

## GC/MS BATCH NUMBER: N40103

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**ESSENTIAL OIL:** NUTMEG  
**BOTANICAL NAME:** MYRISTICA FRAGRANS  
**ORIGIN:** INDONESIA

KEY CONSTITUENTS PRESENT IN THIS BATCH OF NUTMEG OIL	%
$\alpha$ -PINENE	22.0
SABINENE	21.8
$\beta$ -PINENE	15.0
MYRISTICIN	9.7
LIMONENE	3.7
$\gamma$ -TERPINENE	3.4
MYRCENE	2.4
$\alpha$ -TERPINENE	2.3
$\beta$ -PHELLANDRENE + 1,8-CINEOLE	2.0
$\alpha$ -THUJENE	1.7
SAFROLE	15
TERPINOLENE	1.4

Comments from Robert Tisserand: Woody, spicy, clean-earth odor profile. All nine key ISO constituents are within range.

**Date :** February 23, 2018

*CERTIFICATE OF ANALYSIS - GC PROFILING*

*SAMPLE IDENTIFICATION*

**Internal code :** 18B13-PTH3-1-CC

**Customer identification :** Nutmeg - Indonesia - N40103163R

**Type :** Essential oil

**Source :** *Myristica fragrans*

**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 :** Sarah-Eve Tremblay, M. Sc. A., Chimiste

**Analysis date :** February 23, 2018

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:**  $1.4810 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Isovaleral	tr	0.01*	Aliphatic aldehyde
2-Methylbutyral	tr	tr	Aliphatic aldehyde
Toluene	0.01	0.01	Simple phenolic
Nonane	0.01	[0.01]*	Alkane
Tricyclene	0.02	0.02	Monoterpene
$\alpha$ -Thujene	1.65	1.67	Monoterpene
$\alpha$ -Pinene	22.00	22.07	Monoterpene
Camphene	0.36*	0.30	Monoterpene
$\alpha$ -Fenchene	[0.36]*	0.05	Monoterpene
Thuja-2,4(10)-diene	tr	21.96*	Monoterpene
meta-Cymene	0.02	2.43*	Monoterpene
Sabinene	36.82*	[21.96]*	Monoterpene
$\beta$ -Pinene	[36.82]*	15.00	Monoterpene
Myrcene	2.41	[2.43]*	Monoterpene
2-Carene	tr	tr	Monoterpene
$\alpha$ -Phellandrene	0.69*	0.65	Monoterpene
Pseudolimonene	[0.69]*	0.05	Monoterpene
$\Delta^3$ -Carene	0.96	0.97	Monoterpene
$\alpha$ -Terpinene	2.25	2.26	Monoterpene
para-Cymene	0.63	0.64	Monoterpene
$\beta$ -Phellandrene	5.65*	1.95*	Monoterpene
1,8-Cineole	[5.65]*	[1.95]*	Monoterpenic ether
Limonene	[5.65]*	3.71	Monoterpene
(Z)- $\beta$ -Ocimene	0.02	0.01	Monoterpene
(E)- $\beta$ -Ocimene	0.03	0.03	Monoterpene
$\gamma$ -Terpinene	3.42	3.43	Monoterpene
cis-Sabinene hydrate	0.35	0.36	Monoterpenic alcohol
Terpinolene	1.46*	1.41	Monoterpene
para-Cymenene	[1.46]*	0.05	Monoterpene
trans-Sabinene hydrate	0.29*	0.26*	Monoterpenic alcohol
Unknown	[0.29]*	0.06	Oxygenated monoterpene
Linalool	0.16*	0.15	Monoterpenic alcohol
Unknown	[0.16]*	0.01	Oxygenated monoterpene
para-Mentha-1,3,8-triene	0.01	0.01	Monoterpene
endo-Fenchol	0.02	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.18	0.19*	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.02		Aliphatic alcohol
trans-Pinocarveol	0.01	0.01	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.12	0.11	Monoterpenic alcohol
Epoxyterpinolene	0.02*	0.05*	Monoterpenic ether
Unknown	[0.02]*	0.01	Unknown
Sabinaketone	0.01	0.03*	Normonoterpenic ketone
Pinocarvone	0.01	[0.26]*	Monoterpenic ketone
Borneol	0.02	0.60*	Monoterpenic alcohol
$\delta$ -Terpineol	0.01	0.01	Monoterpenic alcohol
Terpinen-4-ol	3.74	3.73	Monoterpenic alcohol
para-Cymen-8-ol	0.03	0.03	Monoterpenic alcohol

