

Date : January 23, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19A10-ORA09-1-CC

Customer identification : Elemi

Type : Essential oil

Source : *Canarium commune*

Customer : Organic Aromas Inc.

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 : Alexis St-Gelais, M. Sc., chimiste

Analysis date : January 20, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow liquid

Refractive index: 1.4783 ± 0.0003 (20 °C)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. However, the botanical source attributed to this sample is probably to review, as the oil features a classical composition for *Canarium luzonicum* (elemi), which is not the same species as *Canarium commune* (syn. *Canarium indicum*).

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Toluene	0.03	0.66*	Simple phenolic
Hashishene	tr	0.60*	Monoterpene
α -Thujene	0.64	[0.66]*	Monoterpene
α -Pinene	0.60	[0.60]*	Monoterpene
α -Fenchene	0.02*	0.02	Monoterpene
Camphene	[0.02]*	tr	Monoterpene
Sabinene	3.16*	2.90	Monoterpene
β -Pinene	[3.16]*	0.24	Monoterpene
3-Methyl-3-cyclohexenone	0.03	0.03	Aliphatic ketone
Myrcene	0.51	0.50	Monoterpene
α -Phellandrene	14.36*	14.31	Monoterpene
Pseudolimonene	[14.36]*	0.05	Monoterpene
Δ 3-Carene	0.05	0.04	Monoterpene
α -Terpinene	0.62	0.62	Monoterpene
ortho-Cymene	0.02	2.33*	Simple phenolic
para-Cymene	2.29	[2.33]*	Monoterpene
β -Phellandrene	54.20*	2.21*	Monoterpene
1,8-Cineole	[54.20]*	[2.21]*	Monoterpenic ether
Limonene	[54.20]*	51.63	Monoterpene
(Z)- β -Ocimene	0.19	0.18	Monoterpene
(E)- β -Ocimene	0.19	0.19	Monoterpene
γ -Terpinene	0.39	0.39	Monoterpene
cis-Sabinene hydrate	0.31	0.33	Monoterpenic alcohol
Fenchone	0.02	0.01	Aliphatic alcohol
Terpinolene	2.16*	2.06	Monoterpene
para-Cymenene	[2.16]*	0.08	Monoterpene
trans-Sabinene hydrate	0.08	0.09	Monoterpenic alcohol
Linalool	0.01	0.02	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	0.01	Monoterpene
trans-para-Mentha-2,8-dien-1-ol	0.12	[0.08]	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	[0.12]	0.05	Monoterpenic alcohol
allo-Ocimene	0.09*	0.07	Monoterpene
cis-Limonene oxide	[0.09]*	0.01	Monoterpenic ether
cis-para-Mentha-2,8-dien-1-ol	0.05	0.06*	Monoterpenic alcohol
Camphor	0.07	0.17*	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.03	0.08	Monoterpenic alcohol
Epoxyterpinolene	0.01	0.02	Monoterpenic ether
Unknown	0.02	0.03*	Oxygenated monoterpene
Unknown	0.03	0.03	Oxygenated monoterpene
Unknown	0.03	0.03*	Oxygenated monoterpene
Terpinen-4-ol	0.39	0.35	Monoterpenic alcohol
Cryptone	0.05	0.05	Normonoterpenic ketone
para-Cymen-8-ol	0.34	0.35	Monoterpenic alcohol
α -Terpineol	2.35	2.40	Monoterpenic alcohol
trans-Isopiperitenol	0.03	0.01	Monoterpenic alcohol
α -Phellandrene epoxide	0.30	0.29	Monoterpenic ether
trans-Piperitol	0.04	0.06	Monoterpenic alcohol
trans-Carveol	0.13*	0.07	Monoterpenic alcohol

