

Date : March 17, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21B23-FEP21

Customer identification : Oregano - Turkey - 53113-11

Type : Essential oil

Source : *Origanum vulgare* ct. Carvacrol

Customer : Fern & Petal

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 : Seydou Ka, M. Sc.

Analysis date : March 11, 2021

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Orange liquid

Refractive index: 1.5103 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

No clear 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
Acetone	0.01	Aliphatic ketone
(2E)-Hexenal	0.01	Aliphatic aldehyde
Heptan-3-one	0.01	Aliphatic ketone
Tricyclene	0.02	Monoterpene
α -Thujene	0.54	Monoterpene
α -Pinene	0.79	Monoterpene
Unknown	0.02	Monoterpene
Camphene	0.23*	Monoterpene
α -Fenchene	[0.23]*	Monoterpene
Thuja-2,4(10)-diene	0.01	Monoterpene
Sabinene	0.01	Monoterpene
β -Pinene	0.02	Monoterpene
Octen-3-ol	0.50	Aliphatic alcohol
Octen-3-one	0.02	Aliphatic ketone
Octan-3-one	0.18	Aliphatic ketone
Myrcene	1.00	Monoterpene
Octan-3-ol	0.05	Aliphatic alcohol
Pseudolimonene	0.01	Monoterpene
α -Phellandrene	0.12	Monoterpene
<i>cis</i> -Dehydroxylinalool oxide	0.01	Monoterpenic ether
Δ^3 -Carene	0.08	Monoterpene
α -Terpinene	0.87	Monoterpene
para-Cymene	10.20	Monoterpene
β -Phellandrene	0.17	Monoterpene
Limonene	0.22	Monoterpene
1,8-Cineole	0.06	Monoterpenic ether
(Z)- β -Ocimene	0.06	Monoterpene
(E)- β -Ocimene	0.01	Monoterpene
γ -Terpinene	2.05	Monoterpene
<i>cis</i> -Sabinene hydrate	0.49	Monoterpenic alcohol
Terpinolene	0.10	Monoterpene
<i>trans</i> -Linalool oxide (fur.)	0.01	Monoterpenic alcohol
<i>trans</i> -Sabinene hydrate	0.32	Monoterpenic alcohol
Linalool	0.20	Monoterpenic alcohol
endo-Fenchol	0.02	Monoterpenic alcohol
β -Thujone	0.01	Monoterpenic ketone
<i>cis</i> -para-Menth-2-en-1-ol	0.04	Monoterpenic alcohol
<i>trans</i> -Pinocarveol	0.03	Monoterpenic alcohol
Camphor	0.03	Monoterpenic ketone
Isoborneol	0.02	Monoterpenic alcohol
Unknown	0.02	Unknown
Borneol	0.55	Monoterpenic alcohol
<i>trans</i> -2-Caren-4-ol?	0.01	Monoterpenic alcohol
Umbellulone	0.02	Monoterpenic ketone
Terpinen-4-ol	0.70	Monoterpenic alcohol

