.02	Monoterpene
Octanal	0.04	Aliphatic aldehyde
α -Terpinene	0.11	Monoterpene
para-Cymene	0.38	Monoterpene
Limonene	39.64	Monoterpene
1,8-Cineole	0.19	Monoterpenic ether
(Z)- β -Ocimene	0.02	Monoterpene
(E)- β -Ocimene	0.17	Monoterpene
γ -Terpinene	5.81	Monoterpene
cis-Sabinene hydrate	0.04	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
Terpinolene	0.28	Monoterpene
trans-Sabinene hydrate	0.01	Monoterpenic alcohol
Linalool	12.84	Monoterpenic alcohol
Nonanal	0.02	Aliphatic aldehyde
cis-Limonene oxide	0.01	Monoterpenic ether
trans-Limonene oxide	0.01	Monoterpenic ether
Camphor	0.01	Monoterpenic ketone
Epoxyterpinolene	0.01	Monoterpenic ether
Citronellal	0.01	Monoterpenic aldehyde
Borneol	0.01	Monoterpenic alcohol
Terpinen-4-ol	0.04	Monoterpenic alcohol
α -Terpineol	0.16	Monoterpenic alcohol
Hodiendiol	0.01	Monoterpenic alcohol
Decanal	0.04	Aliphatic aldehyde
Octyl acetate	0.08	Aliphatic ester
Nerol	0.08	Monoterpenic alcohol
Neral	0.18	Monoterpenic aldehyde
Geraniol	0.05	Monoterpenic alcohol
Linalyl acetate	27.81	Monoterpenic ester
Geranial	0.28	Monoterpenic aldehyde
Bornyl acetate	0.02	Monoterpenic ester
cis-para-Mentha-2,8-diene-1-hydroperoxide	0.01	Monoterpenic peroxide
trans-para-Mentha-2,8-diene-1-hydroperoxide	0.01	Monoterpenic peroxide
para-Mentha-1,8-diene-4-hydroperoxide	0.01	Monoterpenic peroxide

Linalyl propionate	0.04	Monoterpenic ester
Hodiendiol derivative	0.01	Oxygenated monoterpene
α -Terpinyl acetate	0.13	Monoterpenic ester
Unknown	0.02	Monoterpenic ester
Unknown	0.04	Oxygenated monoterpene
Neryl acetate	0.38	Monoterpenic ester
Geranyl acetate	0.33	Monoterpenic ester
β -Elemene	0.01	Sesquiterpene
Dodecanal	0.01	Aliphatic aldehyde
β -Caryophyllene	0.36	Sesquiterpene
<i>cis</i> - α -Bergamotene	0.02	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.33	Sesquiterpene
α -Humulene	0.03	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.07	Sesquiterpene
Germacrene D	0.04	Sesquiterpene
(<i>Z</i>)- α -Bisabolene	0.01	Sesquiterpene
β -Bisabolene	0.47	Sesquiterpene
(<i>Z</i>)- γ -Bisabolene	0.01	Sesquiterpene
δ -Cadinene	tr	Sesquiterpene
(<i>E</i>)- α -Bisabolene	0.02	Sesquiterpene
(<i>E</i>)-Nerolidol	0.02	Sesquiterpenic alcohol
Spathulenol	0.01	Sesquiterpenic alcohol
Germacrene D-4-ol	tr	Sesquiterpenic alcohol
Caryophyllene oxide isomer	tr	Sesquiterpenic ether
Caryophyllene oxide	0.01	Sesquiterpenic ether
Unknown	0.01	Oxygenated sesquiterpene
Unknown	0.02	Oxygenated sesquiterpene
α -Bisabolol	0.03	Sesquiterpenic alcohol
Myristic acid	0.10	Aliphatic acid
Nootkatone	0.04	Sesquiterpenic ketone
Citropten	0.12	Furanocoumarin
Palmitic acid	0.15	Aliphatic acid
Bergapten	0.19	Furanocoumarin
Linoleic acid	0.11	Aliphatic acid
Oleic acid	0.12	Aliphatic acid
Stearic acid	0.03	Aliphatic acid
Consolidated total	98.83%	

