

Date : 2023-10-16

CERTIFICATE OF ANALYSIS - GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 23I26-NPA01

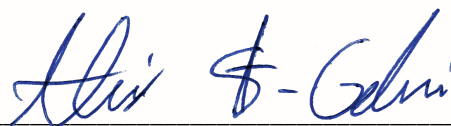
**Customer Identification :** Nutmeg - Indonesia - NP0245 - NPS00109

**Type :** Essential Oil

**Source :** *Myristica fragrans*

**Customer :** Nature Packaged

Checked and approved by:



Alexis St-Gelais, Ph. D., Chimiste 2013-174

*Notes: This report is digitally signed, it is only considered valid if the digital signature is intact. The results only describe the samples that were submitted to the assays.*

This report is an update from the first version issued on 2023-10-11 to format it for online publication.

## GAS CHROMATOGRAPHIC ANALYSIS

**Method :** PC-MAT-014 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID

**✖ISO**

**Results :** See analysis summary (next page)

**Analyst :** Sylvain Mercier, M. Sc., Chimiste 2014-005

**Date :** 2023-10-05

## PHYSICOCHEMICAL DATA

**Refractive index :**  $1.4803 \pm 0.0003$  (20 °C)

**Method :** PC-MAT-016 - Measure of the refractive index of a liquid.

**Analyst :** Cindy Caron B. Sc.

**Date :** 2023-09-26

## 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
Tricyclene	0.02	Monoterpene
$\alpha$ -Thujene	1.27	Monoterpene
$\alpha$ -Pinene	19.13	Monoterpene
$\alpha$ -Fenchene	0.04	Monoterpene
Camphene	0.28	Monoterpene
Thuja-2,4(10)-diene	0.02	Monoterpene
3,7,7-Trimethylcyclohepta-1,3,5-triene	0.04	Monoterpene
$\beta$ -Pinene	16.66	Monoterpene
Sabinene	22.18	Monoterpene
Octen-3-ol	0.02	Aliphatic alcohol
Myrcene	2.58	Monoterpene
2-Carene	0.02	Monoterpene
Decane	0.01	Alkane
Pseudolimonene	0.05	Monoterpene
$\alpha$ -Phellandrene	0.61	Monoterpene
$\Delta^3$ -Carene	0.56	Monoterpene
1,4-Cineole	0.14	Monoterpenic ether
$\alpha$ -Terpinene	2.73	Monoterpene
Carvomenthene	0.03	Aliphatic alcohol
<i>para</i> -Cymene	1.11	Monoterpene
1,8-Cineole	[2.10]	Monoterpenic ether
Limonene	4.23	Monoterpene
$\beta$ -Phellandrene	[2.10]	Monoterpene
( <i>Z</i> )- $\beta$ -Ocimene	0.02	Monoterpene
( <i>E</i> )- $\beta$ -Ocimene	0.03	Monoterpene
$\gamma$ -Terpinene	4.16	Monoterpene
<i>cis</i> -Sabinene hydrate	0.06	Monoterpenic alcohol
Terpinolene	1.33	Monoterpene
<i>para</i> -Cymenene	0.08	Monoterpene
<i>trans</i> -Sabinene hydrate	0.08	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Linalool	0.19	Monoterpenic alcohol
Unknown	0.01	Oxygenated monoterpene
endo-Fenchol	0.03	Monoterpenic alcohol
<i>cis-para</i> -Menth-2-en-1-ol	0.12	Monoterpenic alcohol
<i>cis-para</i> -Mentha-2,8-dien-1-ol	0.02	Monoterpenic alcohol
1-Terpineol	0.06	Monoterpenic alcohol
<i>trans</i> -Pinocarveol	0.02	Monoterpenic alcohol
<i>trans-para</i> -Menth-2-en-1-ol	0.09	Monoterpenic alcohol
Epoxyterpinolene	0.01	Monoterpenic ether