Unknown	[0.13]*	0.11*	Oxygenated monoterpene
Citronellol	0.06*	0.01	Monoterpenic alcohol
<i>cis</i> -Carveol	[0.06]*	0.05	Monoterpenic alcohol
Cuminal	0.04*	0.01	Monoterpenic aldehyde
Unknown	[0.04]*	0.02	Unknown
Carvone	0.06	0.07	Monoterpenic ketone
Carvotanacetone	0.04	[0.06]*	Monoterpenic ketone
Unknown	0.17*	[0.11]*	Unknown
Piperitone	[0.17]*	0.12	Monoterpenic ketone
Unknown	0.03		Unknown
Unknown	0.02	0.02	Unknown
Unknown	0.02		Unknown
Unknown	0.01		Monoterpenic ester
Unknown	0.09	0.07	Unknown
Perillyl alcohol	0.04*	0.02	Monoterpenic alcohol
Unknown	[0.04]*		Unknown
Thymol	0.05*	0.01	Monoterpenic alcohol
<i>cis</i> -Terpin hydrate?	[0.05]*		Monoterpenic alcohol
Carvacrol	0.01	0.04	Monoterpenic alcohol
Unknown	0.28*	0.04	Unknown
Unknown	[0.28]*	0.15	Unknown
Unknown	0.34	0.34	Unknown
<i>trans</i> -Terpin hydrate?	0.03		Monoterpenic alcohol
δ -Elemene	0.03	[0.03]*	Sesquiterpene
Unknown	0.06	0.30*	
α -Cubebene	0.05	0.05	Sesquiterpene
Unknown	0.01	0.01	Unknown
α -Copaene	0.13	[0.17]*	Sesquiterpene
β -Bourbonene	0.01	0.01	Sesquiterpene
β -Cubebene	0.04	[0.03]*	Sesquiterpene
β -Elemene	0.21	0.27*	Sesquiterpene
Unknown	0.02	0.02	Unknown
α -Gurjunene	0.26*	0.03	Sesquiterpene
Methyleugenol	[0.26]*	[0.30]*	Phenylpropanoid
(<i>trans</i> ?) β -6-Hydroxypiperitone	0.05	0.07	Monoterpenic alcohol
β -Caryophyllene	0.17	[0.27]	Sesquiterpene
β -Copaene	0.02	0.01	Sesquiterpene
(<i>cis</i> ?) β -6-Hydroxypiperitone	0.01	0.04	Monoterpenic alcohol
γ -Elemene	0.03	0.02	Sesquiterpene
α -Guaiene	0.02	[0.27]*	Sesquiterpene
α -Humulene	0.09	0.12	Sesquiterpene
Unknown	0.02		Unknown
Germacrene D	0.05	0.04	Sesquiterpene
Viridiflorene	0.05	0.05	Sesquiterpene
Unknown	0.02		Unknown
α -Murolene	0.04	0.05	Sesquiterpene
Cubebol	0.03*	0.01	Sesquiterpenic alcohol
γ -Cadinene	[0.03]*	0.01	Sesquiterpene
epi-Elemol?	0.09	0.07	Sesquiterpenic alcohol
δ -Cadinene	0.05	0.06	Sesquiterpene
α -Elemol	8.17	8.38	Sesquiterpenic alcohol
Elemicin	3.25	3.31	Phenylpropanoid

Germacrene D-4-ol	0.02	0.01	Sesquiterpenic alcohol
Viridiflorol	0.02	0.01	Sesquiterpenic alcohol
Guaiol	0.12	0.15	Sesquiterpenic alcohol
γ -Eudesmol	0.08	0.08	Sesquiterpenic alcohol
Unknown	0.02	0.01	Oxygenated sesquiterpene
α -Eudesmol	0.19	0.20*	Sesquiterpenic alcohol
β -Eudesmol	0.14	0.20	Sesquiterpenic alcohol
Bulnesol	0.16	[0.20]*	Sesquiterpenic alcohol
Cryptomeridiol analog	0.01	0.03	Sesquiterpenic alcohol
α -Phellandrene dimer II	0.03	0.04	Diterpene
Cryptomeridiol	0.16	0.16	Sesquiterpenic alcohol
α -Phellandrene dimer III	0.01	0.02	Diterpene
Unknown	0.02		Oxygenated sesquiterpene
α -Phellandrene dimer IV	0.01	[0.30]*	Diterpene
Total identified	98.47%	97.84%	

