

**Date :** March 16, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 21B23-FEP19


**Customer identification :** Nutmeg - Indonesia - 13174-14

**Type :** Essential oil

**Source :** *Myristica fragrans*

**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 10, 2021

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:**  $1.4764 \pm 0.0003$  (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
Hashishene	0.02	Monoterpene
$\alpha$ -Thujene	2.36	Monoterpene
$\alpha$ -Pinene	17.44	Monoterpene
Camphene	0.23	Monoterpene
$\alpha$ -Fenchene	0.05	Monoterpene
$\beta$ -Pinene	13.49	Monoterpene
Sabinene	22.48	Monoterpene
Myrcene	1.88	Monoterpene
Pseudolimonene	0.05	Monoterpene
$\alpha$ -Phellandrene	0.73	Monoterpene
$\Delta^3$ -Carene	2.49	Monoterpene
$\alpha$ -Terpinene	2.72	Monoterpene
ortho-Cymene	tr	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	1.40	Monoterpene
Limonene	6.76	Monoterpene
1,8-Cineole	2.31*	Monoterpenic ether
$\beta$ -Phellandrene	[2.31]*	Monoterpene
(Z)- $\beta$ -Ocimene	0.01	Monoterpene
(E)- $\beta$ -Ocimene	0.02	Monoterpene
$\gamma$ -Terpinene	4.24	Monoterpene
cis-Sabinene hydrate	0.24	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
para-Cymenene	0.08	Monoterpene
Terpinolene	1.83	Monoterpene
$\alpha$ -Pinene oxide	0.02	Monoterpenic ether
trans-Sabinene hydrate	0.17	Monoterpenic alcohol
Unknown	0.03	Oxygenated monoterpene
Linalool	0.76	Monoterpenic alcohol
Unknown	0.01	Monoterpenic alcohol
Amyl isovalerate	0.03	Aliphatic ester
cis-para-Menth-2-en-1-ol	0.16	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.01	Aliphatic alcohol
cis-para-Mentha-2,8-dien-1-ol	0.04	Monoterpenic alcohol
trans-Pinocarveol	0.01	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.10	Monoterpenic alcohol
Epoxyterpinolene	0.03	Monoterpenic ether
Unknown	0.02	Unknown
Sabinaketone	0.02	Normonoterpenic ketone
Borneol	0.01	Monoterpenic alcohol
$\delta$ -Terpineol	0.01	Monoterpenic alcohol
Terpinen-4-ol	6.30	Monoterpenic alcohol
para-Cymen-8-ol	0.06	Monoterpenic alcohol
$\alpha$ -Terpineol	0.77	Monoterpenic alcohol
cis-Piperitol	0.06	Monoterpenic alcohol