para-Cymen-8-ol	0.12	Monoterpenic alcohol
α -Terpineol	0.23	Monoterpenic alcohol
<i>cis</i> -Dihydrocarvone	0.13	Monoterpenic ketone
Dihydrocarveol	0.14	Monoterpenic alcohol
<i>trans</i> -Piperitol	0.08	Monoterpenic alcohol
Thymol methyl ether analog I	0.01	Monoterpenic ether
Thymol methyl ether	0.03	Monoterpenic ether
Carvone	0.01	Monoterpenic ketone
Carvacrol methyl ether	0.38	Monoterpenic ether
Unknown	0.10	Unknown
Piperitone	0.04	Monoterpenic ketone
Geraniol	0.05	Monoterpenic alcohol
Unknown	0.01	Unknown
Bornyl acetate	0.03	Monoterpenic ester
Cuminol	0.06	Monoterpenic alcohol
Thymol	3.73	Monoterpenic alcohol
Carvacrol	68.78	Monoterpenic alcohol
Eugenol	0.01	Phenylpropanoid
Neryl acetate	0.01	Monoterpenic ester
α -Copaene	0.02	Sesquiterpene
Carvacryl acetate	0.03	Monoterpenic ester
β -Bourbonene	0.03	Sesquiterpene
Geranyl acetate	0.02	Monoterpenic ester
Isocaryophyllene	0.01	Sesquiterpene
Methyleugenol	0.01	Phenylpropanoid
β -Caryophyllene	1.38	Sesquiterpene
β -Copaene	0.01	Sesquiterpene
Aromadendrene	0.04	Sesquiterpene
9-epi-Isocaryophyllene	tr	Sesquiterpene
Thymohydroquinone isomer?	0.36	Simple phenolic
α -Humulene	0.27	Sesquiterpene
allo-Aromadendrene	0.02	Sesquiterpene
(<i>E</i>)- β -Farnesene	0.02	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.01	Sesquiterpene
γ -Muurolene	0.06	Sesquiterpene
β -Selinene	0.01	Sesquiterpene
allo-Aromadendr-9-ene	0.01	Sesquiterpene
Viridiflorene	0.04	Sesquiterpene
α -Muurolene	0.03	Sesquiterpene
γ -Cadinene	0.02	Sesquiterpene
β -Bisabolene	0.77	Sesquiterpene
δ -Cadinene	0.08	Sesquiterpene
β -Sesquiphellandrene	0.06	Sesquiterpene
10-epi-Cubebol?	0.01	Sesquiterpenic alcohol
α -Calacorene	0.01	Sesquiterpene
Thymohydroquinone	0.04	Monoterpenic alcohol
Spathulenol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.28	Sesquiterpenic ether
Humulene epoxide II	0.03	Sesquiterpenic ether
10-epi-Cubenol	0.01	Sesquiterpenic alcohol
Caryophylladienol I	0.01	Sesquiterpenic alcohol
Caryophylladienol II	0.01	Sesquiterpenic alcohol

τ-Cadinol	0.02	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
α-Cadinol	0.02	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
(3Z)-Caryophylla-3,8(13)-dien-5β-ol	0.03	Sesquiterpenic alcohol
Eudesma-4(15),7-dien-1β-ol	0.01	Sesquiterpenic alcohol
Unknown	0.02	Unknown
Unknown	0.06	Unknown
Unknown	0.03	Unknown
Unknown	0.20	Unknown
Unknown	0.03	Unknown
meta-Camphorene	0.01	Diterpene
Camphorene isomer I	0.02	Diterpene
Unknown	0.01	Unknown
Unknown	0.02	Unknown
Unknown	0.02	Unknown
Unknown	0.01	Unknown
Unknown	0.18	Unknown
Unknown	0.25	Unknown
Consolidated total	98.41%	

