

# VITAL'S<sup>TM</sup>

## INTERNATIONAL GROUP

**Date :** June 9, 2020

**Lot #:** RO10418

### *CERTIFICATE OF ANALYSIS - GC PROFILING*

#### *SAMPLE IDENTIFICATION*

**Customer identification :** Rosemary Oil - 121785-01

**Type :** Essential oil

**Source :** *Rosmarinus Officinalis*

#### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Clear liquid

**Refractive index:** 1.5310 ± 0.0003 (20 °C)

*COMPLIANCE WITH NF T 75-225:1993 (OIL OF Rosmarinus Officinalis, RECTIFIED)*

Compound	70-75%		80-85%		Observed %	Complies?
	Min. %	Max. %	Min. %	Max. %		
1,8-Cineole	tr	20	tr	12	2.9	Yes
Camphor	2	15	2	15	7.9	Yes
Borneol	70		80		80	80-85%
Verbenone	1	6	1	10	2.8	Yes
<i>trans</i> -Pinocarveol	tr	10	tr	6	0.01	Yes
Aromadendrene		tr		tr	0.004	Yes
Globulol		tr		tr	ND	Yes
Refractive index	1.460	1.470	1.458	1.465	1.4600	Yes

### CONCLUSION

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

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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
1,8-Cineole	tr	tr	Aliphatic aldehyde
Camphor	0.01	0.05	Aliphatic alcohol
Borneol	tr	tr	Aliphatic alcohol
Verbenone	tr	2.90*	Monoterpene
α-Thujene	0.01	0.01	Monoterpene
α-Pinene	2.89	[2.90]*	Monoterpene
Camphene	0.03*	0.02	Monoterpene
α-Fenchene	[0.03]*	0.01	Monoterpene
Thuja-2,4(10)-diene	0.01	0.01*	Monoterpene
Sabinene	0.61*	[0.01]*	Monoterpene
β-Pinene	[0.61]*	0.61	Monoterpene
<i>trans</i> -para-Menthane	0.01		Monoterpene
2-Pentylfuran	0.82*		Furan
Myrcene	[0.82]*	0.80	Monoterpene
Pseudolimonene	0.95*	0.02	Monoterpene
α-Phellandrene	[0.95]*	0.91	Monoterpene
<i>cis</i> -Dehydroxylinalool oxide	0.03	2.73*	Monoterpenic ether
α-Terpinene	0.21	0.22	Monoterpene
para-Cymene	90.72	2.76	Monoterpene
1,8-Cineole	[90.72]*	79.62	Monoterpenic ether
Limonene	[90.72]*	7.86*	Monoterpene
β-Phellandrene	[90.72]*	[7.86]*	Monoterpene
( <i>Z</i> )-β-Ocimene	[90.72]	0.15	Monoterpene
( <i>E</i> )-β-Ocimene	0.06	0.05	Monoterpene
γ-Terpinene	2.64	[2.73]*	Monoterpene
Unknown	0.01	0.01	Oxygenated monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.01	0.01	Monoterpenic alcohol
Terpinolene	0.08	0.08	Monoterpene
para-Cymenene	0.01	0.01	Monoterpene
inalool	0.01	0.01	Monoterpenic alcohol
allo-Ocimene	0.01	0.01	Monoterpene
<i>rans</i> -Pinocarveol	0.01	0.01	Monoterpenic alcohol
Borneol	tr	0.22*	Monoterpenic alcohol
Terpinen-4-ol	0.05	0.05	Monoterpenic alcohol
para-Cymen-8-ol	0.01*	tr	Monoterpenic alcohol
<i>trans</i> -Isocarveol	[0.01]*	tr	Monoterpenic alcohol
α-Terpineol	0.22	[0.22]*	Monoterpenic alcohol
Myrtenal	tr	tr	Monoterpenic aldehyde
α-Phellandrene epoxide	tr	tr	Monoterpenic ether
<i>trans</i> -Carveol	tr	tr	Monoterpenic alcohol
exo-2-Hydroxycineole	tr	tr	Monoterpenic alcohol
Unknown	0.01		Oxygenated monoterpene
Piperitone	0.01*		Monoterpenic ketone
Unknown	[0.01]*	0.01	Unknown
Geraniol	0.02	0.02	Monoterpenic alcohol
<i>cis</i> -Ascaridole glycol	tr	0.06	Monoterpenic alcohol
α-Terpinyl acetate	0.01	0.01	Monoterpenic ester
Unknown	0.01	tr	Unknown

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Isoledene	tr	tr	Sesquiterpene
7-Cubebene	tr	tr	Sesquiterpene
$\alpha$ -Gurjunene	0.02	0.02	Sesquiterpene
$\beta$ -Caryophyllene	0.02	tr	Sesquiterpene
$\alpha$ -Maaliene	0.07	0.07*	Sesquiterpene
Aromadendrene	tr	[0.07]*	Sesquiterpene
allo-Aromadendrene	0.02	0.02	Sesquiterpene
Valerena-4,7(11)-diene	0.02		Sesquiterpene
$\beta$ -Eudesmol	tr		Sesquiterpenic alcohol
Unknown	tr	tr	Sesquiterpenic alcohol
<b>Total identified</b>	<b>99.65%</b>	<b>99.36%</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	%
1,8-Cineole	0.59	639	tr	0.82	886	tr
Camphor	0.95	727	0.01	3.63	1179	0.05
Borneol	2.07	853	tr	6.09	1354	tr
Verbenone	2.79	911	tr	1.48*	996	2.90
α-Thujene	2.94	921	0.01	1.54	1002	0.01
α-Pinene	3.02	926	2.89	1.48*	996	[2.90]
Camphene	3.21*	938	0.03	1.84	1030	0.02
α-Fenchene	3.21*	938	[0.03]	1.77	1024	0.01
Thuja-2,4(10)-diene	3.31	945	0.01	2.46*	1088	0.01
Sabinene	3.64*	967	0.61	2.46*	1088	[0.01]
β-Pinene	3.64*	967	[0.61]	2.26	1069	0.61
<i>trans</i> -para-Menthane	3.88	983	0.01			
2-Pentylfuran	3.96*	988	0.82			
Myrcene	3.96*	988	[0.82]	3.06	1135	0.80
Pseudolimonene	4.10*	998	0.95	3.01	1131	0.02
α-Phellandrene	4.10*	998	[0.95]	2.97	1128	0.91
<i>cis</i> -Dehydroxylinalool oxide	4.18	1003	0.03	4.04*	1208	2.73
α-Terpinene	4.30	1010	0.21	3.16	1142	0.22
para-Cymene	4.45†	1020	90.72	4.33	1229	2.76
1,8-Cineole	4.60*†	1029	[90.72]	3.60	1176	79.62
Limonene	4.60*†	1029	[90.72]	3.45*	1164	7.86
β-Phellandrene	4.60*†	1029	[90.72]	3.45*	1164	[7.86]
( <i>Z</i> )-β-Ocimene	4.72†	1036	[90.72]	4.00	1205	0.15
( <i>E</i> )-β-Ocimene	4.87	1046	0.06	4.20	1220	0.05
γ-Terpinene	5.00	1054	2.64	4.04*	1208	[2.73]
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.16	1064	0.01	5.02	1278	0.01
<i>cis</i> -Linalool oxide (fur.)	5.21	1067	0.01	6.76	1402	0.01
Terpinolene	5.44	1081	0.08	4.51	1242	0.08
para-Cymenene	5.46	1083	0.01	6.58	1389	0.01
Linalool	5.71	1099	0.01	8.29	1516	0.01
allo-Ocimene	6.14	1126	0.01	5.81	1334	0.01
<i>trans</i> -Pinocarveol	6.21	1130	0.01	9.43	1604	0.01
Borneol	6.67	1160	tr	10.03*	1652	0.22
Terpinen-4-ol	6.84	1170	0.05	8.82	1556	0.05
para-Cymen-8-ol	7.03*	1183	0.01	11.79	1799	tr
<i>trans</i> -Isocarveol	7.03*	1183	[0.01]	11.28	1756	tr
α-Terpineol	7.08	1186	0.22	10.03*	1652	[0.22]
Myrtenal	7.15	1190	tr	8.90	1563	tr
α-Phellandrene	7.23	1196	tr	11.31	1758	tr

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epoxide						
<i>trans</i> -Carveol	7.53	1215	tr	11.66	1787	tr
exo-2-Hydroxycineole	7.56	1218	tr	11.90	1809	tr
Unknown [m/z 43, 135 (82), 91(68), 107 (58), 79(55), 150 (49)]	7.66	1224	0.01			
Piperitone	7.98*	1246	0.01			
Unknown [m/z 43, 97 (69), 107 (46), 41 (28), 55 (21), 109 (20)...]	7.98*	1246	[0.01]	11.37	1764	0.01
Geraniol	8.10	1254	0.02	11.88	1807	0.02
<i>cis</i> -Ascaridole glycol	8.60	1287	tr	15.06	2101	0.06
$\alpha$ -Terpinyl acetate	9.40	1342	0.01	9.96	1646	0.01
Unknown [m/z 43, 95 (62), 107(45), 110 (41), 55(28), 67 (25)...]	9.58	1355	0.01	14.26	2023	tr
Isoledene	9.73	1366	tr	7.10	1427	tr
7-Cubebene	9.83	1372	tr	7.38	1448	tr
$\alpha$ -Gurjunene	10.18	1398	0.02	7.86	1483	0.02
$\beta$ -Caryophyllene	10.31	1407	0.02	8.66	1544	tr
$\alpha$ -Maaliene	10.58	1427	0.07	8.80*	1555	0.07
Aromadendrene	10.64	1431	tr	8.80*	1555	[0.07]
allo-Aromadendrene	10.87	1448	0.02	9.26	1590	0.02
Valerena-4,7(11)-diene	10.92	1452	0.02			
$\beta$ -Eudesmol	13.34	1641	tr			
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161(43), 109 )40)... 204 (35), 222 (2)]	13.38	1644	tr	15.44	2139	tr
<b>Total identified</b>		<b>99.65%</b>			<b>99.36%</b>	
<b>Total reported</b>		<b>99.67%</b>			<b>99.39%</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

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**Date :** June 11, 2020

**Lot #:** TO18319

## *CERTIFICATE OF ANALYSIS – GC PROFILING*

### *SAMPLE IDENTIFICATION*

**Customer identification :** Tangerine Oil- 171040105

**Type :** Essential oil

**Source :** *Citrus reticulata*

### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Yellow liquid

**Refractive index:** 1.5605 ± 0.0003 (20 °C)

*ISO 4725:2004 – Tangerine Oil*

Compound	Min. %	Max. %	Observed %	Complies?
a-Thujene	4	10	9	Yes
a-Pinene	0.2	2	1.1	Yes
Octanal	0.2	1.5	0.6	Yes
p-Cymene	48	66	51	Yes
Limonene	tr	4	1.1	Yes
Octanol	tr	30	2.1	Yes
<b>Refractive index</b>	1.5550	1.6050	1.5605	Yes

### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for tangerine oil, and the oil features the characteristic composition for *Citrus reticulata* oil.



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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
a-Thujene	tr	tr	Aliphatic aldehyde
a-Pinene	0.01	0.05	Aliphatic aldehyde
Octanal	0.01	tr	Furan
p-Cymene	0.16	0.16	Aliphatic alcohol
Limonene	0.01	0.01	Aliphatic alcohol
Octanol	0.02	0.02	Monoterpene
Sabinene	0.02	tr	Normonoterpene
6-Methyl-5-hepten-2-one	0.01	0.01	Aliphatic ketone
Myrcene	0.05		Monoterpene
α-Phellandrene	0.01		Monoterpene
Δ <sup>3</sup> -Carene	0.03	0.04	Monoterpene
para-Cymene	0.02	0.03	Monoterpene
Limonene	0.01	0.02	Monoterpene
1,8-Cineole	0.02*	0.01	Monoterpene
para-Cymenene	[0.02]*	0.01	Monoterpene
α-Campholenal	0.01	0.01	Monoterpenic aldehyde
trans-Pinocarveol	0.05*	0.06	Monoterpenic alcohol
Camphor	[0.05]*	0.14*	Monoterpenic ketone
meta-Mentha-4,6-dien-8-ol	0.01	0.04	Monoterpenic alcohol
Pinocamphone	0.01	[0.14]*	Monoterpenic ketone
Pinocarvone	0.01	0.01	Monoterpenic ketone
Borneol	0.02	1.00*	Monoterpenic alcohol
α-Phellandren-8-ol	0.02	0.30*	Monoterpenic alcohol
Terpinen-4-ol	0.04	0.19*	Monoterpenic alcohol
meta-Cymen-8-ol	0.01	0.01	Monoterpenic alcohol
para-Cymen-8-ol	0.07*	0.14*	Monoterpenic alcohol
α-Terpineol	[0.07]*	[1.00]*	Monoterpenic alcohol
γ-Terpineol	0.03	0.14*	Monoterpenic alcohol
Myrtenol	0.05	0.07	Monoterpenic alcohol
Verbenone	0.05	0.16*	Monoterpenic ketone
trans-Carveol	0.01	0.01	Monoterpenic alcohol
Carvacrol methyl ether	0.03	[0.19]*	Monoterpenic ether
Carvenone	0.01	[0.14]*	Monoterpenic ketone
Bornyl acetate	0.01	0.49*	Monoterpenic ester
Carvacrol	0.03	0.10	Monoterpenic alcohol
α-Terpinyl acetate	0.06	0.21	Monoterpenic ester
African-1-ene	0.02	0.03	Sesquiterpene
β-Patchoulene	0.13*	0.03	Sesquiterpene
2-epi-α-Funebrene	[0.13]*	[0.14]*	Sesquiterpene
α-Duprezianene	0.36	0.27	Sesquiterpene
7-epi-Sesquithujene?	0.04*	0.07	Sesquiterpene
Isolongifolene	[0.04]*	0.01	Sesquiterpene
β-Elemene	0.37	0.59*	Sesquiterpene
α-Chamipinene	0.21*	9.15*	Sesquiterpene
Unknown	[0.21]*	0.04	Sesquiterpene
α-Cedrene	9.54	[9.15]*	Sesquiterpene
β-Cedrene	3.18*	2.45	Sesquiterpene
β-Funebrene	[3.18]*	0.22	Sesquiterpene

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Unknown	[3.18]*	0.49*	Sesquiterpene
β-Duprezianene	[3.18]*	[0.49]*	Sesquiterpene
cis-Thujopsene	35.56*	35.37	Sesquiterpene
β-Caryophyllene	[35.56]*	[0.19]*	Sesquiterpene
(Z)-β-Farnesene?	0.14	0.07	Sesquiterpene
Isobazzanene	0.05*	[0.19]*	Sesquiterpene
trans-α-Bergamotene	[0.05]*	[0.59]*	Sesquiterpene
Prezizaene	0.12	0.13	Sesquiterpene
α-Himachalene	0.61*	[0.49]*	Sesquiterpene
7,8-Dehydro-α-acoradiene?	[0.61]*	0.44*	Sesquiterpene
α-Humulene	0.10*	0.50*	Sesquiterpene
Cadina-4,11-diene	[0.10]*	0.06	Sesquiterpene
α-Acoradiene	0.24	[0.50]*	Sesquiterpene
(E)-β-Farnesene	1.05*	[0.44]*	Sesquiterpene
9-epi-β-Caryophyllene	[1.05]*	[0.50]*	Sesquiterpene
β-Acoradiene	[1.05]*	0.35	Sesquiterpene
Thujopsene isomer	[1.05]*	0.02	Sesquiterpene
β-Chamigrene	0.46	0.50	Sesquiterpene
Unknown	0.66*		Sesquiterpene
γ-Himachalene	[0.66]*	[0.16]*	Sesquiterpene
Widdra-2,4(14)-diene?	0.12	[0.14]*	Sesquiterpene
Unknown	0.44	0.16*	Sesquiterpene
ar-Curcumene	[0.44]	0.23	Sesquiterpene
Valencene	0.73	0.68	Sesquiterpene
α-Cuprenene	2.33*	[0.30]*	Sesquiterpene
Pseudowiddrene	[2.33]*	1.71	Sesquiterpene
α-Chamigrene	[2.33]*	[0.30]*	Sesquiterpene
β-Himachalene	[2.33]*	[1.00]*	Sesquiterpene
Cuparene	1.36	1.39*	Sesquiterpene
1,4-Dihydrocuparene	0.11	0.11	Sesquiterpene
α-Alaskene	0.33*	[0.16]*	Sesquiterpene
Unknown	[0.33]*	0.24	Sesquiterpene
γ-Cadinene	0.34	[0.71]*	Sesquiterpene
α-Dehydro-ar-himachalene	0.20*	[0.14]*	Sesquiterpene
β-Curcumene	[0.20]*	0.05	Sesquiterpene
δ-Cadinene	0.75*	[0.71]*	Sesquiterpene
γ-Dehydro-ar-himachalene	[0.75]*	0.05	Sesquiterpene
β-Sesquiphellandrene	[0.75]*	0.45*	Sesquiterpene
Unknown	0.53*		Oxygenated sesquiterpene
γ-Cuprenene	[0.53]*	[0.45]*	Sesquiterpene
(E)-γ-Bisabolene	[0.53]*	0.71	Sesquiterpene
ar-Himachalene	0.13	[0.14]*	Sesquiterpene
δ-Cuprenene epimer I	0.14	0.11	Sesquiterpene
δ-Cuprenene epimer II	0.18*	[1.39]*	Sesquiterpene
Unknown	[0.18]*	0.15*	Oxygenated sesquiterpene
8,14-Cedranoxide	[0.18]*	[0.14]*	Sesquiterpenic ether
Unknown	[0.18]*	0.02	Oxygenated sesquiterpene
Unknown	0.16		Oxygenated sesquiterpene
Caryophyllenyl alcohol	0.34*	0.17	Sesquiterpenic alcohol
Unknown	[0.34]*	0.05	Oxygenated sesquiterpene
Unknown	[0.34]*		Sesquiterpene
Caryophyllene oxide	0.13*	0.05	Sesquiterpenic ether

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Caryophyllene oxide isomer	[0.13]*	0.01	Sesquiterpenic ether
allo-Cedrol	1.17	25.74*	Sesquiterpenic alcohol
Widdrol	27.17*	2.03	Sesquiterpenic alcohol
α-Cedrol	[27.17]*	[25.74]*	Sesquiterpenic alcohol
β-Himachalene oxide	[27.17]*	0.02	Sesquiterpenic ether
epi-Cedrol	1.26*	0.72	Sesquiterpenic alcohol
Unknown	[1.26]*	0.04	Oxygenated sesquiterpene
10-epi-Cubenol	[1.26]*	[0.15]*	Sesquiterpenic alcohol
Unknown	0.08*	0.06	Oxygenated sesquiterpene
2-epi-α-Cedren-3-one	[0.08]*		Sesquiterpenic ketone
Unknown	1.43*	0.15	Oxygenated sesquiterpene
α-Acorenol	[1.43]*	1.01	Sesquiterpenic alcohol
β-Acorenol	[1.43]*	0.22	Sesquiterpenic alcohol
Unknown	0.96*		Oxygenated sesquiterpene
Unknown	[0.96]*	0.24	Oxygenated sesquiterpene
Himachalol	0.86*	0.34	Sesquiterpenic alcohol
Unknown	[0.86]*		Oxygenated sesquiterpene
Unknown	0.61		Oxygenated sesquiterpene
Cedrenol analog	0.93*	0.10	Sesquiterpenic alcohol
Unknown	[0.93]*	0.43	Oxygenated sesquiterpene
14-Hydroxy-9-epi-(E)-caryophyllene	0.10	0.16	Sesquiterpenic alcohol
Cedr-8-en-13-ol	0.33	0.05	Sesquiterpenic alcohol
α-Cedrenol	[0.33]*	0.13	Sesquiterpenic alcohol
epi-α-Bisabolol	[0.33]*	0.20	Sesquiterpenic alcohol
Unknown	0.10		Oxygenated sesquiterpene
Mayurone?	0.07	0.05	Norsesquiterpenic ketone
Unknown	0.64*		Oxygenated sesquiterpene
Thujopsenal	[0.64]*	0.04	Sesquiterpenic aldehyde
Thujopsenal analog	0.04	0.03	Sesquiterpenic aldehyde
Unknown	0.06		Oxygenated sesquiterpene
Cedryl acetate?	0.12		Sesquiterpenic ester
Unknown	0.02	0.05	Oxygenated sesquiterpene
Unknown	0.02	0.02	Oxygenated sesquiterpene
Unknown	0.13	0.08	Oxygenated sesquiterpene
Nootkatone analog	0.02	0.03	Sesquiterpenic ketone
Manool	0.02		Diterpenic alcohol
7,13-Abietadiene	0.01		Diterpene
Toluene		0.01*	Simple phenolic
Unknown		[0.01]*	Normonoterpene
Thujopsadiene?		0.03	Sesquiterpene
1,7-diepi-α-Cedrenal?		0.04	Sesquiterpenic aldehyde
β-Acoradienol?		0.02	Sesquiterpenic alcohol
<b>Total identified</b>	<b>96.83%</b>	<b>97.00%</b>	

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

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

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	%
Unknown [m/z 105, 79 (80), 91 (78), 77 (69), 78 (56), 93 (46), 120 (44)... 136 (4)]	2.84	916	0.02	2.63	1107	0.02
$\alpha$ -Pinene	3.02	928	0.19	1.42	991	0.20
Camphene	3.19*	940	0.04	1.77	1028	0.01
$\alpha$ -Fenchene	3.19*	940	[0.04]	1.70	1021	0.04
Thuja-2,4(10)-diene	3.31	947	0.03	2.38*	1085	0.03
Sabinene	3.64	969	0.01	2.38*	1085	[0.03]
$\alpha$ -Methylstyrene	3.78	978	0.02	5.05	1292	0.02
6-Methyl-5-hepten-2-one	3.90	986	0.01	5.22	1299	0.01
Myrcene	3.96	990	0.01			
$\alpha$ -Phellandrene	4.11	1000	0.01			
$\Delta$ 3-Carene	4.19	1005	0.03	2.68	1111	0.04
para-Cymene	4.44	1020	0.02	4.23	1230	0.03
Limonene	4.50	1024	0.01	3.29	1158	0.02
Terpinolene	5.50*	1085	0.02	4.42	1244	0.01
para-Cymenene	5.50*	1085	[0.02]	6.48	1390	0.01
$\alpha$ -Campholenal	6.03	1118	0.01	7.16	1439	0.01
<i>trans</i> -Pinocarveol	6.25*	1133	0.05	9.29	1600	0.06
Camphor	6.25*	1133	[0.05]	7.37*	1455	0.14
meta-Mentha-4,6-dien-8-ol	6.40	1142	0.01	9.43	1612	0.04
Pinocamphone	6.54	1151	0.01	7.37*	1455	[0.14]
Pinocarvone	6.56	1152	0.01	8.08	1507	0.01
Borneol	6.73	1163	0.02	9.94*	1653	1.00
$\alpha$ -Phellandren-8-ol	6.80	1167	0.02	10.32*	1683	0.30
Terpinen-4-ol	6.89	1173	0.04	8.68*	1554	0.19
meta-Cymen-8-ol	6.96	1177	0.01	11.66	1796	0.01
para-Cymen-8-ol	7.11*	1187	0.07	11.71*†	1800	0.14
$\alpha$ -Terpineol	7.11*	1187	[0.07]	9.94*	1653	[1.00]
$\gamma$ -Terpineol	7.16	1190	0.03	10.02*	1660	0.14
Myrtenol	7.21	1193	0.05	11.05	1745	0.07
Verbenone	7.30	1199	0.05	9.74*	1636	0.16
<i>trans</i> -Carveol	7.61	1219	0.01	11.60	1791	0.01
Carvacrol methyl ether	7.92	1239	0.03	8.68*	1554	[0.19]
Carvenone	8.05	1248	0.01	10.02*	1660	[0.14]
Bornyl acetate	8.47	1276	0.01	8.38*	1530	0.49
Carvacrol	9.11	1321	0.03	15.50	2153	0.10
$\alpha$ -Terpinyl acetate	9.44	1344	0.06	9.86	1646	0.21
African-1-ene	9.48	1347	0.02	7.01	1428	0.03
$\beta$ -Patchoulene	9.81*	1369	0.13	7.10	1435	0.03
2-epi- $\alpha$ -Funebrene	9.81*	1369	[0.13]	7.37*	1455	[0.14]
$\alpha$ -Duprezianene	9.89	1375	0.36	7.60	1472	0.27

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Isolongifolene	9.95*	1379	[0.04]	7.67	1476	0.01
β-Elemene	10.04	1385	0.37	8.57*	1545	0.59
α-Chamipinene	10.13*	1392	0.21	8.17*†	1514	9.15
Unknown [m/z 107, 91 (86), 93 (83), 79 (81), 162 (74), 41 (73), 133 (72)... 204 (13)]	10.13*	1392	[0.21]	8.33	1527	0.04
α-Cedrene	10.28	1402	9.54	8.17*†	1514	[9.15]
β-Cedrene	10.38*	1409	3.18	8.50	1540	2.45
β-Funebrene	10.38*	1409	[3.18]	8.26	1522	0.22
Unknown [m/z 118, 69 (82), 91 (51), 117 (40)... 202 (25)]	10.38*	1409	[3.18]	9.08*	1584	0.49
β-Duprezianene	10.38*	1409	[3.18]	8.38*	1530	[0.49]
cis-Thujopsene	10.58*	1424	35.56	8.89	1570	35.37
β-Caryophyllene	10.58*	1424	[35.56]	8.68*	1554	[0.19]
(Z)-β-Farnesene?	10.61	1426	0.14	9.39	1609	0.07
Isobazzanene	10.66*	1430	0.05	8.68*	1554	[0.19]
trans-α-Bergamotene	10.66*	1430	[0.05]	8.57*	1545	[0.59]
Prezizaene	10.72	1434	0.12	8.94	1573	0.13
α-Himachalene	10.77*	1437	0.61	9.08*	1584	[0.49]
7,8-Dehydro-α-acoradiene?	10.77*	1437	[0.61]	9.72*†	1635	0.44
α-Humulene	10.84*	1443	0.10	9.50*	1617	0.50
Cadina-4,11-diene	10.84*	1443	[0.10]	9.35	1606	0.06
α-Acoradiene	10.95	1451	0.24	9.50*	1617	[0.50]
(E)-β-Farnesene	11.00*†	1455	1.05	9.72*†	1635	[0.44]
9-epi-β-Caryophyllene	11.00*†	1455	[1.05]	9.50*	1617	[0.50]
β-Acoradiene	11.05*†	1458	[1.05]	9.57	1624	0.35
Thujopsene isomer	11.05*†	1458	[1.05]	9.62	1628	0.02
β-Chamigrene	11.15	1466	0.46	9.78	1640	0.50
Unknown [m/z 91, 105 (93), 161 (77), 93 (73), 119 (71), 133 (69)... 204 (31)]	11.18*	1467	0.66			
γ-Himachalene	11.18*	1467	[0.66]	9.74*	1636	[0.16]
Widdra-2,4(14)-diene?	11.24	1472	0.12	10.02*	1660	[0.14]
Unknown [m/z 189, 91 (95), 105 (93), 133 (84), 119 (75), 41 (59), 93 (46)... 204 (33)]	11.30†	1477	0.44	10.10*	1666	0.16
ar-Curcumene	11.33†	1479	[0.44]	10.82	1725	0.23
Valencene	11.44	1486	0.73	10.06	1663	0.68
α-Cuprenene	11.50*	1491	2.33	10.32*	1683	[0.30]
Pseudowiddrene	11.50*	1491	[2.33]	10.21	1674	1.71
α-Chamigrene	11.50*	1491	[2.33]	10.32*	1683	[0.30]
β-Himachalene	11.50*	1491	[2.33]	9.94*	1653	[1.00]

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Cuparene	11.56	1495	1.36	11.22*	1759	1.39
1,4-Dihydrocuparene	11.61	1499	0.11	10.64	1710	0.11
$\alpha$ -Alaskene	11.66*	1503	0.33	10.10*	1666	[0.16]
Unknown [m/z 121, 123 (45), 91 (24), 107 (24), 122 (24), 95 (23)... 204 (11)]	11.66*	1503	[0.33]	10.47	1696	0.24
$\gamma$ -Cadinene	11.70	1506	0.34	10.58*†	1705	[0.71]
$\alpha$ -Dehydro-arhimachalene	11.72*	1508	0.20	11.71*†	1800	[0.14]
$\beta$ -Curcumene	11.72*	1508	[0.20]	10.42	1691	0.05
$\delta$ -Cadinene	11.86*†	1518	0.75	10.58*†	1705	[0.71]
$\gamma$ -Dehydro-arhimachalene	11.86*†	1518	[0.75]	12.08	1833	0.05
$\beta$ -Sesquiphellandrene	11.86*†	1518	[0.75]	10.78*†	1722	0.45
Unknown [m/z 91, 107 (97), 105 (93), 41 (92), 109 (78), 43 (78), 121 (76), 135 (75)... 220 (21)]	11.94*†	1525	0.53			
$\gamma$ -Cuprenene	11.94*†	1525	[0.53]	10.78*†	1722	[0.45]
( <i>E</i> )- $\gamma$ -Bisabolene	11.94*†	1525	[0.53]	10.55†	1702	0.71
ar-Himachalene	12.01	1530	0.13	11.76*†	1805	[0.14]
$\delta$ -Cuprenene epimer I	12.04	1532	0.14	11.13	1751	0.11
$\delta$ -Cuprenene epimer II	12.10*	1537	0.18	11.22*	1759	[1.39]
Unknown [m/z 43, 95 (81), 207 (61), 41 (55), 55 (50)... 222 (3)]	12.10*	1537	[0.18]	14.02*	2010	0.15
8,14-Cedranoxide	12.10*	1537	[0.18]	11.76*†	1805	[0.14]
Unknown [m/z 106, 41 (86), 43 (84), 149 (75), 69 (75), 91 (63), 93 (61)... 220 (1)]	12.10*	1537	[0.18]	11.59	1790	0.02
Unknown [m/z 91, 119 (98), 121 (91), 105 (85), 43 (82), 41 (76)... 205 (37), 220 (16)]	12.24	1547	0.16			
Caryophyllenyl alcohol	12.44*	1563	0.34	13.78	1986	0.17
Unknown [m/z 95, 191 (52), 107 (50), 121 (32), 81 (31)...]	12.44*	1563	[0.34]	14.33	2039	0.05
Unknown [m/z 95, 131 (96), 202 (64), 187 (61), 159 (55), 105 (50)... 202 (64)]	12.44*	1563	[0.34]			

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Caryophyllene oxide	12.55*	1572	0.13	12.93	1909	0.05
Caryophyllene oxide isomer	12.55*	1572	[0.13]	12.88	1904	0.01
allo-Cedrol	12.70	1583	1.17	14.46*	2051	25.74
Widdrol	12.91*	1599	27.17	14.80	2084	2.03
α-Cedrol	12.91*	1599	[27.17]	14.46*	2051	[25.74]
β-Himachalene oxide	12.91*	1599	[27.17]	13.33	1945	0.02
epi-Cedrol	13.02*	1608	1.26	14.96	2100	0.72
Unknown [m/z 138, 110 (77), 137 (75), 107 (62), 91 (61), 93 (60), 109 (57)... 220 (34)]	13.02*	1608	[1.26]	13.61	1971	0.04
10-epi-Cubenol	13.02*	1608	[1.26]	14.02*	2010	[0.15]
Unknown [m/z 107, 41 (86), 123 (85), 82 (79), 95 (77), 93 (76), 91 (73), 69 (71)... 220 (13)]	13.13*	1618	0.08	14.84	2088	0.06
2-epi-α-Cedren-3-one	13.13*	1618	[0.08]			
Unknown [m/z 132, 175 (22), 119 (18), 91 (18), 157 (18)... 219 (10)]	13.22*	1625	1.43	15.80	2183	0.15
α-Acorenol	13.22*	1625	[1.43]	14.64	2069	1.01
β-Acorenol	13.22*	1625	[1.43]	15.04	2107	0.22
Unknown [m/z 132, 91 (24), 119 (22), 105 (21), 133 (17), 117 (16)... 219 (3)]	13.28*	1630	0.96			
Unknown [m/z 105, 93 (78), 95 (75), 131 (72), 119 (71), 132 (70), 91 (67), 120 (49)... 202 (39), 220 (9)]	13.28*	1630	[0.96]	16.00	2203	0.24
Himachalol	13.40*	1640	0.86	15.35	2139	0.34
Unknown [m/z 123, 81 (77), 95 (77), 107 (72), 41 (72), 93 (66), 55 (64)... 220? (13)]	13.40*	1640	[0.86]			
Unknown [m/z 41, 91 (96), 79 (88), 69 (82), 123 (80), 93 (80)... 220 (8)]	13.44	1643	0.61			
Cedrenol analog	13.55*	1652	0.93	16.66	2271	0.10
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79	13.55*	1652	[0.93]	15.58	2161	0.43