Myrtenol	0.05	Monoterpenic alcohol
<i>cis</i> - $\alpha$ -Phellandrene epoxide (IPP vs Me)	0.02	Monoterpenic ether
<i>trans</i> -Piperitol	0.05	Monoterpenic alcohol
endo-Fenchyl acetate	0.01	Monoterpenic ester
Citronellol	0.05	Monoterpenic alcohol
Unknown	0.03	Oxygenated monoterpene
Unknown	0.01	Unknown
Unknown	0.03	Unknown
Geraniol	0.11	Monoterpenic alcohol
Linalyl acetate	0.02	Monoterpenic ester
<i>trans</i> -Ascaridole glycol	0.01	Monoterpenic alcohol
Bornyl acetate	0.08	Monoterpenic ester
Safrole	0.88	Phenylpropanoid
<i>cis</i> -Ascaridole glycol	0.01	Monoterpenic alcohol
Cuminol	0.03	Monoterpenic alcohol
Terpinen-4-yl acetate	0.01	Monoterpenic ester
Unknown	0.05	Unknown
Thymol	0.02	Monoterpenic alcohol
Thymol analogue II	0.02	Monoterpenic alcohol
Unknown	0.14	Simple phenolic
Carvacrol	tr	Monoterpenic alcohol
4-Vinylguaiaacol	0.01	Simple phenolic
Unknown	0.03	Monoterpenic alcohol
1,4-para-Menthadien-7-ol	0.01	Monoterpenic alcohol
Unknown	0.02	Unknown
$\alpha$ -Cubebene	0.07	Sesquiterpene
$\alpha$ -Terpinyl acetate	0.13	Monoterpenic ester
Citronellyl acetate	0.03	Monoterpenic ester
Eugenol	0.16	Phenylpropanoid
Neryl acetate	0.02	Monoterpenic ester
$\alpha$ -Ylangene	0.04	Sesquiterpene
Dihydroeugenol	0.02	Phenylpropanoid
$\alpha$ -Copaene	0.39	Sesquiterpene
Geranyl acetate	0.17	Monoterpenic ester
$\beta$ -Cubebene	0.03	Sesquiterpene
Methyleugenol	1.22	Phenylpropanoid
( <i>Z</i> )-Isoeugenol	0.04	Phenylpropanoid
$\beta$ -Caryophyllene	0.35	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.08	Sesquiterpene
$\alpha$ -Humulene	0.02	Sesquiterpene
( <i>E</i> )-Isoeugenol	0.08	Phenylpropanoid
( <i>E</i> )- $\beta$ -Farnesene	0.04	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.03	Sesquiterpene
$\gamma$ -Murolene	0.03	Sesquiterpene
Bicyclgermacrene	0.03	Sesquiterpene
$\alpha$ -Murolene	0.03	Sesquiterpene
Methyl ( <i>E</i> )-isoeugenol	0.25	Phenylpropanoid
$\beta$ -Bisabolene	0.07	Sesquiterpene
(3 <i>E</i> ,6 <i>E</i> )- $\alpha$ -Farnesene	0.03	Sesquiterpene
Myristicin	2.65	Phenylpropanoid
$\delta$ -Cadinene	0.09	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.02	Sesquiterpene

(E)- $\alpha$ -Bisabolene	0.01	Sesquiterpene
Elemicin	1.23	Phenylpropanoid
Germacrene D-4-ol	0.01	Sesquiterpenic alcohol
Spathulenol	0.01	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Caryophyllene oxide	0.02	Sesquiterpenic ether
Methoxyeugenol	0.04	Phenylpropanoid
Unknown	0.03	Phenylpropanoid
(E)-Isoelemicin	0.06	Phenylpropanoid
Myristic acid	0.44	Aliphatic acid
meta-Camphorene	0.01	Diterpene
para-Camphorene	0.01	Diterpene
<b>Consolidated total</b>	<b>99.14%</b>	