$\alpha$ -Terpineol	0.54	[0.60]*	Monoterpenic alcohol
Myrtenol	0.06*	0.01	Monoterpenic alcohol
<i>cis</i> -Piperitol	[0.06]*	0.04	Monoterpenic alcohol
$\alpha$ -Phellandrene epoxide	0.02	0.06*	Monoterpenic ether
<i>trans</i> -Piperitol	0.06	0.08*	Monoterpenic alcohol
endo-Fenchyl acetate	0.02	[0.05]*	Aliphatic alcohol
Unknown	0.02	0.01	Oxygenated monoterpene
Citronellol	0.01	0.01	Monoterpenic alcohol
Geraniol	0.03*	0.04	Monoterpenic alcohol
Linalyl acetate	[0.03]*	[0.19]*	Monoterpenic ester
<i>trans</i> -Ascaridole glycol	0.01	tr	Monoterpenic alcohol
Phellandral	0.01	0.03	Monoterpenic aldehyde
Bornyl acetate	0.09	0.10	Monoterpenic ester
Safrole	1.54	1.54	Phenylpropanoid
Cuminol	0.01	tr	Monoterpenic alcohol
Terpinen-4-yl acetate	0.03	[0.03]*	Monoterpenic ester
Unknown	0.07*	[0.06]*	Unknown
Thymol	[0.07]*	0.01	Monoterpenic alcohol
Unknown	0.30	0.30	Simple phenolic
Carvacrol	0.01*	tr	Monoterpenic alcohol
4-Vinylguaiacol	[0.01]*	0.01	Simple phenolic
1,4-para-Menthadien-7-ol	0.01	0.01	Monoterpenic alcohol
Unknown	0.01	0.01	Unknown
$\alpha$ -Cubebene	0.18*	[0.05]*	Sesquiterpene
$\alpha$ -Terpinyl acetate	[0.18]*	0.14	Monoterpenic ester
Citronellyl acetate	0.04	0.06	Monoterpenic ester
Eugenol	0.30	0.28	Phenylpropanoid
Neryl acetate	0.03	0.02	Monoterpenic ester
$\alpha$ -Copaene	0.21	0.21	Sesquiterpene
Geranyl acetate	0.14	0.14	Monoterpenic ester
$\beta$ -Cubebene	0.01	0.02	Sesquiterpene
Vanillin	0.02		Simple phenolic
Unknown	0.01		Terpene derivative
Methyleugenol	0.20	0.19	Phenylpropanoid
( <i>Z</i> )-Isoeugenol	0.04*	9.78*	Phenylpropanoid
$\beta$ -Caryophyllene	[0.04]*	0.13*	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.12	[0.13]*	Sesquiterpene
Unknown	0.01	0.01*	Unknown
$\alpha$ -Humulene	0.01	0.01	Sesquiterpene
( <i>E</i> )-Isoeugenol	0.78	0.78	Phenylpropanoid
( <i>E</i> )- $\beta$ -Farnesene	0.02	0.02	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.01	0.01	Sesquiterpene
$\gamma$ -Murolene	0.01	0.02	Sesquiterpene
Germacrene D	0.04	[0.60]*	Sesquiterpene
<i>trans</i> -Muurolo-4(15),5-diene	0.01	[0.01]*	Sesquiterpene
Bicyclogermacrene	0.02	0.02	Sesquiterpene
$\alpha$ -Muurolo-4	0.02	0.01	Sesquiterpene
( <i>Z</i> )- $\alpha$ -Bisabolene	0.05	0.07	Sesquiterpene
$\beta$ -Bisabolene	0.06	0.07	Sesquiterpene
(3 <i>E</i> ,6 <i>E</i> )- $\alpha$ -Farnesene	0.06	0.05	Sesquiterpene
$\delta$ -Cadinene	9.92*	[0.08]*	Sesquiterpene
<i>trans</i> -Calamenene	[9.92]*	0.01	Sesquiterpene

Myristicin	[9.92]*	[9.78]*	Phenylpropanoid
<i>trans</i> -Cadina-1,4-diene	0.02	0.02	Sesquiterpene
Elemicin	0.30	0.30	Phenylpropanoid
Spathulenol	0.01	tr	Sesquiterpenic alcohol
Methoxyeugenol	0.34	0.32	Phenylpropanoid
Myristic acid	0.12	0.07	Aliphatic acid
<b>Total identified</b>	<b>98.99%</b>	<b>98.95%</b>	

