

**Date :** September 24, 2018

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 18I17-PTH2-1-CC

**Customer identification :** Rosemary - Tunisia - R4010785R

**Type :** Essential oil

**Source :** *Rosmarinus officinalis* ct. 1,8-Cineole

**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 :** Lindsay Girard, B. Sc.

**Analysis date :** September 18, 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:** Clear liquid

**Refractive index:** 1.4660 ± 0.0003 (20 °C)

#### ISO 1342:2001 - OIL OF ROSEMARY - MOROCCO & TUNISIA

Compound	Min. %	Max. %	Observed %	Complies?
Verbenone		0.4	0.1	Yes
Borneol	1	5	2	Yes
α-Terpineol	1.0	2.5	1.7	Yes
Bornyl acetate	0.1	1.6	1.1	Yes
Camphor	5	15	11	Yes
para-Cymene	0.5	2.5	2.0	Yes
1,8-Cineole	38	55	44	Yes
Limonene	1.5	4.0	3.7	Yes
Myrcene	1.0	2.0	1.3	Yes
β-Pinene	4	9	8	Yes
Camphene	2.5	6.0	2.7	Yes
α-Pinene	9	14	13	Yes
<b>Refractive index</b>	1.4640	1.4700	1.4660	Yes

#### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for Tunisian rosemary oil.

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
(3Z)-Hexenol	tr	0.01	Aliphatic alcohol
Hashishene	0.01	12.74*	Monoterpene
Tricyclene	0.12	0.11	Monoterpene
$\alpha$ -Thujene	0.06	0.07	Monoterpene
$\alpha$ -Pinene	12.72	[12.74]*	Monoterpene
Camphene	2.71*	2.73	Monoterpene
$\alpha$ -Fenchene	[2.71]*	0.05	Monoterpene
Thuja-2,4(10)-diene	0.01	0.06*	Monoterpene
Sabinene	7.70*	[0.06]*	Monoterpene
$\beta$ -Pinene	[7.70]*	7.72	Monoterpene
Octen-3-ol	0.01	0.03	Aliphatic alcohol
Octan-3-one	0.03	0.03	Aliphatic ketone
Myrcene	1.27	1.28	Monoterpene
$\alpha$ -Phellandrene	0.40*	0.35	Monoterpene
Pseudolimonene	[0.40]*	0.05	Monoterpene
$\Delta^3$ -Carene	0.58	0.58	Monoterpene
$\alpha$ -Terpinene	0.22	0.23	Monoterpene
para-Cymene	49.85	2.04	Monoterpene
Limonene	[49.85]*	3.68	Monoterpene
1,8-Cineole	[49.85]*	44.04*	Monoterpenic ether
$\beta$ -Phellandrene	[49.85]*	[44.04]*	Monoterpene
(Z)- $\beta$ -Ocimene	0.03	0.04	Monoterpene
(E)- $\beta$ -Ocimene	0.01	0.02	Monoterpene
$\gamma$ -Terpinene	0.95	0.98	Monoterpene
cis-Sabinene hydrate	0.02	0.04	Monoterpenic alcohol
Isoterpinolene	0.01	0.01	Monoterpene
para-Cymenene	0.34*	0.02	Monoterpene
Terpinolene	[0.34]*	0.31	Monoterpene
trans-Sabinene hydrate	0.01	0.01	Monoterpenic alcohol
Linalool	0.69	0.68	Monoterpenic alcohol
endo-Fenchol	0.03	0.03	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.02	0.02	Monoterpenic alcohol
Camphor	11.34	11.26*	Monoterpenic ketone
Camphene hydrate	0.04	4.13*	Monoterpenic alcohol
Isoborneol	0.05	0.09*	Monoterpenic alcohol
Pinocarvone	0.02	0.02	Monoterpenic ketone
Borneol	1.73	3.36*	Monoterpenic alcohol
$\delta$ -Terpineol	0.11	[0.09]*	Monoterpenic alcohol
Terpinen-4-ol	0.58	0.56	Monoterpenic alcohol
para-Cymen-8-ol	0.02	0.02	Monoterpenic alcohol
$\alpha$ -Terpineol	1.66	[3.36]*	Monoterpenic alcohol
Myrtenol	0.02	0.01	Monoterpenic alcohol
Verbenone	0.10	0.09	Monoterpenic ketone
Linalyl acetate	0.01	0.01	Monoterpenic ester
Bornyl acetate	1.15	1.15	Monoterpenic ester
$\alpha$ -Cubebene	0.01	0.01	Sesquiterpene
$\alpha$ -Ylangene	0.02*	0.01	Sesquiterpene
$\alpha$ -Copaene	[0.02]*	[11.26]*	Sesquiterpene