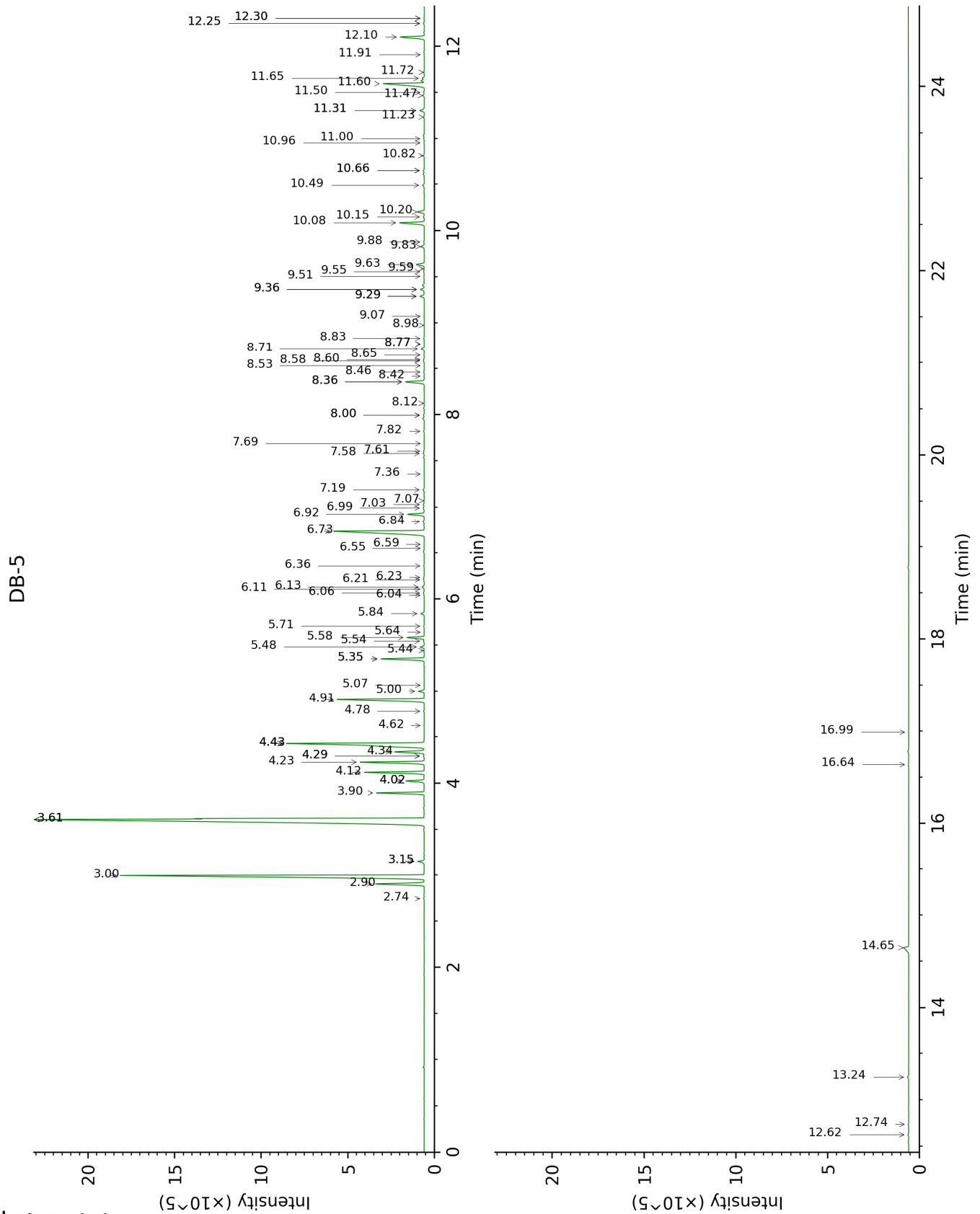
\*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered [xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

