

**Date :** April 09, 2019

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 19D04-PTH08-1-SCC

**Customer identification :** Sea Fennel - Greece - SB510189R

**Type :** Essential oil

**Source :** *Crithmum maritimum*

**Customer :** Plant Therapy

**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 :** Sylvain Mercier, M. Sc., Chimiste

**Analysis date :** April 09, 2019

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Faintly yellow liquid

**Refractive index:**  $1.4796 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Methoxyacetone	0.02	0.02	Aliphatic alcohol
2-Methyl-3-buten-2-ol	tr	tr	Aliphatic alcohol
Heptanal	0.01	0.01	Aliphatic aldehyde
Tricyclene	0.01	tr	Monoterpene
$\alpha$ -Thujene	0.49	0.48	Monoterpene
$\alpha$ -Pinene	2.47	2.45	Monoterpene
Camphene	0.06	0.06	Monoterpene
Sabinene	16.23*	16.00	Monoterpene
$\beta$ -Pinene	[16.23]*	0.25	Monoterpene
Myrcene	1.66	1.64	Monoterpene
$\alpha$ -Phellandrene	0.59*	0.48	Monoterpene
Pseudolimonene	[0.59]*	0.09	Monoterpene
$\Delta^3$ -Carene	0.05	0.05	Monoterpene
$\alpha$ -Terpinene	0.96	0.96	Monoterpene
para-Cymene	6.94	6.91	Monoterpene
Limonene	29.60*	13.45	Monoterpene
1,8-Cineole	[29.60]*	16.15	Monoterpenic ether
(Z)- $\beta$ -Ocimene	4.70	28.56*	Monoterpene
(E)- $\beta$ -Ocimene	0.29	0.30	Monoterpene
$\gamma$ -Terpinene	23.88	[28.56]*	Monoterpene
cis-Sabinene hydrate	0.07	0.10	Monoterpenic alcohol
$\alpha$ -Pinene oxide analog	0.01	0.01	Monoterpenic ether
Terpinolene	0.54*	0.53	Monoterpene
para-Cymenene	[0.54]*	0.02	Monoterpene
trans-Sabinene hydrate	0.07	0.07	Monoterpenic alcohol
Linalool	0.06	0.10	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.16	0.21	Monoterpenic alcohol
allo-Ocimene	0.07*	0.06	Monoterpene
cis-Limonene oxide	[0.07]*	0.02	Monoterpenic ether
cis-para-Mentha-2,8-dien-1-ol	0.03*	0.02	Monoterpenic alcohol
trans-Limonene oxide	[0.03]*	0.02	Monoterpenic ether
trans-para-Menth-2-en-1-ol	0.09	0.09	Monoterpenic alcohol
Epoxyterpinolene	0.05	0.05	Monoterpenic ether
1,4-Dimethyl-4-acetylcyclohexene	0.02	0.08*	Monoterpenic ketone
Sabinaketone	0.03	0.02	Normoterpenic ketone
Unknown	0.07	[0.08]*	Unknown
Unknown	0.04		Oxygenated monoterpene
Terpinen-4-ol	2.80	2.79*	Monoterpenic alcohol
Cryptone	0.16	0.15	Normoterpenic ketone
$\alpha$ -Terpineol	0.17	0.22*	Monoterpenic alcohol
cis-Piperitol	0.04	0.04	Monoterpenic alcohol
$\alpha$ -Phellandrene epoxide	0.02	0.03	Monoterpenic ether
trans-Piperitol	0.06	0.08	Monoterpenic alcohol
trans-Carveol	0.01	0.01	Monoterpenic alcohol
Unknown	0.03		Unknown
Thymol methyl ether analog I	0.12	0.12	Monoterpenic ether
Thymol methyl ether	2.51	2.48	Monoterpenic ether
Carvacrol methyl ether	0.04	[2.79]*	Monoterpenic ether