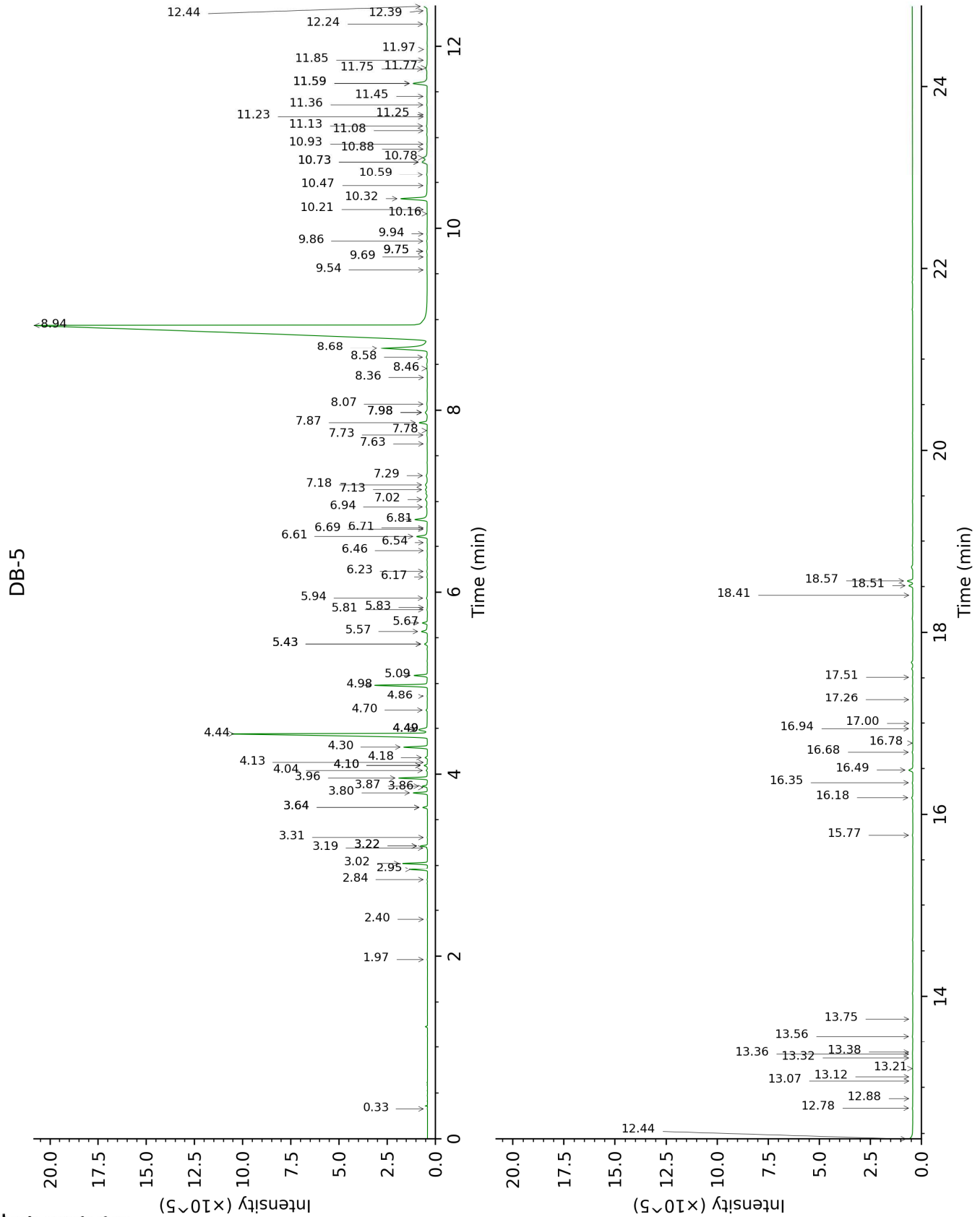
*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered [xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

Note: no correction factor was applied

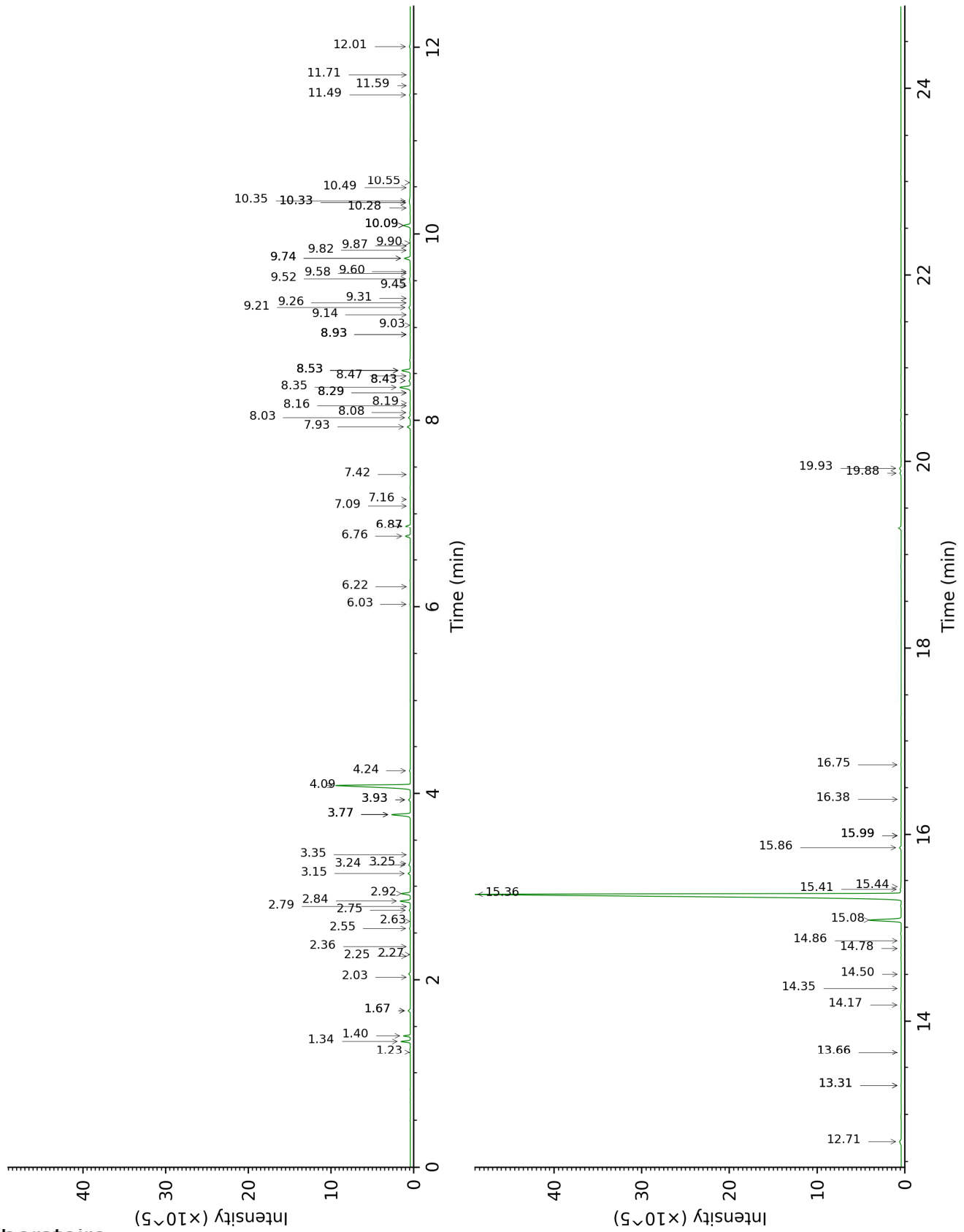
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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-WAX



FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Acetone	0.33	507	0.01			
(2E)-Hexenal	1.96	848	0.01	3.35	1172	0.02
Heptan-3-one	2.40	885	0.01	2.63	1116	0.01
Tricyclene	2.84	917	0.02	1.23	972	0.02
α -Thujene	2.95	925	0.54	1.40	1000	0.54
α -Pinene	3.02	930	0.79	1.34	991	0.81
Unknown [m/z 91, 92 (47), 65 (11)... 134 (1)]	3.19	941	0.02	2.36	1094	0.03
Camphene	3.22*	942	0.23	1.67*	1027	0.23
α -Fenchene	3.22*	942	[0.23]	1.67*	1027	[0.23]
Thuja-2,4(10)-diene	3.31	948	0.01	2.25	1084	0.02
Sabinene	3.64*	970	0.16	2.27	1086	0.01
β -Pinene	3.64*	970	[0.16]	2.03	1062	0.02
Octen-3-ol	3.80	981	0.50	6.76	1421	0.52
Octen-3-one	3.86	985	0.02			
Octan-3-one	3.87	986	0.18	3.93*	1217	0.19
Myrcene	3.96	992	1.00	2.84	1133	1.00
Octan-3-ol	4.04	997	0.05	6.03	1368	0.05
Pseudolimonene	4.10*	1001	0.13	2.79	1129	0.01
α -Phellandrene	4.10*	1001	[0.13]	2.74	1126	0.12
<i>cis</i> -Dehydroxylinalool oxide	4.13	1003	0.01	3.78*	1205	2.14
Δ^3 -Carene	4.18	1007	0.08	2.55	1110	0.08
α -Terpinene	4.30	1014	0.87	2.92	1140	0.88
para-Cymene	4.44	1023	10.20	4.09	1228	10.37
β -Phellandrene	4.49*	1026	0.54	3.24	1164	0.17
Limonene	4.49*	1026	[0.54]	3.15	1157	0.22
1,8-Cineole	4.49*	1026	[0.54]	3.25	1165	0.06
(Z)- β -Ocimene	4.70	1039	0.06	3.78*	1205	[2.14]
(E)- β -Ocimene	4.86	1049	0.01	3.93*	1217	[0.19]
γ -Terpinene	4.98	1057	2.05	3.78*	1205	[2.14]
<i>cis</i> -Sabinene hydrate	5.09	1064	0.49	6.87*	1430	0.50
Terpinolene	5.43*	1085	0.13	4.24	1239	0.10
<i>trans</i> -Linalool oxide (fur.)	5.43*	1085	[0.13]	6.87*	1430	[0.50]
<i>trans</i> -Sabinene hydrate	5.57	1094	0.32	7.93	1510	0.33
Linalool	5.67	1100	0.20	8.03	1517	0.19
endo-Fenchol	5.81	1109	0.02	8.42*	1548	0.16
β -Thujone	5.83	1111	0.01	6.22	1382	0.01
<i>cis</i> -para-Menth-2-en-1-ol	5.94	1118	0.04	8.08	1522	0.07
<i>trans</i> -Pinocarveol	6.17	1132	0.03	9.14	1604	0.02
Camphor	6.23	1136	0.03	7.16	1451	0.01
Isoborneol	6.46	1151	0.02	9.31	1618	0.02