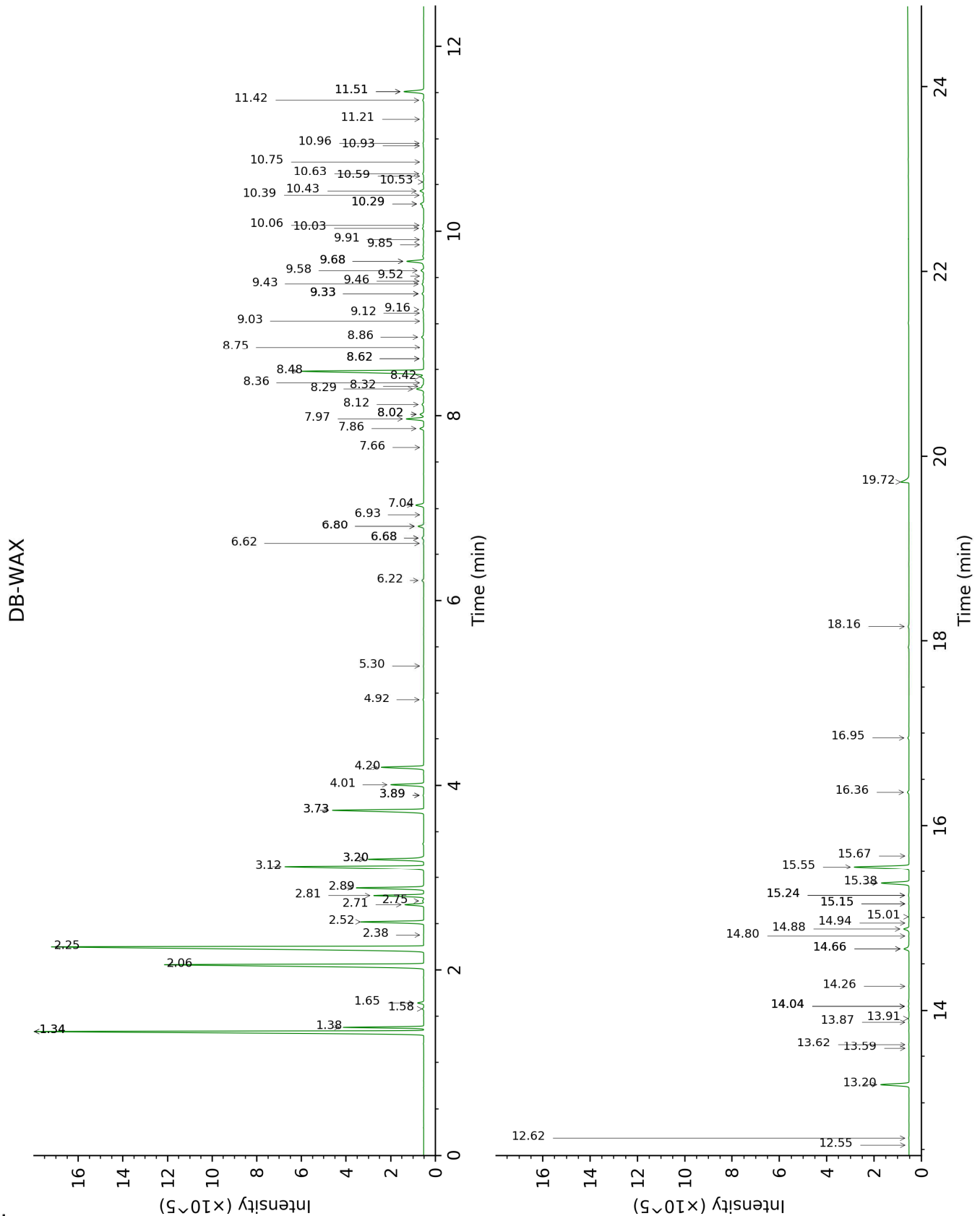
Note: no correction factor was applied

**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.

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	%
Hashishene	2.74	915	0.02	1.34*	996	17.38
$\alpha$ -Thujene	2.90	925	2.36	1.38	1002	2.34
$\alpha$ -Pinene	3.00	932	17.44	1.34*	996	[17.38]
Camphene	3.15*	942	0.29	1.65	1028	0.23
$\alpha$ -Fenchene	3.15*	942	[0.29]	1.58	1021	0.05
$\beta$ -Pinene	3.61*	973	35.89	2.06	1069	13.49
Sabinene	3.61*	973	[35.89]	2.25	1088	22.48
Myrcene	3.90	992	1.88	2.80	1135	1.94
Pseudolimonene	4.02*	1001	0.77	2.75	1130	0.05
$\alpha$ -Phellandrene	4.02*	1001	[0.77]	2.71	1127	0.73
$\Delta^3$ -Carene	4.12	1007	2.49	2.52	1112	2.49
$\alpha$ -Terpinene	4.23	1014	2.72	2.89	1141	2.73
ortho-Cymene	4.29*	1018	0.03	3.89*	1220	0.02
Carvomenthene	4.29*	1018	[0.03]	2.38	1101	0.01
para-Cymene	4.34	1021	1.40	4.01	1229	1.38
Limonene	4.43*	1027	9.07	3.12	1160	6.76
1,8-Cineole	4.43*	1027	[9.07]	3.20*	1166	2.38
$\beta$ -Phellandrene	4.43*	1027	[9.07]	3.20*	1166	[2.38]
(Z)- $\beta$ -Ocimene	4.62	1039	0.01	3.73*	1208	4.27
(E)- $\beta$ -Ocimene	4.78	1049	0.02	3.89*	1220	[0.02]
$\gamma$ -Terpinene	4.91	1057	4.24	3.73*	1208	[4.27]
<i>cis</i> -Sabinene hydrate	5.00	1063	0.24	6.80*	1430	0.25
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.07	1067	0.01			
para-Cymenene	5.35*	1086	1.90	6.22	1387	0.08
Terpinolene	5.35*	1086	[1.90]	4.20	1243	1.83
$\alpha$ -Pinene oxide	5.44	1091	0.02	5.30	1320	0.01
<i>trans</i> -Sabinene hydrate	5.48	1094	0.17	7.86	1510	0.17
Unknown [m/z 95, 152 (20), 67 (17), 96 (16), 41 (12)]	5.54	1098	0.03	4.92	1297	0.03
Linalool	5.58	1100	0.76	7.97	1518	0.75
Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.64	1104	0.01	8.36	1548	0.01
Amyl isovalerate	5.71	1108	0.03			
<i>cis</i> -para-Menth-2-en-1-ol	5.84	1117	0.16	8.02*	1522	0.18