<i>cis</i> - $\beta$ -Terpineol	0.02	Monoterpenic alcohol
Unknown	0.01	Unknown
Sabinaketone	0.02	Normonoterpenic ketone
Pinocarvone	0.02	Monoterpenic ketone
<i>trans</i> - $\beta$ -Terpineol	0.02	Monoterpenic alcohol
Borneol	0.01	Monoterpenic alcohol
$\delta$ -Terpineol	0.03	Monoterpenic alcohol
Terpinen-4-ol	5.83	Monoterpenic alcohol
Cryptone	0.02	Normonoterpenic ketone
<i>meta</i> -Cymen-8-ol	0.01	Monoterpenic alcohol
<i>para</i> -Cymen-8-ol	0.06	Monoterpenic alcohol
$\alpha$ -Terpineol	0.76	Monoterpenic alcohol
<i>cis</i> -Piperitol	0.05	Monoterpenic alcohol
$\gamma$ -Terpineol	0.04	Monoterpenic alcohol
<i>trans</i> -Piperitol	0.07	Monoterpenic alcohol
Citronellol	0.02	Monoterpenic alcohol
Unknown	0.01	Unknown
Unknown	0.04	Unknown
Linalyl acetate	0.03	Monoterpenic ester
Geraniol	0.02	Monoterpenic alcohol
<i>trans</i> -Ascaridole glycol	0.02	Monoterpenic alcohol
Safrole	1.22	Phenylpropanoid
Bornyl acetate	0.08	Monoterpenic ester
<i>cis</i> -Ascaridole glycol	0.01	Monoterpenic alcohol
Cuminol	0.03	Monoterpenic alcohol
Terpinen-4-yl acetate	0.04	Monoterpenic ester
Unknown	0.08	Unknown
Unknown	0.26	Simple phenolic
Unknown	0.01	Monoterpenic alcohol
Unknown	0.01	Unknown
$\alpha$ -Terpinyl acetate	0.14	Monoterpenic ester
$\alpha$ -Cubebene	0.09	Sesquiterpene
Citronellyl acetate	0.08	Monoterpenic ester
Eugenol	0.15	Phenylpropanoid
Neryl acetate	0.04	Monoterpenic ester
$\alpha$ -Copaene	0.28	Sesquiterpene
Geranyl acetate	0.16	Monoterpenic ester
$\beta$ -Elemene	0.02	Sesquiterpene
Vanillin	0.01	Simple phenolic
Methyleugenol	0.17	Phenylpropanoid
( <i>Z</i> )-Isoeugenol	0.01	Phenylpropanoid
$\beta$ -Caryophyllene	0.01	Sesquiterpene
<i>cis</i> - $\alpha$ -Bergamotene	0.04	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.15	Sesquiterpene
Unknown	0.01	Unknown

(E)-Isoeugenol	0.35	Phenylpropanoid
(E)- $\beta$ -Farnesene	0.04	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.01	Sesquiterpene
$\gamma$ -Muurolene	0.01	Sesquiterpene
Germacrene D	0.05	Sesquiterpene
Bicyclogermacrene	0.02	Sesquiterpene
Methyl (E)-isoeugenol	0.03	Phenylpropanoid
$\alpha$ -Muurolene	0.02	Sesquiterpene
$\beta$ -Bisabolene	0.08	Sesquiterpene
(3E,6E)- $\alpha$ -Farnesene	0.04	Sesquiterpene
Myristicin	7.28	Phenylpropanoid
$\delta$ -Cadinene	0.32	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.02	Sesquiterpene
(E)- $\alpha$ -Bisabolene	0.02	Sesquiterpene
Elemicin	0.25	Phenylpropanoid
Spathulenol	0.01	Sesquiterpenic alcohol
Methoxyeugenol	0.12	Phenylpropanoid
Unknown	0.01	Phenylpropanoid
Myristic acid	0.12	Aliphatic acid
<i>meta</i> -Camphorene	0.01	Diterpene
13-epi-Manoyl oxide	0.01	Diterpenic ether
<b>Consolidated total</b>	<b>99.22</b>	