$\alpha$ -Gurjunene	0.01	0.01	Sesquiterpene
Methyleugenol	0.01	0.01	Phenylpropanoid
$\beta$ -Caryophyllene	4.14	[4.13]*	Sesquiterpene
$\beta$ -Copaene	0.03	[4.13]*	Sesquiterpene
$\alpha$ -Humulene	0.50	0.52	Sesquiterpene
allo-Aromadendrene	0.01	0.01	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.01	0.01	Sesquiterpene
$\gamma$ -Muurolene	0.03*	0.03	Sesquiterpene
$\alpha$ -Amorphene	[0.03]*	0.01	Sesquiterpene
$\alpha$ -Muurolene	0.03	0.02	Sesquiterpene
$\beta$ -Bisabolene	0.02	0.02	Sesquiterpene
$\gamma$ -Cadinene	0.02	0.01	Sesquiterpene
$\delta$ -Cadinene	0.06	0.04	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.01	0.02	Sesquiterpene
Caryophyllene oxide isomer	0.03*	0.03*	Sesquiterpenic ether
Caryophyllene oxide	[0.03]*	[0.03]*	Sesquiterpenic ether
meta-Camphorene	0.01	0.02	Diterpene
<b>Total identified</b>	<b>99.58%</b>	<b>99.46%</b>	