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(58)... 204 (48), 220 (2)]						
14-Hydroxy-9-epi-(E)-caryophyllene	13.62	1658	0.10	16.60	2266	0.16
Cedr-8-en-13-ol	13.89†	1680	0.33	17.11	2320	0.05
α-Cedrenol	13.94*†	1683	[0.33]	17.24	2333	0.13
epi-α-Bisabolol	13.94*†	1683	[0.33]	15.65	2168	0.20
Unknown [m/z 91, 105 (87), 123 (74), 135 (70), 107 (60), 79 (59)... 220 (13)]	13.99	1688	0.10			
Mayurone?	14.04	1692	0.07	17.30	2340	0.05
Unknown [m/z 105, 69 (77), 91 (66), 119 (65), 111 (56), 107 (45), 55 (45)... 220? (2)]	14.09*	1696	0.64			
Thujopsenal	14.09*	1696	[0.64]	16.06	2210	0.04
Thujopsenal analog	14.48	1729	0.04	17.65	2378	0.03
Unknown [m/z 105, 91 (83), 79 (78), 135 (67), 107 (56), 67 (53)... 220 (9)]	14.63	1742	0.06			
Cedryl acetate?	14.73	1751	0.12			
Unknown [m/z 91, 105 (74), 93 (67), 79 (59), 133 (54), 41 (47), 107 (46)...]	14.86	1762	0.02	18.57	2480	0.05
Unknown [m/z 189, 91 (48), 133 (40), 105 (40), 41 (34), 187 (34)... 220 (5)]	15.14	1786	0.02	18.79	2505	0.02
Unknown [m/z 121, 136 (53), 91 (22), 93 (19), 79 (15), 105 (13)... 220 (3)]	15.21	1792	0.13	18.73	2498	0.08
Nootkatone analog	15.43	1811	0.02	18.12	2429	0.03
Manool	17.94	2047	0.02			
7,13-Abietadiene	18.16	2068	0.01			
Toluene				1.52*	1004	0.01
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]				1.52*	1004	[0.01]
Thujopsadiene?				10.38	1688	0.03
1,7-diepi-α-Cedrenal?				15.32	2135	0.04
β-Acoradienol?				18.30	2449	0.02
<b>Total identified</b>		<b>87.41%</b>			<b>81.70%</b>	
<b>Total reported</b>		<b>95.14%</b>			<b>89.64%</b>	

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



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[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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index

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## INTERNATIONAL GROUP

**Date :** June 10, 2020

**Lot #:** TO10718

### *CERTIFICATE OF ANALYSIS – GC PROFILING*

#### *SAMPLE IDENTIFICATION*

**Customer identification :** Tea Tree Oil - 071839879

**Type :** Essential oil

**Source :** *Melaleuca alternifolia* ct. Terpinen-4-ol

#### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Clear liquid

**Refractive index:** 1.4778 ± 0.0003 (20 °C)

### ISO 4730:2017 - TEA TREE OIL

Compound	Min. %	Max. %	Observed %	Complies?
Viridiflorol	tr	1.0	0.1	Yes
Globulol	tr	1.0	0.3	Yes
δ-Cadinene	0.2	3.0	1.8	Yes
Viridiflorene	0.1	3.0	1.3	Yes
Aromadendrene	0.2	3.0	1.5	Yes
α-Terpineol	2.0	5.0	2.6	Yes
Terpinen-4-ol	35.0	48.0	42.2	Yes
Terpinolene	1.5	5.0	3.0	Yes
γ-Terpinene	14.0	28.0	17.9	Yes
1,8-Cineole	tr	10.0	3.1	Yes
para-Cymene	0.5	8.0	3.2	Yes
Limonene	0.5	1.5	0.8	Yes
α-Terpinene	6.0	12.0	8.1	Yes
Sabinene	tr	3.5	0.12	Yes
α-Pinene	1.0	4.0	2.3	Yes
<b>Refractive index</b>	1.4750	1.4820	1.4778	Yes

### CONCLUSION

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

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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Ethanol	0.05	0.04	Aliphatic alcohol
Isobutyral	0.04	0.05	Aliphatic aldehyde
Ethyl acetate	0.01	0.01	Aliphatic ester
Isobutanol	0.01	0.65*	Aliphatic alcohol
Isovaleral	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	0.04	0.04	Aliphatic aldehyde
Isoamyl alcohol	0.02	0.03*	Aliphatic alcohol
2-Methylbutanol	0.01	[0.03]*	Aliphatic alcohol
Isobutyric acid	0.01		Aliphatic acid
(3Z)-Hexenol	0.02	0.04	Aliphatic alcohol
Hexanol	tr	tr	Aliphatic alcohol
α-Thujene	0.76	0.77	Monoterpene
α-Pinene	2.34	2.37	Monoterpene
Camphene	0.02*	0.01	Monoterpene
α-Fenchene	[0.02]*	tr	Monoterpene
Thuja-2,4(10)-diene	tr	0.12*	Monoterpene
Sabinene	0.76*	[0.12]*	Monoterpene
β-Pinene	[0.76]*	[0.65]*	Monoterpene
3-Methyl-3-cyclohexenone	0.01	0.02*	Aliphatic ketone
Myrcene	0.68	0.69	Monoterpene
α-Phellandrene	0.46*	0.45	Monoterpene
Pseudolimonene	[0.46]*	0.01	Monoterpene
(3Z)-Hexenyl acetate	tr	tr	Aliphatic ester
α-Terpinene	8.13	8.18	Monoterpene
Carvomenthene	0.01	0.01	Aliphatic alcohol
para-Cymene	3.22	3.24	Monoterpene
Limonene	3.88	0.81	Monoterpene
1,8-Cineole	[3.88]	3.06	Monoterpenic ether
(Z)-β-Ocimene	0.01	18.02*	Monoterpene
(E)-β-Ocimene	0.01	0.02	Monoterpene
γ-Terpinene	17.87	[18.02]*	Monoterpene
cis-Sabinene hydrate	0.02	0.09	Monoterpenic alcohol
Unknown	0.01	0.01	Oxygenated monoterpene
cis-Linalool oxide (fur.)	0.01		Monoterpenic alcohol
Terpinolene	3.05*	2.96	Monoterpene
para-Cymenene	[3.05]*	0.01	Monoterpene
trans-Sabinene hydrate	0.02	0.03	Monoterpenic alcohol
Linalool	0.07	0.07	Monoterpenic alcohol
Unknown	0.02	0.57*	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	[0.02]*	Monoterpene
endo-Fenchol	0.01	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.14	0.15	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.02	0.01	Aliphatic alcohol
Camphor	0.05	0.16*	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.06	0.06	Monoterpenic alcohol
Unknown	0.08	0.09*	Unknown
Borneol	0.02	2.64*	Monoterpenic alcohol

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Terpinen-4-ol	42.10	42.17	Monoterpenic alcohol
Dill ether	[42.10]	0.05	Monoterpenic ether
para-Cymen-8-ol	[42.10]	0.07	Monoterpenic alcohol
$\alpha$ -Terpineol	2.61	[2.64]*	Monoterpenic alcohol
<i>cis</i> -Piperitol	0.04	0.05	Monoterpenic alcohol
Unknown	0.02		Oxygenated monoterpene
<i>trans</i> -Piperitol	0.05	0.05	Monoterpenic alcohol
endo-Fenchyl acetate	0.01	0.01	Monoterpenic ester
exo-2-Hydroxycineole	0.04	0.01	Monoterpenic alcohol
Nerol	0.02	0.03	Monoterpenic alcohol
Unknown	0.02	0.01	Oxygenated monoterpene
Piperitone	0.09	0.16*	Monoterpenic ketone
<i>cis</i> -Carvenone oxide?	0.01		Monoterpenic ketone
<i>trans</i> -Ascaridole glycol	0.04	0.07*	Monoterpenic alcohol
<i>cis</i> -Ascaridole glycol?	0.02	0.04	Monoterpenic alcohol
Thymol	0.01	0.01	Monoterpenic alcohol
Carvacrol	0.02	0.02	Monoterpenic alcohol
Unknown	0.03	0.04	Monoterpenic alcohol
Myrtenyl acetate	0.01	0.01	Monoterpenic ester
Bicycloelemene	0.02	0.02	Sesquiterpene
$\alpha$ -Cubebene	0.07	0.06	Sesquiterpene
Isoledene	0.11	[0.09]*	Sesquiterpene
$\alpha$ -Copaene	0.17	[0.16]*	Sesquiterpene
7-Cubebene	0.09	0.09	Sesquiterpene
7-Cubebene epimer?	0.04	[0.16]*	Aliphatic alcohol
$\beta$ -Cubebene	0.03	0.06	Sesquiterpene
$\beta$ -Elemene	0.05	[0.57]*	Sesquiterpene
$\alpha$ -Gurjunene	0.54*	0.49*	Sesquiterpene
Methyleugenol	[0.54]*	0.11*	Phenylpropanoid
$\beta$ -Maaliene	0.01	[0.49]*	Sesquiterpene
$\beta$ -Caryophyllene	0.57	[0.57]*	Sesquiterpene
$\beta$ -Gurjunene	0.10*	0.04	Sesquiterpene
$\gamma$ -Maaliene	[0.10]*	[0.57]*	Sesquiterpene
$\alpha$ -Maaliene	0.10	0.16	Sesquiterpene
Aromadendrene	1.50	1.49	Sesquiterpene
Selina-5,11-diene	0.20	0.21	Sesquiterpene
Cadina-3,5-diene isomer I?	0.22		Sesquiterpene
<i>trans</i> -Muurola-3,5-diene	0.13	0.11	Sesquiterpene
$\alpha$ -Humulene	0.16	0.11	Sesquiterpene
allo-Aromadendrene	0.72	0.70	Sesquiterpene
Valerena-4,7(11)-diene	0.05	0.11	Sesquiterpene
$\gamma$ -Gurjunene	0.08	0.07	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.42*	0.38	Sesquiterpene
Selina-4,11-diene	[0.42]*	0.05	Sesquiterpene
$\gamma$ -Muurolene	0.07	0.22*	Sesquiterpene
$\beta$ -Selinene	0.13	0.15	Sesquiterpene
allo-Aromadendr-9-ene	0.13*	[0.22]*	Sesquiterpene
<i>trans</i> -Muurola-4(15),5-diene	[0.13]*	[0.16]*	Sesquiterpene
$\delta$ -Selinene	0.16	[0.22]*	Sesquiterpene
Viridiflorene	1.69*	1.25	Sesquiterpene
$\alpha$ -Selinene	[1.69]*	0.13	Sesquiterpene
Bicyclogermacrene	[1.69]*	0.68*	Sesquiterpene

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$\alpha$ -Muurolene	0.21	[0.68]*	Sesquiterpene
$\gamma$ -Cadinene	0.04	1.84*	Sesquiterpene
<i>trans</i> -Calamenene	2.00	0.20	Sesquiterpene
Zonarene	[2.00]*	[1.84]*	Sesquiterpene
$\delta$ -Cadinene	[2.00]*	[1.84]	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.23	0.23	Sesquiterpene
$\alpha$ -Calacorene	0.04	0.03	Sesquiterpene
Epiglobulol?	0.08	[0.11]*	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.02	0.03	Sesquiterpene
Palustrol	0.10*	0.05	Sesquiterpenic alcohol
Unknown	[0.10]*	[0.11]*	Oxygenated sesquiterpene
Unknown	0.01	0.01	Oxygenated sesquiterpene
Spathulenol	0.09	0.10	Sesquiterpenic alcohol
Globulol	0.33	0.31	Sesquiterpenic alcohol
Gleenol	0.03	0.04	Sesquiterpenic alcohol
Viridiflorol	0.15	0.15	Sesquiterpenic alcohol
Cubeban-11-ol	0.13	0.24*	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.12*	[0.07]*	Sesquiterpenic alcohol
Ledol	[0.12]*	0.05	Sesquiterpenic alcohol
10-epi-Cubenol	0.01		Sesquiterpenic alcohol
Rosifoliol	0.14	0.14	Sesquiterpenic alcohol
1-epi-Cubenol	0.20	0.19	Sesquiterpenic alcohol
Isospathulenol	0.04	0.04	Sesquiterpenic alcohol
Cubenol	0.11	[0.24]*	Sesquiterpenic alcohol
$\alpha$ -Muurolol	0.04	0.05	Sesquiterpenic alcohol
<b>Total identified</b>	<b>98.66%</b>	<b>98.62%</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	%
Ethanol	0.36	498	0.05	0.78	902	0.04
Isobutyral	0.41	540	0.04	0.48	770	0.05
Ethyl acetate	0.50	609	0.01	0.66	854	0.01
Isobutanol	0.52	619	0.01	2.03*	1069	0.65
Isovaleral	0.58	640	0.01	0.73	881	0.01
2-Methylbutyral	0.61	649	0.04	0.71	875	0.04
Isoamyl alcohol	0.93	727	0.02	3.29*	1176	0.03
2-Methylbutanol	0.95	730	0.01	3.29*	1176	[0.03]
Isobutyric acid	1.16	761	0.01			
(3Z)-Hexenol	2.02	853	0.02	5.60	1346	0.04
Hexanol	2.22	870	tr	5.26	1321	tr
α-Thujene	2.92	924	0.76	1.38	1002	0.77
α-Pinene	2.99	929	2.34	1.33	994	2.37
Camphene	3.18*	941	0.02	1.64	1031	0.01
α-Fenchene	3.18*	941	[0.02]	1.58	1025	tr
Thuja-2,4(10)-diene	3.27	948	tr	2.20*	1086	0.12
Sabinene	3.60*	970	0.76	2.20*	1086	[0.12]
β-Pinene	3.60*	970	[0.76]	2.03*	1069	[0.65]
3-Methyl-3-cyclohexenone	3.75	980	0.01	5.99*	1374	0.02
Myrcene	3.92	991	0.68	2.79	1137	0.69
α-Phellandrene	4.05*	1000	0.46	2.70	1130	0.45
Pseudolimonene	4.05*	1000	[0.46]	2.74	1132	0.01
(3Z)-Hexenyl acetate	4.19	1009	tr	4.71	1281	tr
α-Terpinene	4.27	1014	8.13	2.89	1145	8.18
Carvomenthene	4.32	1018	0.01	2.39	1104	0.01
para-Cymene	4.38	1021	3.22	3.99	1229	3.24
Limonene	4.44†	1025	3.88	3.10	1161	0.81
1,8-Cineole	4.46†	1026	[3.88]	3.21	1170	3.06
(Z)-β-Ocimene	4.66	1039	0.01	3.75*	1212	18.02
(E)-β-Ocimene	4.82	1049	0.01	3.88	1221	0.02
γ-Terpinene	4.97	1058	17.87	3.75*	1212	[18.02]
cis-Sabinene hydrate	5.05	1064	0.02	6.80	1433	0.09
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.11	1068	0.01	4.68	1278	0.01
cis-Linalool oxide (fur.)	5.15	1070	0.01			
Terpinolene	5.39*	1085	3.05	4.19	1243	2.96
para-Cymenene	5.39*	1085	[3.05]	6.23	1391	0.01
trans-Sabinene hydrate	5.53	1094	0.02	7.80	1508	0.03
Linalool	5.63	1100	0.07	7.90	1516	0.07

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Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.69	1104	0.02	8.34*	1550	0.57
para-Mentha-1,3,8-triene	5.73	1107	0.01	5.99*	1374	[0.02]
endo-Fenchol	5.77	1109	0.01	8.21	1540	0.01
cis-para-Menth-2-en-1-ol	5.89	1117	0.14	7.95	1520	0.15
4-Hydroxy-4-methylcyclohex-2-enone	6.08	1130	0.02	13.85	2027	0.01
Camphor	6.19	1136	0.05	7.08*	1454	0.16
trans-para-Menth-2-en-1-ol	6.20	1137	0.06	8.82	1588	0.06
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.31	1144	0.08	6.71*	1427	0.09
Borneol	6.61	1163	0.02	9.61*	1652	2.64
Terpinen-4-ol	6.86†	1179	42.10	8.47	1561	42.17
Dill ether	6.89†	1182	[42.10]	7.16	1460	0.05
para-Cymen-8-ol	6.92†	1184	[42.10]	11.32	1796	0.07
α-Terpineol	7.01	1189	2.61	9.61*	1652	[2.64]
cis-Piperitol	7.06	1192	0.04	9.36	1632	0.05
Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	7.13	1197	0.02			
trans-Piperitol	7.25	1205	0.05	10.19	1699	0.05
endo-Fenchyl acetate	7.39	1214	0.01	6.74	1428	0.01
exo-2-Hydroxycineole	7.49	1221	0.04	11.44	1806	0.01
Nerol	7.59	1228	0.02	10.87	1757	0.03
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.67	1233	0.02	11.13	1779	0.01
Piperitone	7.88	1247	0.09	9.75*	1663	0.16
cis-Carvenone oxide?	8.01	1256	0.01			
trans-Ascaridole glycol	8.15	1265	0.04	14.04*	2045	0.07
cis-Ascaridole glycol?	8.43	1284	0.02	14.57	2097	0.04
Thymol	8.60	1296	0.01	14.89	2129	0.01
Carvacrol	8.74	1305	0.02	15.13	2153	0.02
Unknown [m/z 97,	8.91	1317	0.03	14.74	2114	0.04



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112 (92), 83(62), 43 (44), 41 (25)... 170? (4)]						
Myrtenyl acetate	9.01	1324	0.01	9.41	1636	0.01
Bicycloelemene	9.13	1333	0.02	6.96	1446	0.02
α-Cubebene	9.32	1346	0.07	6.66	1423	0.06
Isoledene	9.63	1368	0.11	6.71*	1427	[0.09]
α-Copaene	9.67	1371	0.17	7.08*	1454	[0.16]
7-Cubebene	9.71	1374	0.09	7.04	1451	0.09
7-Cubebene epimer?	9.74	1376	0.04	7.08*	1454	[0.16]
β-Cubebene	9.92	1388	0.03	7.66	1498	0.06
β-Elemene	9.94	1390	0.05	8.34*	1550	[0.57]
α-Gurjunene	10.12*	1403	0.54	7.54*	1489	0.49
Methyleugenol	10.12*	1403	[0.54]	13.12*	1958	0.11
β-Maaliene	10.17	1406	0.01	7.54*	1489	[0.49]
β-Caryophyllene	10.24	1412	0.57	8.34*	1550	[0.57]
β-Gurjunene	10.36*	1420	0.10	8.26	1544	0.04
γ-Maaliene	10.36*	1420	[0.10]	8.34*	1550	[0.57]
α-Maaliene	10.44	1426	0.10	8.49	1562	0.16
Aromadendrene	10.51	1432	1.50	8.51	1564	1.49
Selina-5,11-diene	10.53	1433	0.20	8.57	1568	0.21
Cadina-3,5-diene isomer I?	10.57	1436	0.22			
<i>trans</i> -Muurolo-3,5- diene	10.67	1444	0.13	8.77	1584	0.11
α-Humulene	10.70	1446	0.16	9.17	1615	0.11
allo- Aromadendrene	10.80	1453	0.72	8.90	1594	0.70
Valerena-4,7(11)- diene	10.83	1456	0.05	8.79	1586	0.11
γ-Gurjunene	10.96	1466	0.08	9.04	1605	0.07
<i>trans</i> -Cadina- 1(6),4-diene	11.00*	1468	0.42	9.14	1613	0.38
Selina-4,11-diene	11.00*	1468	[0.42]	9.31	1627	0.05
γ-Muuroloene	11.04	1472	0.07	9.45*	1638	0.22
β-Selinene	11.14	1478	0.13	9.70	1659	0.15
allo-Aromadendr- 9-ene	11.17*	1481	0.13	9.45*	1638	[0.22]
<i>trans</i> -Muurolo- 4(15),5-diene	11.17*	1481	[0.13]	9.75*	1663	[0.16]
δ-Selinene	11.23	1486	0.16	9.45*	1638	[0.22]
Viridiflorene	11.28*	1489	1.69	9.55	1646	1.25
α-Selinene	11.28*	1489	[1.69]	9.82	1669	0.13
Bicyclogermacrene	11.28*	1489	[1.69]	9.93*	1678	0.68
α-Muuroloene	11.37	1496	0.21	9.93*	1678	[0.68]
γ-Cadinene	11.52	1508	0.04	10.26*†	1705	1.84
<i>trans</i> -Calamenene	11.65†	1517	2.00	11.09	1776	0.20
Zonarene	11.67*†	1519	[2.00]	10.26*†	1705	[1.84]
δ-Cadinene	11.67*†	1519	[2.00]	10.30†	1709	[1.84]
<i>trans</i> -Cadina-1,4- diene	11.76	1527	0.23	10.54	1729	0.23

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α-Calacorene	11.88	1536	0.04	11.95	1852	0.03
Epiglobulol?	12.09	1552	0.08	13.12*	1958	[0.11]
Eudesma-5,7(11)-diene	12.14	1556	0.02	10.99	1767	0.03
Palustrol	12.17*	1559	0.10	12.13	1867	0.05
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.17*	1559	[0.10]	13.12*	1958	[0.11]
Unknown [m/z 107, 163 (88), 59 (60), 93 (49), 43 (47), 81 (46... 204 (5)...]	12.22	1563	0.01	13.04	1950	0.01
Spathulenol	12.31	1570	0.09	14.21	2062	0.10
Globulol	12.39	1576	0.33	13.72	2015	0.31
Gleenol	12.45	1580	0.03	13.40	1984	0.04
Viridiflorol	12.48	1583	0.15	13.81	2023	0.15
Cubeban-11-ol	12.52	1586	0.13	13.52*	1995	0.24
Eudesm-5-en-11-ol analog	12.62*	1594	0.12	14.04*	2045	[0.07]
Ledol	12.62*	1594	[0.12]	13.20	1966	0.05
10-epi-Cubenol	12.78	1606	0.01			
Rosifoliol	12.87	1615	0.14	14.14	2055	0.14
1-epi-Cubenol	12.95	1621	0.20	13.60	2003	0.19
Isospathulenol	13.07	1631	0.04	15.24	2164	0.04
Cubenol	13.13	1635	0.11	13.52*	1995	[0.24]
α-Muurolol	13.18	1640	0.04	15.00	2140	0.05
<b>Total identified</b>		<b>98.66%</b>			<b>98.62%</b>	
<b>Total reported</b>		<b>98.84%</b>			<b>98.70%</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

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INTERNATIONAL GROUP

**Date :** June 11, 2020

**Lot #:** TO10218

## *CERTIFICATE OF ANALYSIS – GC PROFILING*

### *SAMPLE IDENTIFICATION*

**Customer identification :** Turmeric Oil- 191060284

**Type :** Essential oil

**Source :** *Curcuma longa*

### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Bright yellow liquid

**Refractive index:** 1.5091 ± 0.0003 (20 °C)

### ISO 4725:2004 – Turmeric Oil

Compound	Min. %	Max. %	Observed %	Complies?
ar-Curcumene	4.8	13	12.6	Yes
α-Zingiberene	4.5	5.0	4.9	Yes
β-Bisabolene	1.4	1.7	1.6	Yes
β-Sesquiphellandren	7.9	13.0	12.6	Yes
ar-Turmerone	21.0	23.0%	22.4	Yes
α-Santalal	0.18	0.30	0.26	Yes
<b>Refractive index</b>	1.5040	1.5500	1.5065	Yes

### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for Turmeric oil, and the oil features the characteristic composition for *Curcuma Longa* oil.

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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Toluene	tr	tr	Simple phenolic
Angelic Acid	0.01	0.05	Aliphatic Acid
$\alpha$ -Thujene	tr	tr	Monoterpene
$\alpha$ -Pinene	0.16	0.16	Monoterpene
Camphene	0.01	0.01	Monoterpene
$\beta$ -Pinene	0.02	0.02	Monoterpene
Sabinene	0.02	tr	Normoterpene
6-Methyl-5-hepten-2-one	0.01	0.01	Aliphatic ketone
Myrcene	0.05		Monoterpene
$\alpha$ -Phellandrene	0.01		Monoterpene
$\Delta$ 3-Carene	0.03	0.04	Monoterpene
para-Cymene	0.02	0.03	Monoterpene
Limonene	0.01	0.02	Monoterpene
1,8-Cineole	0.02*	0.01	Monoterpene
para-Cymenene	[0.02]*	0.01	Monoterpene
$\alpha$ -Campholenal	0.01	0.01	Monoterpenic aldehyde
<i>trans</i> -Pinocarveol	0.05*	0.06	Monoterpenic alcohol
Camphor	[0.05]*	0.14*	Monoterpenic ketone
meta-Mentha-4,6-dien-8-ol	0.01	0.04	Monoterpenic alcohol
Pinocamphone	0.01	[0.14]*	Monoterpenic ketone
Pinocarvone	0.01	0.01	Monoterpenic ketone
Borneol	0.02	1.00*	Monoterpenic alcohol
$\alpha$ -Phellandren-8-ol	0.02	0.30*	Monoterpenic alcohol
Terpinen-4-ol	0.04	0.19*	Monoterpenic alcohol
meta-Cymen-8-ol	0.01	0.01	Monoterpenic alcohol
para-Cymen-8-ol	0.07*	0.14*	Monoterpenic alcohol
$\alpha$ -Terpineol	[0.07]*	[1.00]*	Monoterpenic alcohol
$\gamma$ -Terpineol	0.03	0.14*	Monoterpenic alcohol
Myrtenol	0.05	0.07	Monoterpenic alcohol
Verbenone	0.05	0.16*	Monoterpenic ketone
<i>trans</i> -Carveol	0.01	0.01	Monoterpenic alcohol
Carvacrol methyl ether	0.03	[0.19]*	Monoterpenic ether
Carvenone	0.01	[0.14]*	Monoterpenic ketone
Bornyl acetate	0.01	0.49*	Monoterpenic ester
Carvacrol	0.03	0.10	Monoterpenic alcohol
$\alpha$ -Terpinyl acetate	0.06	0.21	Monoterpenic ester
African-1-ene	0.02	0.03	Sesquiterpene
$\beta$ -Patchoulene	0.13*	0.03	Sesquiterpene
2-epi- $\alpha$ -Funebrene	[0.13]*	[0.14]*	Sesquiterpene
$\alpha$ -Duprezianene	0.36	0.27	Sesquiterpene
7-epi-Sesquithujene?	0.04*	0.07	Sesquiterpene
Isolongifolene	[0.04]*	0.01	Sesquiterpene
$\beta$ -Elemene	0.37	0.59*	Sesquiterpene
$\alpha$ -Chamipinene	0.21*	9.15*	Sesquiterpene
Unknown	[0.21]*	0.04	Sesquiterpene
$\alpha$ -Cedrene	9.54	[9.15]*	Sesquiterpene
$\beta$ -Cedrene	3.18*	2.45	Sesquiterpene
$\beta$ -Funebrene	[3.18]*	0.22	Sesquiterpene

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Unknown	[3.18]*	0.49*	Sesquiterpene
β-Duprezianene	[3.18]*	[0.49]*	Sesquiterpene
cis-Thujopsene	35.56*	35.37	Sesquiterpene
β-Caryophyllene	[35.56]*	[0.19]*	Sesquiterpene
(Z)-β-Farnesene?	0.14	0.07	Sesquiterpene
Isobazzanene	0.05*	[0.19]*	Sesquiterpene
trans-α-Bergamotene	[0.05]*	[0.59]*	Sesquiterpene
Prezizaene	0.12	0.13	Sesquiterpene
α-Himachalene	0.61*	[0.49]*	Sesquiterpene
7,8-Dehydro-α-acoradiene?	[0.61]*	0.44*	Sesquiterpene
α-Humulene	0.10*	0.50*	Sesquiterpene
Cadina-4,11-diene	[0.10]*	0.06	Sesquiterpene
α-Acoradiene	0.24	[0.50]*	Sesquiterpene
(E)-β-Farnesene	1.05*	[0.44]*	Sesquiterpene
9-epi-β-Caryophyllene	[1.05]*	[0.50]*	Sesquiterpene
β-Acoradiene	[1.05]*	0.35	Sesquiterpene
Thujopsene isomer	[1.05]*	0.02	Sesquiterpene
β-Chamigrene	0.46	0.50	Sesquiterpene
Unknown	0.66*		Sesquiterpene
γ-Himachalene	[0.66]*	[0.16]*	Sesquiterpene
Widdra-2,4(14)-diene?	0.12	[0.14]*	Sesquiterpene
Unknown	0.44	0.16*	Sesquiterpene
ar-Curcumene	[0.44]	0.23	Sesquiterpene
Valencene	0.73	0.68	Sesquiterpene
α-Cuprenene	2.33*	[0.30]*	Sesquiterpene
Pseudowiddrene	[2.33]*	1.71	Sesquiterpene
α-Chamigrene	[2.33]*	[0.30]*	Sesquiterpene
β-Himachalene	[2.33]*	[1.00]*	Sesquiterpene
Cuparene	1.36	1.39*	Sesquiterpene
1,4-Dihydrocuparene	0.11	0.11	Sesquiterpene
α-Alaskene	0.33*	[0.16]*	Sesquiterpene
Unknown	[0.33]*	0.24	Sesquiterpene
γ-Cadinene	0.34	[0.71]*	Sesquiterpene
α-Dehydro-ar-himachalene	0.20*	[0.14]*	Sesquiterpene
β-Curcumene	[0.20]*	0.05	Sesquiterpene
δ-Cadinene	0.75*	[0.71]*	Sesquiterpene
γ-Dehydro-ar-himachalene	[0.75]*	0.05	Sesquiterpene
β-Sesquiphellandrene	[0.75]*	0.45*	Sesquiterpene
Unknown	0.53*		Oxygenated sesquiterpene
γ-Cuprenene	[0.53]*	[0.45]*	Sesquiterpene
(E)-γ-Bisabolene	[0.53]*	0.71	Sesquiterpene
ar-Himachalene	0.13	[0.14]*	Sesquiterpene
δ-Cuprenene epimer I	0.14	0.11	Sesquiterpene
δ-Cuprenene epimer II	0.18*	[1.39]*	Sesquiterpene
Unknown	[0.18]*	0.15*	Oxygenated sesquiterpene
8,14-Cedranoxide	[0.18]*	[0.14]*	Sesquiterpenic ether
Unknown	[0.18]*	0.02	Oxygenated sesquiterpene
Unknown	0.16		Oxygenated sesquiterpene
Caryophyllenyl alcohol	0.34*	0.17	Sesquiterpenic alcohol
Unknown	[0.34]*	0.05	Oxygenated sesquiterpene
Unknown	[0.34]*		Sesquiterpene
Caryophyllene oxide	0.13*	0.05	Sesquiterpenic ether