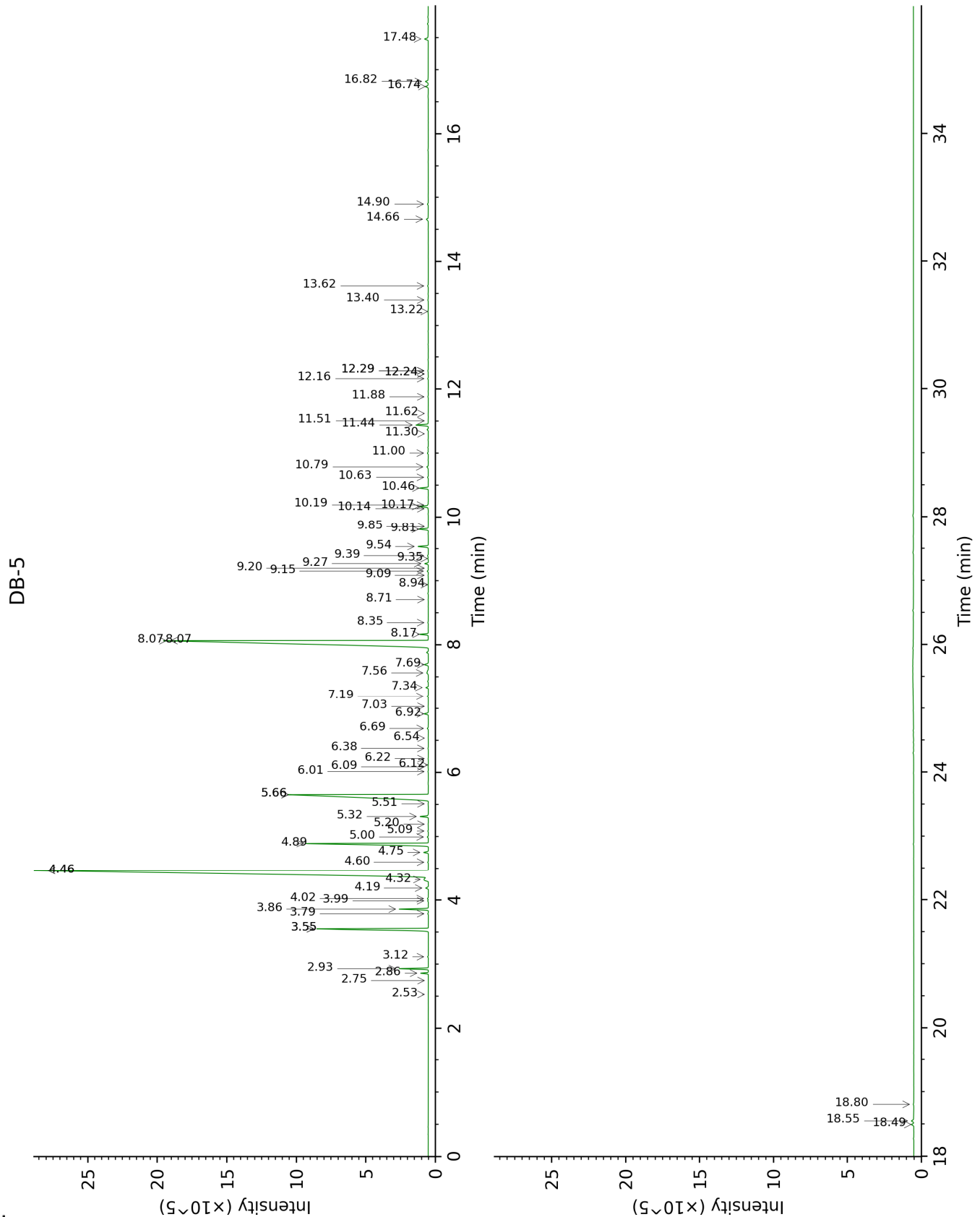
tr: The compound has been detected below 0.005% of total signal.