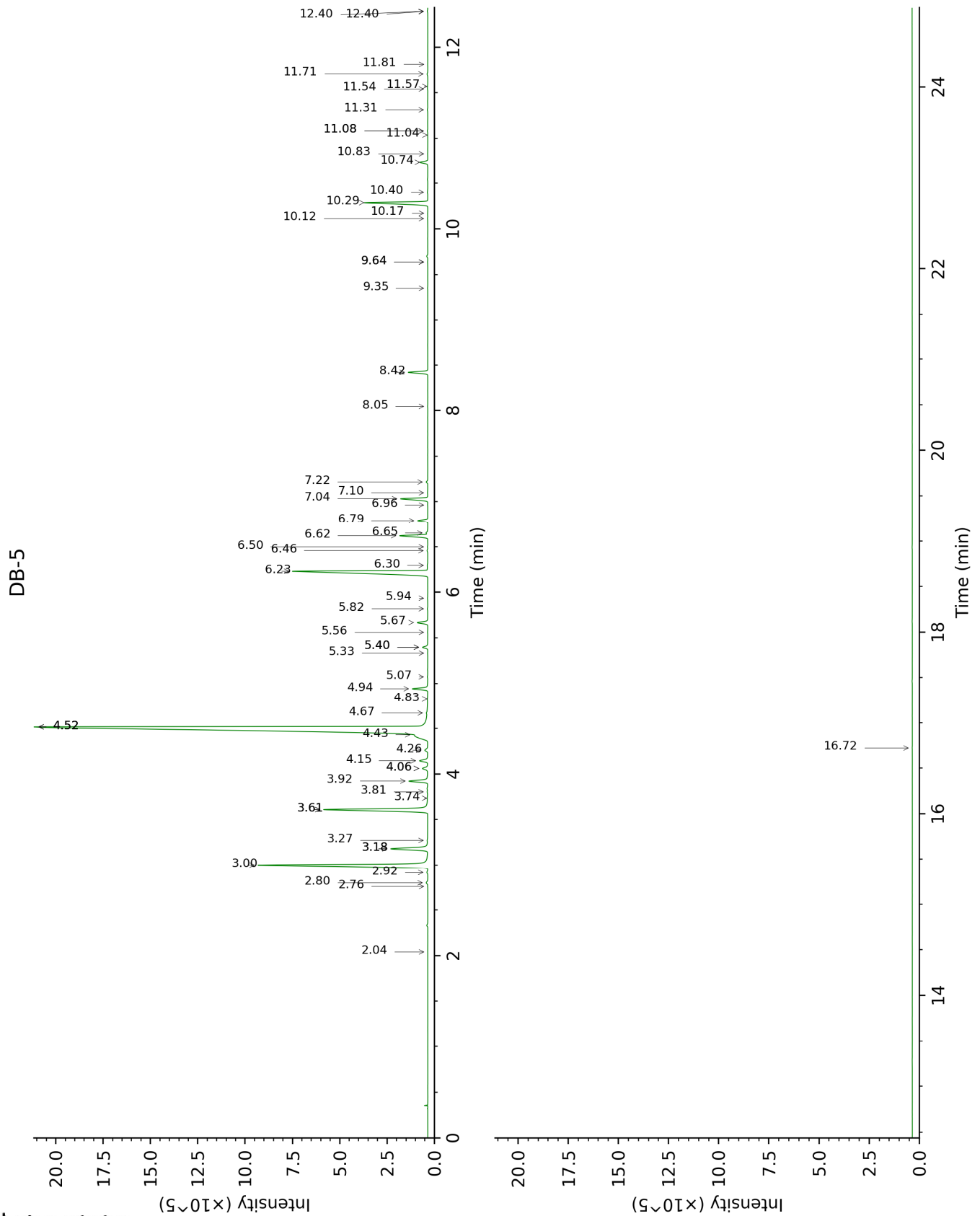
\*: Two or more compounds are coeluting on this column

[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	%
(3Z)-Hexenol	2.04	855	tr	5.80	1346	0.01
Hashishene	2.76	913	0.01	1.43*	998	12.74
Tricyclene	2.80	916	0.12	1.29	976	0.11
$\alpha$ -Thujene	2.92	924	0.06	1.48	1002	0.07
$\alpha$ -Pinene	3.00	929	12.72	1.43*	998	[12.74]
Camphene	3.18*	941	2.71	1.76	1031	2.73
$\alpha$ -Fenchene	3.18*	941	[2.71]	1.69	1024	0.05
Thuja-2,4(10)-diene	3.27	948	0.01	2.35*	1088	0.06
Sabinene	3.61*	970	7.70	2.35*	1088	[0.06]
$\beta$ -Pinene	3.61*	970	[7.70]	2.18	1072	7.72
Octen-3-ol	3.74	979	0.01	6.82	1419	0.03
Octan-3-one	3.81	983	0.03	4.03	1220	0.03
Myrcene	3.92	991	1.27	2.95	1139	1.28
$\alpha$ -Phellandrene	4.06*	1001	0.40	2.86	1132	0.35
Pseudolimonene	4.06*	1001	[0.40]	2.90	1134	0.05
$\Delta^3$ -Carene	4.15	1006	0.58	2.66	1116	0.58
$\alpha$ -Terpinene	4.26	1013	0.22	3.04	1145	0.23
para-Cymene	4.43†	1024	49.85	4.18	1230	2.04
Limonene	4.52*†	1029	[49.85]	3.31	1166	3.68
1,8-Cineole	4.52*†	1029	[49.85]	3.43*	1175	44.04
$\beta$ -Phellandrene	4.52*†	1029	[49.85]	3.43*	1175	[44.04]
(Z)- $\beta$ -Ocimene	4.67	1039	0.03	3.86	1208	0.04
(E)- $\beta$ -Ocimene	4.82	1049	0.01	4.07	1222	0.02
$\gamma$ -Terpinene	4.94	1056	0.95	3.90	1210	0.98
cis-Sabinene hydrate	5.07	1064	0.02	6.94	1428	0.04
Isoterpinolene	5.33	1081	0.01	4.32	1240	0.01
para-Cymenene	5.40*	1085	0.34	6.39	1388	0.02
Terpinolene	5.40*	1085	[0.34]	4.37	1244	0.31
trans-Sabinene hydrate	5.56	1095	0.01	7.99	1506	0.01
Linalool	5.67	1102	0.69	8.10	1514	0.68
endo-Fenchol	5.82	1112	0.03	8.42	1539	0.03
cis-para-Menth-2-en-1-ol	5.94	1119	0.02	8.16	1519	0.02
Camphor	6.23	1138	11.34	7.29*	1454	11.26
Camphene hydrate	6.30	1142	0.04	8.55*	1549	4.13
Isoborneol	6.46	1153	0.05	9.50*	1624	0.09
Pinocarvone	6.50	1155	0.02	7.96	1503	0.02
Borneol	6.62	1163	1.73	9.82*	1649	3.36
$\delta$ -Terpineol	6.65	1165	0.11	9.50*	1624	[0.09]
Terpinen-4-ol	6.79	1174	0.58	8.61	1554	0.56
para-Cymen-8-ol	6.96	1185	0.02	11.65	1803	0.02
$\alpha$ -Terpineol	7.04	1190	1.66	9.82*	1649	[3.36]
Myrtenol	7.10	1194	0.02	10.96	1744	0.01
Verbenone	7.22	1201	0.10	9.63	1634	0.09