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Caryophyllene oxide isomer	[0.13]*	0.01	Sesquiterpenic ether
allo-Cedrol	1.17	25.74*	Sesquiterpenic alcohol
Widdrol	27.17*	2.03	Sesquiterpenic alcohol
α-Cedrol	[27.17]*	[25.74]*	Sesquiterpenic alcohol
β-Himachalene oxide	[27.17]*	0.02	Sesquiterpenic ether
epi-Cedrol	1.26*	0.72	Sesquiterpenic alcohol
Unknown	[1.26]*	0.04	Oxygenated sesquiterpene
10-epi-Cubenol	[1.26]*	[0.15]*	Sesquiterpenic alcohol
Unknown	0.08*	0.06	Oxygenated sesquiterpene
2-epi-α-Cedren-3-one	[0.08]*		Sesquiterpenic ketone
Unknown	1.43*	0.15	Oxygenated sesquiterpene
α-Acorenol	[1.43]*	1.01	Sesquiterpenic alcohol
β-Acorenol	[1.43]*	0.22	Sesquiterpenic alcohol
Unknown	0.96*		Oxygenated sesquiterpene
Unknown	[0.96]*	0.24	Oxygenated sesquiterpene
Himachalol	0.86*	0.34	Sesquiterpenic alcohol
Unknown	[0.86]*		Oxygenated sesquiterpene
Unknown	0.61		Oxygenated sesquiterpene
Cedrenol analog	0.93*	0.10	Sesquiterpenic alcohol
Unknown	[0.93]*	0.43	Oxygenated sesquiterpene
14-Hydroxy-9-epi-(E)-caryophyllene	0.10	0.16	Sesquiterpenic alcohol
Cedr-8-en-13-ol	0.33	0.05	Sesquiterpenic alcohol
α-Cedrenol	[0.33]*	0.13	Sesquiterpenic alcohol
epi-α-Bisabolol	[0.33]*	0.20	Sesquiterpenic alcohol
Unknown	0.10		Oxygenated sesquiterpene
Mayurone?	0.07	0.05	Norsesquiterpenic ketone
Unknown	0.64*		Oxygenated sesquiterpene
Thujopsenal	[0.64]*	0.04	Sesquiterpenic aldehyde
Thujopsenal analog	0.04	0.03	Sesquiterpenic aldehyde
Unknown	0.06		Oxygenated sesquiterpene
Cedryl acetate?	0.12		Sesquiterpenic ester
Unknown	0.02	0.05	Oxygenated sesquiterpene
Unknown	0.02	0.02	Oxygenated sesquiterpene
Unknown	0.13	0.08	Oxygenated sesquiterpene
Nootkatone analog	0.02	0.03	Sesquiterpenic ketone
Manool	0.02		Diterpenic alcohol
7,13-Abietadiene	0.01		Diterpene
Toluene		0.01*	Simple phenolic
Unknown		[0.01]*	Normonoterpene
Thujopsadiene?		0.03	Sesquiterpene
1,7-diepi-α-Cedrenal?		0.04	Sesquiterpenic aldehyde
β-Acoradienol?		0.02	Sesquiterpenic alcohol
<b>Total identified</b>	<b>87.41%</b>	<b>81.70%</b>	

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

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

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	%
Unknown [m/z 105, 79 (80), 91 (78), 77 (69), 78 (56), 93 (46), 120 (44)... 136 (4)]	2.84	916	0.02	2.63	1107	0.02
$\alpha$ -Pinene	3.02	928	0.19	1.42	991	0.20
Camphene	3.19*	940	0.04	1.77	1028	0.01
$\alpha$ -Fenchene	3.19*	940	[0.04]	1.70	1021	0.04
Thuja-2,4(10)-diene	3.31	947	0.03	2.38*	1085	0.03
Sabinene	3.64	969	0.01	2.38*	1085	[0.03]
$\alpha$ -Methylstyrene	3.78	978	0.02	5.05	1292	0.02
6-Methyl-5-hepten-2-one	3.90	986	0.01	5.22	1299	0.01
Myrcene	3.96	990	0.01			
$\alpha$ -Phellandrene	4.11	1000	0.01			
$\Delta$ 3-Carene	4.19	1005	0.03	2.68	1111	0.04
para-Cymene	4.44	1020	0.02	4.23	1230	0.03
Limonene	4.50	1024	0.01	3.29	1158	0.02
Terpinolene	5.50*	1085	0.02	4.42	1244	0.01
para-Cymenene	5.50*	1085	[0.02]	6.48	1390	0.01
$\alpha$ -Campholenal	6.03	1118	0.01	7.16	1439	0.01
<i>trans</i> -Pinocarveol	6.25*	1133	0.05	9.29	1600	0.06
Camphor	6.25*	1133	[0.05]	7.37*	1455	0.14
meta-Mentha-4,6-dien-8-ol	6.40	1142	0.01	9.43	1612	0.04
Pinocamphone	6.54	1151	0.01	7.37*	1455	[0.14]
Pinocarvone	6.56	1152	0.01	8.08	1507	0.01
Borneol	6.73	1163	0.02	9.94*	1653	1.00
$\alpha$ -Phellandren-8-ol	6.80	1167	0.02	10.32*	1683	0.30
Terpinen-4-ol	6.89	1173	0.04	8.68*	1554	0.19
meta-Cymen-8-ol	6.96	1177	0.01	11.66	1796	0.01
para-Cymen-8-ol	7.11*	1187	0.07	11.71*†	1800	0.14
$\alpha$ -Terpineol	7.11*	1187	[0.07]	9.94*	1653	[1.00]
$\gamma$ -Terpineol	7.16	1190	0.03	10.02*	1660	0.14
Myrtenol	7.21	1193	0.05	11.05	1745	0.07
Verbenone	7.30	1199	0.05	9.74*	1636	0.16
<i>trans</i> -Carveol	7.61	1219	0.01	11.60	1791	0.01
Carvacrol methyl ether	7.92	1239	0.03	8.68*	1554	[0.19]
Carvenone	8.05	1248	0.01	10.02*	1660	[0.14]
Bornyl acetate	8.47	1276	0.01	8.38*	1530	0.49
Carvacrol	9.11	1321	0.03	15.50	2153	0.10
$\alpha$ -Terpinyl acetate	9.44	1344	0.06	9.86	1646	0.21
African-1-ene	9.48	1347	0.02	7.01	1428	0.03
$\beta$ -Patchoulene	9.81*	1369	0.13	7.10	1435	0.03
2-epi- $\alpha$ -Funebrene	9.81*	1369	[0.13]	7.37*	1455	[0.14]
$\alpha$ -Duprezianene	9.89	1375	0.36	7.60	1472	0.27



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Isolongifolene	9.95*	1379	[0.04]	7.67	1476	0.01
β-Elemene	10.04	1385	0.37	8.57*	1545	0.59
α-Chamipinene	10.13*	1392	0.21	8.17*†	1514	9.15
Unknown [m/z 107, 91 (86), 93 (83), 79 (81), 162 (74), 41 (73), 133 (72)... 204 (13)]	10.13*	1392	[0.21]	8.33	1527	0.04
α-Cedrene	10.28	1402	9.54	8.17*†	1514	[9.15]
β-Cedrene	10.38*	1409	3.18	8.50	1540	2.45
β-Funebrene	10.38*	1409	[3.18]	8.26	1522	0.22
Unknown [m/z 118, 69 (82), 91 (51), 117 (40)... 202 (25)]	10.38*	1409	[3.18]	9.08*	1584	0.49
β-Duprezianene	10.38*	1409	[3.18]	8.38*	1530	[0.49]
cis-Thujopsene	10.58*	1424	35.56	8.89	1570	35.37
β-Caryophyllene	10.58*	1424	[35.56]	8.68*	1554	[0.19]
(Z)-β-Farnesene?	10.61	1426	0.14	9.39	1609	0.07
Isobazzanene	10.66*	1430	0.05	8.68*	1554	[0.19]
trans-α-Bergamotene	10.66*	1430	[0.05]	8.57*	1545	[0.59]
Prezizaene	10.72	1434	0.12	8.94	1573	0.13
α-Himachalene	10.77*	1437	0.61	9.08*	1584	[0.49]
7,8-Dehydro-α-acoradiene?	10.77*	1437	[0.61]	9.72*†	1635	0.44
α-Humulene	10.84*	1443	0.10	9.50*	1617	0.50
Cadina-4,11-diene	10.84*	1443	[0.10]	9.35	1606	0.06
α-Acoradiene	10.95	1451	0.24	9.50*	1617	[0.50]
(E)-β-Farnesene	11.00*†	1455	1.05	9.72*†	1635	[0.44]
9-epi-β-Caryophyllene	11.00*†	1455	[1.05]	9.50*	1617	[0.50]
β-Acoradiene	11.05*†	1458	[1.05]	9.57	1624	0.35
Thujopsene isomer	11.05*†	1458	[1.05]	9.62	1628	0.02
β-Chamigrene	11.15	1466	0.46	9.78	1640	0.50
Unknown [m/z 91, 105 (93), 161 (77), 93 (73), 119 (71), 133 (69)... 204 (31)]	11.18*	1467	0.66			
γ-Himachalene	11.18*	1467	[0.66]	9.74*	1636	[0.16]
Widdra-2,4(14)-diene?	11.24	1472	0.12	10.02*	1660	[0.14]
Unknown [m/z 189, 91 (95), 105 (93), 133 (84), 119 (75), 41 (59), 93 (46)... 204 (33)]	11.30†	1477	0.44	10.10*	1666	0.16
ar-Curcumene	11.33†	1479	[0.44]	10.82	1725	0.23
Valencene	11.44	1486	0.73	10.06	1663	0.68
α-Cuprenene	11.50*	1491	2.33	10.32*	1683	[0.30]
Pseudowiddrene	11.50*	1491	[2.33]	10.21	1674	1.71
α-Chamigrene	11.50*	1491	[2.33]	10.32*	1683	[0.30]
β-Himachalene	11.50*	1491	[2.33]	9.94*	1653	[1.00]

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Cuparene	11.56	1495	1.36	11.22*	1759	1.39
1,4-Dihydrocuparene	11.61	1499	0.11	10.64	1710	0.11
$\alpha$ -Alaskene	11.66*	1503	0.33	10.10*	1666	[0.16]
Unknown [m/z 121, 123 (45), 91 (24), 107 (24), 122(24), 95 (23)... 204 (11)]	11.66*	1503	[0.33]	10.47	1696	0.24
$\gamma$ -Cadinene	11.70	1506	0.34	10.58*†	1705	[0.71]
$\alpha$ -Dehydro-arhimachalene	11.72*	1508	0.20	11.71*†	1800	[0.14]
$\beta$ -Curcumene	11.72*	1508	[0.20]	10.42	1691	0.05
$\delta$ -Cadinene	11.86*†	1518	0.75	10.58*†	1705	[0.71]
$\gamma$ -Dehydro-arhimachalene	11.86*†	1518	[0.75]	12.08	1833	0.05
$\beta$ -Sesquiphellandrene	11.86*†	1518	[0.75]	10.78*†	1722	0.45
Unknown [m/z 91, 107 (97), 105 (93), 41 (92), 109 (78), 43 (78), 121 (76), 135 (75)... 220 (21)]	11.94*†	1525	0.53			
$\gamma$ -Cuprenene	11.94*†	1525	[0.53]	10.78*†	1722	[0.45]
( <i>E</i> )- $\gamma$ -Bisabolene	11.94*†	1525	[0.53]	10.55†	1702	0.71
ar-Himachalene	12.01	1530	0.13	11.76*†	1805	[0.14]
$\delta$ -Cuprenene epimer I	12.04	1532	0.14	11.13	1751	0.11
$\delta$ -Cuprenene epimer II	12.10*	1537	0.18	11.22*	1759	[1.39]
Unknown [m/z 43, 95 (81), 207 (61), 41 (55), 55 (50)... 222 (3)]	12.10*	1537	[0.18]	14.02*	2010	0.15
8,14-Cedranoxide	12.10*	1537	[0.18]	11.76*†	1805	[0.14]
Unknown [m/z 106, 41 (86), 43 (84), 149 (75), 69 (75), 91 (63), 93 (61)... 220 (1)]	12.10*	1537	[0.18]	11.59	1790	0.02
Unknown [m/z 91, 119 (98), 121 (91), 105 (85), 43 (82), 41 (76)... 205 (37), 220 (16)]	12.24	1547	0.16			
Caryophyllenyl alcohol	12.44*	1563	0.34	13.78	1986	0.17
Unknown [m/z 95, 191 (52), 107(50), 121 (32), 81 (31)...]	12.44*	1563	[0.34]	14.33	2039	0.05
Unknown [m/z 95, 131 (96), 202(64), 187 (61), 159(55), 105 (50)...202 (64)]	12.44*	1563	[0.34]			

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Caryophyllene oxide	12.55*	1572	0.13	12.93	1909	0.05
Caryophyllene oxide isomer	12.55*	1572	[0.13]	12.88	1904	0.01
allo-Cedrol	12.70	1583	1.17	14.46*	2051	25.74
Widdrol	12.91*	1599	27.17	14.80	2084	2.03
α-Cedrol	12.91*	1599	[27.17]	14.46*	2051	[25.74]
β-Himachalene oxide	12.91*	1599	[27.17]	13.33	1945	0.02
epi-Cedrol	13.02*	1608	1.26	14.96	2100	0.72
Unknown [m/z 138, 110 (77), 137 (75), 107 (62), 91 (61), 93 (60), 109 (57)... 220 (34)]	13.02*	1608	[1.26]	13.61	1971	0.04
10-epi-Cubenol	13.02*	1608	[1.26]	14.02*	2010	[0.15]
Unknown [m/z 107, 41 (86), 123 (85), 82 (79), 95 (77), 93 (76), 91 (73), 69 (71)... 220 (13)]	13.13*	1618	0.08	14.84	2088	0.06
2-epi-α-Cedren-3-one	13.13*	1618	[0.08]			
Unknown [m/z 132, 175 (22), 119(18), 91 (18), 157 (18)... 219 (10)]	13.22*	1625	1.43	15.80	2183	0.15
α-Acorenol	13.22*	1625	[1.43]	14.64	2069	1.01
β-Acorenol	13.22*	1625	[1.43]	15.04	2107	0.22
Unknown [m/z 132, 91 (24), 119 (22), 105 (21), 133(17), 117 (16)... 219 (3)]	13.28*	1630	0.96			
Unknown [m/z 105, 93 (78), 95 (75), 131 (72), 119 (71), 132 (70), 91 (67), 120 (49)... 202 (39), 220 (9)]	13.28*	1630	[0.96]	16.00	2203	0.24
Himachalol	13.40*	1640	0.86	15.35	2139	0.34
Unknown [m/z 123, 81 (77), 95 (77), 107 (72), 41 (72), 93 (66), 55 (64)... 220? (13)]	13.40*	1640	[0.86]			
Unknown [m/z 41, 91 (96), 79 (88), 69 (82), 123 (80), 93 (80)... 220 (8)]	13.44	1643	0.61			
Cedrenol analog	13.55*	1652	0.93	16.66	2271	0.10
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79	13.55*	1652	[0.93]	15.58	2161	0.43

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(58)... 204 (48), 220 (2)]						
14-Hydroxy-9-epi-(E)-caryophyllene	13.62	1658	0.10	16.60	2266	0.16
Cedr-8-en-13-ol	13.89†	1680	0.33	17.11	2320	0.05
α-Cedrenol	13.94*†	1683	[0.33]	17.24	2333	0.13
epi-α-Bisabolol	13.94*†	1683	[0.33]	15.65	2168	0.20
Unknown [m/z 91, 105 (87), 123(74), 135 (70), 107(60), 79 (59)... 220 (13)]	13.99	1688	0.10			
Mayurone?	14.04	1692	0.07	17.30	2340	0.05
Unknown [m/z 105, 69 (77), 91 (66), 119 (65), 111 (56), 107 (45), 55 (45)... 220? (2)]	14.09*	1696	0.64			
Thujopsenal	14.09*	1696	[0.64]	16.06	2210	0.04
Thujopsenal analog	14.48	1729	0.04	17.65	2378	0.03
Unknown [m/z 105, 91 (83), 79 (78), 135 (67), 107 (56), 67 (53)... 220 (9)]	14.63	1742	0.06			
Cedryl acetate?	14.73	1751	0.12			
Unknown [m/z 91, 105 (74), 93 (67), 79 (59), 133 (54), 41 (47), 107 (46)...]	14.86	1762	0.02	18.57	2480	0.05
Unknown [m/z 189, 91 (48), 133(40), 105 (40), 41(34), 187 (34)... 220 (5)]	15.14	1786	0.02	18.79	2505	0.02
Unknown [m/z 121, 136 (53), 91 (22), 93 (19), 79 (15), 105 (13)... 220 (3)]	15.21	1792	0.13	18.73	2498	0.08
Nootkatone analog	15.43	1811	0.02	18.12	2429	0.03
Manool	17.94	2047	0.02			
7,13-Abietadiene	18.16	2068	0.01			
Toluene				1.52*	1004	0.01
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]				1.52*	1004	[0.01]
Thujopsadiene?				10.38	1688	0.03
1,7-diepi-α-Cedrenal?				15.32	2135	0.04
β-Acoradienol?				18.30	2449	0.02
<b>Total identified</b>		<b>87.41%</b>			<b>81.70%</b>	
<b>Total reported</b>		<b>95.14%</b>			<b>89.64%</b>	

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

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[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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index

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INTERNATIONAL GROUP

**Date :** June 7, 2020

**Lot #:** YL19419

## *CERTIFICATE OF ANALYSIS – GC PROFILING*

### *SAMPLE IDENTIFICATION*

**Customer identification :** Ylang Ylang Oil- 171040105

**Type :** Essential oil

**Source :** *Cananga odorata*

### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Yellow liquid

**Refractive index:** 1.5605 ± 0.0003 (20 °C)

ISO 4725:2004 – Ylang Ylang Oil

Compound	Min. %	Max. %	Observed %	Complies?
Prenyl acetate	4	10	9	Yes
p-methylanisole	0.2	2	1.1	Yes
α-Pinene	0.2	1.5	0.6	Yes
Linalool	48	66	51	Yes
Geraniol	tr	4	1.1	Yes
B-Caryophyllene	tr	30	2.1	Yes
<b>Refractive index</b>	1.6550	1.6850	1.6620	Yes

### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for Ylang Ylang oil, and the oil features the characteristic composition for *Cananga odorata* oil.

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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Prenyl acetate	tr	tr	Aliphatic aldehyde
p-methylanisole	0.02	0.06	Aliphatic aldehyde
a-Pinene	0.01	tr	Furan
Linalool	0.18	0.19	Aliphatic alcohol
Geraniol	0.01	0.01	Aliphatic alcohol
Octanol	0.04	0.06	Monoterpene
Sabinene	0.02	tr	Normonoterpene
6-Methyl-5-hepten-2-one	0.01	0.01	Aliphatic ketone
Myrcene	0.05		Monoterpene
α-Phellandrene	0.01		Monoterpene
Δ3-Carene	0.03	0.04	Monoterpene
para-Cymene	0.02	0.03	Monoterpene
Limonene	0.01	0.02	Monoterpene
1,8-Cineole	0.02*	0.01	Monoterpene
para-Cymenene	[0.02]*	0.01	Monoterpene
α-Campholenal	0.01	0.01	Monoterpenic aldehyde
trans-Pinocarveol	0.05*	0.06	Monoterpenic alcohol
Camphor	[0.05]*	0.14*	Monoterpenic ketone
meta-Mentha-4,6-dien-8-ol	0.01	0.04	Monoterpenic alcohol
Pinocamphone	0.01	[0.14]*	Monoterpenic ketone
Pinocarvone	0.01	0.01	Monoterpenic ketone
Borneol	0.02	1.00*	Monoterpenic alcohol
α-Phellandren-8-ol	0.02	0.30*	Monoterpenic alcohol
Terpinen-4-ol	0.04	0.19*	Monoterpenic alcohol
meta-Cymen-8-ol	0.01	0.01	Monoterpenic alcohol
para-Cymen-8-ol	0.07*	0.14*	Monoterpenic alcohol
α-Terpineol	[0.07]*	[1.00]*	Monoterpenic alcohol
γ-Terpineol	0.03	0.14*	Monoterpenic alcohol
Myrtenol	0.05	0.07	Monoterpenic alcohol
Verbenone	0.05	0.16*	Monoterpenic ketone
trans-Carveol	0.01	0.01	Monoterpenic alcohol
Carvacrol methyl ether	0.03	[0.19]*	Monoterpenic ether
Carvenone	0.01	[0.14]*	Monoterpenic ketone
Bornyl acetate	0.01	0.49*	Monoterpenic ester
Carvacrol	0.03	0.10	Monoterpenic alcohol
α-Terpinyl acetate	0.06	0.21	Monoterpenic ester
African-1-ene	0.02	0.03	Sesquiterpene
β-Patchoulene	0.13*	0.03	Sesquiterpene
2-epi-α-Funebrene	[0.13]*	[0.14]*	Sesquiterpene
α-Duprezianene	0.36	0.27	Sesquiterpene
7-epi-Sesquithujene?	0.04*	0.07	Sesquiterpene
Isolongifolene	[0.04]*	0.01	Sesquiterpene
β-Elemene	0.37	0.59*	Sesquiterpene
α-Chamipinene	0.21*	9.15*	Sesquiterpene
Unknown	[0.21]*	0.04	Sesquiterpene
α-Cedrene	9.54	[9.15]*	Sesquiterpene
β-Cedrene	3.18*	2.45	Sesquiterpene
β-Funebrene	[3.18]*	0.22	Sesquiterpene



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Unknown	[3.18]*	0.49*	Sesquiterpene
β-Duprezianene	[3.18]*	[0.49]*	Sesquiterpene
cis-Thujopsene	35.56*	35.37	Sesquiterpene
β-Caryophyllene	[35.56]*	[0.19]*	Sesquiterpene
(Z)-β-Farnesene?	0.14	0.07	Sesquiterpene
Isobazzanene	0.05*	[0.19]*	Sesquiterpene
trans-α-Bergamotene	[0.05]*	[0.59]*	Sesquiterpene
Prezizaene	0.12	0.13	Sesquiterpene
α-Himachalene	0.61*	[0.49]*	Sesquiterpene
7,8-Dehydro-α-acoradiene?	[0.61]*	0.44*	Sesquiterpene
α-Humulene	0.10*	0.50*	Sesquiterpene
Cadina-4,11-diene	[0.10]*	0.06	Sesquiterpene
α-Acoradiene	0.24	[0.50]*	Sesquiterpene
(E)-β-Farnesene	1.05*	[0.44]*	Sesquiterpene
9-epi-β-Caryophyllene	[1.05]*	[0.50]*	Sesquiterpene
β-Acoradiene	[1.05]*	0.35	Sesquiterpene
Thujopsene isomer	[1.05]*	0.02	Sesquiterpene
β-Chamigrene	0.46	0.50	Sesquiterpene
Unknown	0.66*		Sesquiterpene
γ-Himachalene	[0.66]*	[0.16]*	Sesquiterpene
Widdra-2,4(14)-diene?	0.12	[0.14]*	Sesquiterpene
Unknown	0.44	0.16*	Sesquiterpene
ar-Curcumene	[0.44]	0.23	Sesquiterpene
Valencene	0.73	0.68	Sesquiterpene
α-Cuprenene	2.33*	[0.30]*	Sesquiterpene
Pseudowiddrene	[2.33]*	1.71	Sesquiterpene
α-Chamigrene	[2.33]*	[0.30]*	Sesquiterpene
β-Himachalene	[2.33]*	[1.00]*	Sesquiterpene
Cuparene	1.36	1.39*	Sesquiterpene
1,4-Dihydrocuparene	0.11	0.11	Sesquiterpene
α-Alaskene	0.33*	[0.16]*	Sesquiterpene
Unknown	[0.33]*	0.24	Sesquiterpene
γ-Cadinene	0.34	[0.71]*	Sesquiterpene
α-Dehydro-ar-himachalene	0.20*	[0.14]*	Sesquiterpene
β-Curcumene	[0.20]*	0.05	Sesquiterpene
δ-Cadinene	0.75*	[0.71]*	Sesquiterpene
γ-Dehydro-ar-himachalene	[0.75]*	0.05	Sesquiterpene
β-Sesquiphellandrene	[0.75]*	0.45*	Sesquiterpene
Unknown	0.53*		Oxygenated sesquiterpene
γ-Cuprenene	[0.53]*	[0.45]*	Sesquiterpene
(E)-γ-Bisabolene	[0.53]*	0.71	Sesquiterpene
ar-Himachalene	0.13	[0.14]*	Sesquiterpene
δ-Cuprenene epimer I	0.14	0.11	Sesquiterpene
δ-Cuprenene epimer II	0.18*	[1.39]*	Sesquiterpene
Unknown	[0.18]*	0.15*	Oxygenated sesquiterpene
8,14-Cedranoxide	[0.18]*	[0.14]*	Sesquiterpenic ether
Unknown	[0.18]*	0.02	Oxygenated sesquiterpene
Unknown	0.16		Oxygenated sesquiterpene
Caryophyllenyl alcohol	0.34*	0.17	Sesquiterpenic alcohol
Unknown	[0.34]*	0.05	Oxygenated sesquiterpene
Unknown	[0.34]*		Sesquiterpene
Caryophyllene oxide	0.13*	0.05	Sesquiterpenic ether

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Caryophyllene oxide isomer	[0.13]*	0.01	Sesquiterpenic ether
allo-Cedrol	1.17	25.74*	Sesquiterpenic alcohol
Widdrol	27.17*	2.03	Sesquiterpenic alcohol
α-Cedrol	[27.17]*	[25.74]*	Sesquiterpenic alcohol
β-Himachalene oxide	[27.17]*	0.02	Sesquiterpenic ether
epi-Cedrol	1.26*	0.72	Sesquiterpenic alcohol
Unknown	[1.26]*	0.04	Oxygenated sesquiterpene
10-epi-Cubenol	[1.26]*	[0.15]*	Sesquiterpenic alcohol
Unknown	0.08*	0.06	Oxygenated sesquiterpene
2-epi-α-Cedren-3-one	[0.08]*		Sesquiterpenic ketone
Unknown	1.43*	0.15	Oxygenated sesquiterpene
α-Acorenol	[1.43]*	1.01	Sesquiterpenic alcohol
β-Acorenol	[1.43]*	0.22	Sesquiterpenic alcohol
Unknown	0.96*		Oxygenated sesquiterpene
Unknown	[0.96]*	0.24	Oxygenated sesquiterpene
Himachalol	0.86*	0.34	Sesquiterpenic alcohol
Unknown	[0.86]*		Oxygenated sesquiterpene
Unknown	0.61		Oxygenated sesquiterpene
Cedrenol analog	0.93*	0.10	Sesquiterpenic alcohol
Unknown	[0.93]*	0.43	Oxygenated sesquiterpene
14-Hydroxy-9-epi-(E)-caryophyllene	0.10	0.16	Sesquiterpenic alcohol
Cedr-8-en-13-ol	0.33	0.05	Sesquiterpenic alcohol
α-Cedrenol	[0.33]*	0.13	Sesquiterpenic alcohol
epi-α-Bisabolol	[0.33]*	0.20	Sesquiterpenic alcohol
Unknown	0.10		Oxygenated sesquiterpene
Mayurone?	0.07	0.05	Norsesquiterpenic ketone
Unknown	0.64*		Oxygenated sesquiterpene
Thujopsenal	[0.64]*	0.04	Sesquiterpenic aldehyde
Thujopsenal analog	0.04	0.03	Sesquiterpenic aldehyde
Unknown	0.06		Oxygenated sesquiterpene
Cedryl acetate?	0.12		Sesquiterpenic ester
Unknown	0.02	0.05	Oxygenated sesquiterpene
Unknown	0.02	0.02	Oxygenated sesquiterpene
Unknown	0.13	0.08	Oxygenated sesquiterpene
Nootkatone analog	0.02	0.03	Sesquiterpenic ketone
Manool	0.02		Diterpenic alcohol
7,13-Abietadiene	0.01		Diterpene
Toluene		0.01*	Simple phenolic
Unknown		[0.01]*	Normonoterpene
Thujopsadiene?		0.03	Sesquiterpene
1,7-diepi-α-Cedrenal?		0.04	Sesquiterpenic aldehyde
β-Acoradienol?		0.02	Sesquiterpenic alcohol
<b>Total identified</b>	<b>96.83%</b>	<b>97.00%</b>	

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

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

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	%
Unknown [m/z 105, 79 (80), 91 (78), 77 (69), 78 (56), 93 (46), 120 (44)... 136 (4)]	2.84	916	0.02	2.63	1107	0.02
$\alpha$ -Pinene	3.02	928	0.19	1.42	991	0.20
Camphene	3.19*	940	0.04	1.77	1028	0.01
$\alpha$ -Fenchene	3.19*	940	[0.04]	1.70	1021	0.04
Thuja-2,4(10)-diene	3.31	947	0.03	2.38*	1085	0.03
Sabinene	3.64	969	0.01	2.38*	1085	[0.03]
$\alpha$ -Methylstyrene	3.78	978	0.02	5.05	1292	0.02
6-Methyl-5-hepten-2-one	3.90	986	0.01	5.22	1299	0.01
Myrcene	3.96	990	0.01			
$\alpha$ -Phellandrene	4.11	1000	0.01			
$\Delta$ 3-Carene	4.19	1005	0.03	2.68	1111	0.04
para-Cymene	4.44	1020	0.02	4.23	1230	0.03
Limonene	4.50	1024	0.01	3.29	1158	0.02
Terpinolene	5.50*	1085	0.02	4.42	1244	0.01
para-Cymenene	5.50*	1085	[0.02]	6.48	1390	0.01
$\alpha$ -Campholenal	6.03	1118	0.01	7.16	1439	0.01
<i>trans</i> -Pinocarveol	6.25*	1133	0.05	9.29	1600	0.06
Camphor	6.25*	1133	[0.05]	7.37*	1455	0.14
meta-Mentha-4,6-dien-8-ol	6.40	1142	0.01	9.43	1612	0.04
Pinocamphone	6.54	1151	0.01	7.37*	1455	[0.14]
Pinocarvone	6.56	1152	0.01	8.08	1507	0.01
Borneol	6.73	1163	0.02	9.94*	1653	1.00
$\alpha$ -Phellandren-8-ol	6.80	1167	0.02	10.32*	1683	0.30
Terpinen-4-ol	6.89	1173	0.04	8.68*	1554	0.19
meta-Cymen-8-ol	6.96	1177	0.01	11.66	1796	0.01
para-Cymen-8-ol	7.11*	1187	0.07	11.71*†	1800	0.14
$\alpha$ -Terpineol	7.11*	1187	[0.07]	9.94*	1653	[1.00]
$\gamma$ -Terpineol	7.16	1190	0.03	10.02*	1660	0.14
Myrtenol	7.21	1193	0.05	11.05	1745	0.07
Verbenone	7.30	1199	0.05	9.74*	1636	0.16
<i>trans</i> -Carveol	7.61	1219	0.01	11.60	1791	0.01
Carvacrol methyl ether	7.92	1239	0.03	8.68*	1554	[0.19]
Carvenone	8.05	1248	0.01	10.02*	1660	[0.14]
Bornyl acetate	8.47	1276	0.01	8.38*	1530	0.49
Carvacrol	9.11	1321	0.03	15.50	2153	0.10
$\alpha$ -Terpinyl acetate	9.44	1344	0.06	9.86	1646	0.21
African-1-ene	9.48	1347	0.02	7.01	1428	0.03
$\beta$ -Patchoulene	9.81*	1369	0.13	7.10	1435	0.03
2-epi- $\alpha$ -Funebrene	9.81*	1369	[0.13]	7.37*	1455	[0.14]
$\alpha$ -Duprezianene	9.89	1375	0.36	7.60	1472	0.27