Unknown	0.07		Unknown
(2E)-Decenal	0.04	0.02	Aliphatic aldehyde
<i>trans</i> -Ascaridole glycol	0.06*	0.07	Monoterpenic alcohol
Phellandral	[0.06]*	0.02	Monoterpenic aldehyde
Geranial	0.07	0.05	Monoterpenic aldehyde
Bornyl acetate	0.06	0.06	Monoterpenic ester
<i>cis</i> -Ascaridole glycol	0.06	0.07	Monoterpenic alcohol
Cuminol	0.03	0.03	Monoterpenic alcohol
Thymol	0.05	0.03	Monoterpenic alcohol
Unknown	0.06		Unknown
Unknown	0.03		Unknown
Unknown	0.02	0.13*	Unknown
Carvacrol	0.03	0.03	Monoterpenic alcohol
Unknown	0.05	0.06	Unknown
Unknown	0.09	0.09	Monoterpenic alcohol
Unknown	0.10		Unknown
Unknown	0.02		Unknown
Unknown	0.05		Unknown
Unknown	0.01		Unknown
Unknown	0.07		Unknown
$\beta$ -Caryophyllene	0.08	0.06	Sesquiterpene
Aromadendrene	0.02	[2.79]*	Sesquiterpene
Unknown	0.05	0.07	Unknown
Unknown	0.01		Sesquiterpene
allo-Aromadendrene	0.01	0.01	Sesquiterpene
Germacrene D	0.12*	[0.22]*	Sesquiterpene
(1S,2S,4S)- <i>para</i> -Menthane-1,2,4-triol	[0.12]*	0.08	Monoterpenic alcohol
Unknown	0.05	0.05	Sesquiterpene
$\beta$ -Bisabolene	0.03	0.02	Sesquiterpene
$\beta$ -Sesquiphellandrene	0.05	0.07	Sesquiterpene
Unknown	0.01	0.01	Sesquiterpene
Elemicin	0.02	0.02	Phenylpropanoid
Spathulenol	0.12	[0.13]*	Sesquiterpenic alcohol
Caryophyllene oxide	0.02	0.02	Sesquiterpenic ether
Dill apiole	1.18	1.15	Phenylpropanoid
Germacra-4(15),5,10(14)-trien-1 $\alpha$ -ol	0.02	0.03	Sesquiterpenic alcohol
<b>Total identified</b>	<b>97.20%</b>	<b>97.16%</b>	

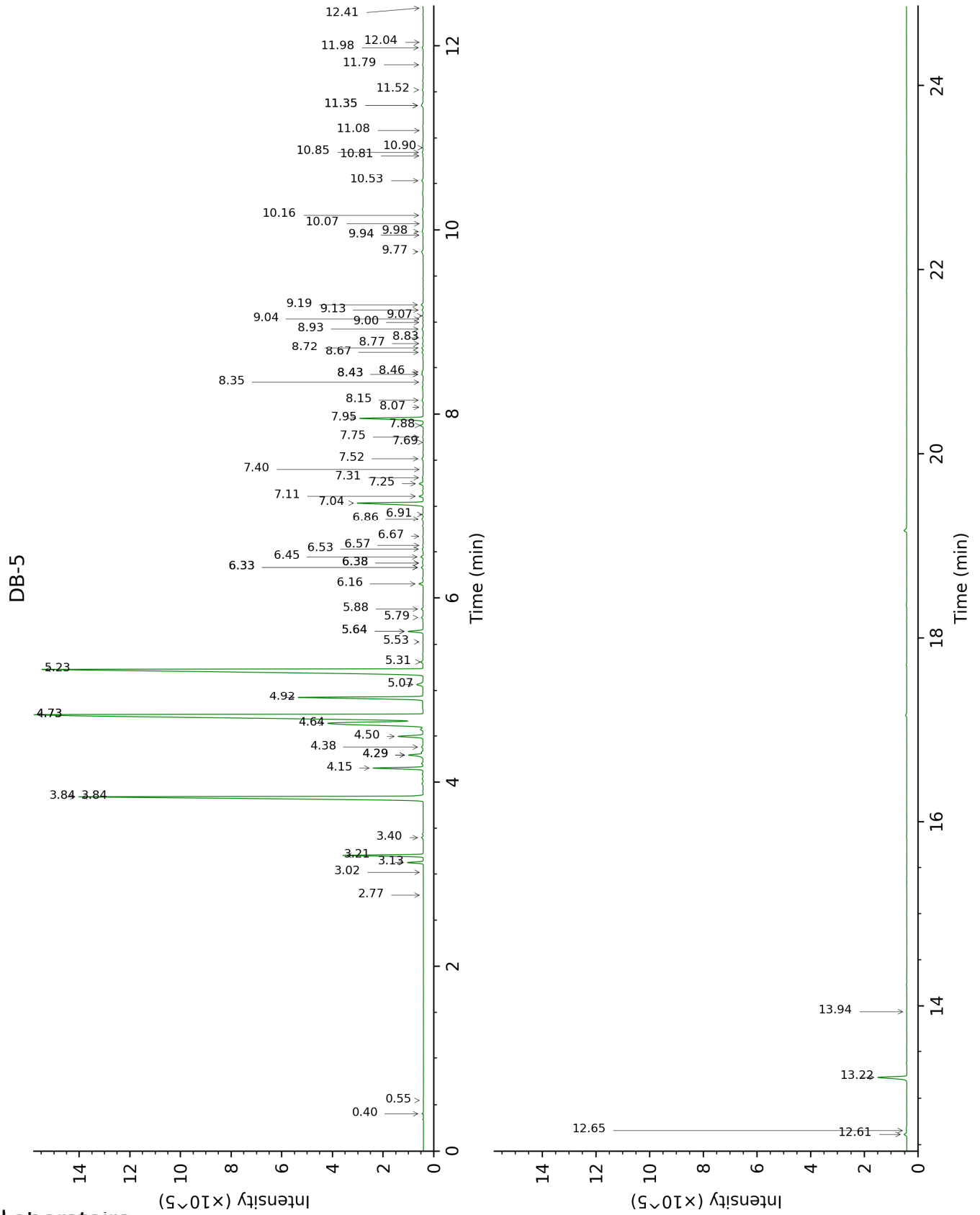
\*: Two or more compounds are coeluting on this column