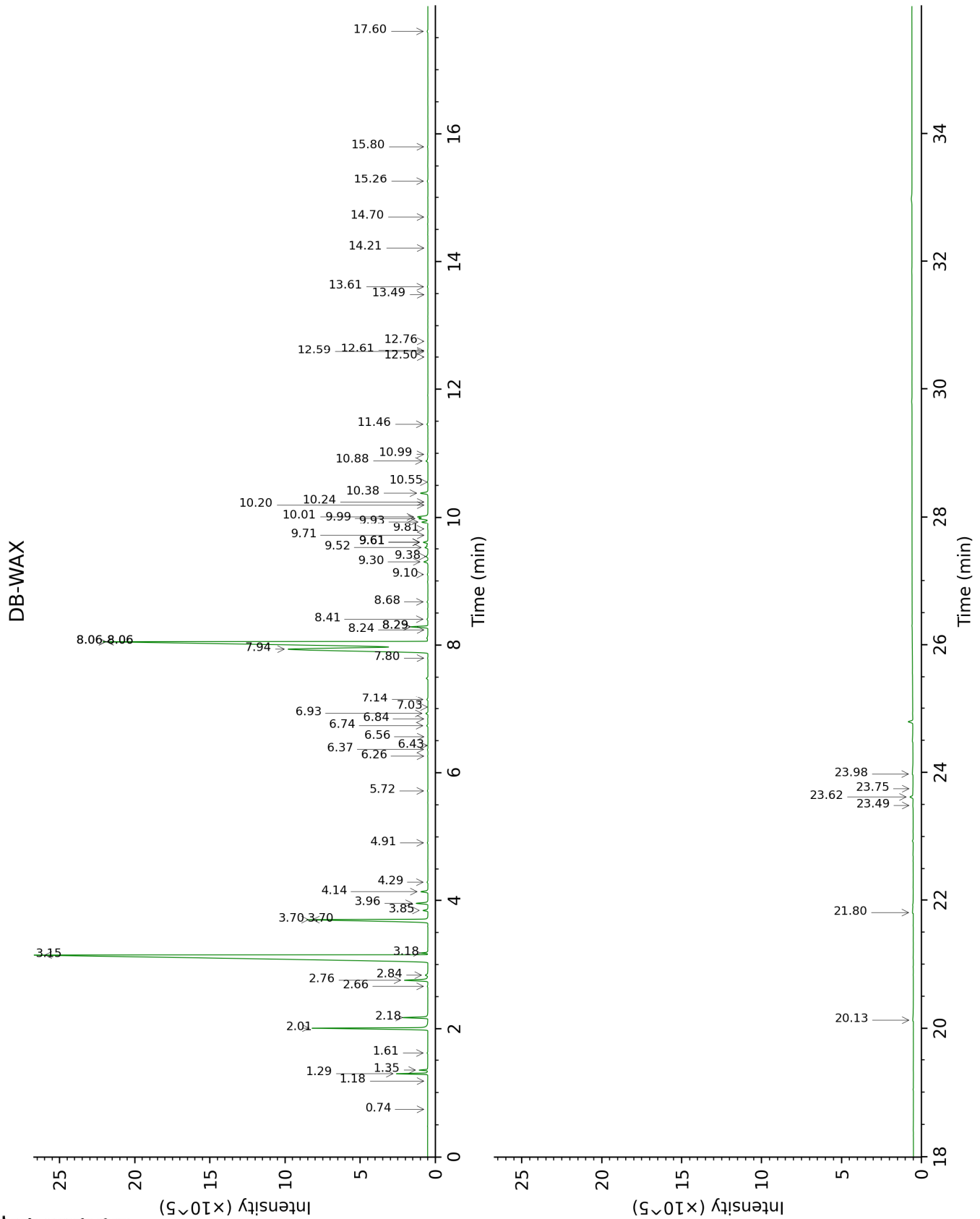
Note: no correction factor was applied

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.

This page was intentionally left blank. The following pages present the complete data of the analysis.





FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Nonane	2.53	903	tr	0.74	895	tr
Tricyclene	2.75	918	tr	1.18	972	tr
α -Thujene	2.86	926	0.22	1.35	1000	0.23
α -Pinene	2.93	930	0.84	1.29	991	0.83
Camphene	3.12	943	0.02	1.61	1026	0.02
β -Pinene	3.55*	972	5.06	2.01	1067	4.24
Sabinene	3.55*	972	[5.06]	2.18	1084	0.82
6-Methyl-5-hepten-2-one	3.79	988	0.02	4.91	1300	0.02
Myrcene	3.86	993	0.94	2.76	1134	0.95
α -Phellandrene	3.99	1002	0.02	2.66	1126	0.02
Octanal	4.02	1004	0.04	4.29	1253	0.03
α -Terpinene	4.19	1014	0.11	2.84	1140	0.12
para-Cymene	4.32	1023	0.38	3.96	1228	0.45
Limonene	4.46*	1032	39.85	3.15	1165	39.64
1,8-Cineole	4.46*	1032	[39.85]	3.18	1168	0.19
(Z)- β -Ocimene	4.60	1041	0.02	3.70*	1209	5.84
(E)- β -Ocimene	4.76	1050	0.17	3.85	1220	0.18
γ -Terpinene	4.89	1059	5.81	3.70*	1209	[5.84]
cis-Sabinene hydrate	5.00	1066	0.04	6.74	1428	0.05
cis-Linalool oxide (fur.)	5.09	1072	0.02	6.37	1400	0.02
Octanol	5.20	1078	0.01	8.06*†	1528	[40.69]
Terpinolene	5.32	1086	0.28	4.14	1242	0.28
trans-Sabinene hydrate	5.51	1098	0.01	7.80	1508	0.01
Linalool	5.66*	1107	12.86	7.94†	1518	40.69
Nonanal	5.66*	1107	[12.86]	5.72	1353	0.02
cis-Limonene oxide	6.02	1130	0.01	6.26	1392	0.01
trans-Limonene oxide	6.09	1135	0.01	6.43	1405	0.01
Camphor	6.12	1137	0.01	7.03	1449	0.01
Epoxyterpinolene	6.22	1144	0.01	6.56	1415	0.01
Citronellal	6.38	1154	0.01	6.84	1436	0.01
Borneol	6.54	1164	0.01	9.61*	1650	0.20
Terpinen-4-ol	6.69	1174	0.04	8.41	1555	0.04
α -Terpineol	6.92	1188	0.16	9.61*	1650	[0.20]
Hodiendiol	7.03	1196	0.01	12.61	1909	0.01
Decanal	7.19	1206	0.04	7.14	1458	0.05
Octyl acetate	7.34	1216	0.08	6.93	1442	0.08
Nerol	7.56	1231	0.08	10.88	1757	0.08
Neral	7.69	1240	0.18	9.30	1626	0.19
Geraniol	8.07*	1265	27.86	11.46	1806	0.05
Linalyl acetate	8.07*	1265	[27.86]	8.06*†	1528	[40.69]
Geranial	8.17	1272	0.28	9.93	1677	0.27
Bornyl acetate	8.35	1284	0.02	8.06*†	1528	[40.69]