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Isolongifolene	9.95*	1379	[0.04]	7.67	1476	0.01
β-Elemene	10.04	1385	0.37	8.57*	1545	0.59
α-Chamipinene	10.13*	1392	0.21	8.17*†	1514	9.15
Unknown [m/z 107, 91 (86), 93 (83), 79 (81), 162 (74), 41 (73), 133 (72)... 204 (13)]	10.13*	1392	[0.21]	8.33	1527	0.04
α-Cedrene	10.28	1402	9.54	8.17*†	1514	[9.15]
β-Cedrene	10.38*	1409	3.18	8.50	1540	2.45
β-Funebrene	10.38*	1409	[3.18]	8.26	1522	0.22
Unknown [m/z 118, 69 (82), 91 (51), 117 (40)... 202 (25)]	10.38*	1409	[3.18]	9.08*	1584	0.49
β-Duprezianene	10.38*	1409	[3.18]	8.38*	1530	[0.49]
cis-Thujopsene	10.58*	1424	35.56	8.89	1570	35.37
β-Caryophyllene	10.58*	1424	[35.56]	8.68*	1554	[0.19]
(Z)-β-Farnesene?	10.61	1426	0.14	9.39	1609	0.07
Isobazzanene	10.66*	1430	0.05	8.68*	1554	[0.19]
trans-α-Bergamotene	10.66*	1430	[0.05]	8.57*	1545	[0.59]
Prezizaene	10.72	1434	0.12	8.94	1573	0.13
α-Himachalene	10.77*	1437	0.61	9.08*	1584	[0.49]
7,8-Dehydro-α-acoradiene?	10.77*	1437	[0.61]	9.72*†	1635	0.44
α-Humulene	10.84*	1443	0.10	9.50*	1617	0.50
Cadina-4,11-diene	10.84*	1443	[0.10]	9.35	1606	0.06
α-Acoradiene	10.95	1451	0.24	9.50*	1617	[0.50]
(E)-β-Farnesene	11.00*†	1455	1.05	9.72*†	1635	[0.44]
9-epi-β-Caryophyllene	11.00*†	1455	[1.05]	9.50*	1617	[0.50]
β-Acoradiene	11.05*†	1458	[1.05]	9.57	1624	0.35
Thujopsene isomer	11.05*†	1458	[1.05]	9.62	1628	0.02
β-Chamigrene	11.15	1466	0.46	9.78	1640	0.50
Unknown [m/z 91, 105 (93), 161 (77), 93 (73), 119 (71), 133 (69)... 204 (31)]	11.18*	1467	0.66			
γ-Himachalene	11.18*	1467	[0.66]	9.74*	1636	[0.16]
Widdra-2,4(14)-diene?	11.24	1472	0.12	10.02*	1660	[0.14]
Unknown [m/z 189, 91 (95), 105 (93), 133 (84), 119 (75), 41 (59), 93 (46)... 204 (33)]	11.30†	1477	0.44	10.10*	1666	0.16
ar-Curcumene	11.33†	1479	[0.44]	10.82	1725	0.23
Valencene	11.44	1486	0.73	10.06	1663	0.68
α-Cuprenene	11.50*	1491	2.33	10.32*	1683	[0.30]
Pseudowiddrene	11.50*	1491	[2.33]	10.21	1674	1.71
α-Chamigrene	11.50*	1491	[2.33]	10.32*	1683	[0.30]
β-Himachalene	11.50*	1491	[2.33]	9.94*	1653	[1.00]

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Cuparene	11.56	1495	1.36	11.22*	1759	1.39
1,4-Dihydrocuparene	11.61	1499	0.11	10.64	1710	0.11
$\alpha$ -Alaskene	11.66*	1503	0.33	10.10*	1666	[0.16]
Unknown [m/z 121, 123 (45), 91 (24), 107 (24), 122(24), 95 (23)... 204 (11)]	11.66*	1503	[0.33]	10.47	1696	0.24
$\gamma$ -Cadinene	11.70	1506	0.34	10.58*†	1705	[0.71]
$\alpha$ -Dehydro-arhimachalene	11.72*	1508	0.20	11.71*†	1800	[0.14]
$\beta$ -Curcumene	11.72*	1508	[0.20]	10.42	1691	0.05
$\delta$ -Cadinene	11.86*†	1518	0.75	10.58*†	1705	[0.71]
$\gamma$ -Dehydro-arhimachalene	11.86*†	1518	[0.75]	12.08	1833	0.05
$\beta$ -Sesquiphellandrene	11.86*†	1518	[0.75]	10.78*†	1722	0.45
Unknown [m/z 91, 107 (97), 105 (93), 41 (92), 109 (78), 43 (78), 121 (76), 135 (75)... 220 (21)]	11.94*†	1525	0.53			
$\gamma$ -Cuprenene	11.94*†	1525	[0.53]	10.78*†	1722	[0.45]
(E)- $\gamma$ -Bisabolene	11.94*†	1525	[0.53]	10.55†	1702	0.71
ar-Himachalene	12.01	1530	0.13	11.76*†	1805	[0.14]
$\delta$ -Cuprenene epimer I	12.04	1532	0.14	11.13	1751	0.11
$\delta$ -Cuprenene epimer II	12.10*	1537	0.18	11.22*	1759	[1.39]
Unknown [m/z 43, 95 (81), 207 (61), 41 (55), 55 (50)... 222 (3)]	12.10*	1537	[0.18]	14.02*	2010	0.15
8,14-Cedranoxide	12.10*	1537	[0.18]	11.76*†	1805	[0.14]
Unknown [m/z 106, 41 (86), 43 (84), 149 (75), 69 (75), 91 (63), 93 (61)... 220 (1)]	12.10*	1537	[0.18]	11.59	1790	0.02
Unknown [m/z 91, 119 (98), 121 (91), 105 (85), 43 (82), 41 (76)... 205 (37), 220 (16)]	12.24	1547	0.16			
Caryophyllenyl alcohol	12.44*	1563	0.34	13.78	1986	0.17
Unknown [m/z 95, 191 (52), 107(50), 121 (32), 81 (31)...]	12.44*	1563	[0.34]	14.33	2039	0.05
Unknown [m/z 95, 131 (96), 202(64), 187 (61), 159(55), 105 (50)...202 (64)]	12.44*	1563	[0.34]			

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Caryophyllene oxide	12.55*	1572	0.13	12.93	1909	0.05
Caryophyllene oxide isomer	12.55*	1572	[0.13]	12.88	1904	0.01
allo-Cedrol	12.70	1583	1.17	14.46*	2051	25.74
Widdrol	12.91*	1599	27.17	14.80	2084	2.03
$\alpha$ -Cedrol	12.91*	1599	[27.17]	14.46*	2051	[25.74]
$\beta$ -Himachalene oxide	12.91*	1599	[27.17]	13.33	1945	0.02
epi-Cedrol	13.02*	1608	1.26	14.96	2100	0.72
Unknown [m/z 138, 110 (77), 137 (75), 107 (62), 91 (61), 93 (60), 109 (57)... 220 (34)]	13.02*	1608	[1.26]	13.61	1971	0.04
10-epi-Cubenol	13.02*	1608	[1.26]	14.02*	2010	[0.15]
Unknown [m/z 107, 41 (86), 123 (85), 82 (79), 95 (77), 93 (76), 91 (73), 69 (71)... 220 (13)]	13.13*	1618	0.08	14.84	2088	0.06
2-epi- $\alpha$ -Cedren-3-one	13.13*	1618	[0.08]			
Unknown [m/z 132, 175 (22), 119(18), 91 (18), 157 (18)... 219 (10)]	13.22*	1625	1.43	15.80	2183	0.15
$\alpha$ -Acorenol	13.22*	1625	[1.43]	14.64	2069	1.01
$\beta$ -Acorenol	13.22*	1625	[1.43]	15.04	2107	0.22
Unknown [m/z 132, 91 (24), 119 (22), 105 (21), 133(17), 117 (16)... 219 (3)]	13.28*	1630	0.96			
Unknown [m/z 105, 93 (78), 95 (75), 131 (72), 119 (71), 132 (70), 91 (67), 120 (49)... 202 (39), 220 (9)]	13.28*	1630	[0.96]	16.00	2203	0.24
Himachalol	13.40*	1640	0.86	15.35	2139	0.34
Unknown [m/z 123, 81 (77), 95 (77), 107 (72), 41 (72), 93 (66), 55 (64)... 220? (13)]	13.40*	1640	[0.86]			
Unknown [m/z 41, 91 (96), 79 (88), 69 (82), 123 (80), 93 (80)... 220 (8)]	13.44	1643	0.61			
Cedrenol analog	13.55*	1652	0.93	16.66	2271	0.10
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79	13.55*	1652	[0.93]	15.58	2161	0.43

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(58)... 204 (48), 220 (2)]						
14-Hydroxy-9-epi-(E)-caryophyllene	13.62	1658	0.10	16.60	2266	0.16
Cedr-8-en-13-ol	13.89†	1680	0.33	17.11	2320	0.05
α-Cedrenol	13.94*†	1683	[0.33]	17.24	2333	0.13
epi-α-Bisabolol	13.94*†	1683	[0.33]	15.65	2168	0.20
Unknown [m/z 91, 105 (87), 123(74), 135 (70), 107(60), 79 (59)... 220 (13)]	13.99	1688	0.10			
Mayurone?	14.04	1692	0.07	17.30	2340	0.05
Unknown [m/z 105, 69 (77), 91 (66), 119 (65), 111 (56), 107 (45), 55 (45)... 220? (2)]	14.09*	1696	0.64			
Thujopsenal	14.09*	1696	[0.64]	16.06	2210	0.04
Thujopsenal analog	14.48	1729	0.04	17.65	2378	0.03
Unknown [m/z 105, 91 (83), 79 (78), 135 (67), 107 (56), 67 (53)... 220 (9)]	14.63	1742	0.06			
Cedryl acetate?	14.73	1751	0.12			
Unknown [m/z 91, 105 (74), 93 (67), 79 (59), 133 (54), 41 (47), 107 (46)...]	14.86	1762	0.02	18.57	2480	0.05
Unknown [m/z 189, 91 (48), 133(40), 105 (40), 41(34), 187 (34)... 220 (5)]	15.14	1786	0.02	18.79	2505	0.02
Unknown [m/z 121, 136 (53), 91 (22), 93 (19), 79 (15), 105 (13)... 220 (3)]	15.21	1792	0.13	18.73	2498	0.08
Nootkatone analog	15.43	1811	0.02	18.12	2429	0.03
Manool	17.94	2047	0.02			
7,13-Abietadiene	18.16	2068	0.01			
Toluene				1.52*	1004	0.01
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]				1.52*	1004	[0.01]
Thujopsadiene?				10.38	1688	0.03
1,7-diepi-α-Cedrenal?				15.32	2135	0.04
β-Acoradienol?				18.30	2449	0.02
<b>Total identified</b>		<b>87.41%</b>			<b>81.70%</b>	
<b>Total reported</b>		<b>95.14%</b>			<b>89.64%</b>	

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

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[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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index



# VITAL'S™

INTERNATIONAL GROUP

**Date :** June 10, 2020

**Lot #:** BO11019

## *CERTIFICATE OF ANALYSIS – GC PROFILING*

### *SAMPLE IDENTIFICATION*

**Customer identification :** Basil Oil- 191240897

**Type :** Essential oil

**Source :** *Ocimum basilicum*

### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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## INTERNATIONAL GROUP

### PHYSICOCHEMICAL DATA

**Physical aspect:** Faintly yellow liquid

**Refractive index:** 1.4745 ± 0.0003 (20 °C)

### ISO 4725:2004 – Basil Oil

Compound	Min. %	Max. %	Observed %	Complies?
1,8-Cineole	2	8	8	Yes
Trans- β-Ocimene	0.2	2	0.6	Yes
Camphor	0.2	1.5	0.5	Yes
Linalool	45	62	50	Yes
Terpinen-4-ol	tr	4	0.6	Yes
Methylchavicol	tr	30	0.7	Yes
Eugenol	2	15	3.7	Yes
<b>Refractive index</b>	1.4750	1.4950	1.4785	Yes

### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for Basil oil, and the oil features the characteristic composition for *Ocimum basilicum* oil.

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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Isovaleral	tr	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	0.05	Aliphatic aldehyde
2-Ethylfuran	0.01	tr	Furan
Isoamyl alcohol	0.16	0.16	Aliphatic alcohol
2-Methylbutanol	0.01	0.01	Aliphatic alcohol
β-Pinene	0.02	0.02	Monoterpene
Sabinene	0.02	tr	Normonoterpene
6-Methyl-5-hepten-2-one	0.01	0.01	Aliphatic ketone
Myrcene	0.05		Monoterpene
α-Phellandrene	0.01		Monoterpene
Δ3-Carene	0.03	0.04	Monoterpene
para-Cymene	0.02	0.03	Monoterpene
Limonene	0.01	0.02	Monoterpene
1,8-Cineole	0.02*	0.01	Monoterpene
para-Cymenene	[0.02]*	0.01	Monoterpene
α-Campholenal	0.01	0.01	Monoterpenic aldehyde
trans-Pinocarveol	0.05*	0.06	Monoterpenic alcohol
Camphor	[0.05]*	0.14*	Monoterpenic ketone
meta-Mentha-4,6-dien-8-ol	0.01	0.04	Monoterpenic alcohol
Pinocamphone	0.01	[0.14]*	Monoterpenic ketone
Pinocarvone	0.01	0.01	Monoterpenic ketone
Borneol	0.02	1.00*	Monoterpenic alcohol
α-Phellandren-8-ol	0.02	0.30*	Monoterpenic alcohol
Terpinen-4-ol	0.04	0.19*	Monoterpenic alcohol
meta-Cymen-8-ol	0.01	0.01	Monoterpenic alcohol
para-Cymen-8-ol	0.07*	0.14*	Monoterpenic alcohol
α-Terpineol	[0.07]*	[1.00]*	Monoterpenic alcohol
γ-Terpineol	0.03	0.14*	Monoterpenic alcohol
Myrtenol	0.05	0.07	Monoterpenic alcohol
Verbenone	0.05	0.16*	Monoterpenic ketone
trans-Carveol	0.01	0.01	Monoterpenic alcohol
Carvacrol methyl ether	0.03	[0.19]*	Monoterpenic ether
Carvenone	0.01	[0.14]*	Monoterpenic ketone
Bornyl acetate	0.01	0.49*	Monoterpenic ester
Carvacrol	0.03	0.10	Monoterpenic alcohol
α-Terpinyl acetate	0.06	0.21	Monoterpenic ester
African-1-ene	0.02	0.03	Sesquiterpene
β-Patchoulene	0.13*	0.03	Sesquiterpene
2-epi-α-Funebrene	[0.13]*	[0.14]*	Sesquiterpene
α-Duprezianene	0.36	0.27	Sesquiterpene
7-epi-Sesquithujene?	0.04*	0.07	Sesquiterpene
Isolongifolene	[0.04]*	0.01	Sesquiterpene
β-Elemene	0.37	0.59*	Sesquiterpene
α-Chamipinene	0.21*	9.15*	Sesquiterpene
Unknown	[0.21]*	0.04	Sesquiterpene
α-Cedrene	9.54	[9.15]*	Sesquiterpene
β-Cedrene	3.18*	2.45	Sesquiterpene
β-Funebrene	[3.18]*	0.22	Sesquiterpene

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## INTERNATIONAL GROUP

Unknown	[3.18]*	0.49*	Sesquiterpene
β-Duprezianene	[3.18]*	[0.49]*	Sesquiterpene
cis-Thujopsene	35.56*	35.37	Sesquiterpene
β-Caryophyllene	[35.56]*	[0.19]*	Sesquiterpene
(Z)-β-Farnesene?	0.14	0.07	Sesquiterpene
Isobazzanene	0.05*	[0.19]*	Sesquiterpene
trans-α-Bergamotene	[0.05]*	[0.59]*	Sesquiterpene
Prezizaene	0.12	0.13	Sesquiterpene
α-Himachalene	0.61*	[0.49]*	Sesquiterpene
7,8-Dehydro-α-acoradiene?	[0.61]*	0.44*	Sesquiterpene
α-Humulene	0.10*	0.50*	Sesquiterpene
Cadina-4,11-diene	[0.10]*	0.06	Sesquiterpene
α-Acoradiene	0.24	[0.50]*	Sesquiterpene
(E)-β-Farnesene	1.05*	[0.44]*	Sesquiterpene
9-epi-β-Caryophyllene	[1.05]*	[0.50]*	Sesquiterpene
β-Acoradiene	[1.05]*	0.35	Sesquiterpene
Thujopsene isomer	[1.05]*	0.02	Sesquiterpene
β-Chamigrene	0.46	0.50	Sesquiterpene
Unknown	0.66*		Sesquiterpene
γ-Himachalene	[0.66]*	[0.16]*	Sesquiterpene
Widdra-2,4(14)-diene?	0.12	[0.14]*	Sesquiterpene
Unknown	0.44	0.16*	Sesquiterpene
ar-Curcumene	[0.44]	0.23	Sesquiterpene
Valencene	0.73	0.68	Sesquiterpene
α-Cuprenene	2.33*	[0.30]*	Sesquiterpene
Pseudowiddrene	[2.33]*	1.71	Sesquiterpene
α-Chamigrene	[2.33]*	[0.30]*	Sesquiterpene
β-Himachalene	[2.33]*	[1.00]*	Sesquiterpene
Cuparene	1.36	1.39*	Sesquiterpene
1,4-Dihydrocuparene	0.11	0.11	Sesquiterpene
α-Alaskene	0.33*	[0.16]*	Sesquiterpene
Unknown	[0.33]*	0.24	Sesquiterpene
γ-Cadinene	0.34	[0.71]*	Sesquiterpene
α-Dehydro-ar-himachalene	0.20*	[0.14]*	Sesquiterpene
β-Curcumene	[0.20]*	0.05	Sesquiterpene
δ-Cadinene	0.75*	[0.71]*	Sesquiterpene
γ-Dehydro-ar-himachalene	[0.75]*	0.05	Sesquiterpene
β-Sesquiphellandrene	[0.75]*	0.45*	Sesquiterpene
Unknown	0.53*		Oxygenated sesquiterpene
γ-Cuprenene	[0.53]*	[0.45]*	Sesquiterpene
(E)-γ-Bisabolene	[0.53]*	0.71	Sesquiterpene
ar-Himachalene	0.13	[0.14]*	Sesquiterpene
δ-Cuprenene epimer I	0.14	0.11	Sesquiterpene
δ-Cuprenene epimer II	0.18*	[1.39]*	Sesquiterpene
Unknown	[0.18]*	0.15*	Oxygenated sesquiterpene
8,14-Cedranoxide	[0.18]*	[0.14]*	Sesquiterpenic ether
Unknown	[0.18]*	0.02	Oxygenated sesquiterpene
Unknown	0.16		Oxygenated sesquiterpene
Caryophyllenyl alcohol	0.34*	0.17	Sesquiterpenic alcohol
Unknown	[0.34]*	0.05	Oxygenated sesquiterpene
Unknown	[0.34]*		Sesquiterpene
Caryophyllene oxide	0.13*	0.05	Sesquiterpenic ether

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Caryophyllene oxide isomer	[0.13]*	0.01	Sesquiterpenic ether
allo-Cedrol	1.17	25.74*	Sesquiterpenic alcohol
Widdrol	27.17*	2.03	Sesquiterpenic alcohol
α-Cedrol	[27.17]*	[25.74]*	Sesquiterpenic alcohol
β-Himachalene oxide	[27.17]*	0.02	Sesquiterpenic ether
epi-Cedrol	1.26*	0.72	Sesquiterpenic alcohol
Unknown	[1.26]*	0.04	Oxygenated sesquiterpene
10-epi-Cubenol	[1.26]*	[0.15]*	Sesquiterpenic alcohol
Unknown	0.08*	0.06	Oxygenated sesquiterpene
2-epi-α-Cedren-3-one	[0.08]*		Sesquiterpenic ketone
Unknown	1.43*	0.15	Oxygenated sesquiterpene
α-Acorenol	[1.43]*	1.01	Sesquiterpenic alcohol
β-Acorenol	[1.43]*	0.22	Sesquiterpenic alcohol
Unknown	0.96*		Oxygenated sesquiterpene
Unknown	[0.96]*	0.24	Oxygenated sesquiterpene
Himachalol	0.86*	0.34	Sesquiterpenic alcohol
Unknown	[0.86]*		Oxygenated sesquiterpene
Unknown	0.61		Oxygenated sesquiterpene
Cedrenol analog	0.93*	0.10	Sesquiterpenic alcohol
Unknown	[0.93]*	0.43	Oxygenated sesquiterpene
14-Hydroxy-9-epi-(E)-caryophyllene	0.10	0.16	Sesquiterpenic alcohol
Cedr-8-en-13-ol	0.33	0.05	Sesquiterpenic alcohol
α-Cedrenol	[0.33]*	0.13	Sesquiterpenic alcohol
epi-α-Bisabolol	[0.33]*	0.20	Sesquiterpenic alcohol
Unknown	0.10		Oxygenated sesquiterpene
Mayurone?	0.07	0.05	Norsesquiterpenic ketone
Unknown	0.64*		Oxygenated sesquiterpene
Thujopsenal	[0.64]*	0.04	Sesquiterpenic aldehyde
Thujopsenal analog	0.04	0.03	Sesquiterpenic aldehyde
Unknown	0.06		Oxygenated sesquiterpene
Cedryl acetate?	0.12		Sesquiterpenic ester
Unknown	0.02	0.05	Oxygenated sesquiterpene
Unknown	0.02	0.02	Oxygenated sesquiterpene
Unknown	0.13	0.08	Oxygenated sesquiterpene
Nootkatone analog	0.02	0.03	Sesquiterpenic ketone
Manool	0.02		Diterpenic alcohol
7,13-Abietadiene	0.01		Diterpene
Toluene		0.01*	Simple phenolic
Unknown		[0.01]*	Normonoterpene
Thujopsadiene?		0.03	Sesquiterpene
1,7-diepi-α-Cedrenal?		0.04	Sesquiterpenic aldehyde
β-Acoradienol?		0.02	Sesquiterpenic alcohol
<b>Total identified</b>	<b>97.96%</b>	<b>97.39%</b>	

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

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

Note: no correction factor was applied

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## INTERNATIONAL GROUP

### FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Unknown [m/z 105, 79 (80), 91 (78), 77 (69), 78 (56), 93 (46), 120 (44)... 136 (4)]	2.84	916	0.02	2.63	1107	0.02
$\alpha$ -Pinene	3.02	928	0.19	1.42	991	0.20
Camphene	3.19*	940	0.04	1.77	1028	0.01
$\alpha$ -Fenchene	3.19*	940	[0.04]	1.70	1021	0.04
Thuja-2,4(10)-diene	3.31	947	0.03	2.38*	1085	0.03
Sabinene	3.64	969	0.01	2.38*	1085	[0.03]
$\alpha$ -Methylstyrene	3.78	978	0.02	5.05	1292	0.02
6-Methyl-5-hepten-2-one	3.90	986	0.01	5.22	1299	0.01
Myrcene	3.96	990	0.01			
$\alpha$ -Phellandrene	4.11	1000	0.01			
$\Delta$ 3-Carene	4.19	1005	0.03	2.68	1111	0.04
para-Cymene	4.44	1020	0.02	4.23	1230	0.03
Limonene	4.50	1024	0.01	3.29	1158	0.02
Terpinolene	5.50*	1085	0.02	4.42	1244	0.01
para-Cymenene	5.50*	1085	[0.02]	6.48	1390	0.01
$\alpha$ -Campholenal	6.03	1118	0.01	7.16	1439	0.01
<i>trans</i> -Pinocarveol	6.25*	1133	0.05	9.29	1600	0.06
Camphor	6.25*	1133	[0.05]	7.37*	1455	0.14
meta-Mentha-4,6-dien-8-ol	6.40	1142	0.01	9.43	1612	0.04
Pinocamphone	6.54	1151	0.01	7.37*	1455	[0.14]
Pinocarvone	6.56	1152	0.01	8.08	1507	0.01
Borneol	6.73	1163	0.02	9.94*	1653	1.00
$\alpha$ -Phellandren-8-ol	6.80	1167	0.02	10.32*	1683	0.30
Terpinen-4-ol	6.89	1173	0.04	8.68*	1554	0.19
meta-Cymen-8-ol	6.96	1177	0.01	11.66	1796	0.01
para-Cymen-8-ol	7.11*	1187	0.07	11.71*†	1800	0.14
$\alpha$ -Terpineol	7.11*	1187	[0.07]	9.94*	1653	[1.00]
$\gamma$ -Terpineol	7.16	1190	0.03	10.02*	1660	0.14
Myrtenol	7.21	1193	0.05	11.05	1745	0.07
Verbenone	7.30	1199	0.05	9.74*	1636	0.16
<i>trans</i> -Carveol	7.61	1219	0.01	11.60	1791	0.01
Carvacrol methyl ether	7.92	1239	0.03	8.68*	1554	[0.19]
Carvenone	8.05	1248	0.01	10.02*	1660	[0.14]
Bornyl acetate	8.47	1276	0.01	8.38*	1530	0.49
Carvacrol	9.11	1321	0.03	15.50	2153	0.10
$\alpha$ -Terpinyl acetate	9.44	1344	0.06	9.86	1646	0.21
African-1-ene	9.48	1347	0.02	7.01	1428	0.03
$\beta$ -Patchoulene	9.81*	1369	0.13	7.10	1435	0.03
2-epi- $\alpha$ -Funebrene	9.81*	1369	[0.13]	7.37*	1455	[0.14]
$\alpha$ -Duprezianene	9.89	1375	0.36	7.60	1472	0.27

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Isolongifolene	9.95*	1379	[0.04]	7.67	1476	0.01
β-Elemene	10.04	1385	0.37	8.57*	1545	0.59
α-Chamipinene	10.13*	1392	0.21	8.17*†	1514	9.15
Unknown [m/z 107, 91 (86), 93 (83), 79 (81), 162 (74), 41 (73), 133 (72)... 204 (13)]	10.13*	1392	[0.21]	8.33	1527	0.04
α-Cedrene	10.28	1402	9.54	8.17*†	1514	[9.15]
β-Cedrene	10.38*	1409	3.18	8.50	1540	2.45
β-Funebrene	10.38*	1409	[3.18]	8.26	1522	0.22
Unknown [m/z 118, 69 (82), 91 (51), 117 (40)... 202 (25)]	10.38*	1409	[3.18]	9.08*	1584	0.49
β-Duprezianene	10.38*	1409	[3.18]	8.38*	1530	[0.49]
cis-Thujopsene	10.58*	1424	35.56	8.89	1570	35.37
β-Caryophyllene	10.58*	1424	[35.56]	8.68*	1554	[0.19]
(Z)-β-Farnesene?	10.61	1426	0.14	9.39	1609	0.07
Isobazzanene	10.66*	1430	0.05	8.68*	1554	[0.19]
trans-α-Bergamotene	10.66*	1430	[0.05]	8.57*	1545	[0.59]
Prezizaene	10.72	1434	0.12	8.94	1573	0.13
α-Himachalene	10.77*	1437	0.61	9.08*	1584	[0.49]
7,8-Dehydro-α-acoradiene?	10.77*	1437	[0.61]	9.72*†	1635	0.44
α-Humulene	10.84*	1443	0.10	9.50*	1617	0.50
Cadina-4,11-diene	10.84*	1443	[0.10]	9.35	1606	0.06
α-Acoradiene	10.95	1451	0.24	9.50*	1617	[0.50]
(E)-β-Farnesene	11.00*†	1455	1.05	9.72*†	1635	[0.44]
9-epi-β-Caryophyllene	11.00*†	1455	[1.05]	9.50*	1617	[0.50]
β-Acoradiene	11.05*†	1458	[1.05]	9.57	1624	0.35
Thujopsene isomer	11.05*†	1458	[1.05]	9.62	1628	0.02
β-Chamigrene	11.15	1466	0.46	9.78	1640	0.50
Unknown [m/z 91, 105 (93), 161 (77), 93 (73), 119 (71), 133 (69)... 204 (31)]	11.18*	1467	0.66			
γ-Himachalene	11.18*	1467	[0.66]	9.74*	1636	[0.16]
Widdra-2,4(14)-diene?	11.24	1472	0.12	10.02*	1660	[0.14]
Unknown [m/z 189, 91 (95), 105 (93), 133 (84), 119 (75), 41 (59), 93 (46)... 204 (33)]	11.30†	1477	0.44	10.10*	1666	0.16
ar-Curcumene	11.33†	1479	[0.44]	10.82	1725	0.23
Valencene	11.44	1486	0.73	10.06	1663	0.68
α-Cuprenene	11.50*	1491	2.33	10.32*	1683	[0.30]
Pseudowiddrene	11.50*	1491	[2.33]	10.21	1674	1.71
α-Chamigrene	11.50*	1491	[2.33]	10.32*	1683	[0.30]
β-Himachalene	11.50*	1491	[2.33]	9.94*	1653	[1.00]

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Cuparene	11.56	1495	1.36	11.22*	1759	1.39
1,4-Dihydrocuparene	11.61	1499	0.11	10.64	1710	0.11
α-Alaskene	11.66*	1503	0.33	10.10*	1666	[0.16]
Unknown [m/z 121, 123 (45), 91 (24), 107 (24), 122(24), 95 (23)... 204 (11)]	11.66*	1503	[0.33]	10.47	1696	0.24
γ-Cadinene	11.70	1506	0.34	10.58*†	1705	[0.71]
α-Dehydro-arhimachalene	11.72*	1508	0.20	11.71*†	1800	[0.14]
β-Curcumene	11.72*	1508	[0.20]	10.42	1691	0.05
δ-Cadinene	11.86*†	1518	0.75	10.58*†	1705	[0.71]
γ-Dehydro-arhimachalene	11.86*†	1518	[0.75]	12.08	1833	0.05
β-Sesquiphellandrene	11.86*†	1518	[0.75]	10.78*†	1722	0.45
Unknown [m/z 91, 107 (97), 105 (93), 41 (92), 109 (78), 43 (78), 121 (76), 135 (75)... 220 (21)]	11.94*†	1525	0.53			
γ-Cuprenene	11.94*†	1525	[0.53]	10.78*†	1722	[0.45]
(E)-γ-Bisabolene	11.94*†	1525	[0.53]	10.55†	1702	0.71
ar-Himachalene	12.01	1530	0.13	11.76*†	1805	[0.14]
δ-Cuprenene epimer I	12.04	1532	0.14	11.13	1751	0.11
δ-Cuprenene epimer II	12.10*	1537	0.18	11.22*	1759	[1.39]
Unknown [m/z 43, 95 (81), 207 (61), 41 (55), 55 (50)... 222 (3)]	12.10*	1537	[0.18]	14.02*	2010	0.15
8,14-Cedranoxide	12.10*	1537	[0.18]	11.76*†	1805	[0.14]
Unknown [m/z 106, 41 (86), 43 (84), 149 (75), 69 (75), 91 (63), 93 (61)... 220 (1)]	12.10*	1537	[0.18]	11.59	1790	0.02
Unknown [m/z 91, 119 (98), 121 (91), 105 (85), 43 (82), 41 (76)... 205 (37), 220 (16)]	12.24	1547	0.16			
Caryophyllenyl alcohol	12.44*	1563	0.34	13.78	1986	0.17
Unknown [m/z 95, 191 (52), 107(50), 121 (32), 81 (31)...]	12.44*	1563	[0.34]	14.33	2039	0.05
Unknown [m/z 95, 131 (96), 202(64), 187 (61), 159(55), 105 (50)...202 (64)]	12.44*	1563	[0.34]			