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

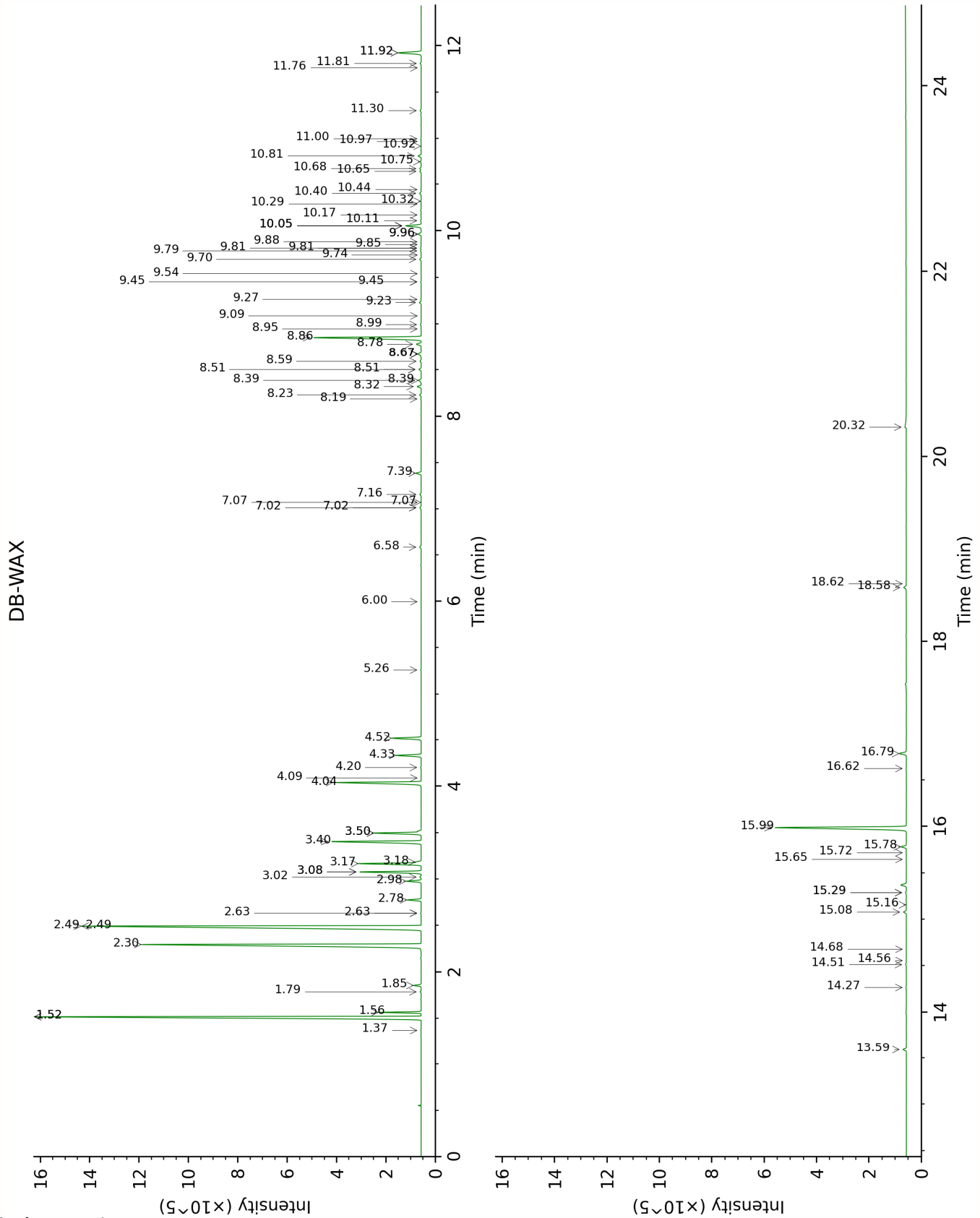
Note: no correction factor was applied

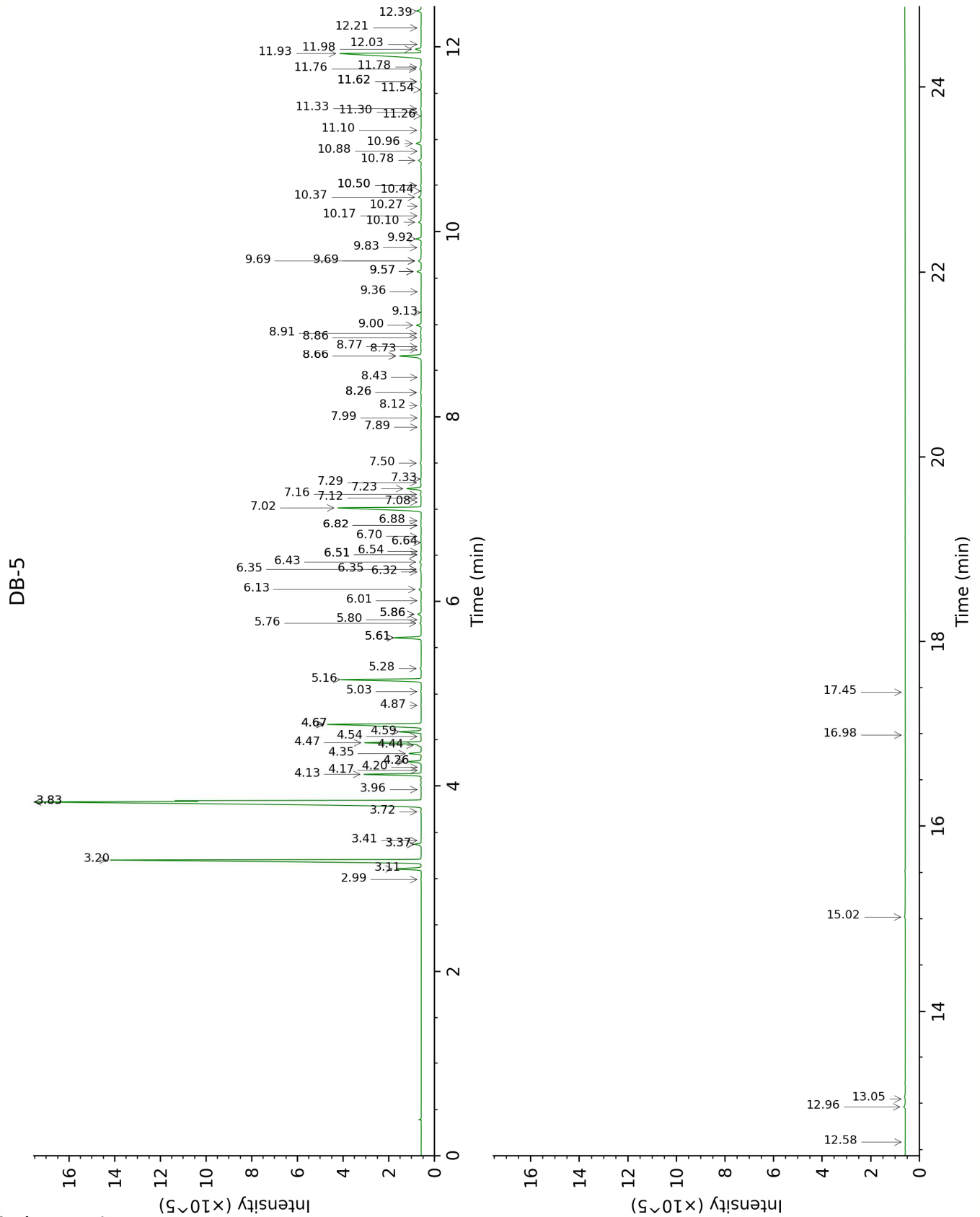
**About "consolidated" data:** The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm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

**Bracketed value (xx):** A bracketed percent value indicate that two or more compound percentage could not be solved due to coelution.