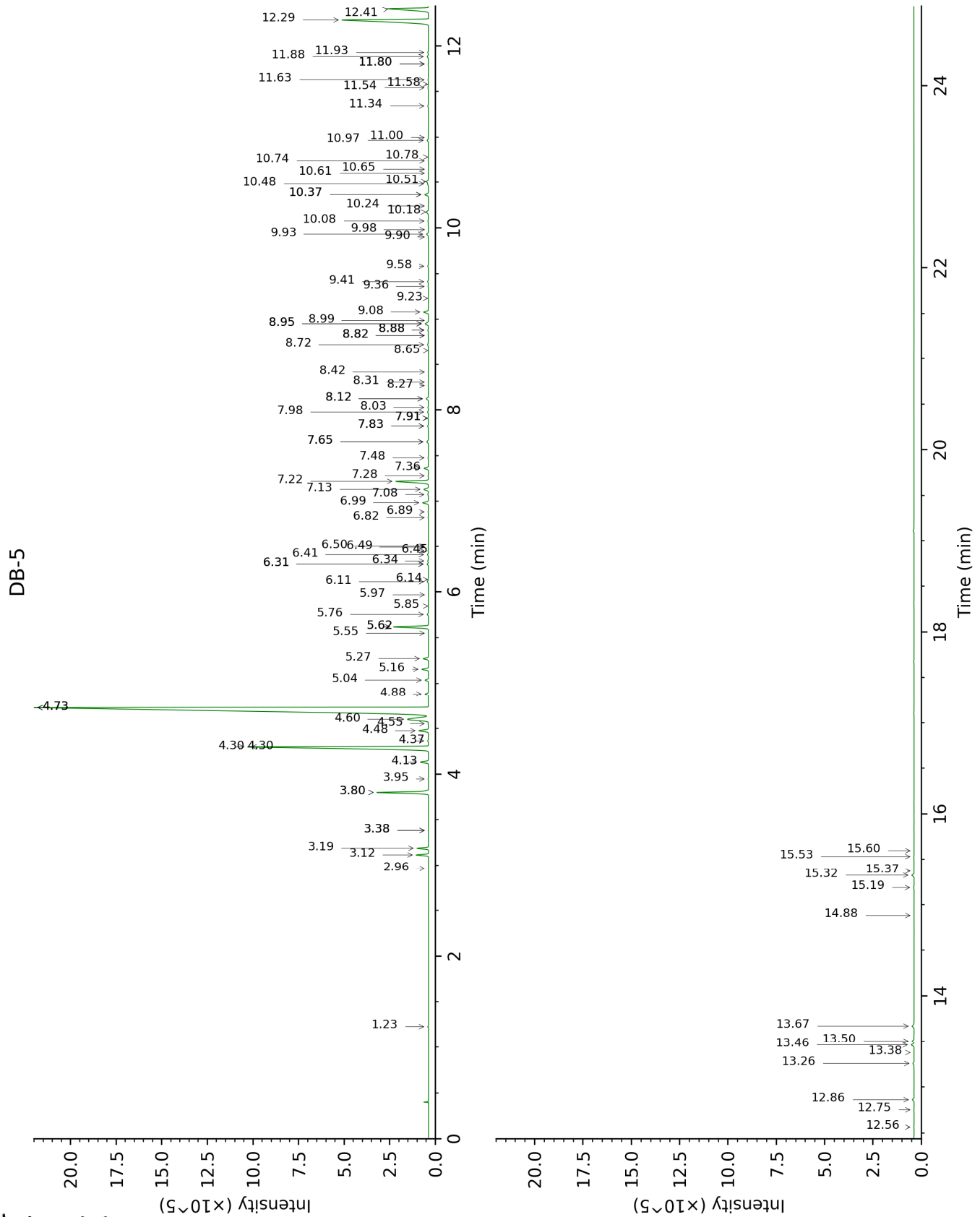
*: Two or more compounds are coeluting on this column