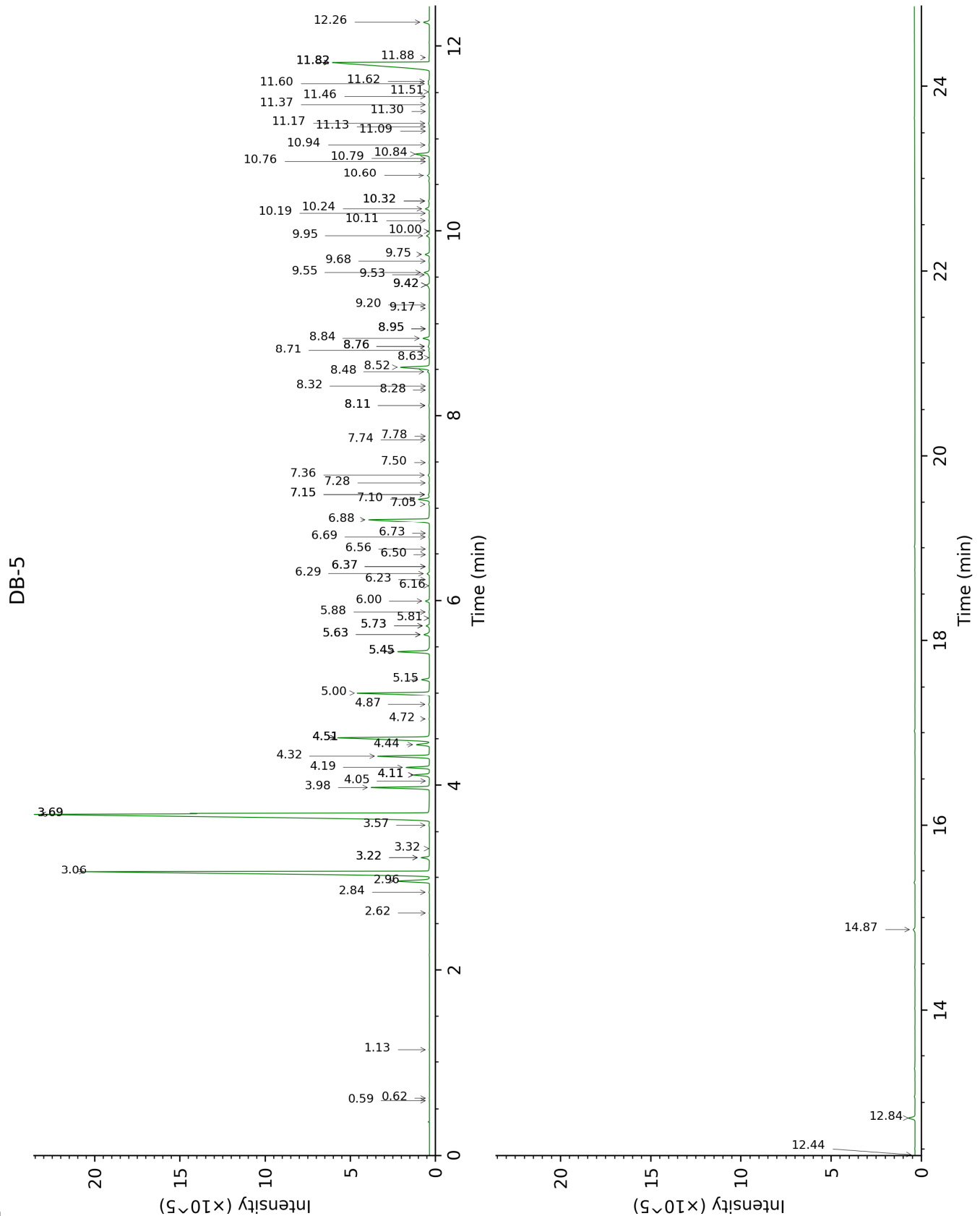
\*: Two or more compounds are coeluting on this column