Linalyl acetate	8.05	1257	0.01	8.18	1521	0.01
Bornyl acetate	8.42	1282	1.15	8.32	1531	1.15
$\alpha$ -Cubebene	9.35	1346	0.01	6.91	1426	0.01
$\alpha$ -Ylangene	9.64*	1367	0.02	7.18	1445	0.01
$\alpha$ -Copaene	9.64*	1367	[0.02]	7.29*	1454	[11.26]
$\alpha$ -Gurjunene	10.12	1400	0.01	7.74	1487	0.01
Methyleugenol	10.17	1405	0.01	13.35	1955	0.01
$\beta$ -Caryophyllene	10.29	1413	4.14	8.55*	1549	[4.13]
$\beta$ -Copaene	10.40	1422	0.03	8.55*	1549	[4.13]
$\alpha$ -Humulene	10.74	1447	0.50	9.40	1615	0.52
allo-Aromadendrene	10.83	1454	0.01	9.12	1593	0.01
<i>trans</i> -Cadina-1(6),4-diene	11.04	1469	0.01	9.37	1613	0.01
$\gamma$ -Muuroleone	11.08*	1472	0.03	9.70	1640	0.03
$\alpha$ -Amorphene	11.08*	1472	[0.03]	9.67	1637	0.01
$\alpha$ -Muuroleone	11.32	1490	0.03	10.16	1677	0.02
$\beta$ -Bisabolene	11.54	1507	0.02	10.26	1685	0.02
$\gamma$ -Cadinene	11.57	1509	0.02	10.50	1705	0.01
$\delta$ -Cadinene	11.71	1520	0.06	10.53	1707	0.04
<i>trans</i> -Cadina-1,4-diene	11.81	1528	0.01	10.77	1728	0.02
Caryophyllene oxide isomer	12.40*	1574	0.03	12.84*	1908	0.03
Caryophyllene oxide	12.40*	1574	[0.03]	12.84*	1908	[0.03]
meta-Camphorene	16.72	1950	0.01	15.49	2162	0.02
<b>Total identified</b>		<b>99.58%</b>			<b>99.46%</b>	
<b>Total reported</b>		<b>99.58%</b>			<b>99.46%</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