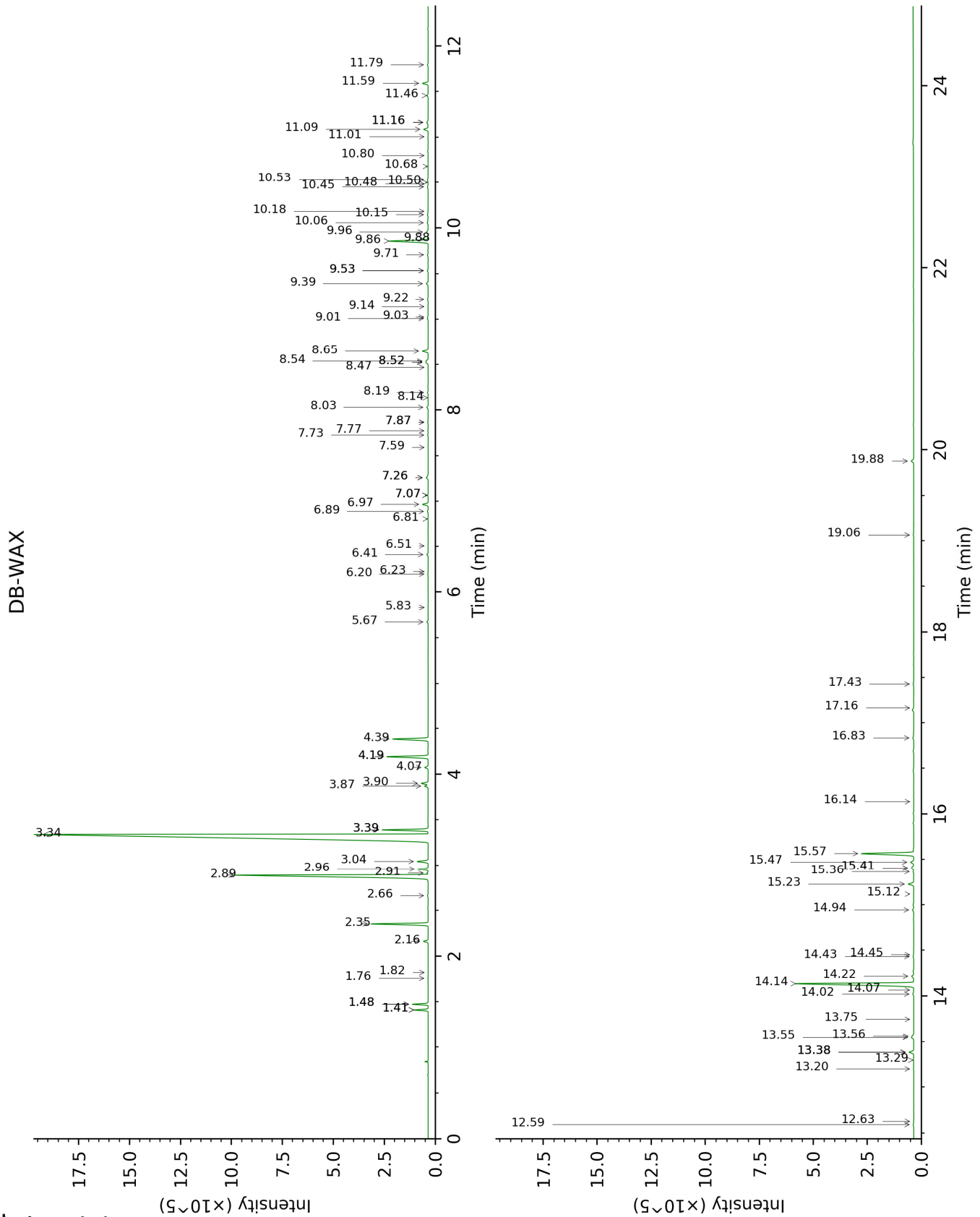
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Toluene	1.23	756	0.03	1.48*	1003	0.66
Hashishene	2.96	914	tr	1.41*	993	0.60
α -Thujene	3.12	924	0.64	1.48*	1003	[0.66]
α -Pinene	3.19	929	0.60	1.41*	993	[0.60]
α -Fenchene	3.38*	942	0.02	1.76	1029	0.02
Camphene	3.38*	942	[0.02]	1.82	1035	tr
Sabinene	3.80*	969	3.16	2.36	1086	2.90
β -Pinene	3.80*	969	[3.16]	2.16	1067	0.24
3-Methyl-3-cyclohexenone	3.95	979	0.03	6.20	1372	0.03
Myrcene	4.13	991	0.51	2.96	1135	0.50
α -Phellandrene	4.30*	1002	14.36	2.89	1130	14.31
Pseudolimonene	4.30*	1002	[14.36]	2.91	1132	0.05
Δ 3-Carene	4.36	1006	0.05	2.66	1112	0.04
α -Terpinene	4.48	1013	0.62	3.04	1142	0.62
ortho-Cymene	4.55	1018	0.02	4.19*	1232	2.33
para-Cymene	4.60	1021	2.29	4.19*	1232	[2.33]
β -Phellandrene	4.73*	1029	54.20	3.39*	1170	2.21
1,8-Cineole	4.73*	1029	[54.20]	3.39*	1170	[2.21]
Limonene	4.73*	1029	[54.20]	3.34	1166	51.63
(Z)- β -Ocimene	4.88	1039	0.19	3.87	1208	0.18
(E)- β -Ocimene	5.04	1048	0.19	4.07	1223	0.19
γ -Terpinene	5.16	1056	0.39	3.90	1210	0.39
<i>cis</i> -Sabinene hydrate	5.27	1063	0.31	6.97	1429	0.33
Fenchone	5.55	1081	0.02	5.83	1345	0.01
Terpinolene	5.62*	1085	2.16	4.39	1247	2.06
para-Cymenene	5.62*	1085	[2.16]	6.41	1387	0.08
<i>trans</i> -Sabinene hydrate	5.76	1094	0.08	8.03	1509	0.09
Linalool	5.85	1100	0.01	8.14	1517	0.02
para-Mentha-1,3,8-triene	5.97	1108	0.01	6.23	1374	0.01
<i>trans</i> -para-Mentha-2,8-dien-1-ol	6.11†	1117	0.12	9.03†	1586	[0.08]
<i>cis</i> -para-Menth-2-en-1-ol	6.14†	1118	[0.12]	8.19	1521	0.05
allo-Ocimene	6.31*	1129	0.09	5.67	1334	0.07
<i>cis</i> -Limonene oxide	6.31*	1129	[0.09]	6.51	1394	0.01
<i>cis</i> -para-Mentha-2,8-dien-1-ol	6.34	1131	0.05	9.53*	1628	0.06
Camphor	6.41	1136	0.07	7.26*	1451	0.17
<i>trans</i> -para-Menth-2-en-1-ol	6.45	1139	0.03	9.01†	1585	0.08
Epoxyterpinolene	6.49	1141	0.01	6.81	1417	0.02
Unknown [m/z 95,	6.50	1142	0.02	7.07*	1436	0.03