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







FULL ANALYSIS DATA

Tricyclene	Column DB-WAX			Column DB-5		
	1.37	969.8	0.01	2.99	919.1	0.02
α-Thujene	1.56	997.3	1.26	3.11	926.6	1.27
α-Pinene	1.52*	991.9	[19.00]	3.20	932.9	19.13
α-Fenchene	1.79	1018.1	0.04	3.37*	944.0	[0.34]
Camphene	1.86	1024.6	0.28	3.37*	944.0	[0.34]
Thuja-2,4(10)-diene	2.49*	1084.9	[22.03]	3.41	946.7	0.02
3,7,7-Trimethylcyclohepta-1,3,5-triene	3.08*	1131.4	[2.59]	3.72	967.1	0.04
β-Pinene	2.30	1066.2	16.66	3.83*	974.0	[38.84]
Sabinene	2.49*	1084.9	[22.03]	3.83*	974.0	[38.84]
Octen-3-ol	7.07*	1421.6	[0.01]	3.96	982.7	0.02
Myrcene	3.08*	1131.4	[2.59]	4.13	993.6	2.58
2-Carene	2.63*	1097.4	[0.03]	4.17	996.4	0.02
Decane	1.52*	991.9	[19.00]	4.20	998.6	0.01
Pseudolimonene	3.02	1127.1	0.05	4.26*	1002.5	[0.66]
α-Phellandrene	2.98	1123.7	0.61	4.26*	1002.5	[0.66]
Δ3-Carene	2.78	1108.3	0.56	4.35	1008.1	0.56
1,4-Cineole	3.18	1139.6	0.17	4.44	1013.7	0.14
α-Terpinene	3.17	1138.3	2.70	4.47	1015.4	2.73
Carvomenthene	2.63*	1097.4	[0.03]	4.54	1019.6	0.03
para-Cymene	4.33	1226.3	1.11	4.59	1022.7	1.11
1,8-Cineole	3.50*	1163.6	[2.10]	4.67*	1027.7	[6.44]
Limonene	3.40	1156.5	4.23	4.67*	1027.7	[6.44]
β-Phellandrene	3.50*	1163.6	[2.10]	4.67*	1027.7	[6.44]
(Z)-β-Ocimene	4.09	1208.6	0.01	4.87	1040.5	0.02
(E)-β-Ocimene	4.20	1216.8	0.03	5.03	1050.2	0.03
γ-Terpinene	4.04	1205.0	4.17	5.16	1058.3	4.16
cis-Sabinene hydrate	7.16	1427.9	0.07	5.28	1065.8	0.06
Terpinolene	4.52	1239.8	1.33	5.61*	1086.5	[1.40]
para-Cymenene	6.58	1385.7	0.08	5.61*	1086.5	[1.40]
trans-Sabinene hydrate	8.23	1507.6	0.08	5.76	1096.2	0.08
Unknown MYFR I [m/z 95, 152 (20), 67 (17), 96 (16), 41 (12)]	5.26	1294.2	0.02	5.80	1098.6	0.02
Linalool	8.32	1514.5	0.19	5.86*	1102.3	[0.19]
Unknown CEDE I [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	6.00	1343.8	0.01	5.86*	1102.3	[0.19]
endo-Fenchol	8.67*	1541.4	[0.20]	6.01	1111.6	0.03
cis-para-Menth-2-en-	8.39*	1519.6	[0.16]	6.13	1119.3	0.12