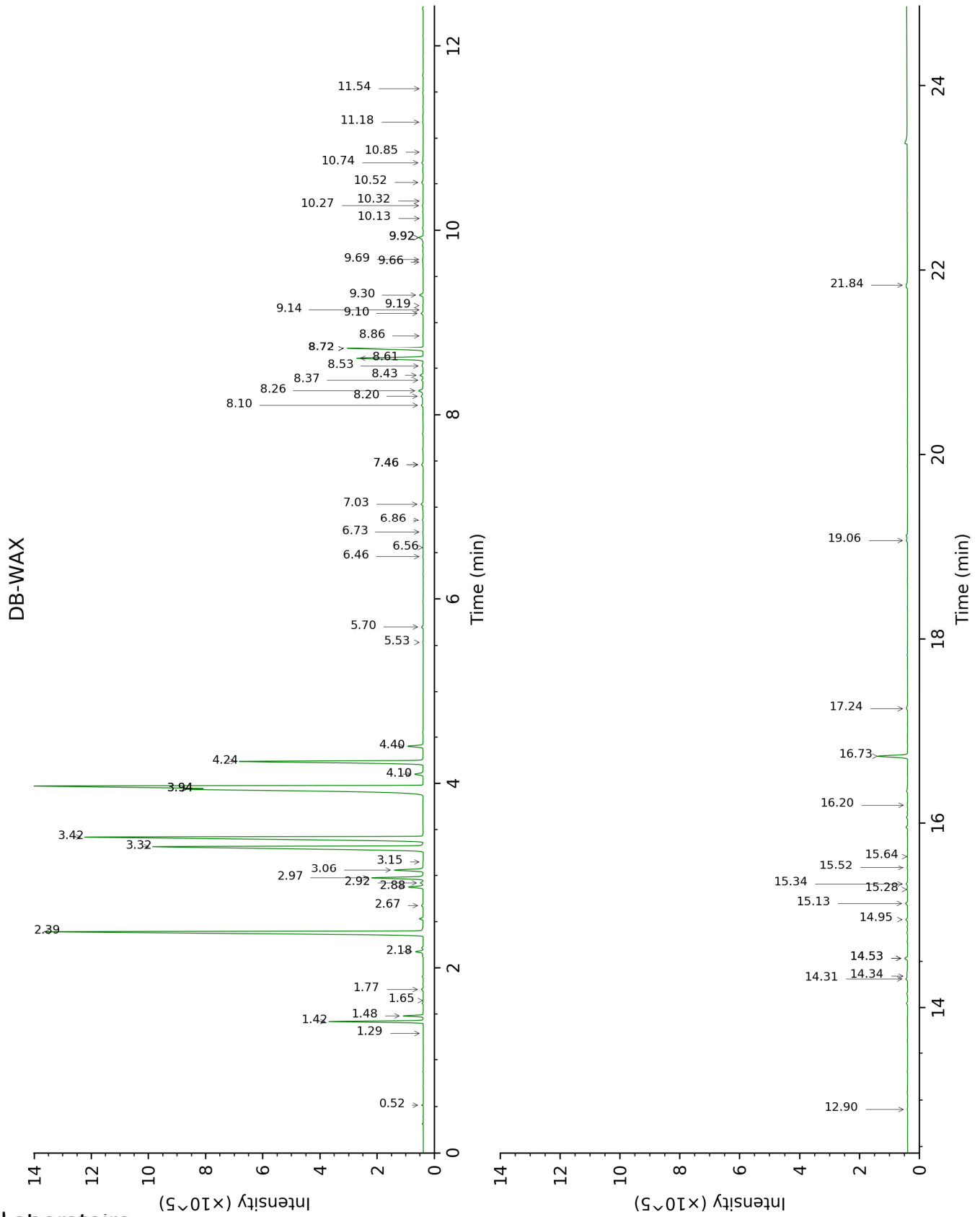
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Methoxyacetone	0.40	501	0.02	0.52	781	0.02
2-Methyl-3-buten-2-ol	0.55	608	tr	1.65	1014	tr
Heptanal	2.77	900	0.01	3.15	1147	0.01
Tricyclene	3.02	917	0.01	1.29	971	tr
$\alpha$ -Thujene	3.13	924	0.49	1.48	998	0.48
$\alpha$ -Pinene	3.21	929	2.47	1.42	992	2.45
Camphene	3.40	942	0.06	1.77	1026	0.06
Sabinene	3.84*	971	16.23	2.39	1087	16.00
$\beta$ -Pinene	3.84*	971	[16.23]	2.18	1066	0.25
Myrcene	4.15	992	1.66	2.97	1133	1.64
$\alpha$ -Phellandrene	4.30*	1001	0.59	2.88	1126	0.48
Pseudolimonene	4.30*	1001	[0.59]	2.92	1129	0.09
$\Delta^3$ -Carene	4.38	1007	0.05	2.67	1110	0.05
$\alpha$ -Terpinene	4.50	1014	0.96	3.06	1140	0.96
para-Cymene	4.64	1023	6.94	4.24	1228	6.91
Limonene	4.73*	1029	29.60	3.32	1160	13.45
1,8-Cineole	4.73*	1029	[29.60]	3.42	1168	16.15
(Z)- $\beta$ -Ocimene	4.92	1040	4.70	3.94*†	1207	28.56
(E)- $\beta$ -Ocimene	5.06	1050	0.29	4.10	1218	0.30
$\gamma$ -Terpinene	5.23	1060	23.88	3.94*†	1207	[28.56]
cis-Sabinene hydrate	5.31	1065	0.07	7.03	1429	0.10
$\alpha$ -Pinene oxide analog	5.53	1079	0.01	5.53	1321	0.01
Terpinolene	5.64*	1086	0.54	4.40	1240	0.53
para-Cymenene	5.64*	1086	[0.54]	6.46	1387	0.02
trans-Sabinene hydrate	5.79	1096	0.07	8.10	1509	0.07
Linalool	5.88	1101	0.06	8.20	1517	0.10
cis-para-Menth-2-en-1-ol	6.16	1119	0.16	8.26	1521	0.21
allo-Ocimene	6.33*	1130	0.07	5.70	1333	0.06
cis-Limonene oxide	6.33*	1130	[0.07]	6.56	1394	0.02
cis-para-Mentha-2,8-dien-1-ol	6.38*	1133	0.03	9.66	1630	0.02
trans-Limonene oxide	6.38*	1133	[0.03]	6.73	1407	0.02
trans-para-Menth-2-en-1-ol	6.45	1138	0.09	9.10	1586	0.09
Epoxyterpinolene	6.53	1143	0.05	6.86	1417	0.05
1,4-Dimethyl-4-acetylcyclohexene	6.57	1146	0.02	7.46*	1461	0.08
Sabinaketone	6.67	1152	0.03	8.86	1567	0.02
Unknown [m/z 43, 109 (68), 67 (62), 81 (36), 41 (31), 137 (29), 79 (26)...]	6.86	1165	0.07	7.46*	1461	[0.08]