4-Hydroxy-4-methylcyclohex-2-enone	6.04	1130	0.01	13.87	2025	0.02
<i>cis</i> -para-Mentha-2,8-dien-1-ol	6.06	1132	0.04	9.33*	1625	0.08
<i>trans</i> -Pinocarveol	6.11	1134	0.01	9.03	1601	0.01
<i>trans</i> -para-Mentha-2-en-1-ol	6.13	1136	0.10	8.86	1588	0.10
Epoxyterpinolene	6.21	1141	0.03	6.62	1416	0.02
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.23	1142	0.02	6.80*	1430	[0.25]
Sabinaketone	6.36	1151	0.02	8.62*	1569	0.04
Borneol	6.55	1163	0.01	9.68*	1654	0.78
δ-Terpineol	6.59	1166	0.01	9.33*	1625	[0.08]
Terpinen-4-ol	6.73	1175	6.30	8.48	1558	6.35
para-Cymen-8-ol	6.84	1182	0.06	11.42	1800	0.05
α-Terpineol	6.92	1188	0.77	9.68*	1654	[0.78]
<i>cis</i> -Piperitol	6.99	1192	0.06	9.43	1634	0.08
Myrtenol	7.03	1194	0.05	10.75	1744	0.01
<i>cis</i> -α-Phellandrene epoxide (IPP vs Me)	7.07	1197	0.02	10.93	1758	0.03
<i>trans</i> -Piperitol	7.19	1205	0.05	10.29*	1704	0.16
endo-Fenchyl acetate	7.36	1216	0.01	6.68*	1421	0.08
Citronellol	7.58	1232	0.05	10.63	1733	0.05
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.61	1233	0.03	11.22	1783	0.02
Unknown [m/z 123, 165 (21), 180 (18), 79 (9), 124 (9)]	7.69	1239	0.01			
Unknown [m/z 43, 109 (63), 71 (50), 81 (31), 55 (29), 85 (26)...]	7.82	1248	0.03			
Geraniol	8.00*	1260	0.04	11.51*	1809	0.99
Linalyl acetate	8.00*	1260	[0.04]	8.02*	1522	[0.18]
<i>trans</i> -Ascaridole glycol	8.12	1269	0.01	14.04*	2042	0.04
Bornyl acetate	8.36*	1285	0.96	8.12	1530	0.08
Safrole	8.36*	1285	[0.96]	11.51*	1809	[0.99]
<i>cis</i> -Ascaridole glycol	8.42	1289	0.01	14.66*	2101	0.26
Cuminol	8.46	1292	0.03	14.04*	2042	[0.04]
Terpinen-4-yl acetate	8.53	1297	0.01	8.62*	1569	[0.04]