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

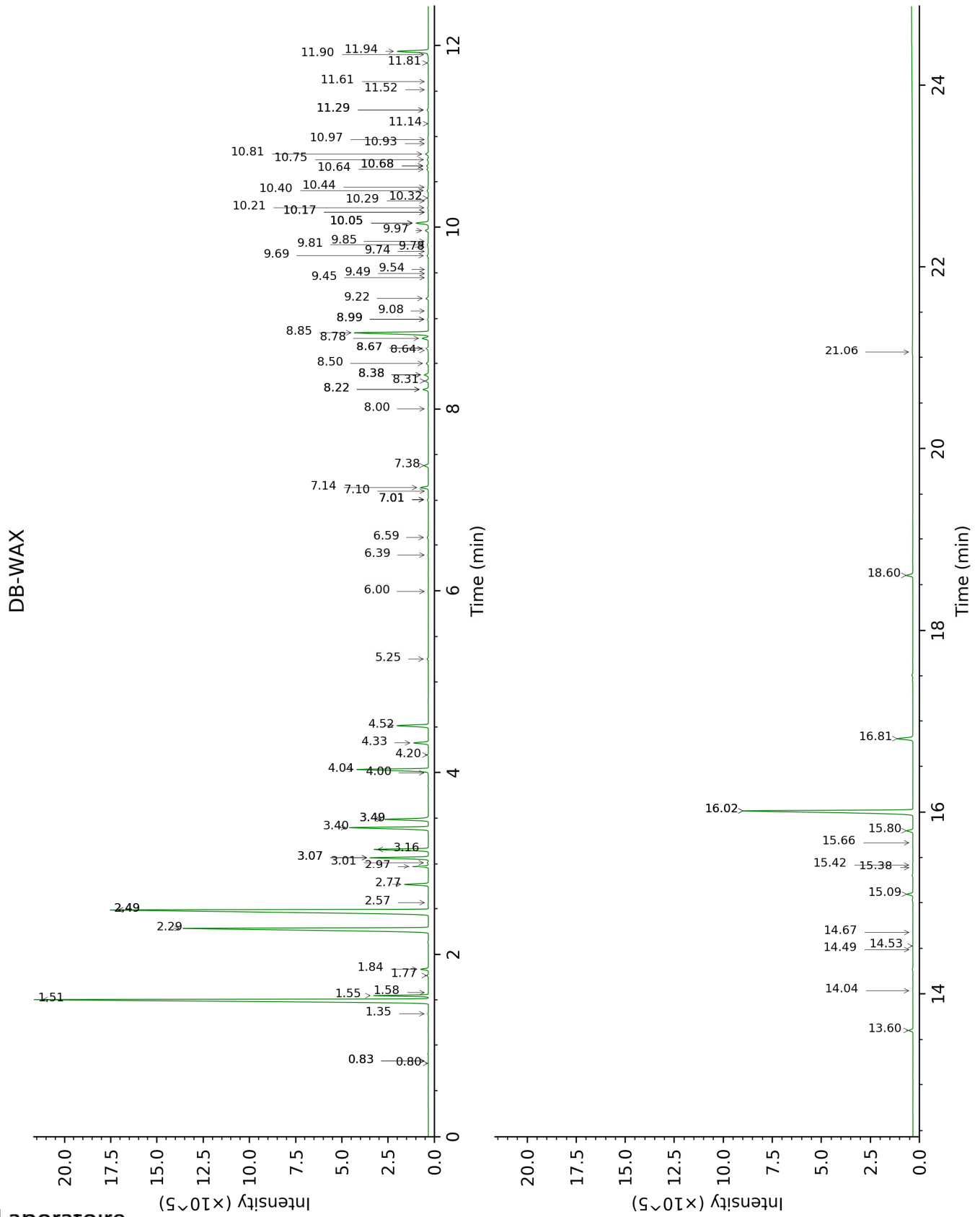
tr: The compound has been detected below 0.005% of total signal.