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Caryophyllene oxide	12.55*	1572	0.13	12.93	1909	0.05
Caryophyllene oxide isomer	12.55*	1572	[0.13]	12.88	1904	0.01
allo-Cedrol	12.70	1583	1.17	14.46*	2051	25.74
Widdrol	12.91*	1599	27.17	14.80	2084	2.03
α-Cedrol	12.91*	1599	[27.17]	14.46*	2051	[25.74]
β-Himachalene oxide	12.91*	1599	[27.17]	13.33	1945	0.02
epi-Cedrol	13.02*	1608	1.26	14.96	2100	0.72
Unknown [m/z 138, 110 (77), 137 (75), 107 (62), 91 (61), 93 (60), 109 (57)... 220 (34)]	13.02*	1608	[1.26]	13.61	1971	0.04
10-epi-Cubenol	13.02*	1608	[1.26]	14.02*	2010	[0.15]
Unknown [m/z 107, 41 (86), 123 (85), 82 (79), 95 (77), 93 (76), 91 (73), 69 (71)... 220 (13)]	13.13*	1618	0.08	14.84	2088	0.06
2-epi-α-Cedren-3-one	13.13*	1618	[0.08]			
Unknown [m/z 132, 175 (22), 119(18), 91 (18), 157 (18)... 219 (10)]	13.22*	1625	1.43	15.80	2183	0.15
α-Acorenol	13.22*	1625	[1.43]	14.64	2069	1.01
β-Acorenol	13.22*	1625	[1.43]	15.04	2107	0.22
Unknown [m/z 132, 91 (24), 119 (22), 105 (21), 133(17), 117 (16)... 219 (3)]	13.28*	1630	0.96			
Unknown [m/z 105, 93 (78), 95 (75), 131 (72), 119 (71), 132 (70), 91 (67), 120 (49)... 202 (39), 220 (9)]	13.28*	1630	[0.96]	16.00	2203	0.24
Himachalol	13.40*	1640	0.86	15.35	2139	0.34
Unknown [m/z 123, 81 (77), 95 (77), 107 (72), 41 (72), 93 (66), 55 (64)... 220? (13)]	13.40*	1640	[0.86]			
Unknown [m/z 41, 91 (96), 79 (88), 69 (82), 123 (80), 93 (80)... 220 (8)]	13.44	1643	0.61			
Cedrenol analog	13.55*	1652	0.93	16.66	2271	0.10
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79	13.55*	1652	[0.93]	15.58	2161	0.43

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(58)... 204 (48), 220 (2)]						
14-Hydroxy-9-epi-(E)-caryophyllene	13.62	1658	0.10	16.60	2266	0.16
Cedr-8-en-13-ol	13.89†	1680	0.33	17.11	2320	0.05
α-Cedrenol	13.94*†	1683	[0.33]	17.24	2333	0.13
epi-α-Bisabolol	13.94*†	1683	[0.33]	15.65	2168	0.20
Unknown [m/z 91, 105 (87), 123(74), 135 (70), 107(60), 79 (59)... 220 (13)]	13.99	1688	0.10			
Mayurone?	14.04	1692	0.07	17.30	2340	0.05
Unknown [m/z 105, 69 (77), 91 (66), 119 (65), 111 (56), 107 (45), 55 (45)... 220? (2)]	14.09*	1696	0.64			
Thujopsenal	14.09*	1696	[0.64]	16.06	2210	0.04
Thujopsenal analog	14.48	1729	0.04	17.65	2378	0.03
Unknown [m/z 105, 91 (83), 79 (78), 135 (67), 107 (56), 67 (53)... 220 (9)]	14.63	1742	0.06			
Cedryl acetate?	14.73	1751	0.12			
Unknown [m/z 91, 105 (74), 93 (67), 79 (59), 133 (54), 41 (47), 107 (46)...]	14.86	1762	0.02	18.57	2480	0.05
Unknown [m/z 189, 91 (48), 133(40), 105 (40), 41(34), 187 (34)... 220 (5)]	15.14	1786	0.02	18.79	2505	0.02
Unknown [m/z 121, 136 (53), 91 (22), 93 (19), 79 (15), 105 (13)... 220 (3)]	15.21	1792	0.13	18.73	2498	0.08
Nootkatone analog	15.43	1811	0.02	18.12	2429	0.03
Manool	17.94	2047	0.02			
7,13-Abietadiene	18.16	2068	0.01			
Toluene				1.52*	1004	0.01
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]				1.52*	1004	[0.01]
Thujopsadiene?				10.38	1688	0.03
1,7-diepi-α-Cedrenal?				15.32	2135	0.04
β-Acoradienol?				18.30	2449	0.02
<b>Total identified</b>		<b>87.41%</b>			<b>81.70%</b>	
<b>Total reported</b>		<b>95.14%</b>			<b>89.64%</b>	

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

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[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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index

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INTERNATIONAL GROUP

**Date :** June 10, 2020

**Lot #:** BG13219

## *CERTIFICATE OF ANALYSIS – GC PROFILING*

### *SAMPLE IDENTIFICATION*

**Customer identification :** Bergamot Oil- 191840604

**Type :** Essential oil

**Source :** *Citrus aurantium*

### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Faintly yellow liquid

**Refractive index:** 1.5645 ± 0.0003 (20 °C)

*ISO 4725:2004 – Bergamot Oil*

Compound	Min. %	Max. %	Observed %	Complies?
Tricyclene	4	10	9	Yes
a-Thujene	0.2	2	0.6	Yes
a-Pinene	0.2	1.5	0.5	Yes
Camphene	45	62	50	Yes
Octanal	tr	4	0.6	Yes
Methylchavicol	tr	30	0.7	Yes
<b>Refractive index</b>	1.5550	1.5750	1.5685	Yes

### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for Basil oil, and the oil features the characteristic composition for *Citrus aurantium* oil.

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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Isovaleral	tr	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	0.05	Aliphatic aldehyde
2-Ethylfuran	0.01	tr	Furan
Isoamyl alcohol	0.16	0.16	Aliphatic alcohol
2-Methylbutanol	0.01	0.01	Aliphatic alcohol
β-Pinene	0.02	0.02	Monoterpene
Sabinene	0.02	tr	Normonoterpene
6-Methyl-5-hepten-2-one	0.01	0.01	Aliphatic ketone
Myrcene	0.05		Monoterpene
α-Phellandrene	0.01		Monoterpene
Δ3-Carene	0.03	0.04	Monoterpene
para-Cymene	0.02	0.03	Monoterpene
Limonene	0.01	0.02	Monoterpene
1,8-Cineole	0.02*	0.01	Monoterpene
para-Cymenene	[0.02]*	0.01	Monoterpene
α-Campholenal	0.01	0.01	Monoterpenic aldehyde
trans-Pinocarveol	0.05*	0.06	Monoterpenic alcohol
Camphor	[0.05]*	0.14*	Monoterpenic ketone
meta-Mentha-4,6-dien-8-ol	0.01	0.04	Monoterpenic alcohol
Pinocamphone	0.01	[0.14]*	Monoterpenic ketone
Pinocarvone	0.01	0.01	Monoterpenic ketone
Borneol	0.02	1.00*	Monoterpenic alcohol
α-Phellandren-8-ol	0.02	0.30*	Monoterpenic alcohol
Terpinen-4-ol	0.04	0.19*	Monoterpenic alcohol
meta-Cymen-8-ol	0.01	0.01	Monoterpenic alcohol
para-Cymen-8-ol	0.07*	0.14*	Monoterpenic alcohol
α-Terpineol	[0.07]*	[1.00]*	Monoterpenic alcohol
γ-Terpineol	0.03	0.14*	Monoterpenic alcohol
Myrtenol	0.05	0.07	Monoterpenic alcohol
Verbenone	0.05	0.16*	Monoterpenic ketone
trans-Carveol	0.01	0.01	Monoterpenic alcohol
Carvacrol methyl ether	0.03	[0.19]*	Monoterpenic ether
Carvenone	0.01	[0.14]*	Monoterpenic ketone
Bornyl acetate	0.01	0.49*	Monoterpenic ester
Carvacrol	0.03	0.10	Monoterpenic alcohol
α-Terpinyl acetate	0.06	0.21	Monoterpenic ester
African-1-ene	0.02	0.03	Sesquiterpene
β-Patchoulene	0.13*	0.03	Sesquiterpene
2-epi-α-Funebrene	[0.13]*	[0.14]*	Sesquiterpene
α-Duprezianene	0.36	0.27	Sesquiterpene
7-epi-Sesquithujene?	0.04*	0.07	Sesquiterpene
Isolongifolene	[0.04]*	0.01	Sesquiterpene
β-Elemene	0.37	0.59*	Sesquiterpene
α-Chamipinene	0.21*	9.15*	Sesquiterpene
Unknown	[0.21]*	0.04	Sesquiterpene
α-Cedrene	9.54	[9.15]*	Sesquiterpene
β-Cedrene	3.18*	2.45	Sesquiterpene
β-Funebrene	[3.18]*	0.22	Sesquiterpene

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Unknown	[3.18]*	0.49*	Sesquiterpene
β-Duprezianene	[3.18]*	[0.49]*	Sesquiterpene
cis-Thujopsene	35.56*	35.37	Sesquiterpene
β-Caryophyllene	[35.56]*	[0.19]*	Sesquiterpene
(Z)-β-Farnesene?	0.14	0.07	Sesquiterpene
Isobazzanene	0.05*	[0.19]*	Sesquiterpene
trans-α-Bergamotene	[0.05]*	[0.59]*	Sesquiterpene
Prezizaene	0.12	0.13	Sesquiterpene
α-Himachalene	0.61*	[0.49]*	Sesquiterpene
7,8-Dehydro-α-acoradiene?	[0.61]*	0.44*	Sesquiterpene
α-Humulene	0.10*	0.50*	Sesquiterpene
Cadina-4,11-diene	[0.10]*	0.06	Sesquiterpene
α-Acoradiene	0.24	[0.50]*	Sesquiterpene
(E)-β-Farnesene	1.05*	[0.44]*	Sesquiterpene
9-epi-β-Caryophyllene	[1.05]*	[0.50]*	Sesquiterpene
β-Acoradiene	[1.05]*	0.35	Sesquiterpene
Thujopsene isomer	[1.05]*	0.02	Sesquiterpene
β-Chamigrene	0.46	0.50	Sesquiterpene
Unknown	0.66*		Sesquiterpene
γ-Himachalene	[0.66]*	[0.16]*	Sesquiterpene
Widdra-2,4(14)-diene?	0.12	[0.14]*	Sesquiterpene
Unknown	0.44	0.16*	Sesquiterpene
ar-Curcumene	[0.44]	0.23	Sesquiterpene
Valencene	0.73	0.68	Sesquiterpene
α-Cuprenene	2.33*	[0.30]*	Sesquiterpene
Pseudowiddrene	[2.33]*	1.71	Sesquiterpene
α-Chamigrene	[2.33]*	[0.30]*	Sesquiterpene
β-Himachalene	[2.33]*	[1.00]*	Sesquiterpene
Cuparene	1.36	1.39*	Sesquiterpene
1,4-Dihydrocuparene	0.11	0.11	Sesquiterpene
α-Alaskene	0.33*	[0.16]*	Sesquiterpene
Unknown	[0.33]*	0.24	Sesquiterpene
γ-Cadinene	0.34	[0.71]*	Sesquiterpene
α-Dehydro-ar-himachalene	0.20*	[0.14]*	Sesquiterpene
β-Curcumene	[0.20]*	0.05	Sesquiterpene
δ-Cadinene	0.75*	[0.71]*	Sesquiterpene
γ-Dehydro-ar-himachalene	[0.75]*	0.05	Sesquiterpene
β-Sesquiphellandrene	[0.75]*	0.45*	Sesquiterpene
Unknown	0.53*		Oxygenated sesquiterpene
γ-Cuprenene	[0.53]*	[0.45]*	Sesquiterpene
(E)-γ-Bisabolene	[0.53]*	0.71	Sesquiterpene
ar-Himachalene	0.13	[0.14]*	Sesquiterpene
δ-Cuprenene epimer I	0.14	0.11	Sesquiterpene
δ-Cuprenene epimer II	0.18*	[1.39]*	Sesquiterpene
Unknown	[0.18]*	0.15*	Oxygenated sesquiterpene
8,14-Cedranoxide	[0.18]*	[0.14]*	Sesquiterpenic ether
Unknown	[0.18]*	0.02	Oxygenated sesquiterpene
Unknown	0.16		Oxygenated sesquiterpene
Caryophyllenyl alcohol	0.34*	0.17	Sesquiterpenic alcohol
Unknown	[0.34]*	0.05	Oxygenated sesquiterpene
Unknown	[0.34]*		Sesquiterpene
Caryophyllene oxide	0.13*	0.05	Sesquiterpenic ether

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Caryophyllene oxide isomer	[0.13]*	0.01	Sesquiterpenic ether
allo-Cedrol	1.17	25.74*	Sesquiterpenic alcohol
Widdrol	27.17*	2.03	Sesquiterpenic alcohol
α-Cedrol	[27.17]*	[25.74]*	Sesquiterpenic alcohol
β-Himachalene oxide	[27.17]*	0.02	Sesquiterpenic ether
epi-Cedrol	1.26*	0.72	Sesquiterpenic alcohol
Unknown	[1.26]*	0.04	Oxygenated sesquiterpene
10-epi-Cubenol	[1.26]*	[0.15]*	Sesquiterpenic alcohol
Unknown	0.08*	0.06	Oxygenated sesquiterpene
2-epi-α-Cedren-3-one	[0.08]*		Sesquiterpenic ketone
Unknown	1.43*	0.15	Oxygenated sesquiterpene
α-Acorenol	[1.43]*	1.01	Sesquiterpenic alcohol
β-Acorenol	[1.43]*	0.22	Sesquiterpenic alcohol
Unknown	0.96*		Oxygenated sesquiterpene
Unknown	[0.96]*	0.24	Oxygenated sesquiterpene
Himachalol	0.86*	0.34	Sesquiterpenic alcohol
Unknown	[0.86]*		Oxygenated sesquiterpene
Unknown	0.61		Oxygenated sesquiterpene
Cedrenol analog	0.93*	0.10	Sesquiterpenic alcohol
Unknown	[0.93]*	0.43	Oxygenated sesquiterpene
14-Hydroxy-9-epi-(E)-caryophyllene	0.10	0.16	Sesquiterpenic alcohol
Cedr-8-en-13-ol	0.33	0.05	Sesquiterpenic alcohol
α-Cedrenol	[0.33]*	0.13	Sesquiterpenic alcohol
epi-α-Bisabolol	[0.33]*	0.20	Sesquiterpenic alcohol
Unknown	0.10		Oxygenated sesquiterpene
Mayurone?	0.07	0.05	Norsesquiterpenic ketone
Unknown	0.64*		Oxygenated sesquiterpene
Thujopsenal	[0.64]*	0.04	Sesquiterpenic aldehyde
Thujopsenal analog	0.04	0.03	Sesquiterpenic aldehyde
Unknown	0.06		Oxygenated sesquiterpene
Cedryl acetate?	0.12		Sesquiterpenic ester
Unknown	0.02	0.05	Oxygenated sesquiterpene
Unknown	0.02	0.02	Oxygenated sesquiterpene
Unknown	0.13	0.08	Oxygenated sesquiterpene
Nootkatone analog	0.02	0.03	Sesquiterpenic ketone
Manool	0.02		Diterpenic alcohol
7,13-Abietadiene	0.01		Diterpene
Toluene		0.01*	Simple phenolic
Unknown		[0.01]*	Normonoterpene
Thujopsadiene?		0.03	Sesquiterpene
1,7-diepi-α-Cedrenal?		0.04	Sesquiterpenic aldehyde
β-Acoradienol?		0.02	Sesquiterpenic alcohol
<b>Total identified</b>	<b>97.73%</b>	<b>99.90%</b>	

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

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

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	%
Unknown [m/z 105, 79 (80), 91 (78), 77 (69), 78 (56), 93 (46), 120 (44)... 136 (4)]	2.84	916	0.02	2.63	1107	0.02
α-Pinene	3.02	928	0.19	1.42	991	0.20
Camphene	3.19*	940	0.04	1.77	1028	0.01
α-Fenchene	3.19*	940	[0.04]	1.70	1021	0.04
Thuja-2,4(10)-diene	3.31	947	0.03	2.38*	1085	0.03
Sabinene	3.64	969	0.01	2.38*	1085	[0.03]
α-Methylstyrene	3.78	978	0.02	5.05	1292	0.02
6-Methyl-5-hepten-2-one	3.90	986	0.01	5.22	1299	0.01
Myrcene	3.96	990	0.01			
α-Phellandrene	4.11	1000	0.01			
Δ3-Carene	4.19	1005	0.03	2.68	1111	0.04
para-Cymene	4.44	1020	0.02	4.23	1230	0.03
Limonene	4.50	1024	0.01	3.29	1158	0.02
Terpinolene	5.50*	1085	0.02	4.42	1244	0.01
para-Cymenene	5.50*	1085	[0.02]	6.48	1390	0.01
α-Campholenal	6.03	1118	0.01	7.16	1439	0.01
trans-Pinocarveol	6.25*	1133	0.05	9.29	1600	0.06
Camphor	6.25*	1133	[0.05]	7.37*	1455	0.14
meta-Mentha-4,6-dien-8-ol	6.40	1142	0.01	9.43	1612	0.04
Pinocamphone	6.54	1151	0.01	7.37*	1455	[0.14]
Pinocarvone	6.56	1152	0.01	8.08	1507	0.01
Borneol	6.73	1163	0.02	9.94*	1653	1.00
α-Phellandren-8-ol	6.80	1167	0.02	10.32*	1683	0.30
Terpinen-4-ol	6.89	1173	0.04	8.68*	1554	0.19
meta-Cymen-8-ol	6.96	1177	0.01	11.66	1796	0.01
para-Cymen-8-ol	7.11*	1187	0.07	11.71*†	1800	0.14
α-Terpineol	7.11*	1187	[0.07]	9.94*	1653	[1.00]
γ-Terpineol	7.16	1190	0.03	10.02*	1660	0.14
Myrtenol	7.21	1193	0.05	11.05	1745	0.07
Verbenone	7.30	1199	0.05	9.74*	1636	0.16
trans-Carveol	7.61	1219	0.01	11.60	1791	0.01
Carvacrol methyl ether	7.92	1239	0.03	8.68*	1554	[0.19]
Carvenone	8.05	1248	0.01	10.02*	1660	[0.14]
Bornyl acetate	8.47	1276	0.01	8.38*	1530	0.49
Carvacrol	9.11	1321	0.03	15.50	2153	0.10
α-Terpinyl acetate	9.44	1344	0.06	9.86	1646	0.21
African-1-ene	9.48	1347	0.02	7.01	1428	0.03
β-Patchoulene	9.81*	1369	0.13	7.10	1435	0.03
2-epi-α-Funebrene	9.81*	1369	[0.13]	7.37*	1455	[0.14]
α-Duprezianene	9.89	1375	0.36	7.60	1472	0.27

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Isolongifolene	9.95*	1379	[0.04]	7.67	1476	0.01
β-Elemene	10.04	1385	0.37	8.57*	1545	0.59
α-Chamipinene	10.13*	1392	0.21	8.17*†	1514	9.15
Unknown [m/z 107, 91 (86), 93 (83), 79 (81), 162 (74), 41 (73), 133 (72)... 204 (13)]	10.13*	1392	[0.21]	8.33	1527	0.04
α-Cedrene	10.28	1402	9.54	8.17*†	1514	[9.15]
β-Cedrene	10.38*	1409	3.18	8.50	1540	2.45
β-Funebrene	10.38*	1409	[3.18]	8.26	1522	0.22
Unknown [m/z 118, 69 (82), 91 (51), 117 (40)... 202 (25)]	10.38*	1409	[3.18]	9.08*	1584	0.49
β-Duprezianene	10.38*	1409	[3.18]	8.38*	1530	[0.49]
cis-Thujopsene	10.58*	1424	35.56	8.89	1570	35.37
β-Caryophyllene	10.58*	1424	[35.56]	8.68*	1554	[0.19]
(Z)-β-Farnesene?	10.61	1426	0.14	9.39	1609	0.07
Isobazzanene	10.66*	1430	0.05	8.68*	1554	[0.19]
trans-α-Bergamotene	10.66*	1430	[0.05]	8.57*	1545	[0.59]
Prezizaene	10.72	1434	0.12	8.94	1573	0.13
α-Himachalene	10.77*	1437	0.61	9.08*	1584	[0.49]
7,8-Dehydro-α-acoradiene?	10.77*	1437	[0.61]	9.72*†	1635	0.44
α-Humulene	10.84*	1443	0.10	9.50*	1617	0.50
Cadina-4,11-diene	10.84*	1443	[0.10]	9.35	1606	0.06
α-Acoradiene	10.95	1451	0.24	9.50*	1617	[0.50]
(E)-β-Farnesene	11.00*†	1455	1.05	9.72*†	1635	[0.44]
9-epi-β-Caryophyllene	11.00*†	1455	[1.05]	9.50*	1617	[0.50]
β-Acoradiene	11.05*†	1458	[1.05]	9.57	1624	0.35
Thujopsene isomer	11.05*†	1458	[1.05]	9.62	1628	0.02
β-Chamigrene	11.15	1466	0.46	9.78	1640	0.50
Unknown [m/z 91, 105 (93), 161 (77), 93 (73), 119 (71), 133 (69)... 204 (31)]	11.18*	1467	0.66			
γ-Himachalene	11.18*	1467	[0.66]	9.74*	1636	[0.16]
Widdra-2,4(14)-diene?	11.24	1472	0.12	10.02*	1660	[0.14]
Unknown [m/z 189, 91 (95), 105 (93), 133 (84), 119 (75), 41 (59), 93 (46)... 204 (33)]	11.30†	1477	0.44	10.10*	1666	0.16
ar-Curcumene	11.33†	1479	[0.44]	10.82	1725	0.23
Valencene	11.44	1486	0.73	10.06	1663	0.68
α-Cuprenene	11.50*	1491	2.33	10.32*	1683	[0.30]
Pseudowiddrene	11.50*	1491	[2.33]	10.21	1674	1.71
α-Chamigrene	11.50*	1491	[2.33]	10.32*	1683	[0.30]
β-Himachalene	11.50*	1491	[2.33]	9.94*	1653	[1.00]

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Cuparene	11.56	1495	1.36	11.22*	1759	1.39
1,4-Dihydrocuparene	11.61	1499	0.11	10.64	1710	0.11
α-Alaskene	11.66*	1503	0.33	10.10*	1666	[0.16]
Unknown [m/z 121, 123 (45), 91 (24), 107 (24), 122(24), 95 (23)... 204 (11)]	11.66*	1503	[0.33]	10.47	1696	0.24
γ-Cadinene	11.70	1506	0.34	10.58*†	1705	[0.71]
α-Dehydro-arhimachalene	11.72*	1508	0.20	11.71*†	1800	[0.14]
β-Curcumene	11.72*	1508	[0.20]	10.42	1691	0.05
δ-Cadinene	11.86*†	1518	0.75	10.58*†	1705	[0.71]
γ-Dehydro-arhimachalene	11.86*†	1518	[0.75]	12.08	1833	0.05
β-Sesquiphellandrene	11.86*†	1518	[0.75]	10.78*†	1722	0.45
Unknown [m/z 91, 107 (97), 105 (93), 41 (92), 109 (78), 43 (78), 121 (76), 135 (75)... 220 (21)]	11.94*†	1525	0.53			
γ-Cuprenene	11.94*†	1525	[0.53]	10.78*†	1722	[0.45]
(E)-γ-Bisabolene	11.94*†	1525	[0.53]	10.55†	1702	0.71
ar-Himachalene	12.01	1530	0.13	11.76*†	1805	[0.14]
δ-Cuprenene epimer I	12.04	1532	0.14	11.13	1751	0.11
δ-Cuprenene epimer II	12.10*	1537	0.18	11.22*	1759	[1.39]
Unknown [m/z 43, 95 (81), 207 (61), 41 (55), 55 (50)... 222 (3)]	12.10*	1537	[0.18]	14.02*	2010	0.15
8,14-Cedranoxide	12.10*	1537	[0.18]	11.76*†	1805	[0.14]
Unknown [m/z 106, 41 (86), 43 (84), 149 (75), 69 (75), 91 (63), 93 (61)... 220 (1)]	12.10*	1537	[0.18]	11.59	1790	0.02
Unknown [m/z 91, 119 (98), 121 (91), 105 (85), 43 (82), 41 (76)... 205 (37), 220 (16)]	12.24	1547	0.16			
Caryophyllenyl alcohol	12.44*	1563	0.34	13.78	1986	0.17
Unknown [m/z 95, 191 (52), 107(50), 121 (32), 81 (31)...]	12.44*	1563	[0.34]	14.33	2039	0.05
Unknown [m/z 95, 131 (96), 202(64), 187 (61), 159(55), 105 (50)...202 (64)]	12.44*	1563	[0.34]			

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Caryophyllene oxide	12.55*	1572	0.13	12.93	1909	0.05
Caryophyllene oxide isomer	12.55*	1572	[0.13]	12.88	1904	0.01
allo-Cedrol	12.70	1583	1.17	14.46*	2051	25.74
Widdrol	12.91*	1599	27.17	14.80	2084	2.03
α-Cedrol	12.91*	1599	[27.17]	14.46*	2051	[25.74]
β-Himachalene oxide	12.91*	1599	[27.17]	13.33	1945	0.02
epi-Cedrol	13.02*	1608	1.26	14.96	2100	0.72
Unknown [m/z 138, 110 (77), 137 (75), 107 (62), 91 (61), 93 (60), 109 (57)... 220 (34)]	13.02*	1608	[1.26]	13.61	1971	0.04
10-epi-Cubenol	13.02*	1608	[1.26]	14.02*	2010	[0.15]
Unknown [m/z 107, 41 (86), 123 (85), 82 (79), 95 (77), 93 (76), 91 (73), 69 (71)... 220 (13)]	13.13*	1618	0.08	14.84	2088	0.06
2-epi-α-Cedren-3-one	13.13*	1618	[0.08]			
Unknown [m/z 132, 175 (22), 119(18), 91 (18), 157 (18)... 219 (10)]	13.22*	1625	1.43	15.80	2183	0.15
α-Acorenol	13.22*	1625	[1.43]	14.64	2069	1.01
β-Acorenol	13.22*	1625	[1.43]	15.04	2107	0.22
Unknown [m/z 132, 91 (24), 119 (22), 105 (21), 133(17), 117 (16)... 219 (3)]	13.28*	1630	0.96			
Unknown [m/z 105, 93 (78), 95 (75), 131 (72), 119 (71), 132 (70), 91 (67), 120 (49)... 202 (39), 220 (9)]	13.28*	1630	[0.96]	16.00	2203	0.24
Himachalol	13.40*	1640	0.86	15.35	2139	0.34
Unknown [m/z 123, 81 (77), 95 (77), 107 (72), 41 (72), 93 (66), 55 (64)... 220? (13)]	13.40*	1640	[0.86]			
Unknown [m/z 41, 91 (96), 79 (88), 69 (82), 123 (80), 93 (80)... 220 (8)]	13.44	1643	0.61			
Cedrenol analog	13.55*	1652	0.93	16.66	2271	0.10
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79	13.55*	1652	[0.93]	15.58	2161	0.43

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(58)... 204 (48), 220 (2)]						
14-Hydroxy-9-epi-(E)-caryophyllene	13.62	1658	0.10	16.60	2266	0.16
Cedr-8-en-13-ol	13.89†	1680	0.33	17.11	2320	0.05
α-Cedrenol	13.94*†	1683	[0.33]	17.24	2333	0.13
epi-α-Bisabolol	13.94*†	1683	[0.33]	15.65	2168	0.20
Unknown [m/z 91, 105 (87), 123(74), 135 (70), 107(60), 79 (59)... 220 (13)]	13.99	1688	0.10			
Mayurone?	14.04	1692	0.07	17.30	2340	0.05
Unknown [m/z 105, 69 (77), 91 (66), 119 (65), 111 (56), 107 (45), 55 (45)... 220? (2)]	14.09*	1696	0.64			
Thujopsenal	14.09*	1696	[0.64]	16.06	2210	0.04
Thujopsenal analog	14.48	1729	0.04	17.65	2378	0.03
Unknown [m/z 105, 91 (83), 79 (78), 135 (67), 107 (56), 67 (53)... 220 (9)]	14.63	1742	0.06			
Cedryl acetate?	14.73	1751	0.12			
Unknown [m/z 91, 105 (74), 93 (67), 79 (59), 133 (54), 41 (47), 107 (46)...]	14.86	1762	0.02	18.57	2480	0.05
Unknown [m/z 189, 91 (48), 133(40), 105 (40), 41(34), 187 (34)... 220 (5)]	15.14	1786	0.02	18.79	2505	0.02
Unknown [m/z 121, 136 (53), 91 (22), 93 (19), 79 (15), 105 (13)... 220 (3)]	15.21	1792	0.13	18.73	2498	0.08
Nootkatone analog	15.43	1811	0.02	18.12	2429	0.03
Manool	17.94	2047	0.02			
7,13-Abietadiene	18.16	2068	0.01			
Toluene				1.52*	1004	0.01
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]				1.52*	1004	[0.01]
Thujopsadiene?				10.38	1688	0.03
1,7-diepi-α-Cedrenal?				15.32	2135	0.04
β-Acoradienol?				18.30	2449	0.02
<b>Total identified</b>		<b>87.41%</b>			<b>81.70%</b>	
<b>Total reported</b>		<b>95.14%</b>			<b>89.64%</b>	

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

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[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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index

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INTERNATIONAL GROUP

**Date :** June 10, 2020

**Lot #:** CE10218

## *CERTIFICATE OF ANALYSIS – GC PROFILING*

### *SAMPLE IDENTIFICATION*

**Customer identification :** Cedarwood Oil- 181040561

**Type :** Essential oil

**Source :** *Juniperus mexicana*

### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Faintly yellow liquid

**Refractive index:** 1.5055 ± 0.0003 (20 °C)

ISO 4725:2004 - OIL OF CEDARWOOD

Compound	Min. %	Max. %	Observed %	Complies?
Widdrol	2.5		2.0	No
α-Cedrol	20.0		25.1	Yes
Cuparene	1.5	3.2	1.4	No
cis-Thujopsene	25.0	35.0	35.4	No
β-Cedrene	3.0	8.0	2.4	No
α-Cedrene	15.0	25.0	9.5	No
<b>Refractive index</b>	1.5020	1.5100	1.5055	Yes

### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for cedarwood oil, and the oil features the characteristic composition for *Juniperus* wood oil.