43 (74), 109 (72), 82 (62), 110 (50)... 152 (14)]						
Unknown [m/z 95, 110 (38), 81 (21), 79 (16)... 152 (7)]	6.82	1163	0.03	7.77	1489	0.03
Unknown [m/z 95, 110 (43), 81 (28), 41 (15)... 152 (8)]	6.89	1167	0.03	7.87*	1496	0.03
Terpinen-4-ol	6.99	1173	0.39	8.65	1557	0.35
Cryptone	7.08	1179	0.05	9.22	1602	0.05
para-Cymen-8-ol	7.13	1183	0.34	11.59	1800	0.35
α -Terpineol	7.22	1188	2.35	9.86	1654	2.40
<i>trans</i> - Isopiperitenol	7.28	1192	0.03	10.48	1705	0.01
α -Phellandrene epoxide	7.36	1198	0.30	11.09	1757	0.29
<i>trans</i> -Piperitol	7.48	1205	0.04	10.45	1702	0.06
<i>trans</i> -Carveol	7.65*	1217	0.13	11.46	1788	0.07
Unknown [m/z 43, 111 (88), 126 (74), 125 (61)... 168? (2)]	7.65*	1217	[0.13]	11.16*	1763	0.11
Citronellol	7.83*	1229	0.06	10.80	1732	0.01
<i>cis</i> -Carveol	7.83*	1229	[0.06]	11.79	1818	0.05
Cuminal	7.91*	1235	0.04	10.68	1722	0.01
Unknown [m/z 126, 111 (98), 43 (96), 71 (49), 125 (37), 97 (37)...]	7.91*	1235	[0.04]	11.01	1750	0.02
Carvone	7.98	1239	0.06	10.06	1670	0.07
Carvotanacetone	8.03	1243	0.04	9.53*	1628	[0.06]
Unknown [m/z 43, 97 (69), 107 (46), 41 (28), 55 (21), 109 (20)...]	8.12*	1249	0.17	11.16*	1763	[0.11]
Piperitone	8.12*	1249	[0.17]	9.96	1662	0.12
Unknown [m/z 43, 97 (62), 41 (39), 55 (35), 83 (22), 69 (21), 107 (19)...]	8.27	1259	0.03			
Unknown [m/z 43, 56 (54), 69 (40), 155 (40), 41 (35), 55 (33)...]	8.31	1262	0.02	10.18	1680	0.02
Unknown [m/z 109, 127 (55), 43 (40), 81 (36), 79 (39), 82 (29)...]	8.42	1270	0.02			
Unknown [m/z 93, 43 (60), 108 (58), 69 (36), 41 (35)... 150 (5), 184 (1)]	8.65	1286	0.01			