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	%
Isovaleral	0.59	639	tr	0.83*	889	0.01
2-Methylbutyral	0.62	648	tr	0.80	880	tr
Toluene	1.13	754	0.01	1.58	1006	0.01
Nonane	2.62	898	0.01	0.83*	889	[0.01]
Tricyclene	2.84	914	0.02	1.35	976	0.02
$\alpha$ -Thujene	2.96	922	1.65	1.55	1003	1.67
$\alpha$ -Pinene	3.06	928	22.00	1.51	999	22.07
Camphene	3.22*	939	0.36	1.84	1030	0.30
$\alpha$ -Fenchene	3.22*	939	[0.36]	1.77	1024	0.05
Thuja-2,4(10)-diene	3.32	946	tr	2.49*	1091	21.96
meta-Cymene	3.57	962	0.02	3.07*	1136	2.43
Sabinene	3.69*	970	36.82	2.49*	1091	[21.96]
$\beta$ -Pinene	3.69*	970	[36.82]	2.29	1072	15.00
Myrcene	3.98	989	2.41	3.07*	1136	[2.43]
2-Carene	4.05	994	tr	2.57	1098	tr
$\alpha$ -Phellandrene	4.11*	998	0.69	2.97	1128	0.65
Pseudolimonene	4.11*	998	[0.69]	3.01	1131	0.05
$\Delta$ 3-Carene	4.19	1004	0.96	2.77	1113	0.97
$\alpha$ -Terpinene	4.32	1011	2.25	3.16	1143	2.26
para-Cymene	4.44	1019	0.63	4.33	1229	0.64
$\beta$ -Phellandrene	4.51*	1024	5.65	3.49*	1168	1.95
1,8-Cineole	4.51*	1024	[5.65]	3.49*	1168	[1.95]
Limonene	4.51*	1024	[5.65]	3.40	1161	3.71
(Z)- $\beta$ -Ocimene	4.72	1036	0.02	4.00	1206	0.01
(E)- $\beta$ -Ocimene	4.87	1046	0.03	4.20	1219	0.03
$\gamma$ -Terpinene	5.00	1054	3.42	4.04	1208	3.43
cis-Sabinene hydrate	5.15	1063	0.35	7.14	1430	0.36
Terpinolene	5.45*	1082	1.46	4.52	1242	1.41
para-Cymenene	5.45*	1082	[1.46]	6.59	1390	0.05
trans-Sabinene hydrate	5.63*	1094	0.29	8.22*	1510	0.26
Unknown [m/z 95, 152 (20), 67 (17), 96 (16), 41 (12)]	5.63*	1094	[0.29]	5.25	1294	0.06
Linalool	5.73*	1100	0.16	8.31	1517	0.15
Unknown [m/z 95, 150 (45), 110 (35), 107 (23), 109 (21)]	5.73*	1100	[0.16]	6.00	1347	0.01
para-Mentha-1,3,8-triene	5.81	1105	0.01	6.39	1376	0.01
endo-Fenchol	5.88	1109	0.02	8.64	1543	0.01
cis-para-Menth-2-en-1-ol	6.00	1117	0.18	8.38*	1522	0.19
4-Hydroxy-4-methylcyclohex-2-enone	6.16	1127	0.02			

<i>trans</i> -Pinocarveol	6.23	1132	0.01	9.45	1606	0.01
<i>trans</i> -para-Menth-2-en-1-ol	6.29	1136	0.12	9.22	1588	0.11
Epoxyterpinolene	6.37*	1140	0.02	7.01*	1420	0.05
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.37*	1140	[0.02]	7.10	1427	0.01
Sabinaketone	6.50	1149	0.01	8.99*	1570	0.03
Pinocarvone	6.56	1153	0.01	8.22*	1510	[0.26]
Borneol	6.69	1161	0.02	10.05*	1654	0.60
δ-Terpineol	6.73	1164	0.01	9.74	1629	0.01
Terpinen-4-ol	6.88	1173	3.74	8.85	1559	3.73
para-Cymen-8-ol	7.05	1184	0.03	11.81	1801	0.03
α-Terpineol	7.10	1187	0.54	10.05*	1654	[0.60]
Myrtenol	7.15*	1191	0.06	11.14	1744	0.01
<i>cis</i> -Piperitol	7.15*	1191	[0.06]	9.81	1635	0.04
α-Phellandrene epoxide	7.28	1199	0.02	11.30*	1757	0.06
<i>trans</i> -Piperitol	7.36	1204	0.06	10.68*	1706	0.08
endo-Fenchyl acetate	7.50	1213	0.02	7.01*	1420	[0.05]
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.74	1229	0.02	11.61	1783	0.01
Citronellol	7.78	1232	0.01	10.97	1730	0.01
Geraniol	8.11*	1254	0.03	11.90	1809	0.04
Linalyl acetate	8.11*	1254	[0.03]	8.38*	1522	[0.19]
<i>trans</i> -Ascaridole glycol	8.28	1265	0.01	14.49	2045	tr
Phellandral	8.32	1268	0.01	10.22	1667	0.03
Bornyl acetate	8.48	1279	0.09	8.50	1532	0.10
Safrole	8.52	1282	1.54	11.94	1812	1.54
Cuminol	8.63	1289	0.01	14.53	2049	tr
Terpinen-4-yl acetate	8.71	1294	0.03	8.99*	1570	[0.03]
Unknown [m/z 81, 55 (82), 41 (58), 69 (51), 67 (49)...]	8.76*	1297	0.07	11.30*	1757	[0.06]
Thymol	8.76*	1297	[0.07]	15.42	2137	0.01
Unknown [m/z 121, 178 (20), 77 (13), 122 (10)]	8.84	1303	0.30	8.78	1554	0.30
Carvacrol	8.95*	1310	0.01	15.66	2161	tr
4-Vinylguaiaicol	8.95*	1310	[0.01]	15.38	2133	0.01
1,4-para-Menthadien-7-ol	9.17	1326	0.01	14.04	2002	0.01
Unknown [m/z 149, 178 (41), 121 (36), 91 (30), 55 (21)]	9.20	1329	0.01	9.08	1577	0.01