Unknown [m/z 123, 81 (46), 43 (45), 95 (34), 166 (30)]	6.54	1157	0.02	8.93*	1587	0.04
Borneol	6.61	1161	0.55	9.74*	1653	0.70
<i>trans</i> -2-Caren-4-ol?	6.69	1166	0.01			
Umbellulone	6.71	1167	0.02	8.93*	1587	[0.04]
Terpinen-4-ol	6.81	1174	0.70	8.53*	1556	1.03
<i>para</i> -Cymen-8-ol	6.94	1182	0.12	11.49	1800	0.09
α -Terpineol	7.02	1188	0.23	9.74*	1653	[0.70]
<i>cis</i> -Dihydrocarvone	7.13	1195	0.13	8.42*	1548	[0.16]
Dihydrocarveol	7.18	1198	0.14	10.35	1703	0.25
<i>trans</i> -Piperitol	7.29	1205	0.08	10.33*	1701	0.08
Thymol methyl ether analog I	7.63	1228	0.01	8.30*	1538	0.01
Thymol methyl ether	7.73	1235	0.03	8.48	1552	0.03
Carvone	7.78	1238	0.01	9.90	1666	0.01
Carvacrol methyl ether	7.86	1244	0.38	8.53*	1556	[1.03]
Unknown [m/z 69, 41 (75), 109 (35), 95 (34), 55 (28), 43 (27), 110 (26)...]	7.98*	1252	0.15			
Piperitone	7.98*	1252	[0.15]	9.82	1660	0.04
Geraniol	8.07	1258	0.05	11.59	1808	0.03
Unknown [m/z 119, 79 (94), 91 (0), 84 (80), 93 (68)...]	8.36	1278	0.01			
Bornyl acetate	8.46	1284	0.03	8.19	1530	0.03
Cuminol	8.58	1293	0.06	14.17	2046	0.06
Thymol	8.68	1300	3.73	15.08	2134	3.70
Carvacrol	8.94	1318	68.78	15.36	2162	68.34
Eugenol	9.54	1356	0.01	14.78	2104	0.02
Neryl acetate	9.69	1366	0.01	10.09*	1681	0.81
α -Copaene	9.75*	1371	0.04	7.09	1446	0.02
Carvacryl acetate	9.75*	1371	[0.04]	11.71	1818	0.03
β -Bourbonene	9.86	1378	0.03	7.42	1471	0.03
Geranyl acetate	9.94	1384	0.02	10.49	1715	0.02
Isocaryophyllene	10.16	1400	0.01	8.16	1527	0.01
Methyleugenol	10.21	1403	0.01	13.31*	1965	0.03
β -Caryophyllene	10.32	1412	1.38	8.35	1542	1.37
β -Copaene	10.47	1422	0.01	8.30*	1538	[0.01]
Aromadendrene	10.59	1432	0.04	8.53*	1556	[1.03]
9-epi-Isocaryophyllene	10.73*	1442	0.35	8.93*	1587	[0.04]
Thymohydroquinone isomer?	10.73*	1442	[0.35]			
α -Humulene	10.78	1446	0.27	9.21	1610	0.17
allo-Aromadendrene	10.88	1453	0.02	9.02	1595	0.02
(<i>E</i>)- β -Farnesene	10.93	1457	0.02	9.60	1641	0.03
<i>trans</i> -Cadina-1(6),4-diene	11.08	1468	0.01	9.26	1614	0.02
γ -Murolene	11.13	1471	0.06	9.52	1635	0.10