1-ol						
<i>cis-para</i> -Mentha-2,8-dien-1-ol	9.79	1628.7	0.03	6.32	1131.3	0.02
1-Terpineol	8.59	1535.4	0.06	6.35*	1133.1	[0.08]
<i>trans</i> -Pinocarveol	9.45*	1601.9	[0.03]	6.35*	1133.1	[0.08]
<i>trans-para</i> -Menth-2-en-1-ol	9.23	1584.5	0.09	6.43	1138.1	0.09
Epoxyterpinolene	7.02*	1417.3	[0.08]	6.51*	1143.2	[0.03]
<i>cis</i> - $\beta$ -Terpineol	9.27	1587.1	0.02	6.51*	1143.2	[0.03]
Unknown MEAL II [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	7.07*	1421.6	[0.01]	6.54	1145.4	0.01
Sabinaketone	8.95	1562.7	0.02	6.64	1151.5	0.02
Pinocarvone	8.19	1504.2	0.02	6.70	1155.8	0.02
<i>trans</i> - $\beta$ -Terpineol	9.88	1636.5	0.02	6.82*	1163.2	[0.04]
Borneol	10.05*	1650.2	[0.83]	6.82*	1163.2	[0.04]
$\delta$ -Terpineol	9.74	1625.1	0.01	6.88	1166.9	0.03
Terpinen-4-ol	8.86	1555.5	5.83	7.02	1175.8	5.83
Cryptone	9.45*	1601.9	[0.03]	7.08	1179.7	0.02
<i>meta</i> -Cymen-8-ol	11.76	1791.8	0.01	7.12	1182.6	0.01
<i>para</i> -Cymen-8-ol	11.81	1796.0	0.06	7.16	1185.0	0.06
$\alpha$ -Terpineol	10.05*	1650.2	[0.83]	7.23	1189.0	0.76
<i>cis</i> -Piperitol	9.82*	1631.0	[0.04]	7.29	1193.1	0.05
$\gamma$ -Terpineol	10.11	1654.7	0.03	7.33	1195.6	0.04
<i>trans</i> -Piperitol	10.65	1698.2	0.07	7.50	1206.6	0.07
Citronellol	11.00	1727.6	0.02	7.89	1232.5	0.02
Unknown MYFR II [m/z 123, 165 (21), 180 (18), 79 (9), 124 (9)]				7.99	1239.1	0.01
Unknown MISC CV [m/z 43, 109 (63), 71 (50), 81 (31), 55 (29), 85 (26)...]	9.96*	1643.1	[0.18]	8.12	1248.0	0.04
Linalyl acetate	8.39*	1519.6	[0.16]	8.26*	1257.4	[0.05]
Geraniol	11.92*	1806.0	[1.24]	8.26*	1257.4	[0.05]
<i>trans</i> -Ascaridole glycol	14.51	2040.8	0.05	8.43	1268.3	0.02
Safrole	11.92*	1806.0	[1.24]	8.66*	1283.7	[1.31]
Bornyl acetate	8.50*	1528.6	[0.12]	8.66*	1283.7	[1.31]
<i>cis</i> -Ascaridole glycol	15.16	2102.6	0.01	8.73	1288.6	0.01
Cuminol	14.56	2044.9	0.01	8.77	1291.0	0.03
Terpinen-4-yl acetate	9.00	1566.3	0.04	8.86	1297.5	0.04
Unknown MYFR III	11.30	1753.0	0.06	8.91	1300.4	0.08