Unknown [m/z 81, 55 (82), 41 (58), 69 (51), 67 (49)...]	8.58	1300	0.05	10.96	1761	0.03
Thymol	8.60	1301	0.02	15.01	2136	0.01
Thymol analogue II	8.65	1305	0.02	15.15*	2150	0.01
Unknown [m/z 121, 178 (20), 77 (13), 122 (10)]	8.71	1306	0.14	8.42	1554	0.15
Carvacrol	8.77*	1310	0.01	15.24*	2160	0.03
4-Vinylguaiacol	8.77*	1310	[0.01]	14.94	2130	0.01
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.83	1314	0.03	14.80	2115	0.01
1,4-para-Menthadien-7-ol	8.98	1324	0.01	13.62	2001	0.01
Unknown [m/z 149, 178 (41), 121 (36), 91 (30), 55 (21)]	9.07	1331	0.02	8.75	1579	0.01
$\alpha$ -Cubebene	9.29*	1347	0.20	6.68*	1421	[0.08]
$\alpha$ -Terpinyl acetate	9.29*	1347	[0.20]	9.58	1646	0.13
Citronellyl acetate	9.36*	1352	0.19	9.33*	1625	[0.08]
Eugenol	9.36*	1352	[0.19]	14.66*	2101	[0.26]
Neryl acetate	9.50	1362	0.02	10.06	1685	0.04
$\alpha$ -Ylangene	9.56	1366	0.04	6.93	1440	0.01
Dihydroeugenol	9.59	1368	0.02	14.04*	2042	[0.04]
$\alpha$ -Copaene	9.63	1371	0.39	7.04	1448	0.38
Geranyl acetate	9.83	1385	0.17	10.43	1716	0.17
$\beta$ -Cubebene	9.88	1388	0.03	7.66	1494	0.01
Methyleugenol	10.08	1403	1.22	13.20	1961	1.28
(Z)-Isoeugenol	10.15	1408	0.04	15.15*	2150	[0.01]
$\beta$ -Caryophyllene	10.20	1412	0.35	8.29	1543	0.38
<i>trans</i> - $\alpha$ -Bergamotene	10.49	1433	0.08	8.32	1545	0.08
$\alpha$ -Humulene	10.66*	1446	0.05	9.12	1608	0.02
(E)-Isoeugenol	10.66*	1446	[0.05]	16.36	2275	0.08
(E)- $\beta$ -Farnesene	10.82	1458	0.04	9.46	1636	0.04
<i>trans</i> -Cadina-1(6),4-diene	10.96	1468	0.03	9.16	1611	0.07
$\gamma$ -Muurolene	11.00	1471	0.03	9.52	1641	0.01
Bicyclogermacrene	11.24	1489	0.03	9.85	1668	0.02
$\alpha$ -Muurolene	11.31*	1494	0.25	9.91	1673	0.03
Methyl (E)-isoeugenol	11.31*	1494	[0.25]	14.88	2123	0.25
$\beta$ -Bisabolene	11.47	1506	0.07	10.03	1683	0.06
(3E,6E)- $\alpha$ -Farnesene	11.50	1509	0.03	10.39	1712	0.03
Myristicin	11.60	1517	2.65	15.55	2191	2.67
$\delta$ -Cadinene	11.65	1521	0.09	10.29*	1704	[0.16]
<i>trans</i> -Cadina-1,4-diene	11.72	1526	0.02	10.53	1724	0.02

(E)- $\alpha$ -Bisabolene	11.91	1541	0.01	10.59	1730	0.01
Elemicin	12.10	1556	1.23	15.38	2173	1.28
Germacrene D-4-ol	12.25*	1568	0.04	13.58	1997	0.01
Spathulenol	12.25*	1568	[0.04]	14.26	2062	0.01
Caryophyllene oxide isomer	12.30*	1572	0.02	12.55	1901	0.01
Caryophyllene oxide	12.30*	1572	[0.02]	12.62	1908	0.02
Methoxyeugenol	12.62	1598	0.04	18.16	2471	0.05
Unknown [m/z 165, 121 (81), 181 (25), 238 (25)]	12.74	1607	0.03	13.91	2029	0.02
(E)-Isoelemicin	13.24	1649	0.06	16.95	2338	0.06
Myristic acid	14.65	1768	0.44	19.72	2654	0.47
meta-Camphorene	16.64	1950	0.01	15.24*	2160	[0.03]
para-Camphorene	16.99	1984	0.01	15.67	2203	0.01
<b>Total identified</b>		<b>98.52%</b>			<b>99.00%</b>	
<b>Total reported</b>		<b>98.91%</b>			<b>99.29%</b>	

\*: 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