α-Cubebene	9.42*	1344	0.18	7.01*	1420	[0.05]
α-Terpinyl acetate	9.42*	1344	[0.18]	9.97	1647	0.14
Citronellyl acetate	9.53	1352	0.04	9.69	1625	0.06
Eugenol	9.55	1353	0.30	15.09	2104	0.28
Neryl acetate	9.68	1362	0.03	10.44	1685	0.02
α-Copaene	9.75	1367	0.21	7.38	1448	0.21
Geranyl acetate	9.95	1381	0.14	10.81	1716	0.14
β-Cubebene	10.00	1384	0.01	8.00	1494	0.02
Vanillin	10.11	1392	0.02			
Unknown [m/z 120, 91 (34), 105 (27), 43 (27), 77 (20), 93 (17)... 178 (t)]	10.19	1398	0.01			
Methyleugenol	10.24	1402	0.20	13.60	1962	0.19
(Z)-Isoeugenol	10.32*	1408	0.04	16.02*	2196	9.78
β-Caryophyllene	10.32*	1408	[0.04]	8.67*	1545	0.13
<i>trans</i> -α-Bergamotene	10.60	1429	0.12	8.67*	1545	[0.13]
Unknown [m/z 81, 43 (45), 68 (33), 67 (30), 95 (29), 55 (28)...]	10.76	1440	0.01	10.17*	1663	0.01
α-Humulene	10.79	1443	0.01	9.54	1613	0.01
(E)-Isoeugenol	10.84	1446	0.78	16.81	2278	0.78
(E)-β-Farnesene	10.94	1453	0.02	9.78	1632	0.02
<i>trans</i> -Cadina-1(6),4-diene	11.08	1464	0.01	9.50	1609	0.01
γ-Murolene	11.13	1468	0.01	9.85	1638	0.02
Germacrene D	11.17	1471	0.04	10.05*	1654	[0.60]
<i>trans</i> -Muurolo-4(15),5-diene	11.30	1480	0.01	10.17*	1663	[0.01]
Bicyclogermacrene	11.37	1486	0.02	10.32	1676	0.02
α-Murolene	11.46	1492	0.02	10.29	1673	0.01
(Z)-α-Bisabolene	11.51	1496	0.05	10.64	1702	0.07
β-Bisabolene	11.60	1502	0.06	10.40	1682	0.07
(3E,6E)-α-Farnesene	11.62	1504	0.06	10.75	1711	0.05
δ-Cadinene	11.82*	1520	9.92	10.68*	1706	[0.08]
<i>trans</i> -Calamenene	11.82*	1520	[9.92]	11.52	1776	0.01
Myristicin	11.82*	1520	[9.92]	16.02*	2196	[9.78]
<i>trans</i> -Cadina-1,4-diene	11.88	1525	0.02	10.93	1726	0.02
Elemicin	12.26	1554	0.30	15.80	2174	0.30
Spathulenol	12.44	1568	0.01	14.67	2063	tr
Methoxyeugenol	12.84	1600	0.34	18.60	2474	0.32
Myristic acid	14.87	1770	0.12	21.06	2766	0.07
<b>Total identified</b>		<b>98.99%</b>			<b>98.95%</b>	
<b>Total reported</b>		<b>99.34%</b>			<b>99.35%</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  
R.T.: Retention time (minutes)  
R.I.: Retention index