Unknown [m/z 43, 126 (98), 111 (93), 71 (79), 109 (42), 95 (38)...]	8.72	1290	0.09	14.02	2022	0.07
Perillyl alcohol	8.82*	1298	0.04	13.29	1954	0.02
Unknown [m/z 95, 110 (95), 67 (31), 43 (29), 122 (18), 41 (14)...]	8.82*	1298	[0.04]			
Thymol	8.88*	1302	0.05	15.12	2129	0.01
<i>cis</i> -Terpin hydrate?	8.88*	1302	[0.05]			
Carvacrol	8.99	1305	0.01	15.36	2154	0.04
Unknown [m/z 43, 111 (84), 109 (71), 126 (70)...]	8.95*	1306	0.28	14.43	2062	0.04
Unknown [m/z 93, 111 (86), 43 (70), 110 (55), 59 (53), 69 (52), 41 (47)...]	8.95*	1306	[0.28]	13.55	1977	0.15
Unknown [m/z 111, 126 (93), 43 (90), 71 (60)...]	9.08	1312	0.34	15.23	2140	0.34
<i>trans</i> -Terpin hydrate?	9.23	1322	0.03			
δ -Elemene	9.36	1332	0.03	7.07*	1436	[0.03]
Unknown [m/z 43, 97 (99), 107 (47), 41 (35), 55 (30)...]	9.41	1335	0.06	13.38*	1962	0.30
α -Cubebene	9.58	1347	0.05	6.89	1423	0.05
Unknown [m/z 84, 83 (13), 41 (11), 43 (11), 55 (9), 40 (8)...]	9.90	1370	0.01	16.14	2233	0.01
α -Copaene	9.93	1372	0.13	7.26*	1451	[0.17]
β -Bourbonene	9.98	1376	0.01	7.59	1476	0.01
β -Cubebene	10.08	1382	0.04	7.87*	1496	[0.03]
β -Elemene	10.18	1389	0.21	8.52*†	1547	0.27
Unknown [m/z 71, 100 (92), 111 (79), 69 (46), 109 (45)...]	10.24	1394	0.02	17.16	2341	0.02
α -Gurjunene	10.37*	1403	0.26	7.73	1486	0.03
Methyleugenol	10.37*	1403	[0.26]	13.38*	1962	[0.30]
(<i>trans</i> ?) β -Hydroxypiperitone	10.48	1412	0.05	16.83	2306	0.07
β -Caryophyllene	10.51	1414	0.17	8.54†	1548	[0.27]
β -Copaene	10.61	1421	0.02	8.47	1543	0.01
(<i>cis</i> ?) β -Hydroxypiperitone	10.65	1424	0.01	17.43	2371	0.04
γ -Elemene	10.74	1431	0.03	9.14	1596	0.02
α -Guaiene	10.78	1434	0.02	8.52*†	1547	[0.27]
α -Humulene	10.97	1448	0.09	9.39	1616	0.12
Unknown [m/z	11.00	1450	0.02			