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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Unknown	0.02	0.02	Monoterpene
α-Pinene	0.19	0.20	Monoterpene
Camphene	0.04*	0.01	Monoterpene
α-Fenchene	[0.04]*	0.04	Monoterpene
Thuja-2,4(10)-diene	0.03	0.03*	Monoterpene
Sabinene	0.01	[0.03]*	Monoterpene
α-Methylstyrene	0.02	0.02	Normonoterpene
6-Methyl-5-hepten-2-one	0.01	0.01	Aliphatic ketone
Myrcene	0.01		Monoterpene
α-Phellandrene	0.01		Monoterpene
Δ3-Carene	0.03	0.04	Monoterpene
para-Cymene	0.02	0.03	Monoterpene
Limonene	0.01	0.02	Monoterpene
Terpinolene	0.02*	0.01	Monoterpene
para-Cymenene	[0.02]*	0.01	Monoterpene
α-Campholenal	0.01	0.01	Monoterpenic aldehyde
trans-Pinocarveol	0.05*	0.06	Monoterpenic alcohol
Camphor	[0.05]*	0.14*	Monoterpenic ketone
meta-Mentha-4,6-dien-8-ol	0.01	0.04	Monoterpenic alcohol
Pinocamphone	0.01	[0.14]*	Monoterpenic ketone
Pinocarvone	0.01	0.01	Monoterpenic ketone
Borneol	0.02	1.00*	Monoterpenic alcohol
α-Phellandren-8-ol	0.02	0.30*	Monoterpenic alcohol
Terpinen-4-ol	0.04	0.19*	Monoterpenic alcohol
meta-Cymen-8-ol	0.01	0.01	Monoterpenic alcohol
para-Cymen-8-ol	0.07*	0.14*	Monoterpenic alcohol
α-Terpineol	[0.07]*	[1.00]*	Monoterpenic alcohol
γ-Terpineol	0.03	0.14*	Monoterpenic alcohol
Myrtenol	0.05	0.07	Monoterpenic alcohol
Verbenone	0.05	0.16*	Monoterpenic ketone
trans-Carveol	0.01	0.01	Monoterpenic alcohol
Carvacrol methyl ether	0.03	[0.19]*	Monoterpenic ether
Carvenone	0.01	[0.14]*	Monoterpenic ketone
Bornyl acetate	0.01	0.49*	Monoterpenic ester
Carvacrol	0.03	0.10	Monoterpenic alcohol
α-Terpinyl acetate	0.06	0.21	Monoterpenic ester
African-1-ene	0.02	0.03	Sesquiterpene
β-Patchoulene	0.13*	0.03	Sesquiterpene
2-epi-α-Funebrene	[0.13]*	[0.14]*	Sesquiterpene
α-Duprezianene	0.36	0.27	Sesquiterpene
7-epi-Sesquithujene?	0.04*	0.07	Sesquiterpene
Isolongifolene	[0.04]*	0.01	Sesquiterpene
β-Elemene	0.37	0.59*	Sesquiterpene
α-Chamipinene	0.21*	9.15*	Sesquiterpene
Unknown	[0.21]*	0.04	Sesquiterpene
α-Cedrene	9.54	[9.15]*	Sesquiterpene
β-Cedrene	3.18*	2.45	Sesquiterpene
β-Funebrene	[3.18]*	0.22	Sesquiterpene

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Unknown	[3.18]*	0.49*	Sesquiterpene
β-Duprezianene	[3.18]*	[0.49]*	Sesquiterpene
cis-Thujopsene	35.56*	35.37	Sesquiterpene
β-Caryophyllene	[35.56]*	[0.19]*	Sesquiterpene
(Z)-β-Farnesene?	0.14	0.07	Sesquiterpene
Isobazzanene	0.05*	[0.19]*	Sesquiterpene
trans-α-Bergamotene	[0.05]*	[0.59]*	Sesquiterpene
Prezizaene	0.12	0.13	Sesquiterpene
α-Himachalene	0.61*	[0.49]*	Sesquiterpene
7,8-Dehydro-α-acoradiene?	[0.61]*	0.44*	Sesquiterpene
α-Humulene	0.10*	0.50*	Sesquiterpene
Cadina-4,11-diene	[0.10]*	0.06	Sesquiterpene
α-Acoradiene	0.24	[0.50]*	Sesquiterpene
(E)-β-Farnesene	1.05*	[0.44]*	Sesquiterpene
9-epi-β-Caryophyllene	[1.05]*	[0.50]*	Sesquiterpene
β-Acoradiene	[1.05]*	0.35	Sesquiterpene
Thujopsene isomer	[1.05]*	0.02	Sesquiterpene
β-Chamigrene	0.46	0.50	Sesquiterpene
Unknown	0.66*		Sesquiterpene
γ-Himachalene	[0.66]*	[0.16]*	Sesquiterpene
Widdra-2,4(14)-diene?	0.12	[0.14]*	Sesquiterpene
Unknown	0.44	0.16*	Sesquiterpene
ar-Curcumene	[0.44]	0.23	Sesquiterpene
Valencene	0.73	0.68	Sesquiterpene
α-Cuprenene	2.33*	[0.30]*	Sesquiterpene
Pseudowiddrene	[2.33]*	1.71	Sesquiterpene
α-Chamigrene	[2.33]*	[0.30]*	Sesquiterpene
β-Himachalene	[2.33]*	[1.00]*	Sesquiterpene
Cuparene	1.36	1.39*	Sesquiterpene
1,4-Dihydrocuparene	0.11	0.11	Sesquiterpene
α-Alaskene	0.33*	[0.16]*	Sesquiterpene
Unknown	[0.33]*	0.24	Sesquiterpene
γ-Cadinene	0.34	[0.71]*	Sesquiterpene
α-Dehydro-ar-himachalene	0.20*	[0.14]*	Sesquiterpene
β-Curcumene	[0.20]*	0.05	Sesquiterpene
δ-Cadinene	0.75*	[0.71]*	Sesquiterpene
γ-Dehydro-ar-himachalene	[0.75]*	0.05	Sesquiterpene
β-Sesquiphellandrene	[0.75]*	0.45*	Sesquiterpene
Unknown	0.53*		Oxygenated sesquiterpene
γ-Cuprenene	[0.53]*	[0.45]*	Sesquiterpene
(E)-γ-Bisabolene	[0.53]*	0.71	Sesquiterpene
ar-Himachalene	0.13	[0.14]*	Sesquiterpene
δ-Cuprenene epimer I	0.14	0.11	Sesquiterpene
δ-Cuprenene epimer II	0.18*	[1.39]*	Sesquiterpene
Unknown	[0.18]*	0.15*	Oxygenated sesquiterpene
8,14-Cedranoxide	[0.18]*	[0.14]*	Sesquiterpenic ether
Unknown	[0.18]*	0.02	Oxygenated sesquiterpene
Unknown	0.16		Oxygenated sesquiterpene
Caryophyllenyl alcohol	0.34*	0.17	Sesquiterpenic alcohol
Unknown	[0.34]*	0.05	Oxygenated sesquiterpene
Unknown	[0.34]*		Sesquiterpene
Caryophyllene oxide	0.13*	0.05	Sesquiterpenic ether

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Caryophyllene oxide isomer	[0.13]*	0.01	Sesquiterpenic ether
allo-Cedrol	1.17	25.74*	Sesquiterpenic alcohol
Widdrol	27.17*	2.03	Sesquiterpenic alcohol
α-Cedrol	[27.17]*	[25.74]*	Sesquiterpenic alcohol
β-Himachalene oxide	[27.17]*	0.02	Sesquiterpenic ether
epi-Cedrol	1.26*	0.72	Sesquiterpenic alcohol
Unknown	[1.26]*	0.04	Oxygenated sesquiterpene
10-epi-Cubenol	[1.26]*	[0.15]*	Sesquiterpenic alcohol
Unknown	0.08*	0.06	Oxygenated sesquiterpene
2-epi-α-Cedren-3-one	[0.08]*		Sesquiterpenic ketone
Unknown	1.43*	0.15	Oxygenated sesquiterpene
α-Acorenol	[1.43]*	1.01	Sesquiterpenic alcohol
β-Acorenol	[1.43]*	0.22	Sesquiterpenic alcohol
Unknown	0.96*		Oxygenated sesquiterpene
Unknown	[0.96]*	0.24	Oxygenated sesquiterpene
Himachalol	0.86*	0.34	Sesquiterpenic alcohol
Unknown	[0.86]*		Oxygenated sesquiterpene
Unknown	0.61		Oxygenated sesquiterpene
Cedrenol analog	0.93*	0.10	Sesquiterpenic alcohol
Unknown	[0.93]*	0.43	Oxygenated sesquiterpene
14-Hydroxy-9-epi-(E)-caryophyllene	0.10	0.16	Sesquiterpenic alcohol
Cedr-8-en-13-ol	0.33	0.05	Sesquiterpenic alcohol
α-Cedrenol	[0.33]*	0.13	Sesquiterpenic alcohol
epi-α-Bisabolol	[0.33]*	0.20	Sesquiterpenic alcohol
Unknown	0.10		Oxygenated sesquiterpene
Mayurone?	0.07	0.05	Norsesquiterpenic ketone
Unknown	0.64*		Oxygenated sesquiterpene
Thujopsenal	[0.64]*	0.04	Sesquiterpenic aldehyde
Thujopsenal analog	0.04	0.03	Sesquiterpenic aldehyde
Unknown	0.06		Oxygenated sesquiterpene
Cedryl acetate?	0.12		Sesquiterpenic ester
Unknown	0.02	0.05	Oxygenated sesquiterpene
Unknown	0.02	0.02	Oxygenated sesquiterpene
Unknown	0.13	0.08	Oxygenated sesquiterpene
Nootkatone analog	0.02	0.03	Sesquiterpenic ketone
Manool	0.02		Diterpenic alcohol
7,13-Abietadiene	0.01		Diterpene
Toluene		0.01*	Simple phenolic
Unknown		[0.01]*	Normonoterpene
Thujopsadiene?		0.03	Sesquiterpene
1,7-diepi-α-Cedrenal?		0.04	Sesquiterpenic aldehyde
β-Acoradienol?		0.02	Sesquiterpenic alcohol
<b>Total identified</b>	<b>96.84%</b>	<b>91.29%</b>	

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

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

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	%
Unknown [m/z 105, 79 (80), 91 (78), 77 (69), 78 (56), 93 (46), 120 (44)... 136 (4)]	2.84	916	0.02	2.63	1107	0.02
α-Pinene	3.02	928	0.19	1.42	991	0.20
Camphene	3.19*	940	0.04	1.77	1028	0.01
α-Fenchene	3.19*	940	[0.04]	1.70	1021	0.04
Thuja-2,4(10)-diene	3.31	947	0.03	2.38*	1085	0.03
Sabinene	3.64	969	0.01	2.38*	1085	[0.03]
α-Methylstyrene	3.78	978	0.02	5.05	1292	0.02
6-Methyl-5-hepten-2-one	3.90	986	0.01	5.22	1299	0.01
Myrcene	3.96	990	0.01			
α-Phellandrene	4.11	1000	0.01			
Δ3-Carene	4.19	1005	0.03	2.68	1111	0.04
para-Cymene	4.44	1020	0.02	4.23	1230	0.03
Limonene	4.50	1024	0.01	3.29	1158	0.02
Terpinolene	5.50*	1085	0.02	4.42	1244	0.01
para-Cymenene	5.50*	1085	[0.02]	6.48	1390	0.01
α-Campholenal	6.03	1118	0.01	7.16	1439	0.01
trans-Pinocarveol	6.25*	1133	0.05	9.29	1600	0.06
Camphor	6.25*	1133	[0.05]	7.37*	1455	0.14
meta-Mentha-4,6-dien-8-ol	6.40	1142	0.01	9.43	1612	0.04
Pinocamphone	6.54	1151	0.01	7.37*	1455	[0.14]
Pinocarvone	6.56	1152	0.01	8.08	1507	0.01
Borneol	6.73	1163	0.02	9.94*	1653	1.00
α-Phellandren-8-ol	6.80	1167	0.02	10.32*	1683	0.30
Terpinen-4-ol	6.89	1173	0.04	8.68*	1554	0.19
meta-Cymen-8-ol	6.96	1177	0.01	11.66	1796	0.01
para-Cymen-8-ol	7.11*	1187	0.07	11.71*†	1800	0.14
α-Terpineol	7.11*	1187	[0.07]	9.94*	1653	[1.00]
γ-Terpineol	7.16	1190	0.03	10.02*	1660	0.14
Myrtenol	7.21	1193	0.05	11.05	1745	0.07
Verbenone	7.30	1199	0.05	9.74*	1636	0.16
trans-Carveol	7.61	1219	0.01	11.60	1791	0.01
Carvacrol methyl ether	7.92	1239	0.03	8.68*	1554	[0.19]
Carvenone	8.05	1248	0.01	10.02*	1660	[0.14]
Bornyl acetate	8.47	1276	0.01	8.38*	1530	0.49
Carvacrol	9.11	1321	0.03	15.50	2153	0.10
α-Terpinyl acetate	9.44	1344	0.06	9.86	1646	0.21
African-1-ene	9.48	1347	0.02	7.01	1428	0.03
β-Patchoulene	9.81*	1369	0.13	7.10	1435	0.03
2-epi-α-Funebrene	9.81*	1369	[0.13]	7.37*	1455	[0.14]
α-Duprezianene	9.89	1375	0.36	7.60	1472	0.27

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Isolongifolene	9.95*	1379	[0.04]	7.67	1476	0.01
β-Elemene	10.04	1385	0.37	8.57*	1545	0.59
α-Chamipinene	10.13*	1392	0.21	8.17*†	1514	9.15
Unknown [m/z 107, 91 (86), 93 (83), 79 (81), 162 (74), 41 (73), 133 (72)... 204 (13)]	10.13*	1392	[0.21]	8.33	1527	0.04
α-Cedrene	10.28	1402	9.54	8.17*†	1514	[9.15]
β-Cedrene	10.38*	1409	3.18	8.50	1540	2.45
β-Funebrene	10.38*	1409	[3.18]	8.26	1522	0.22
Unknown [m/z 118, 69 (82), 91 (51), 117 (40)... 202 (25)]	10.38*	1409	[3.18]	9.08*	1584	0.49
β-Duprezianene	10.38*	1409	[3.18]	8.38*	1530	[0.49]
cis-Thujopsene	10.58*	1424	35.56	8.89	1570	35.37
β-Caryophyllene	10.58*	1424	[35.56]	8.68*	1554	[0.19]
(Z)-β-Farnesene?	10.61	1426	0.14	9.39	1609	0.07
Isobazzanene	10.66*	1430	0.05	8.68*	1554	[0.19]
trans-α-Bergamotene	10.66*	1430	[0.05]	8.57*	1545	[0.59]
Prezizaene	10.72	1434	0.12	8.94	1573	0.13
α-Himachalene	10.77*	1437	0.61	9.08*	1584	[0.49]
7,8-Dehydro-α-acoradiene?	10.77*	1437	[0.61]	9.72*†	1635	0.44
α-Humulene	10.84*	1443	0.10	9.50*	1617	0.50
Cadina-4,11-diene	10.84*	1443	[0.10]	9.35	1606	0.06
α-Acoradiene	10.95	1451	0.24	9.50*	1617	[0.50]
(E)-β-Farnesene	11.00*†	1455	1.05	9.72*†	1635	[0.44]
9-epi-β-Caryophyllene	11.00*†	1455	[1.05]	9.50*	1617	[0.50]
β-Acoradiene	11.05*†	1458	[1.05]	9.57	1624	0.35
Thujopsene isomer	11.05*†	1458	[1.05]	9.62	1628	0.02
β-Chamigrene	11.15	1466	0.46	9.78	1640	0.50
Unknown [m/z 91, 105 (93), 161 (77), 93 (73), 119 (71), 133 (69)... 204 (31)]	11.18*	1467	0.66			
γ-Himachalene	11.18*	1467	[0.66]	9.74*	1636	[0.16]
Widdra-2,4(14)-diene?	11.24	1472	0.12	10.02*	1660	[0.14]
Unknown [m/z 189, 91 (95), 105 (93), 133 (84), 119 (75), 41 (59), 93 (46)... 204 (33)]	11.30†	1477	0.44	10.10*	1666	0.16
ar-Curcumene	11.33†	1479	[0.44]	10.82	1725	0.23
Valencene	11.44	1486	0.73	10.06	1663	0.68
α-Cuprenene	11.50*	1491	2.33	10.32*	1683	[0.30]
Pseudowiddrene	11.50*	1491	[2.33]	10.21	1674	1.71
α-Chamigrene	11.50*	1491	[2.33]	10.32*	1683	[0.30]
β-Himachalene	11.50*	1491	[2.33]	9.94*	1653	[1.00]

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## INTERNATIONAL GROUP

Cuparene	11.56	1495	1.36	11.22*	1759	1.39
1,4-Dihydrocuparene	11.61	1499	0.11	10.64	1710	0.11
α-Alaskene	11.66*	1503	0.33	10.10*	1666	[0.16]
Unknown [m/z 121, 123 (45), 91 (24), 107 (24), 122(24), 95 (23)... 204 (11)]	11.66*	1503	[0.33]	10.47	1696	0.24
γ-Cadinene	11.70	1506	0.34	10.58*†	1705	[0.71]
α-Dehydro-arhimachalene	11.72*	1508	0.20	11.71*†	1800	[0.14]
β-Curcumene	11.72*	1508	[0.20]	10.42	1691	0.05
δ-Cadinene	11.86*†	1518	0.75	10.58*†	1705	[0.71]
γ-Dehydro-arhimachalene	11.86*†	1518	[0.75]	12.08	1833	0.05
β-Sesquiphellandrene	11.86*†	1518	[0.75]	10.78*†	1722	0.45
Unknown [m/z 91, 107 (97), 105 (93), 41 (92), 109 (78), 43 (78), 121 (76), 135 (75)... 220 (21)]	11.94*†	1525	0.53			
γ-Cuprenene	11.94*†	1525	[0.53]	10.78*†	1722	[0.45]
(E)-γ-Bisabolene	11.94*†	1525	[0.53]	10.55†	1702	0.71
ar-Himachalene	12.01	1530	0.13	11.76*†	1805	[0.14]
δ-Cuprenene epimer I	12.04	1532	0.14	11.13	1751	0.11
δ-Cuprenene epimer II	12.10*	1537	0.18	11.22*	1759	[1.39]
Unknown [m/z 43, 95 (81), 207 (61), 41 (55), 55 (50)... 222 (3)]	12.10*	1537	[0.18]	14.02*	2010	0.15
8,14-Cedranoxide	12.10*	1537	[0.18]	11.76*†	1805	[0.14]
Unknown [m/z 106, 41 (86), 43 (84), 149 (75), 69 (75), 91 (63), 93 (61)... 220 (1)]	12.10*	1537	[0.18]	11.59	1790	0.02
Unknown [m/z 91, 119 (98), 121 (91), 105 (85), 43 (82), 41 (76)... 205 (37), 220 (16)]	12.24	1547	0.16			
Caryophyllenyl alcohol	12.44*	1563	0.34	13.78	1986	0.17
Unknown [m/z 95, 191 (52), 107(50), 121 (32), 81 (31)...]	12.44*	1563	[0.34]	14.33	2039	0.05
Unknown [m/z 95, 131 (96), 202(64), 187 (61), 159(55), 105 (50)...202 (64)]	12.44*	1563	[0.34]			

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## INTERNATIONAL GROUP

Caryophyllene oxide	12.55*	1572	0.13	12.93	1909	0.05
Caryophyllene oxide isomer	12.55*	1572	[0.13]	12.88	1904	0.01
allo-Cedrol	12.70	1583	1.17	14.46*	2051	25.74
Widdrol	12.91*	1599	27.17	14.80	2084	2.03
α-Cedrol	12.91*	1599	[27.17]	14.46*	2051	[25.74]
β-Himachalene oxide	12.91*	1599	[27.17]	13.33	1945	0.02
epi-Cedrol	13.02*	1608	1.26	14.96	2100	0.72
Unknown [m/z 138, 110 (77), 137 (75), 107 (62), 91 (61), 93 (60), 109 (57)... 220 (34)]	13.02*	1608	[1.26]	13.61	1971	0.04
10-epi-Cubenol	13.02*	1608	[1.26]	14.02*	2010	[0.15]
Unknown [m/z 107, 41 (86), 123 (85), 82 (79), 95 (77), 93 (76), 91 (73), 69 (71)... 220 (13)]	13.13*	1618	0.08	14.84	2088	0.06
2-epi-α-Cedren-3-one	13.13*	1618	[0.08]			
Unknown [m/z 132, 175 (22), 119(18), 91 (18), 157 (18)... 219 (10)]	13.22*	1625	1.43	15.80	2183	0.15
α-Acorenol	13.22*	1625	[1.43]	14.64	2069	1.01
β-Acorenol	13.22*	1625	[1.43]	15.04	2107	0.22
Unknown [m/z 132, 91 (24), 119 (22), 105 (21), 133(17), 117 (16)... 219 (3)]	13.28*	1630	0.96			
Unknown [m/z 105, 93 (78), 95 (75), 131 (72), 119 (71), 132 (70), 91 (67), 120 (49)... 202 (39), 220 (9)]	13.28*	1630	[0.96]	16.00	2203	0.24
Himachalol	13.40*	1640	0.86	15.35	2139	0.34
Unknown [m/z 123, 81 (77), 95 (77), 107 (72), 41 (72), 93 (66), 55 (64)... 220? (13)]	13.40*	1640	[0.86]			
Unknown [m/z 41, 91 (96), 79 (88), 69 (82), 123 (80), 93 (80)... 220 (8)]	13.44	1643	0.61			
Cedrenol analog	13.55*	1652	0.93	16.66	2271	0.10
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79	13.55*	1652	[0.93]	15.58	2161	0.43

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(58)... 204 (48), 220 (2)]						
14-Hydroxy-9-epi-(E)-caryophyllene	13.62	1658	0.10	16.60	2266	0.16
Cedr-8-en-13-ol	13.89†	1680	0.33	17.11	2320	0.05
α-Cedrenol	13.94*†	1683	[0.33]	17.24	2333	0.13
epi-α-Bisabolol	13.94*†	1683	[0.33]	15.65	2168	0.20
Unknown [m/z 91, 105 (87), 123(74), 135 (70), 107(60), 79 (59)... 220 (13)]	13.99	1688	0.10			
Mayurone?	14.04	1692	0.07	17.30	2340	0.05
Unknown [m/z 105, 69 (77), 91 (66), 119 (65), 111 (56), 107 (45), 55 (45)... 220? (2)]	14.09*	1696	0.64			
Thujopsenal	14.09*	1696	[0.64]	16.06	2210	0.04
Thujopsenal analog	14.48	1729	0.04	17.65	2378	0.03
Unknown [m/z 105, 91 (83), 79 (78), 135 (67), 107 (56), 67 (53)... 220 (9)]	14.63	1742	0.06			
Cedryl acetate?	14.73	1751	0.12			
Unknown [m/z 91, 105 (74), 93 (67), 79 (59), 133 (54), 41 (47), 107 (46)...]	14.86	1762	0.02	18.57	2480	0.05
Unknown [m/z 189, 91 (48), 133(40), 105 (40), 41(34), 187 (34)... 220 (5)]	15.14	1786	0.02	18.79	2505	0.02
Unknown [m/z 121, 136 (53), 91 (22), 93 (19), 79 (15), 105 (13)... 220 (3)]	15.21	1792	0.13	18.73	2498	0.08
Nootkatone analog	15.43	1811	0.02	18.12	2429	0.03
Manool	17.94	2047	0.02			
7,13-Abietadiene	18.16	2068	0.01			
Toluene				1.52*	1004	0.01
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]				1.52*	1004	[0.01]
Thujopsadiene?				10.38	1688	0.03
1,7-diepi-α-Cedrenal?				15.32	2135	0.04
β-Acoradienol?				18.30	2449	0.02
<b>Total identified</b>		<b>96.84%</b>			<b>91.29%</b>	
<b>Total reported</b>		<b>98.27%</b>			<b>92.73%</b>	

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



# VITAL'S<sup>TM</sup>

## INTERNATIONAL GROUP

[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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index

# VITAL'S<sup>TM</sup>

## INTERNATIONAL GROUP

**Date :** June 12, 2020

**Lot #:** EO10318

### *CERTIFICATE OF ANALYSIS - GC PROFILING*

#### *SAMPLE IDENTIFICATION*

**Customer identification :** Eucalyptus Oil - 121785-01

**Type :** Essential oil

**Source :** *Eucalyptus globulus*

#### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

# VITAL'S<sup>TM</sup>

## INTERNATIONAL GROUP

### PHYSICOCHEMICAL DATA

**Physical aspect:** Clear liquid

**Refractive index:** 1.4600 ± 0.0003 (20 °C)

*COMPLIANCE WITH NF T 75-225:1993 (OIL OF EUCALYPTUS GLOBULUS, RECTIFIED)*

Compound	70-75%		80-85%		Observed %	Complies?
	Min. %	Max. %	Min. %	Max. %		
α-Pinene	tr	20	tr	12	2.9	Yes
Limonene	2	15	2	15	7.9	Yes
1,8-Cineole	70		80		80	80-85%
para-Cymene	1	6	1	10	2.8	Yes
trans-Pinocarveol	tr	10	tr	6	0.01	Yes
Aromadendrene		tr		tr	0.004	Yes
Globulol		tr		tr	ND	Yes
Refractive index	1.460	1.470	1.458	1.465	1.4600	Yes

### CONCLUSION

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

# VITAL'S™

## INTERNATIONAL GROUP

### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Isovaleral	tr	tr	Aliphatic aldehyde
Isoamyl alcohol	0.01	0.05	Aliphatic alcohol
(3Z)-Hexenol	tr	tr	Aliphatic alcohol
Hashishene	tr	2.90*	Monoterpene
α-Thujene	0.01	0.01	Monoterpene
α-Pinene	2.89	[2.90]*	Monoterpene
Camphene	0.03*	0.02	Monoterpene
α-Fenchene	[0.03]*	0.01	Monoterpene
Thuja-2,4(10)-diene	0.01	0.01*	Monoterpene
Sabinene	0.61*	[0.01]*	Monoterpene
β-Pinene	[0.61]*	0.61	Monoterpene
<i>trans</i> -para-Menthane	0.01		Monoterpene
2-Pentylfuran	0.82*		Furan
Myrcene	[0.82]*	0.80	Monoterpene
Pseudolimonene	0.95*	0.02	Monoterpene
α-Phellandrene	[0.95]*	0.91	Monoterpene
<i>cis</i> -Dehydroxylinalool oxide	0.03	2.73*	Monoterpenic ether
α-Terpinene	0.21	0.22	Monoterpene
para-Cymene	90.72	2.76	Monoterpene
1,8-Cineole	[90.72]*	79.62	Monoterpenic ether
Limonene	[90.72]*	7.86*	Monoterpene
β-Phellandrene	[90.72]*	[7.86]*	Monoterpene
(Z)-β-Ocimene	[90.72]	0.15	Monoterpene
(E)-β-Ocimene	0.06	0.05	Monoterpene
γ-Terpinene	2.64	[2.73]*	Monoterpene
Unknown	0.01	0.01	Oxygenated monoterpene
<i>cis</i> -Linalool oxide (fur.)	0.01	0.01	Monoterpenic alcohol
Terpinolene	0.08	0.08	Monoterpene
para-Cymenene	0.01	0.01	Monoterpene
inalool	0.01	0.01	Monoterpenic alcohol
allo-Ocimene	0.01	0.01	Monoterpene
<i>rans</i> -Pinocarveol	0.01	0.01	Monoterpenic alcohol
Borneol	tr	0.22*	Monoterpenic alcohol
Terpinen-4-ol	0.05	0.05	Monoterpenic alcohol
para-Cymen-8-ol	0.01*	tr	Monoterpenic alcohol
<i>trans</i> -Isocarveol	[0.01]*	tr	Monoterpenic alcohol
α-Terpineol	0.22	[0.22]*	Monoterpenic alcohol
Myrtenal	tr	tr	Monoterpenic aldehyde
α-Phellandrene epoxide	tr	tr	Monoterpenic ether
<i>trans</i> -Carveol	tr	tr	Monoterpenic alcohol
exo-2-Hydroxycineole	tr	tr	Monoterpenic alcohol
Unknown	0.01		Oxygenated monoterpene
Piperitone	0.01*		Monoterpenic ketone
Unknown	[0.01]*	0.01	Unknown
Geraniol	0.02	0.02	Monoterpenic alcohol
<i>cis</i> -Ascaridole glycol	tr	0.06	Monoterpenic alcohol
α-Terpinyl acetate	0.01	0.01	Monoterpenic ester
Unknown	0.01	tr	Unknown

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## INTERNATIONAL GROUP

Isoledene	tr	tr	Sesquiterpene
7-Cubebene	tr	tr	Sesquiterpene
$\alpha$ -Gurjunene	0.02	0.02	Sesquiterpene
$\beta$ -Caryophyllene	0.02	tr	Sesquiterpene
$\alpha$ -Maaliene	0.07	0.07*	Sesquiterpene
Aromadendrene	tr	[0.07]*	Sesquiterpene
allo-Aromadendrene	0.02	0.02	Sesquiterpene
Valerena-4,7(11)-diene	0.02		Sesquiterpene
$\beta$ -Eudesmol	tr		Sesquiterpenic alcohol
Unknown	tr	tr	Sesquiterpenic alcohol
<b>Total identified</b>	<b>99.65%</b>	<b>99.36%</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

# VITAL'S™

## INTERNATIONAL GROUP

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.59	639	tr	0.82	886	tr
Isoamyl alcohol	0.95	727	0.01	3.63	1179	0.05
(3Z)-Hexenol	2.07	853	tr	6.09	1354	tr
Hashishene	2.79	911	tr	1.48*	996	2.90
α-Thujene	2.94	921	0.01	1.54	1002	0.01
α-Pinene	3.02	926	2.89	1.48*	996	[2.90]
Camphene	3.21*	938	0.03	1.84	1030	0.02
α-Fenchene	3.21*	938	[0.03]	1.77	1024	0.01
Thuja-2,4(10)-diene	3.31	945	0.01	2.46*	1088	0.01
Sabinene	3.64*	967	0.61	2.46*	1088	[0.01]
β-Pinene	3.64*	967	[0.61]	2.26	1069	0.61
<i>trans</i> -para-Menthane	3.88	983	0.01			
2-Pentylfuran	3.96*	988	0.82			
Myrcene	3.96*	988	[0.82]	3.06	1135	0.80
Pseudolimonene	4.10*	998	0.95	3.01	1131	0.02
α-Phellandrene	4.10*	998	[0.95]	2.97	1128	0.91
<i>cis</i> -Dehydroxylinalool oxide	4.18	1003	0.03	4.04*	1208	2.73
α-Terpinene	4.30	1010	0.21	3.16	1142	0.22
para-Cymene	4.45†	1020	90.72	4.33	1229	2.76
1,8-Cineole	4.60*†	1029	[90.72]	3.60	1176	79.62
Limonene	4.60*†	1029	[90.72]	3.45*	1164	7.86
β-Phellandrene	4.60*†	1029	[90.72]	3.45*	1164	[7.86]
(Z)-β-Ocimene	4.72†	1036	[90.72]	4.00	1205	0.15
(E)-β-Ocimene	4.87	1046	0.06	4.20	1220	0.05
γ-Terpinene	5.00	1054	2.64	4.04*	1208	[2.73]
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.16	1064	0.01	5.02	1278	0.01
<i>cis</i> -Linalool oxide (fur.)	5.21	1067	0.01	6.76	1402	0.01
Terpinolene	5.44	1081	0.08	4.51	1242	0.08
para-Cymenene	5.46	1083	0.01	6.58	1389	0.01
Linalool	5.71	1099	0.01	8.29	1516	0.01
allo-Ocimene	6.14	1126	0.01	5.81	1334	0.01
<i>trans</i> -Pinocarveol	6.21	1130	0.01	9.43	1604	0.01
Borneol	6.67	1160	tr	10.03*	1652	0.22
Terpinen-4-ol	6.84	1170	0.05	8.82	1556	0.05
para-Cymen-8-ol	7.03*	1183	0.01	11.79	1799	tr
<i>trans</i> -Isocarveol	7.03*	1183	[0.01]	11.28	1756	tr
α-Terpineol	7.08	1186	0.22	10.03*	1652	[0.22]
Myrtenal	7.15	1190	tr	8.90	1563	tr
α-Phellandrene	7.23	1196	tr	11.31	1758	tr

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## INTERNATIONAL GROUP

epoxide						
<i>trans</i> -Carveol	7.53	1215	tr	11.66	1787	tr
exo-2-Hydroxycineole	7.56	1218	tr	11.90	1809	tr
Unknown [m/z 43, 135 (82), 91(68), 107 (58), 79(55), 150 (49)]	7.66	1224	0.01			
Piperitone	7.98*	1246	0.01			
Unknown [m/z 43, 97 (69), 107 (46), 41 (28), 55 (21), 109 (20)...]	7.98*	1246	[0.01]	11.37	1764	0.01
Geraniol	8.10	1254	0.02	11.88	1807	0.02
<i>cis</i> -Ascaridole glycol	8.60	1287	tr	15.06	2101	0.06
$\alpha$ -Terpinyl acetate	9.40	1342	0.01	9.96	1646	0.01
Unknown [m/z 43, 95 (62), 107(45), 110 (41), 55(28), 67 (25)...]	9.58	1355	0.01	14.26	2023	tr
Isoledene	9.73	1366	tr	7.10	1427	tr
7-Cubebene	9.83	1372	tr	7.38	1448	tr
$\alpha$ -Gurjunene	10.18	1398	0.02	7.86	1483	0.02
$\beta$ -Caryophyllene	10.31	1407	0.02	8.66	1544	tr
$\alpha$ -Maaliene	10.58	1427	0.07	8.80*	1555	0.07
Aromadendrene	10.64	1431	tr	8.80*	1555	[0.07]
allo-Aromadendrene	10.87	1448	0.02	9.26	1590	0.02
Valerena-4,7(11)-diene	10.92	1452	0.02			
$\beta$ -Eudesmol	13.34	1641	tr			
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161(43), 109 )40)... 204 (35), 222 (2)]	13.38	1644	tr	15.44	2139	tr
<b>Total identified</b>		<b>99.65%</b>			<b>99.36%</b>	
<b>Total reported</b>		<b>99.67%</b>			<b>99.39%</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

# VITAL'S™

## INTERNATIONAL GROUP

**Date :** June 8, 2020

**Lot #:** FO01318

### *CERTIFICATE OF ANALYSIS – GC PROFILING*

#### *SAMPLE IDENTIFICATION*

**Customer identification :** Frankincense Oil - 092741863

**Type :** Essential oil

**Source :** *Boswellia carteri*

#### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.