β-Selinene	11.23	1479	0.01	9.87	1663	0.01
allo-Aromadendr-9-ene	11.25	1481	0.01	9.44	1629	0.02
Viridiflorene	11.36	1489	0.04	9.58	1640	0.02
α-Muurolene	11.45	1496	0.03	10.09*	1681	[0.81]
γ-Cadinene	11.59*	1506	0.84	10.28	1696	0.02
β-Bisabolene	11.59*	1506	[0.84]	10.09*	1681	[0.81]
δ-Cadinene	11.75	1519	0.08	10.33*	1701	[0.08]
β-Sesquiphellandrene	11.76	1520	0.06	10.55	1719	0.03
10-epi-Cubebol?	11.85	1526	0.01	13.66*	1998	0.01
α-Calacorene	11.97	1535	0.01	12.01	1845	0.14
Thymohydroquinone	12.24	1557	0.04			
Spathulenol	12.39	1569	0.02	14.35	2063	0.03
Caryophyllene oxide	12.44	1572	0.28	12.71	1911	0.29
Humulene epoxide II	12.78	1599	0.03	13.31*	1965	[0.03]
10-epi-Cubenol	12.88	1607	0.01	13.66*	1998	[0.01]
Caryophylladienol I	13.07	1623	0.01	15.99*	2226	0.02
Caryophylladienol II	13.12	1627	0.01	15.99*	2226	[0.02]
τ-Cadinol	13.21	1634	0.02	14.86	2112	0.03
Unknown [m/z 81, 93 (84), 41 (70), 79 (61), 55 (56), 123 (55), 95 (54), 107 (50)... 220 (t)]	13.32	1644	0.01	16.38	2266	0.02
α-Cadinol	13.36	1647	0.02	15.44	2170	0.02
Unknown [m/z 161, 59 (67), 95 (45), 93 (40), 105 (40), 149 (39), 81 (39), 43 (38), 204 (37)... 220 (5)]	13.38	1649	0.01	14.50	2078	0.01
(3Z)-Caryophylla-3,8(13)-dien-5β-ol	13.56	1664	0.03	16.75	2304	0.04
Eudesma-4(15),7-dien-1β-ol	13.75	1679	0.01	15.99*	2226	[0.02]
Unknown [m/z 81, 150 (90), 136 (88), 135 (74), 93 (54), 121 (41)...]	15.77	1855	0.02			
Unknown [m/z 81, 150 (83), 136 (81), 135 (67), 93 (48), 121 (36)...]	16.18	1892	0.06			
Unknown [m/z 93, 149 (98), 150 (85), 135 (55), 43 (29)...]	16.35	1907	0.03			
Unknown [m/z 136, 81 (81), 150 (74), 135 (52), 93 (46), 121 (42)...]	16.49	1920	0.20	15.86	2212	0.19

Unknown [m/z 81, 136 (71), 150 (57), 93 (47), 135 (42)...]	16.68	1939	0.03			
meta-Camphorene	16.78	1948	0.01	15.41	2167	0.11
Camphorene isomer I	16.94	1964	0.02			
Unknown [m/z 93, 132 (36), 69 (31), 41 (25), 136 (25), 147 (23)...]	17.00	1969	0.01			
Unknown [m/z 99, 43 (43), 69 (37), 71 (37), 41 (28)...]	17.26	1994	0.02			
Unknown [m/z 135, 150 (66), 43 (38), 109 (27), 93 (25), 137 (20)...]	17.51	2018	0.02			
Unknown [m/z 255, 270 (52), 119 (31), 122 (26), 91 (22), 256 (22)...]	18.41	2107	0.01			
Unknown [m/z 69, 41 (81), 91 (37), 166 (35), 105 (33), 43 (30)...]	18.51	2118	0.18	19.88	2659	0.16
Unknown [m/z 69, 41 (74), 166 (36), 91 (32), 105 (28), 43 (25)...]	18.56	2123	0.25	19.93	2665	0.21
Total identified		97.83%			96.78%	
Total reported		98.72%			97.40%	

*: 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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index