Unknown [m/z 43, 71 (87), 95 (50), 81 (38), 109 (30), 41 (27)...152 (5)]	6.91	1168	0.04			
Terpinen-4-ol	7.04	1176	2.80	8.72*	1556	2.79
Cryptone	7.11	1181	0.16	9.30	1602	0.15
$\alpha$ -Terpineol	7.25	1190	0.17	9.92*	1652	0.22
<i>cis</i> -Piperitol	7.31	1194	0.04	9.68	1633	0.04
$\alpha$ -Phellandrene epoxide	7.40	1200	0.02	11.18	1756	0.03
<i>trans</i> -Piperitol	7.52	1207	0.06	10.52	1700	0.08
<i>trans</i> -Carveol	7.69	1219	0.01	11.54	1786	0.01
Unknown [m/z 43, 119 (32), 97 (32), 41 (29), 71 (28), 58 (25)...]	7.75	1223	0.03			
Thymol methyl ether analog I	7.88	1232	0.12	8.43	1534	0.12
Thymol methyl ether	7.95	1237	2.51	8.61	1548	2.48
Carvacrol methyl ether	8.07	1245	0.04	8.72*	1556	[2.79]
Unknown [m/z 43, 109 (63), 71 (50), 81 (31), 55 (29), 85 (26)...]	8.15	1250	0.07			
(2E)-Decenal	8.34	1263	0.04	9.19	1593	0.02
<i>trans</i> -Ascaridole glycol	8.43*	1269	0.06	14.31	2039	0.07
Phellandral	8.43*	1269	[0.06]	10.13	1668	0.02
Geranial	8.46	1271	0.07	10.27	1680	0.05
Bornyl acetate	8.67	1285	0.06	8.37	1530	0.06
<i>cis</i> -Ascaridole glycol	8.72	1289	0.06	14.95	2101	0.07
Cuminol	8.77	1292	0.03	14.34	2042	0.03
Thymol	8.83	1297	0.05	15.28	2133	0.03
Unknown [m/z 112, 97 (93), 83 (60), 43 (46), 41 (20), 69 (19)...]	8.93	1303	0.06			
Unknown [m/z 81, 137 (39), 43 (36), 95 (27), 69 (23), 79 (18)...]	9.00	1303	0.03			
Unknown [m/z 43, 111 (84), 109 (71), 126 (70)...]	9.04	1306	0.02	14.53*	2060	0.13
Carvacrol	9.07	1308	0.03	15.52	2157	0.03
Unknown [m/z 111, 126 (93), 43 (90), 71 (60)...]	9.13	1313	0.05	15.34	2139	0.06
Unknown [m/z 97,	9.19	1317	0.09	15.13	2118	0.09