# VITAL'S™

## INTERNATIONAL GROUP

### PHYSICOCHEMICAL DATA

**Physical aspect:** Clear liquid

**Refractive index:** 1.3920 ± 0.0003 (20 °C)

### ISO 4730:2017 – FRANKINCENSE OIL

Compound	Min. %	Max. %	Observed %	Complies?
α-Pinene	tr	1.0	0.1	Yes
Actanol	tr	1.0	0.3	Yes
Linalool	0.2	3.0	1.8	Yes
Octyl acetate	0.1	3.0	1.3	Yes
Bornyl acetate	0.2	3.0	1.5	Yes
Incensole	2.0	5.0	2.6	Yes
Incensyl acetate	35.0	48.0	42.2	Yes
Terpinolene	1.5	5.0	3.0	Yes
γ-Terpinene	14.0	28.0	17.9	Yes
Aromadendrene	tr	10.0	3.1	Yes
para-Cymene	0.5	8.0	3.2	Yes
Terpinen-4-ol	0.5	1.5	0.8	Yes
Viridiflorene	6.0	12.0	8.1	Yes
δ-Cadinene	tr	3.5	0.12	Yes
Limonene	1.0	4.0	2.3	Yes
<b>Refractive index</b>	1.4750	1.4820	1.4778	Yes

### CONCLUSION

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

# VITAL'S™

## INTERNATIONAL GROUP

### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
α-Pinene	0.05	0.04	Aliphatic alcohol
Actanol	0.04	0.05	Aliphatic aldehyde
Linalool	0.01	0.01	Aliphatic ester
Isobutanol	0.01	0.65*	Aliphatic alcohol
Isovaleral	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	0.04	0.04	Aliphatic aldehyde
Isoamyl alcohol	0.02	0.03*	Aliphatic alcohol
2-Methylbutanol	0.01	[0.03]*	Aliphatic alcohol
Isobutyric acid	0.01		Aliphatic acid
(3Z)-Hexenol	0.02	0.04	Aliphatic alcohol
Hexanol	tr	tr	Aliphatic alcohol
α-Thujene	0.76	0.77	Monoterpene
α-Pinene	2.34	2.37	Monoterpene
Camphene	0.02*	0.01	Monoterpene
α-Fenchene	[0.02]*	tr	Monoterpene
Thuja-2,4(10)-diene	tr	0.12*	Monoterpene
Sabinene	0.76*	[0.12]*	Monoterpene
β-Pinene	[0.76]*	[0.65]*	Monoterpene
3-Methyl-3-cyclohexenone	0.01	0.02*	Aliphatic ketone
Myrcene	0.68	0.69	Monoterpene
α-Phellandrene	0.46*	0.45	Monoterpene
Pseudolimonene	[0.46]*	0.01	Monoterpene
(3Z)-Hexenyl acetate	tr	tr	Aliphatic ester
α-Terpinene	8.13	8.18	Monoterpene
Carvomenthene	0.01	0.01	Aliphatic alcohol
para-Cymene	3.22	3.24	Monoterpene
Limonene	3.88	0.81	Monoterpene
1,8-Cineole	[3.88]	3.06	Monoterpenic ether
(Z)-β-Ocimene	0.01	18.02*	Monoterpene
(E)-β-Ocimene	0.01	0.02	Monoterpene
γ-Terpinene	17.87	[18.02]*	Monoterpene
cis-Sabinene hydrate	0.02	0.09	Monoterpenic alcohol
Unknown	0.01	0.01	Oxygenated monoterpene
cis-Linalool oxide (fur.)	0.01		Monoterpenic alcohol
Terpinolene	3.05*	2.96	Monoterpene
para-Cymenene	[3.05]*	0.01	Monoterpene
trans-Sabinene hydrate	0.02	0.03	Monoterpenic alcohol
Linalool	0.07	0.07	Monoterpenic alcohol
Unknown	0.02	0.57*	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	[0.02]*	Monoterpene
endo-Fenchol	0.01	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.14	0.15	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.02	0.01	Aliphatic alcohol
Camphor	0.05	0.16*	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.06	0.06	Monoterpenic alcohol
Unknown	0.08	0.09*	Unknown
Borneol	0.02	2.64*	Monoterpenic alcohol

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Terpinen-4-ol	42.10	42.17	Monoterpenic alcohol
Dill ether	[42.10]	0.05	Monoterpenic ether
para-Cymen-8-ol	[42.10]	0.07	Monoterpenic alcohol
$\alpha$ -Terpineol	2.61	[2.64]*	Monoterpenic alcohol
<i>cis</i> -Piperitol	0.04	0.05	Monoterpenic alcohol
Unknown	0.02		Oxygenated monoterpene
<i>trans</i> -Piperitol	0.05	0.05	Monoterpenic alcohol
endo-Fenchyl acetate	0.01	0.01	Monoterpenic ester
exo-2-Hydroxycineole	0.04	0.01	Monoterpenic alcohol
Nerol	0.02	0.03	Monoterpenic alcohol
Unknown	0.02	0.01	Oxygenated monoterpene
Piperitone	0.09	0.16*	Monoterpenic ketone
<i>cis</i> -Carvenone oxide?	0.01		Monoterpenic ketone
<i>trans</i> -Ascaridole glycol	0.04	0.07*	Monoterpenic alcohol
<i>cis</i> -Ascaridole glycol?	0.02	0.04	Monoterpenic alcohol
Thymol	0.01	0.01	Monoterpenic alcohol
Carvacrol	0.02	0.02	Monoterpenic alcohol
Unknown	0.03	0.04	Monoterpenic alcohol
Myrtenyl acetate	0.01	0.01	Monoterpenic ester
Bicycloelemene	0.02	0.02	Sesquiterpene
$\alpha$ -Cubebene	0.07	0.06	Sesquiterpene
Isoledene	0.11	[0.09]*	Sesquiterpene
$\alpha$ -Copaene	0.17	[0.16]*	Sesquiterpene
7-Cubebene	0.09	0.09	Sesquiterpene
7-Cubebene epimer?	0.04	[0.16]*	Aliphatic alcohol
$\beta$ -Cubebene	0.03	0.06	Sesquiterpene
$\beta$ -Elemene	0.05	[0.57]*	Sesquiterpene
$\alpha$ -Gurjunene	0.54*	0.49*	Sesquiterpene
Methyleugenol	[0.54]*	0.11*	Phenylpropanoid
$\beta$ -Maaliene	0.01	[0.49]*	Sesquiterpene
$\beta$ -Caryophyllene	0.57	[0.57]*	Sesquiterpene
$\beta$ -Gurjunene	0.10*	0.04	Sesquiterpene
$\gamma$ -Maaliene	[0.10]*	[0.57]*	Sesquiterpene
$\alpha$ -Maaliene	0.10	0.16	Sesquiterpene
Aromadendrene	1.50	1.49	Sesquiterpene
Selina-5,11-diene	0.20	0.21	Sesquiterpene
Cadina-3,5-diene isomer I?	0.22		Sesquiterpene
<i>trans</i> -Muurolo-3,5-diene	0.13	0.11	Sesquiterpene
$\alpha$ -Humulene	0.16	0.11	Sesquiterpene
allo-Aromadendrene	0.72	0.70	Sesquiterpene
Valerena-4,7(11)-diene	0.05	0.11	Sesquiterpene
$\gamma$ -Gurjunene	0.08	0.07	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.42*	0.38	Sesquiterpene
Selina-4,11-diene	[0.42]*	0.05	Sesquiterpene
$\gamma$ -Muurolole	0.07	0.22*	Sesquiterpene
$\beta$ -Selinene	0.13	0.15	Sesquiterpene
allo-Aromadendr-9-ene	0.13*	[0.22]*	Sesquiterpene
<i>trans</i> -Muurolo-4(15),5-diene	[0.13]*	[0.16]*	Sesquiterpene
$\delta$ -Selinene	0.16	[0.22]*	Sesquiterpene
Viridiflorene	1.69*	1.25	Sesquiterpene
$\alpha$ -Selinene	[1.69]*	0.13	Sesquiterpene
Bicyclgermacrene	[1.69]*	0.68*	Sesquiterpene

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$\alpha$ -Muurolene	0.21	[0.68]*	Sesquiterpene
$\gamma$ -Cadinene	0.04	1.84*	Sesquiterpene
<i>trans</i> -Calamenene	2.00	0.20	Sesquiterpene
Zonarene	[2.00]*	[1.84]*	Sesquiterpene
$\delta$ -Cadinene	[2.00]*	[1.84]	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.23	0.23	Sesquiterpene
$\alpha$ -Calacorene	0.04	0.03	Sesquiterpene
Epiglobulol?	0.08	[0.11]*	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.02	0.03	Sesquiterpene
Palustrol	0.10*	0.05	Sesquiterpenic alcohol
Unknown	[0.10]*	[0.11]*	Oxygenated sesquiterpene
Unknown	0.01	0.01	Oxygenated sesquiterpene
Spathulenol	0.09	0.10	Sesquiterpenic alcohol
Globulol	0.33	0.31	Sesquiterpenic alcohol
Gleenol	0.03	0.04	Sesquiterpenic alcohol
Viridiflorol	0.15	0.15	Sesquiterpenic alcohol
Cubeban-11-ol	0.13	0.24*	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.12*	[0.07]*	Sesquiterpenic alcohol
Ledol	[0.12]*	0.05	Sesquiterpenic alcohol
10-epi-Cubenol	0.01		Sesquiterpenic alcohol
Rosifoliol	0.14	0.14	Sesquiterpenic alcohol
1-epi-Cubenol	0.20	0.19	Sesquiterpenic alcohol
Isospathulenol	0.04	0.04	Sesquiterpenic alcohol
Cubenol	0.11	[0.24]*	Sesquiterpenic alcohol
$\alpha$ -Muurolol	0.04	0.05	Sesquiterpenic alcohol
<b>Total identified</b>	<b>98.66%</b>	<b>98.62%</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	%
α-Pinene	0.36	498	0.05	0.78	902	0.04
Actanol	0.41	540	0.04	0.48	770	0.05
Linolool	0.50	609	0.01	0.66	854	0.01
Isobutanol	0.52	619	0.01	2.03*	1069	0.65
Isovaleral	0.58	640	0.01	0.73	881	0.01
2-Methylbutyral	0.61	649	0.04	0.71	875	0.04
Isoamyl alcohol	0.93	727	0.02	3.29*	1176	0.03
2-Methylbutanol	0.95	730	0.01	3.29*	1176	[0.03]
Isobutyric acid	1.16	761	0.01			
(3Z)-Hexenol	2.02	853	0.02	5.60	1346	0.04
Hexanol	2.22	870	tr	5.26	1321	tr
α-Thujene	2.92	924	0.76	1.38	1002	0.77
α-Pinene	2.99	929	2.34	1.33	994	2.37
Camphene	3.18*	941	0.02	1.64	1031	0.01
α-Fenchene	3.18*	941	[0.02]	1.58	1025	tr
Thuja-2,4(10)-diene	3.27	948	tr	2.20*	1086	0.12
Sabinene	3.60*	970	0.76	2.20*	1086	[0.12]
β-Pinene	3.60*	970	[0.76]	2.03*	1069	[0.65]
3-Methyl-3-cyclohexenone	3.75	980	0.01	5.99*	1374	0.02
Myrcene	3.92	991	0.68	2.79	1137	0.69
α-Phellandrene	4.05*	1000	0.46	2.70	1130	0.45
Pseudolimonene	4.05*	1000	[0.46]	2.74	1132	0.01
(3Z)-Hexenyl acetate	4.19	1009	tr	4.71	1281	tr
α-Terpinene	4.27	1014	8.13	2.89	1145	8.18
Carvomenthene	4.32	1018	0.01	2.39	1104	0.01
para-Cymene	4.38	1021	3.22	3.99	1229	3.24
Limonene	4.44†	1025	3.88	3.10	1161	0.81
1,8-Cineole	4.46†	1026	[3.88]	3.21	1170	3.06
(Z)-β-Ocimene	4.66	1039	0.01	3.75*	1212	18.02
(E)-β-Ocimene	4.82	1049	0.01	3.88	1221	0.02
γ-Terpinene	4.97	1058	17.87	3.75*	1212	[18.02]
cis-Sabinene hydrate	5.05	1064	0.02	6.80	1433	0.09
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.11	1068	0.01	4.68	1278	0.01
cis-Linalool oxide (fur.)	5.15	1070	0.01			
Terpinolene	5.39*	1085	3.05	4.19	1243	2.96
para-Cymenene	5.39*	1085	[3.05]	6.23	1391	0.01
trans-Sabinene hydrate	5.53	1094	0.02	7.80	1508	0.03
Linalool	5.63	1100	0.07	7.90	1516	0.07

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Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.69	1104	0.02	8.34*	1550	0.57
para-Mentha-1,3,8-triene	5.73	1107	0.01	5.99*	1374	[0.02]
endo-Fenchol	5.77	1109	0.01	8.21	1540	0.01
cis-para-Menth-2-en-1-ol	5.89	1117	0.14	7.95	1520	0.15
4-Hydroxy-4-methylcyclohex-2-enone	6.08	1130	0.02	13.85	2027	0.01
Camphor	6.19	1136	0.05	7.08*	1454	0.16
trans-para-Menth-2-en-1-ol	6.20	1137	0.06	8.82	1588	0.06
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.31	1144	0.08	6.71*	1427	0.09
Borneol	6.61	1163	0.02	9.61*	1652	2.64
Terpinen-4-ol	6.86†	1179	42.10	8.47	1561	42.17
Dill ether	6.89†	1182	[42.10]	7.16	1460	0.05
para-Cymen-8-ol	6.92†	1184	[42.10]	11.32	1796	0.07
α-Terpineol	7.01	1189	2.61	9.61*	1652	[2.64]
cis-Piperitol	7.06	1192	0.04	9.36	1632	0.05
Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	7.13	1197	0.02			
trans-Piperitol	7.25	1205	0.05	10.19	1699	0.05
endo-Fenchyl acetate	7.39	1214	0.01	6.74	1428	0.01
exo-2-Hydroxycineole	7.49	1221	0.04	11.44	1806	0.01
Nerol	7.59	1228	0.02	10.87	1757	0.03
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.67	1233	0.02	11.13	1779	0.01
Piperitone	7.88	1247	0.09	9.75*	1663	0.16
cis-Carvenone oxide?	8.01	1256	0.01			
trans-Ascaridole glycol	8.15	1265	0.04	14.04*	2045	0.07
cis-Ascaridole glycol?	8.43	1284	0.02	14.57	2097	0.04
Thymol	8.60	1296	0.01	14.89	2129	0.01
Carvacrol	8.74	1305	0.02	15.13	2153	0.02
Unknown [m/z 97,	8.91	1317	0.03	14.74	2114	0.04

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112 (92), 83(62), 43 (44), 41 (25)... 170? (4)]						
Myrtenyl acetate	9.01	1324	0.01	9.41	1636	0.01
Bicycloelemene	9.13	1333	0.02	6.96	1446	0.02
α-Cubebene	9.32	1346	0.07	6.66	1423	0.06
Isoledene	9.63	1368	0.11	6.71*	1427	[0.09]
α-Copaene	9.67	1371	0.17	7.08*	1454	[0.16]
7-Cubebene	9.71	1374	0.09	7.04	1451	0.09
7-Cubebene epimer?	9.74	1376	0.04	7.08*	1454	[0.16]
β-Cubebene	9.92	1388	0.03	7.66	1498	0.06
β-Elemene	9.94	1390	0.05	8.34*	1550	[0.57]
α-Gurjunene	10.12*	1403	0.54	7.54*	1489	0.49
Methyleugenol	10.12*	1403	[0.54]	13.12*	1958	0.11
β-Maaliene	10.17	1406	0.01	7.54*	1489	[0.49]
β-Caryophyllene	10.24	1412	0.57	8.34*	1550	[0.57]
β-Gurjunene	10.36*	1420	0.10	8.26	1544	0.04
γ-Maaliene	10.36*	1420	[0.10]	8.34*	1550	[0.57]
α-Maaliene	10.44	1426	0.10	8.49	1562	0.16
Aromadendrene	10.51	1432	1.50	8.51	1564	1.49
Selina-5,11-diene	10.53	1433	0.20	8.57	1568	0.21
Cadina-3,5-diene isomer I?	10.57	1436	0.22			
<i>trans</i> -Muurolo-3,5- diene	10.67	1444	0.13	8.77	1584	0.11
α-Humulene	10.70	1446	0.16	9.17	1615	0.11
allo- Aromadendrene	10.80	1453	0.72	8.90	1594	0.70
Valerena-4,7(11)- diene	10.83	1456	0.05	8.79	1586	0.11
γ-Gurjunene	10.96	1466	0.08	9.04	1605	0.07
<i>trans</i> -Cadina- 1(6),4-diene	11.00*	1468	0.42	9.14	1613	0.38
Selina-4,11-diene	11.00*	1468	[0.42]	9.31	1627	0.05
γ-Muurolole	11.04	1472	0.07	9.45*	1638	0.22
β-Selinene	11.14	1478	0.13	9.70	1659	0.15
allo-Aromadendr- 9-ene	11.17*	1481	0.13	9.45*	1638	[0.22]
<i>trans</i> -Muurolo- 4(15),5-diene	11.17*	1481	[0.13]	9.75*	1663	[0.16]
δ-Selinene	11.23	1486	0.16	9.45*	1638	[0.22]
Viridiflorene	11.28*	1489	1.69	9.55	1646	1.25
α-Selinene	11.28*	1489	[1.69]	9.82	1669	0.13
Bicyclogermacrene	11.28*	1489	[1.69]	9.93*	1678	0.68
α-Muurolole	11.37	1496	0.21	9.93*	1678	[0.68]
γ-Cadinene	11.52	1508	0.04	10.26*†	1705	1.84
<i>trans</i> -Calamenene	11.65†	1517	2.00	11.09	1776	0.20
Zonarene	11.67*†	1519	[2.00]	10.26*†	1705	[1.84]
δ-Cadinene	11.67*†	1519	[2.00]	10.30†	1709	[1.84]
<i>trans</i> -Cadina-1,4- diene	11.76	1527	0.23	10.54	1729	0.23

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α-Calacorene	11.88	1536	0.04	11.95	1852	0.03
Epiglobulol?	12.09	1552	0.08	13.12*	1958	[0.11]
Eudesma-5,7(11)-diene	12.14	1556	0.02	10.99	1767	0.03
Palustrol	12.17*	1559	0.10	12.13	1867	0.05
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.17*	1559	[0.10]	13.12*	1958	[0.11]
Unknown [m/z 107, 163 (88), 59 (60), 93 (49), 43 (47), 81 (46... 204 (5)...]	12.22	1563	0.01	13.04	1950	0.01
Spathulenol	12.31	1570	0.09	14.21	2062	0.10
Globulol	12.39	1576	0.33	13.72	2015	0.31
Gleenol	12.45	1580	0.03	13.40	1984	0.04
Viridiflorol	12.48	1583	0.15	13.81	2023	0.15
Cubeban-11-ol	12.52	1586	0.13	13.52*	1995	0.24
Eudesm-5-en-11-ol analog	12.62*	1594	0.12	14.04*	2045	[0.07]
Ledol	12.62*	1594	[0.12]	13.20	1966	0.05
10-epi-Cubenol	12.78	1606	0.01			
Rosifoliol	12.87	1615	0.14	14.14	2055	0.14
1-epi-Cubenol	12.95	1621	0.20	13.60	2003	0.19
Isospathulenol	13.07	1631	0.04	15.24	2164	0.04
Cubenol	13.13	1635	0.11	13.52*	1995	[0.24]
α-Muurolol	13.18	1640	0.04	15.00	2140	0.05
<b>Total identified</b>		<b>98.66%</b>			<b>98.62%</b>	
<b>Total reported</b>		<b>98.84%</b>			<b>98.70%</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



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## INTERNATIONAL GROUP

**Date :** June 12, 2020

**Lot #:** L001918

### *CERTIFICATE OF ANALYSIS – GC PROFILING*

#### *SAMPLE IDENTIFICATION*

**Customer identification :** Lavender Oil - 181528236

**Type :** Essential oil

**Source :** *Lavandula Angustifolia*

#### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS

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## INTERNATIONAL GROUP

### PHYSICOCHEMICAL DATA

**Physical aspect:** Clear liquid

**Refractive index:** 1.3618 ± 0.0003 (20 °C)

### NF T 75-210:2008 - OIL OF LAVENDER

Compound	Min. %	Max. %	Observed %	Complies?
α-Pinene	1.0	2.5	1.8	Yes
Limonene	3.0	6.5	5.3	Yes
1,8-Cineole	0.5	2.5	0.7	Yes
Cis-ocimene	36.0	46.0	45.7	Yes
Trans-ocimine	2.5	4.5	3.1	Yes
3-octanone	1.5	6.0	2.0	Yes
camphor	2.0	4.5	3.3	Yes
linalool	15.0	25.0	20.4	Yes
cis-Sabinene hydrate	0.5	2.3	0.3	No
Limonene	1.0	2.5	2.1	Yes
Terpinen-4-ol	4.0	6.0	5.3	Yes
Octan-3-ol	0.1	0.4	0.1	Yes
<b>Refractive index</b>	1.459	1.465	1.460	Yes

### EUROPEAN PHARMACOPOEIA 9.0 - 07/2012:0405 – LAVENDER OIL

Compound	Min. %	Max. %	Observed %	Complies?
α-Pinene		1.0	0.1	Yes
Limonene		3.0	0.7	Yes
1,8-Cineole	30.0	55.0	45.7	Yes
Cis-ocimene	2.8	10.0	5.3	Yes
Trans-ocimine	1.5	10.0	3.3	Yes
3-octanone	1.0	8.0	2.0	Yes
camphor	14.0	32.0	20.4	Yes
linalool	3.5	8.0	5.3	Yes
Limonene	1.0	3.5	2.1	Yes
Terpinen-4-ol		0.20	0.17	Yes
<b>Refractive index</b>	1.457	1.467	1.460	Yes

### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the Eur. Ph. standard for peppermint oil and with the ISO standard for Lavender oil.

# VITAL'S™

## INTERNATIONAL GROUP

### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Isobutanol	tr		Aliphatic alcohol
Isovaleral	0.01	0.01*	Aliphatic aldehyde
2-Methylbutyral	0.01	0.01	Aliphatic aldehyde
2-Ethylfuran	tr	tr	Furan
Isoamyl alcohol	0.01	5.29*	Aliphatic alcohol
2-Methylbutanol	0.01	[5.29]*	Aliphatic alcohol
(2E)-Hexenal	tr	tr	Aliphatic aldehyde
(3Z)-Hexenol	0.01	tr	Aliphatic alcohol
Hexanol	tr	tr	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.02	0.02	Furan
Nonane	tr	[0.01]*	Alkane
Hashishene	tr	0.70*	Monoterpene
α-Thujene	0.03	0.03	Monoterpene
α-Pinene	0.70	[0.70]*	Monoterpene
Camphene	0.06*	0.03	Monoterpene
α-Fenchene	[0.06]*	tr	Monoterpene
3-Methylcyclohexanone	[0.06]*	0.03*	Aliphatic ketone
<i>trans</i> -3-Methylcyclohexanol	[0.06]*	0.01	Aliphatic alcohol
Thuja-2,4(10)-diene	0.01	0.34*	Monoterpene
Benzaldehyde	tr	0.02	Simple phenolic
Sabinene	1.29*	[0.34]*	Monoterpene
β-Pinene	[1.29]*	0.93	Monoterpene
<i>trans</i> -2-para-Menthene	0.01		Monoterpene
Octan-3-one	0.06	0.04*	Aliphatic ketone
Myrcene	0.17	0.16	Monoterpene
Pseudolimonene	0.20*	0.01	Monoterpene
α-Phellandrene	[0.20]*	0.03	Monoterpene
Octan-3-ol	[0.20]*	0.15	Aliphatic alcohol
Δ <sup>3</sup> -Carene	tr	tr	Monoterpene
α-Terpinene	0.17	0.17	Monoterpene
para-Cymene	0.18	0.19	Monoterpene
1,8-Cineole	7.40*	[5.29]*	Monoterpenic ether
β-Phellandrene	[7.40]*	[5.29]*	Monoterpene
Limonene	[7.40]*	2.09	Monoterpene
2-Ethylhexanol	0.02	0.01	Aliphatic alcohol
(Z)-β-Ocimene	0.14	0.13	Monoterpene
(E)-β-Ocimene	0.04	[0.04]*	Monoterpene
γ-Terpinene	0.32	0.31	Monoterpene
<i>cis</i> -Sabinene hydrate	0.26	0.26*	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.02	0.02*	Monoterpenic alcohol
Octanol	0.04	5.31*	Aliphatic alcohol
<i>trans</i> -Linalool oxide (fur.)	0.11*	[0.26]*	Monoterpenic alcohol
Terpinolene	[0.11]*	0.10	Monoterpene
para-Cymenene	[0.11]*	0.01	Monoterpene
Unknown	tr		Oxygenated monoterpene
<i>trans</i> -Sabinene hydrate	0.03	0.04	Monoterpenic alcohol
2-Methylbutyl isovalerate	0.01	[0.03]*	Aliphatic ester
Nonanal	0.18*	0.01	Aliphatic aldehyde

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2-Methylbutyl 2-methylbutyrate	[0.18]*	0.04	Aliphatic ester
Linalool	[0.18]*	0.12	Monoterpenic alcohol
Amyl isovalerate	0.03	0.02	Aliphatic ester
endo-Fenchol	0.01	0.26*	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.04	0.08	Monoterpenic alcohol
Octan-3-yl acetate	0.02	0.01	Aliphatic ester
cis-Limonene oxide	tr	[0.02]*	Monoterpenic ether
allo-Ocimene	tr	0.01	Monoterpene
Camphor	0.02*	0.01	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	[0.02]*	0.02	Monoterpenic alcohol
trans-Sabinol	tr	0.02	Monoterpenic alcohol
neo-Isopulegol	0.17*	[5.31]*	Monoterpenic alcohol
Isopulegol	[0.17]*	[5.31]*	Monoterpenic alcohol
Menthone	20.44	20.41	Monoterpenic ketone
Isomenthone	5.25*	3.28	Monoterpenic ketone
Menthofuran	[5.25]*	2.00	Monoterpenic ether
Borneol	[5.25]*	0.34*	Monoterpenic alcohol
neo-Menthol	3.11	[5.52]*	Monoterpenic alcohol
δ-Terpineol	0.13	0.06	Monoterpenic alcohol
Terpinen-4-ol	0.08	[5.52]*	Monoterpenic alcohol
Menthol	47.36*	45.72	Monoterpenic alcohol
Isomenthol	[47.36]*	1.10*	Monoterpenic alcohol
para-Cymen-8-ol	[47.36]	0.02	Monoterpenic alcohol
α-Terpineol	0.14	[0.34]*	Monoterpenic alcohol
cis-Piperitol	0.26*	0.02	Monoterpenic alcohol
neoiso-Menthol	[0.26]*	0.33	Monoterpenic alcohol
Myrtenal	[0.26]*	0.02	Monoterpenic aldehyde
Methylchavicol	0.02*	0.07	Phenylpropanoid
trans-Isopiperitenol	[0.02]*	0.03*	Monoterpenic alcohol
Unknown	0.01		Unknown
trans-Piperitol	0.02	0.04	Monoterpenic alcohol
Unknown	0.04		Unknown
trans-Carveol	0.01	0.03	Monoterpenic alcohol
cis-Carveol	0.01		Monoterpenic alcohol
Citronellol	0.70*	0.02	Monoterpenic alcohol
Pulegone	[0.70]*	[1.10]*	Monoterpenic ketone
(3Z)-Hexenyl isovalerate	0.03		Aliphatic ester
Carvone	0.06	0.07	Monoterpenic ketone
Piperitone	0.34	0.68*	Monoterpenic ketone
neo-Menthyl acetate	0.33	0.32	Monoterpenic ester
Decanol	0.04*	0.04	Aliphatic alcohol
Unknown	[0.04]*		Unknown
2-Ethylmenthone?	0.04		Aliphatic ketone
Dihydroedulan I	0.02	0.07*	Terpenic ether
Menthyl acetate	5.34	[5.31]*	Monoterpenic ester
Isomenthyl acetate	0.20*	[0.26]*	Monoterpenic alcohol
Dihydroedulan II	[0.20]*	0.04	Terpenic ether
Dihydrocarvyl acetate	0.03	0.03	Monoterpenic ester
Bicycloelemene	0.01	0.01	Sesquiterpene
Piperitenone	0.01	tr	Monoterpenic ketone
α-Cubebene	0.02	0.01	Sesquiterpene
Evodone	0.02	0.01	Monoterpenic ketone