109, 110 (33), 43 (30), 95 (23), 71 (20), 41 (19)...						
Germacrene D	11.34	1476	0.05	9.88	1656	0.04
Viridiflorene	11.54	1491	0.05	9.71	1642	0.05
Unknown [m/z 43, 127 (65), 55 (43), 126 (41), 100 (24), 81 (22)...	11.58	1494	0.02			
α -Muurolene	11.63	1498	0.04	10.15	1678	0.05
Cubebol	11.80*	1511	0.03	12.63	1892	0.01
γ -Cadinene	11.80*	1511	[0.03]	10.50	1707	0.01
epi-Elemol?	11.88	1517	0.09	13.56	1979	0.07
δ -Cadinene	11.93	1521	0.05	10.53	1709	0.06
α -Elemol	12.28	1549	8.17	14.14	2033	8.38
Elemicin	12.41	1558	3.25	15.57	2175	3.31
Germacrene D-4-ol	12.56	1571	0.02	13.75	1996	0.01
Viridiflorol	12.75	1586	0.02	14.07	2027	0.01
Guaiol	12.86	1594	0.12	14.22	2041	0.15
γ -Eudesmol	13.26	1626	0.08	14.94	2112	0.08
Unknown [m/z 59, 161 (53), 81 (47), 204 (40), 107 (36), 95 (33), 93 (33)... 222 (1)]	13.38	1636	0.02	14.45	2064	0.01
α -Eudesmol	13.46	1643	0.19	15.41*	2158	0.20
β -Eudesmol	13.50	1647	0.14	15.47	2165	0.20
Bulnesol	13.67	1661	0.16	15.41*	2158	[0.20]
Cryptomeridiol analog	14.88	1764	0.01	19.06	2554	0.03
α -Phellandrene dimer II	15.19	1790	0.03	12.59	1889	0.04
Cryptomeridiol	15.32	1802	0.16	19.88	2651	0.16
α -Phellandrene dimer III	15.37	1806	0.01	13.20	1945	0.02
Unknown [m/z 159, 93 (87), 146 (72), 43 (72), 119 (48), 121 (48), 59 (25)... 220 (31)]	15.53	1821	0.02			
α -Phellandrene dimer IV	15.60	1827	0.01	13.38*	1962	[0.30]
Total identified		98.47%			97.84%	
Total reported		99.23%			98.55%	

*: 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

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