112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]						
Unknown [m/z 139, 69 (45), 83 (38), 121 (34), 79 (29), 43 (27)...]	9.76	1358	0.10			
Unknown [m/z 69, 43 (89), 71 (78), 139 (74), 41 (67), 81 (60)...]	9.94	1370	0.02			
Unknown [m/z 139, 69 (53), 83 (42), 121 (39), 43 (30), 79 (28)...]	9.98	1373	0.05			
Unknown [m/z 139, 69 (63), 83 (53), 43 (49), 41 (39)...]	10.07	1379	0.01			
Unknown [m/z 159, 43 (68), 91 (57), 119 (52), 105 (51), 107 (42)...]	10.16	1385	0.07			
$\beta$ -Caryophyllene	10.53	1412	0.08	8.53	1542	0.06
Aromadendrene	10.81	1433	0.02	8.72*	1556	[2.79]
Unknown [m/z 41, 97 (78), 69 (77), 43 (71), 125 (67), 55 (56)... 168 (39)]	10.85	1436	0.05	17.24	2336	0.07
Unknown [m/z 139, 69 (60), 41 (51), 43 (47), 119 (41)... 204 (1)]	10.90	1440	0.01			
allo-Aromadendrene	11.08	1454	0.01	9.14	1589	0.01
Germacrene D	11.35*	1474	0.12	9.92*	1652	[0.22]
(1S,2S,4S)-para-Menthane-1,2,4-triol	11.35*	1474	[0.12]	21.84	2880	0.08
Unknown [m/z 81, 82 (62), 41 (37), 69 (36), 43 (36), 110 (33), 71 (32)...204 (1)]	11.52	1486	0.05	19.06	2540	0.05
$\beta$ -Bisabolene	11.80	1507	0.03	10.32	1684	0.02
$\beta$ -Sesquiphellandrene	11.98	1522	0.05	10.74	1719	0.07
Unknown [m/z 119, 105 (53), 161 (33), 93 (28), 91 (25), 40 (20)...204]	12.04	1526	0.01	10.85	1728	0.01
Elemicin	12.41	1556	0.02	15.64	2170	0.02
Spathulenol	12.61	1571	0.12	14.53*	2060	[0.13]

Caryophyllene oxide	12.65	1574	0.02	12.90	1907	0.02
Dill apiole	13.22	1620	1.18	16.73	2281	1.15
Germacra-4(15),5,10(14)-trien-1 $\alpha$ -ol	13.94	1679	0.02	16.20	2226	0.03
<b>Total identified</b>	<b>97.20%</b>			<b>97.16%</b>		
<b>Total reported</b>	<b>98.04%</b>			<b>97.44%</b>		

\*: 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