[m/z 81, 55 (82), 41 (58), 69 (51), 67 (49)...]						
Unknown MYFR IV [m/z 121, 178 (20), 77 (13), 122 (10)]	8.78	1550.1	0.26	9.00	1306.5	0.26
Unknown MEAL I [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	15.29*	2115.6	[0.04]	9.13	1316.1	0.01
Unknown MYFR V [m/z 149, 178 (41), 121 (36), 91 (30), 55 (21)]	9.09	1573.4	0.01	9.36	1331.7	0.01
$\alpha$ -Terpinyl acetate	9.96*	1643.1	[0.18]	9.57*	1347.0	[0.23]
$\alpha$ -Cubebene	7.02*	1417.3	[0.08]	9.57*	1347.0	[0.23]
Citronellyl acetate	9.70	1621.4	0.08	9.69*	1355.1	[0.20]
Eugenol	15.08	2094.9	0.15	9.69*	1355.1	[0.20]
Neryl acetate	10.44	1681.5	0.02	9.83	1365.1	0.04
$\alpha$ -Copaene	7.39	1444.8	0.28	9.92	1371.7	0.28
Geranyl acetate	10.81	1712.1	0.16	10.10	1384.3	0.16
$\beta$ -Elemene	8.67*	1541.4	[0.20]	10.17	1389.1	0.02
Vanillin	18.62	2463.9	0.02	10.27	1396.3	0.01
Methyleugenol	13.59	1954.6	0.17	10.37	1403.2	0.17
(Z)-Isoeugenol	15.65	2150.9	0.01	10.44	1408.2	0.01
$\beta$ -Caryophyllene	8.67*	1541.4	[0.20]	10.50*	1412.4	[0.04]
<i>cis</i> - $\alpha$ -Bergamotene	8.50*	1528.6	[0.12]	10.50*	1412.4	[0.04]
<i>trans</i> - $\alpha$ -Bergamotene	8.67*	1541.4	[0.20]	10.78	1433.2	0.15
Unknown MYFR VI [m/z 81, 43 (45), 68 (33), 67 (30), 95 (29), 55 (28)...]	10.17	1659.6	0.02	10.88	1440.6	0.01
(E)-Isoeugenol	16.79	2266.5	0.38	10.96	1446.7	0.35
(E)- $\beta$ -Farnesene	9.82*	1631.0	[0.04]	11.10	1457.4	0.04
<i>trans</i> -Cadina-1(6),4-diene	9.54	1609.0	0.01	11.26	1468.8	0.01
$\gamma$ -Muurolene	9.85	1634.1	0.02	11.30	1472.0	0.01
Germacrene D	10.05*	1650.2	[0.83]	11.33	1474.6	0.05
Bicyclogermacrene	10.29	1669.1	0.02	11.54	1489.9	0.02
Methyl (E)-isoeugenol	15.29*	2115.6	[0.04]	11.62*	1496.2	[0.05]
$\alpha$ -Muurolene	10.32	1671.5	0.02	11.62*	1496.2	[0.05]
$\beta$ -Bisabolene	10.40	1678.2	0.09	11.76	1506.5	0.08
(3E,6E)- $\alpha$ -Farnesene	10.75	1706.9	0.04	11.78	1508.2	0.04

Myristicin	15.99	2184.7	7.26	11.93	1519.7	7.28
$\delta$ -Cadinene	10.68	1700.6	0.08	11.98	1523.4	0.32
<i>trans</i> -Cadin-1,4-diene	10.92	1721.0	0.02	12.03	1527.4	0.02
( <i>E</i> )- $\alpha$ -Bisabolene	10.97	1725.2	0.02	12.21	1541.4	0.02
Elemicin	15.78	2164.3	0.26	12.39	1555.7	0.25
Spathulenol	14.68	2056.5	0.02	12.58	1570.8	0.01
Methoxyeugenol	18.58	2459.4	0.15	12.96	1600.6	0.12
Unknown MYFR VII [m/z 165, 121 (81), 181 (25), 238 (25)]	14.27	2017.4	0.03	13.05	1607.4	0.01
Myristic acid	20.32	2658.7	0.20	15.02	1773.4	0.12
<i>meta</i> -Camphorene	15.72	2158.0	0.03	16.98	1952.6	0.01
13- <i>epi</i> -Manoyl oxide	16.62	2250.0	0.02	17.45	1997.3	0.01
Total reported		98.66%			99.30%	

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

[xx]: Duplicate percentage due to coelutions, only the first one is 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