<i>cis</i> -para-Mentha-2,8-diene-1-hydroperoxide	8.71	1308	0.01			
<i>trans</i> -para-Mentha-2,8-diene-1-hydroperoxide	8.94	1325	0.01			
para-Mentha-1,8-diene-4-hydroperoxide	9.09	1335	0.01			
Linalyl propionate	9.15	1340	0.04	8.68	1576	0.04
Hodiendiol derivative	9.20	1343	0.01	12.76	1923	0.01
α -Terpinyl acetate	9.27	1348	0.13	9.52	1644	0.13
Unknown [m/z 43, 121 (52), 93 (48), 79 (33), 41 (30), 136 (26), 81 (25)...]	9.35	1354	0.02			
Unknown [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	9.39	1357	0.04	10.99	1766	0.02
Neryl acetate	9.54	1367	0.38	10.01†	1684	[0.89]
Geranyl acetate	9.81	1386	0.33	10.38	1714	0.35
β -Elemene	9.85	1389	0.01	8.24	1542	0.01
Dodecanal	10.14	1410	0.01	9.81	1667	0.01
β -Caryophyllene	10.17	1412	0.36	8.29*	1546	0.64
<i>cis</i> - α -Bergamotene	10.19	1414	0.02	8.06*†	1528	[40.69]
<i>trans</i> - α -Bergamotene	10.46	1434	0.33	8.29*	1546	[0.64]
α -Humulene	10.63	1446	0.03	9.10	1610	0.03
(<i>E</i>)- β -Farnesene	10.79	1458	0.07	9.38	1632	0.10
Germacrene D	11.00	1474	0.04	9.61*	1650	[0.20]
(<i>Z</i>)- α -Bisabolene	11.30	1497	0.01	10.20	1698	tr
β -Bisabolene	11.44	1507	0.47	9.99†	1681	0.89
(<i>Z</i>)- γ -Bisabolene	11.51	1512	0.01	9.71	1659	0.01
δ -Cadinene	11.62	1521	tr	10.24	1703	tr
(<i>E</i>)- α -Bisabolene	11.88	1542	0.02	10.55	1729	0.02
(<i>E</i>)-Nerolidol	12.16	1564	0.02	13.61	2002	0.02
Spathulenol	12.24*	1570	0.01	14.21	2060	0.01
Germacrene D-4-ol	12.24*	1570	[0.01]	13.49	1990	tr
Caryophyllene oxide isomer	12.29*	1574	0.03	12.50	1899	tr
Caryophyllene oxide	12.29*	1574	[0.03]	12.59	1907	0.01

Unknown [m/z 94, 43 (89), 41 (67), 122 (46), 69 (41)...222]	13.22	1650	0.01	14.70	2107	0.01
Unknown [m/z 69, 95 (100), 41 (89), 109 (68), 67 (61)...222]	13.40	1664	0.02	15.80	2218	0.02
α -Bisabolol	13.62	1682	0.03	15.26	2163	0.03
Myristic acid	14.66	1772	0.10	20.13	2703	0.12
Nootkatone	14.90	1792	0.04	17.60	2410	0.04
Citropten	16.74	1962	0.12	23.62†	3158	0.19
Palmitic acid	16.82	1970	0.15	21.80	2914	0.16
Bergapten	17.48	2034	0.19			
Linoleic acid	18.49	2136	0.11	23.98	3208	0.10
Oleic acid	18.55	2141	0.12	23.75†	3176	[0.19]
Stearic acid	18.80	2168	0.03	23.49	3140	0.03
Total identified		98.77%			98.64%	
Total reported		98.86%			98.69%	

*: 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