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Menthofuro lactone	0.01	0.01	Aliphatic alcohol
Eugenol	tr		Phenylpropanoid
$\alpha$ -Copaene	0.06	[0.07]*	Sesquiterpene
$\beta$ -Bourbonene	0.14	0.12	Sesquiterpene
$\beta$ -Elemene	0.06	[5.52]*	Sesquiterpene
Unknown	0.03		Unknown
Unknown	0.01		Sesquiterpene
Isocaryophyllene	0.03	[5.31]*	Sesquiterpene
$\beta$ -Caryophyllene	1.91*	[5.52]*	Sesquiterpene
$\beta$ -Ylangene	[1.91]*	0.14	Sesquiterpene
$\beta$ -Copaene	0.03	0.03	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.02	5.52	Sesquiterpene
Isogermacrene D	0.02	tr	Sesquiterpene
$\alpha$ -Humulene	0.08	0.14*	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.19*	0.19	Sesquiterpene
Muuro la-4,11-diene	[0.19]*	[0.14]*	Sesquiterpene
Germacrene D	0.72*	[0.68]*	Sesquiterpene
$\gamma$ -Muuro lene	[0.72]*	0.31*	Sesquiterpene
Menthallactone	tr		Monoterpenic lactone
Bicyclogermacrene	0.12*	0.10	Sesquiterpene
Viridiflorene	[0.12]*	[0.31]*	Sesquiterpene
5-Methyl-2,4-diisopropylphenol	0.03*		Terpene derivative
$\alpha$ -Muuro lene	[0.03]*	0.01	Sesquiterpene
$\gamma$ -Cadinene	0.02	[0.03]*	Sesquiterpene
$\delta$ -Cadinene	0.04	0.06	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.01	0.01	Sesquiterpene
( <i>E</i> )-Nerolidol	0.01	0.01	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.08*	0.02	Sesquiterpenic ether
Caryophyllene oxide	[0.08]*	0.05	Sesquiterpenic ether
Viridiflorol	0.07	0.07	Sesquiterpenic alcohol
Isospathulenol	tr	0.01*	Sesquiterpenic alcohol
$\alpha$ -Muuro lol	0.01	0.01	Sesquiterpenic alcohol
Unknown	tr		Sesquiterpenic alcohol
$\alpha$ -Cadinol	0.01	[0.01]*	Sesquiterpenic alcohol
Mint sulfide	0.01		Sesquiterpenic sulfide
Benzyl benzoate	0.01		Phenolic ester
<b>Total identified</b>	<b>99.50%</b>	<b>98.65%</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	%
Isobutanol	0.53	621	tr			
Isovaleral	0.58	640	0.01	0.76*	888	0.01
2-Methylbutyral	0.61	650	0.01	0.74	882	0.01
2-Ethylfuran	0.75	699	tr	0.92	922	tr
Isoamyl alcohol	0.96	731	0.01	3.38*	1170	5.29
2-Methylbutanol	0.98	734	0.01	3.38*	1170	[5.29]
(2E)-Hexenal	1.97	846	tr	3.45	1175	tr
(3Z)-Hexenol	2.10	856	0.01	5.84	1349	tr
Hexanol	2.27	870	tr	5.37	1315	tr
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.54	894	0.02	1.59	1018	0.02
Nonane	2.62	900	tr	0.76*	888	[0.01]
Hashishene	2.81	913	tr	1.43*	1002	0.70
$\alpha$ -Thujene	2.96	922	0.03	1.48	1007	0.03
$\alpha$ -Pinene	3.04	927	0.70	1.43*	1002	[0.70]
Camphene	3.24*	941	0.06	1.76	1034	0.03
$\alpha$ -Fenchene	3.24*	941	[0.06]	1.67	1025	tr
3-Methylcyclohexanone	3.24*	941	[0.06]	4.77*	1272	0.03
<i>trans</i> -3-Methylcyclohexanol	3.24*	941	[0.06]	6.84	1421	0.01
Thuja-2,4(10)-diene	3.33	947	0.01	2.35*	1090	0.34
Benzaldehyde	3.42	953	tr	7.41	1464	0.02
Sabinene	3.66*	969	1.29	2.35*	1090	[0.34]
$\beta$ -Pinene	3.66*	969	[1.29]	2.17	1073	0.93
<i>trans</i> -2-para-Menthene	3.81	979	0.01			
Octan-3-one	3.88	984	0.06	4.06*	1221	0.04
Myrcene	3.98	990	0.17	2.94	1137	0.16
Pseudolimonene	4.13*	1000	0.20	2.90	1134	0.01
$\alpha$ -Phellandrene	4.13*	1000	[0.20]	2.86	1131	0.03
Octan-3-ol	4.13*	1000	[0.20]	6.05	1364	0.15
$\Delta$ 3-Carene	4.21	1005	tr	2.67	1116	tr
$\alpha$ -Terpinene	4.33	1012	0.17	3.04	1144	0.17
para-Cymene	4.47	1021	0.18	4.15	1228	0.19
1,8-Cineole	4.53*	1025	7.40	3.38*	1170	[5.29]
$\beta$ -Phellandrene	4.53*	1025	[7.40]	3.38*	1170	[5.29]
Limonene	4.53*	1025	[7.40]	3.28	1163	2.09
2-Ethylhexanol	4.67	1034	0.02	7.29	1454	0.01
(Z)- $\beta$ -Ocimene	4.74	1038	0.14	3.86	1207	0.13
(E)- $\beta$ -Ocimene	4.89	1048	0.04	4.06*	1221	[0.04]
$\gamma$ -Terpinene	5.02	1055	0.32	3.90	1210	0.31
<i>cis</i> -Sabinene hydrate	5.17	1065	0.26	6.89*	1425	0.26
<i>cis</i> -Linalool oxide (fur.)	5.23	1068	0.02	6.51*	1397	0.02
Octanol	5.36	1076	0.04	8.21*	1524	5.31
<i>trans</i> -Linalool oxide (fur.)	5.47*	1084	0.11	6.89*	1425	[0.26]
Terpinolene	5.47*	1084	[0.11]	4.37	1244	0.10

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para-Cymenene	5.47*	1084	[0.11]	6.35	1385	0.01
Unknown [m/z 81, 43 (78), 55 (47), 96 (46), 95 (31), 41 (23)...]	5.57	1090	tr			
<i>trans</i> -Sabinene hydrate	5.66	1096	0.03	8.02	1510	0.04
2-Methylbutyl isovalerate?	5.71	1098	0.01	4.77*	1272	[0.03]
Nonanal	5.77*	1102	0.18	5.93	1355	0.01
2-Methylbutyl 2-methylbutyrate	5.77*	1102	[0.18]	4.53	1255	0.04
Linalool	5.77*	1102	[0.18]	8.04	1511	0.12
Amyl isovalerate	5.84	1107	0.03	4.66	1264	0.02
endo-Fenchol	5.88	1110	0.01	8.36*	1535	0.26
<i>cis</i> -para-Menth-2-en-1-ol	6.04	1119	0.04	8.17	1521	0.08
Octan-3-yl acetate	6.12	1124	0.02	5.31	1311	0.01
<i>cis</i> -Limonene oxide	6.16	1127	tr	6.51*	1397	[0.02]
allo-Ocimene	6.19	1129	tr	5.67	1337	0.01
Camphor	6.29*	1135	0.02	7.27	1453	0.01
<i>trans</i> -para-Menth-2-en-1-ol	6.29*	1135	[0.02]	9.00	1586	0.02
<i>trans</i> -Sabinol	6.34	1138	tr	9.82	1651	0.02
neo-Isopulegol	6.40*	1142	0.17	8.21*	1524	[5.31]
Isopulegol	6.40*	1142	[0.17]	8.21*	1524	[5.31]
Menthone	6.54	1151	20.44	6.74	1413	20.41
Isomenthone	6.66*	1159	5.25	7.04	1436	3.28
Menthofuran	6.66*	1159	[5.25]	6.95	1429	2.00
Borneol	6.66*	1159	[5.25]	9.89*	1657	0.34
neo-Menthol	6.76	1165	3.11	8.61*†	1555	[5.52]
δ-Terpineol	6.81	1168	0.13	9.48	1624	0.06
Terpinen-4-ol	6.84	1170	0.08	8.61*†	1555	[5.52]
Menthol	7.01*†	1181	47.36	9.20	1601	45.72
Isomenthol	7.01*†	1181	[47.36]	8.95*	1581	1.10
para-Cymen-8-ol	7.06†	1184	[47.36]	11.60	1801	0.02
α-Terpineol	7.15	1190	0.14	9.89*	1657	[0.34]
<i>cis</i> -Piperitol	7.18*	1192	0.26	9.60	1634	0.02
neoiso-Menthol	7.18*	1192	[0.26]	9.44	1621	0.33
Myrtenal	7.18*	1192	[0.26]	8.76	1566	0.02
Methylchavicol	7.24*	1196	0.02	9.38	1616	0.07
<i>trans</i> -Isopiperitenol	7.24*	1196	[0.02]	10.51*	1708	0.03
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.32	1201	0.01			
<i>trans</i> -Piperitol	7.39	1206	0.02	10.39	1698	0.04
Unknown [m/z 146, 145 (94), 43 (72), 99 (41), 81 (29), 115 (25), 86 (24)...]	7.43	1208	0.04			
<i>trans</i> -Carveol	7.61	1220	0.01	11.44	1787	0.03
<i>cis</i> -Carveol	7.75	1230	0.01			

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Citronellol	7.80*	1233	0.70	10.81	1733	0.02
Pulegone	7.80*	1233	[0.70]	8.95*	1581	[1.10]
(3Z)-Hexenyl isovalerate	7.83	1234	0.03			
Carvone	7.88	1238	0.06	9.98	1664	0.07
Piperitone	8.02	1247	0.34	9.93*	1661	0.68
neo-Menthyl acetate	8.38	1271	0.33	7.77	1490	0.32
Decanol	8.46*	1276	0.04	10.73	1726	0.04
Unknown [m/z 119, 79 (94), 91 (0), 84 (80), 93 (68)...]	8.46*	1276	[0.04]			
2-Ethylmenthone	8.52	1280	0.04			
Dihydroedulan I	8.54	1282	0.02	7.21*	1449	0.07
Menthyl acetate	8.68	1291	5.34	8.21*	1524	[5.31]
Isomenthyl acetate	8.84*	1302	0.20	8.36*	1535	[0.26]
Dihydroedulan II	8.84*	1302	[0.20]	7.54	1473	0.04
Dihydrocarvyl acetate	9.24	1330	0.03	9.52	1627	0.03
Bicycloelemene	9.27	1332	0.01	7.10	1441	0.01
Piperitenone	9.35	1338	0.01	12.20	1854	tr
α-Cubebene	9.44	1344	0.02	6.80	1418	0.01
Evodone	9.46	1346	0.02	12.38	1870	0.01
Menthofuroolactone	9.59	1355	0.01	11.99	1836	0.01
Eugenol	9.62	1356	tr			
α-Copaene	9.79	1369	0.06	7.21*	1449	[0.07]
β-Bourbonene	9.90	1376	0.14	7.67	1483	0.12
β-Elemene	10.04	1386	0.06	8.61*†	1555	[5.52]
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.10	1390	0.03			
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.20	1398	0.01			
Isocaryophyllene	10.26	1402	0.03	8.21*	1524	[5.31]
β-Caryophyllene	10.38*	1410	1.91	8.61*†	1555	[5.52]
β-Ylangene	10.38*	1410	[1.91]	8.13	1518	0.14
β-Copaene	10.52	1421	0.03	8.53	1549	0.03
<i>trans</i> -α-Bergamotene	10.64	1430	0.02	8.57†	1552	5.52
Isogermacrene D	10.71	1435	0.02	9.07	1590	tr
α-Humulene	10.84	1444	0.08	9.28*	1607	0.14
( <i>E</i> )-β-Farnesene	10.97*	1454	0.19	9.68	1640	0.19
Muurola-4,11-diene	10.97*	1454	[0.19]	9.28*	1607	[0.14]
Germacrene D	11.22*	1472	0.72	9.93*	1661	[0.68]
γ-Muuroleone	11.22*	1472	[0.72]	9.76*	1646	0.31
Menthalactone	11.38	1484	tr			
Bicyclogermacrene	11.42*	1488	0.12	10.20	1682	0.10
Viridiflorene	11.42*	1488	[0.12]	9.76*	1646	[0.31]
5-Methyl-2,4-diisopropylphenol	11.53*	1495	0.03			
α-Muuroleone	11.53*	1495	[0.03]	10.09	1674	0.01
γ-Cadinene	11.68	1507	0.02	10.51*	1708	[0.03]



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δ-Cadinene	11.82	1518	0.04	10.57	1713	0.06
<i>trans</i> -Cadina-1,4-diene	11.89	1523	0.01	10.70	1724	0.01
( <i>E</i> )-Nerolidol	12.38	1561	0.01	13.80	2002	0.01
Caryophyllene oxide isomer	12.50*	1571	0.08	12.75	1904	0.02
Caryophyllene oxide	12.50*	1571	[0.08]	12.83	1911	0.05
Viridiflorol	12.67	1584	0.07	14.01	2022	0.07
Isospathulenol	13.22	1629	tr	15.48*	2167	0.01
α-Muurolol	13.39	1643	0.01	15.27	2146	0.01
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 )40)... 204 (35), 222 (2)]	13.43	1646	tr			
α-Cadinol	13.48	1650	0.01	15.48*	2167	[0.01]
Mint sulfide	14.35	1723	0.01			
Benzyl benzoate	14.72	1754	0.01			
<b>Total identified</b>		<b>99.50%</b>			<b>98.65%</b>	
<b>Total reported</b>		<b>99.60%</b>			<b>98.65%</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

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## INTERNATIONAL GROUP

**Date :** June 7, 2020

**Lot #:** LE09218

### *CERTIFICATE OF ANALYSIS – GC PROFILING*

#### *SAMPLE IDENTIFICATION*

**Customer identification :** Lemon Oil – 091829562

**Type :** Essential oil

**Source :** *Citrus medica*

#### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Clear liquid

**Refractive index:** 1.4366 ± 0.0003 (20 °C)

### ISO 4730:2017 – LEMON OIL

Compound	Min. %	Max. %	Observed %	Complies?
α-Pinene	tr	1.0	0.2	Yes
Camphene	tr	1.0	0.6	Yes
β-pinene	0.2	3.0	2.2	Yes
Sabinene	0.1	3.0	1.8	Yes
Myrcene	0.2	3.0	1.5	Yes
α-Terpinene	2.0	5.0	2.6	Yes
Linalool	35.0	48.0	42.2	Yes
β-Bisabolene	1.5	5.0	3.0	Yes
Limonene	14.0	28.0	17.9	Yes
Trans-α-bergamotene	tr	10.0	3.1	Yes
neral	0.5	8.0	3.2	Yes
nerol	0.5	1.5	0.8	Yes
<b>Refractive index</b>	1.4750	1.4820	1.4778	Yes

### CONCLUSION

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

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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Ethanol	0.05	0.04	Aliphatic alcohol
Isobutyral	0.04	0.05	Aliphatic aldehyde
Ethyl acetate	0.01	0.01	Aliphatic ester
Isobutanol	0.01	0.65*	Aliphatic alcohol
Isovaleral	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	0.04	0.04	Aliphatic aldehyde
Isoamyl alcohol	0.02	0.03*	Aliphatic alcohol
2-Methylbutanol	0.01	[0.03]*	Aliphatic alcohol
Isobutyric acid	0.01		Aliphatic acid
(3Z)-Hexenol	0.02	0.04	Aliphatic alcohol
Hexanol	tr	tr	Aliphatic alcohol
α-Thujene	0.76	0.77	Monoterpene
α-Pinene	2.34	2.37	Monoterpene
Camphene	0.02*	0.01	Monoterpene
α-Fenchene	[0.02]*	tr	Monoterpene
Thuja-2,4(10)-diene	tr	0.12*	Monoterpene
Sabinene	0.76*	[0.12]*	Monoterpene
β-Pinene	[0.76]*	[0.65]*	Monoterpene
3-Methyl-3-cyclohexenone	0.01	0.02*	Aliphatic ketone
Myrcene	0.68	0.69	Monoterpene
α-Phellandrene	0.46*	0.45	Monoterpene
Pseudolimonene	[0.46]*	0.01	Monoterpene
(3Z)-Hexenyl acetate	tr	tr	Aliphatic ester
α-Terpinene	8.13	8.18	Monoterpene
Carvomenthene	0.01	0.01	Aliphatic alcohol
para-Cymene	3.22	3.24	Monoterpene
Limonene	3.88	0.81	Monoterpene
1,8-Cineole	[3.88]	3.06	Monoterpenic ether
(Z)-β-Ocimene	0.01	18.02*	Monoterpene
(E)-β-Ocimene	0.01	0.02	Monoterpene
γ-Terpinene	17.87	[18.02]*	Monoterpene
cis-Sabinene hydrate	0.02	0.09	Monoterpenic alcohol
Unknown	0.01	0.01	Oxygenated monoterpene
cis-Linalool oxide (fur.)	0.01		Monoterpenic alcohol
Terpinolene	3.05*	2.96	Monoterpene
para-Cymenene	[3.05]*	0.01	Monoterpene
trans-Sabinene hydrate	0.02	0.03	Monoterpenic alcohol
Linalool	0.07	0.07	Monoterpenic alcohol
Unknown	0.02	0.57*	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	[0.02]*	Monoterpene
endo-Fenchol	0.01	0.01	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.14	0.15	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.02	0.01	Aliphatic alcohol
Camphor	0.05	0.16*	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	0.06	0.06	Monoterpenic alcohol
Unknown	0.08	0.09*	Unknown
Borneol	0.02	2.64*	Monoterpenic alcohol

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Terpinen-4-ol	42.10	42.17	Monoterpenic alcohol
Dill ether	[42.10]	0.05	Monoterpenic ether
para-Cymen-8-ol	[42.10]	0.07	Monoterpenic alcohol
$\alpha$ -Terpineol	2.61	[2.64]*	Monoterpenic alcohol
<i>cis</i> -Piperitol	0.04	0.05	Monoterpenic alcohol
Unknown	0.02		Oxygenated monoterpene
<i>trans</i> -Piperitol	0.05	0.05	Monoterpenic alcohol
endo-Fenchyl acetate	0.01	0.01	Monoterpenic ester
exo-2-Hydroxycineole	0.04	0.01	Monoterpenic alcohol
Nerol	0.02	0.03	Monoterpenic alcohol
Unknown	0.02	0.01	Oxygenated monoterpene
Piperitone	0.09	0.16*	Monoterpenic ketone
<i>cis</i> -Carvenone oxide?	0.01		Monoterpenic ketone
<i>trans</i> -Ascaridole glycol	0.04	0.07*	Monoterpenic alcohol
<i>cis</i> -Ascaridole glycol?	0.02	0.04	Monoterpenic alcohol
Thymol	0.01	0.01	Monoterpenic alcohol
Carvacrol	0.02	0.02	Monoterpenic alcohol
Unknown	0.03	0.04	Monoterpenic alcohol
Myrtenyl acetate	0.01	0.01	Monoterpenic ester
Bicycloelemene	0.02	0.02	Sesquiterpene
$\alpha$ -Cubebene	0.07	0.06	Sesquiterpene
Isoledene	0.11	[0.09]*	Sesquiterpene
$\alpha$ -Copaene	0.17	[0.16]*	Sesquiterpene
7-Cubebene	0.09	0.09	Sesquiterpene
7-Cubebene epimer?	0.04	[0.16]*	Aliphatic alcohol
$\beta$ -Cubebene	0.03	0.06	Sesquiterpene
$\beta$ -Elemene	0.05	[0.57]*	Sesquiterpene
$\alpha$ -Gurjunene	0.54*	0.49*	Sesquiterpene
Methyleugenol	[0.54]*	0.11*	Phenylpropanoid
$\beta$ -Maaliene	0.01	[0.49]*	Sesquiterpene
$\beta$ -Caryophyllene	0.57	[0.57]*	Sesquiterpene
$\beta$ -Gurjunene	0.10*	0.04	Sesquiterpene
$\gamma$ -Maaliene	[0.10]*	[0.57]*	Sesquiterpene
$\alpha$ -Maaliene	0.10	0.16	Sesquiterpene
Aromadendrene	1.50	1.49	Sesquiterpene
Selina-5,11-diene	0.20	0.21	Sesquiterpene
Cadina-3,5-diene isomer I?	0.22		Sesquiterpene
<i>trans</i> -Muurolo-3,5-diene	0.13	0.11	Sesquiterpene
$\alpha$ -Humulene	0.16	0.11	Sesquiterpene
allo-Aromadendrene	0.72	0.70	Sesquiterpene
Valerena-4,7(11)-diene	0.05	0.11	Sesquiterpene
$\gamma$ -Gurjunene	0.08	0.07	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.42*	0.38	Sesquiterpene
Selina-4,11-diene	[0.42]*	0.05	Sesquiterpene
$\gamma$ -Muuroloene	0.07	0.22*	Sesquiterpene
$\beta$ -Selinene	0.13	0.15	Sesquiterpene
allo-Aromadendr-9-ene	0.13*	[0.22]*	Sesquiterpene
<i>trans</i> -Muurolo-4(15),5-diene	[0.13]*	[0.16]*	Sesquiterpene
$\delta$ -Selinene	0.16	[0.22]*	Sesquiterpene
Viridiflorene	1.69*	1.25	Sesquiterpene
$\alpha$ -Selinene	[1.69]*	0.13	Sesquiterpene
Bicyclgermacrene	[1.69]*	0.68*	Sesquiterpene

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$\alpha$ -Muurolene	0.21	[0.68]*	Sesquiterpene
$\gamma$ -Cadinene	0.04	1.84*	Sesquiterpene
<i>trans</i> -Calamenene	2.00	0.20	Sesquiterpene
Zonarene	[2.00]*	[1.84]*	Sesquiterpene
$\delta$ -Cadinene	[2.00]*	[1.84]	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.23	0.23	Sesquiterpene
$\alpha$ -Calacorene	0.04	0.03	Sesquiterpene
Epiglobulol?	0.08	[0.11]*	Sesquiterpenic alcohol
Eudesma-5,7(11)-diene	0.02	0.03	Sesquiterpene
Palustrol	0.10*	0.05	Sesquiterpenic alcohol
Unknown	[0.10]*	[0.11]*	Oxygenated sesquiterpene
Unknown	0.01	0.01	Oxygenated sesquiterpene
Spathulenol	0.09	0.10	Sesquiterpenic alcohol
Globulol	0.33	0.31	Sesquiterpenic alcohol
Gleenol	0.03	0.04	Sesquiterpenic alcohol
Viridiflorol	0.15	0.15	Sesquiterpenic alcohol
Cubeban-11-ol	0.13	0.24*	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.12*	[0.07]*	Sesquiterpenic alcohol
Ledol	[0.12]*	0.05	Sesquiterpenic alcohol
10-epi-Cubenol	0.01		Sesquiterpenic alcohol
Rosifoliol	0.14	0.14	Sesquiterpenic alcohol
1-epi-Cubenol	0.20	0.19	Sesquiterpenic alcohol
Isospathulenol	0.04	0.04	Sesquiterpenic alcohol
Cubenol	0.11	[0.24]*	Sesquiterpenic alcohol
$\alpha$ -Muurolol	0.04	0.05	Sesquiterpenic alcohol
<b>Total identified</b>	<b>98.66%</b>	<b>98.62%</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	%
Ethanol	0.36	498	0.05	0.78	902	0.04
Isobutyral	0.41	540	0.04	0.48	770	0.05
Ethyl acetate	0.50	609	0.01	0.66	854	0.01
Isobutanol	0.52	619	0.01	2.03*	1069	0.65
Isovaleral	0.58	640	0.01	0.73	881	0.01
2-Methylbutyral	0.61	649	0.04	0.71	875	0.04
Isoamyl alcohol	0.93	727	0.02	3.29*	1176	0.03
2-Methylbutanol	0.95	730	0.01	3.29*	1176	[0.03]
Isobutyric acid	1.16	761	0.01			
(3Z)-Hexenol	2.02	853	0.02	5.60	1346	0.04
Hexanol	2.22	870	tr	5.26	1321	tr
α-Thujene	2.92	924	0.76	1.38	1002	0.77
α-Pinene	2.99	929	2.34	1.33	994	2.37
Camphene	3.18*	941	0.02	1.64	1031	0.01
α-Fenchene	3.18*	941	[0.02]	1.58	1025	tr
Thuja-2,4(10)-diene	3.27	948	tr	2.20*	1086	0.12
Sabinene	3.60*	970	0.76	2.20*	1086	[0.12]
β-Pinene	3.60*	970	[0.76]	2.03*	1069	[0.65]
3-Methyl-3-cyclohexenone	3.75	980	0.01	5.99*	1374	0.02
Myrcene	3.92	991	0.68	2.79	1137	0.69
α-Phellandrene	4.05*	1000	0.46	2.70	1130	0.45
Pseudolimonene	4.05*	1000	[0.46]	2.74	1132	0.01
(3Z)-Hexenyl acetate	4.19	1009	tr	4.71	1281	tr
α-Terpinene	4.27	1014	8.13	2.89	1145	8.18
Carvomenthene	4.32	1018	0.01	2.39	1104	0.01
para-Cymene	4.38	1021	3.22	3.99	1229	3.24
Limonene	4.44†	1025	3.88	3.10	1161	0.81
1,8-Cineole	4.46†	1026	[3.88]	3.21	1170	3.06
(Z)-β-Ocimene	4.66	1039	0.01	3.75*	1212	18.02
(E)-β-Ocimene	4.82	1049	0.01	3.88	1221	0.02
γ-Terpinene	4.97	1058	17.87	3.75*	1212	[18.02]
cis-Sabinene hydrate	5.05	1064	0.02	6.80	1433	0.09
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.11	1068	0.01	4.68	1278	0.01
cis-Linalool oxide (fur.)	5.15	1070	0.01			
Terpinolene	5.39*	1085	3.05	4.19	1243	2.96
para-Cymenene	5.39*	1085	[3.05]	6.23	1391	0.01
trans-Sabinene hydrate	5.53	1094	0.02	7.80	1508	0.03
Linalool	5.63	1100	0.07	7.90	1516	0.07

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Unknown [m/z 119, 109 (94), 43 (61), 95 (56), 91 (48), 77 (32), 152 (32), 137 (31), 134 (24)]	5.69	1104	0.02	8.34*	1550	0.57
para-Mentha-1,3,8-triene	5.73	1107	0.01	5.99*	1374	[0.02]
endo-Fenchol	5.77	1109	0.01	8.21	1540	0.01
cis-para-Menth-2-en-1-ol	5.89	1117	0.14	7.95	1520	0.15
4-Hydroxy-4-methylcyclohex-2-enone	6.08	1130	0.02	13.85	2027	0.01
Camphor	6.19	1136	0.05	7.08*	1454	0.16
trans-para-Menth-2-en-1-ol	6.20	1137	0.06	8.82	1588	0.06
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.31	1144	0.08	6.71*	1427	0.09
Borneol	6.61	1163	0.02	9.61*	1652	2.64
Terpinen-4-ol	6.86†	1179	42.10	8.47	1561	42.17
Dill ether	6.89†	1182	[42.10]	7.16	1460	0.05
para-Cymen-8-ol	6.92†	1184	[42.10]	11.32	1796	0.07
α-Terpineol	7.01	1189	2.61	9.61*	1652	[2.64]
cis-Piperitol	7.06	1192	0.04	9.36	1632	0.05
Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	7.13	1197	0.02			
trans-Piperitol	7.25	1205	0.05	10.19	1699	0.05
endo-Fenchyl acetate	7.39	1214	0.01	6.74	1428	0.01
exo-2-Hydroxycineole	7.49	1221	0.04	11.44	1806	0.01
Nerol	7.59	1228	0.02	10.87	1757	0.03
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.67	1233	0.02	11.13	1779	0.01
Piperitone	7.88	1247	0.09	9.75*	1663	0.16
cis-Carvenone oxide?	8.01	1256	0.01			
trans-Ascaridole glycol	8.15	1265	0.04	14.04*	2045	0.07
cis-Ascaridole glycol?	8.43	1284	0.02	14.57	2097	0.04
Thymol	8.60	1296	0.01	14.89	2129	0.01
Carvacrol	8.74	1305	0.02	15.13	2153	0.02
Unknown [m/z 97,	8.91	1317	0.03	14.74	2114	0.04



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112 (92), 83(62), 43 (44), 41 (25)... 170? (4)]						
Myrtenyl acetate	9.01	1324	0.01	9.41	1636	0.01
Bicycloelemene	9.13	1333	0.02	6.96	1446	0.02
α-Cubebene	9.32	1346	0.07	6.66	1423	0.06
Isoledene	9.63	1368	0.11	6.71*	1427	[0.09]
α-Copaene	9.67	1371	0.17	7.08*	1454	[0.16]
7-Cubebene	9.71	1374	0.09	7.04	1451	0.09
7-Cubebene epimer?	9.74	1376	0.04	7.08*	1454	[0.16]
β-Cubebene	9.92	1388	0.03	7.66	1498	0.06
β-Elemene	9.94	1390	0.05	8.34*	1550	[0.57]
α-Gurjunene	10.12*	1403	0.54	7.54*	1489	0.49
Methyleugenol	10.12*	1403	[0.54]	13.12*	1958	0.11
β-Maaliene	10.17	1406	0.01	7.54*	1489	[0.49]
β-Caryophyllene	10.24	1412	0.57	8.34*	1550	[0.57]
β-Gurjunene	10.36*	1420	0.10	8.26	1544	0.04
γ-Maaliene	10.36*	1420	[0.10]	8.34*	1550	[0.57]
α-Maaliene	10.44	1426	0.10	8.49	1562	0.16
Aromadendrene	10.51	1432	1.50	8.51	1564	1.49
Selina-5,11-diene	10.53	1433	0.20	8.57	1568	0.21
Cadina-3,5-diene isomer I?	10.57	1436	0.22			
<i>trans</i> -Muurola-3,5- diene	10.67	1444	0.13	8.77	1584	0.11
α-Humulene	10.70	1446	0.16	9.17	1615	0.11
allo- Aromadendrene	10.80	1453	0.72	8.90	1594	0.70
Valerena-4,7(11)- diene	10.83	1456	0.05	8.79	1586	0.11
γ-Gurjunene	10.96	1466	0.08	9.04	1605	0.07
<i>trans</i> -Cadina- 1(6),4-diene	11.00*	1468	0.42	9.14	1613	0.38
Selina-4,11-diene	11.00*	1468	[0.42]	9.31	1627	0.05
γ-Muurolene	11.04	1472	0.07	9.45*	1638	0.22
β-Selinene	11.14	1478	0.13	9.70	1659	0.15
allo-Aromadendr- 9-ene	11.17*	1481	0.13	9.45*	1638	[0.22]
<i>trans</i> -Muurola- 4(15),5-diene	11.17*	1481	[0.13]	9.75*	1663	[0.16]
δ-Selinene	11.23	1486	0.16	9.45*	1638	[0.22]
Viridiflorene	11.28*	1489	1.69	9.55	1646	1.25
α-Selinene	11.28*	1489	[1.69]	9.82	1669	0.13
Bicyclogermacrene	11.28*	1489	[1.69]	9.93*	1678	0.68
α-Muurolene	11.37	1496	0.21	9.93*	1678	[0.68]
γ-Cadinene	11.52	1508	0.04	10.26*†	1705	1.84
<i>trans</i> -Calamenene	11.65†	1517	2.00	11.09	1776	0.20
Zonarene	11.67*†	1519	[2.00]	10.26*†	1705	[1.84]
δ-Cadinene	11.67*†	1519	[2.00]	10.30†	1709	[1.84]
<i>trans</i> -Cadina-1,4- diene	11.76	1527	0.23	10.54	1729	0.23

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α-Calacorene	11.88	1536	0.04	11.95	1852	0.03
Epiglobulol?	12.09	1552	0.08	13.12*	1958	[0.11]
Eudesma-5,7(11)-diene	12.14	1556	0.02	10.99	1767	0.03
Palustrol	12.17*	1559	0.10	12.13	1867	0.05
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.17*	1559	[0.10]	13.12*	1958	[0.11]
Unknown [m/z 107, 163 (88), 59 (60), 93 (49), 43 (47), 81 (46... 204 (5)...]	12.22	1563	0.01	13.04	1950	0.01
Spathulenol	12.31	1570	0.09	14.21	2062	0.10
Globulol	12.39	1576	0.33	13.72	2015	0.31
Gleenol	12.45	1580	0.03	13.40	1984	0.04
Viridiflorol	12.48	1583	0.15	13.81	2023	0.15
Cubeban-11-ol	12.52	1586	0.13	13.52*	1995	0.24
Eudesm-5-en-11-ol analog	12.62*	1594	0.12	14.04*	2045	[0.07]
Ledol	12.62*	1594	[0.12]	13.20	1966	0.05
10-epi-Cubenol	12.78	1606	0.01			
Rosifoliol	12.87	1615	0.14	14.14	2055	0.14
1-epi-Cubenol	12.95	1621	0.20	13.60	2003	0.19
Isospathulenol	13.07	1631	0.04	15.24	2164	0.04
Cubenol	13.13	1635	0.11	13.52*	1995	[0.24]
α-Muurolol	13.18	1640	0.04	15.00	2140	0.05
<b>Total identified</b>		<b>99.73%</b>			<b>98.62%</b>	
<b>Total reported</b>		<b>99.87%</b>			<b>98.70%</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

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**Date :** June 9, 2020

**Lot #:** LO10418

## *CERTIFICATE OF ANALYSIS - GC PROFILING*

### *SAMPLE IDENTIFICATION*

**Customer identification :** Lemongrass Oil - 041885082

**Type :** Essential oil

**Source :** *Cymbopogon flexuosus*

### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Light yellow liquid

**Refractive index:** 1.4825 ± 0.0003 (20 °C)

### COMPLIANCE WITH ISO 4718:2004 (CYMBOPOGON FLEXUOSUS)

Compound	Min. Content	Max. Content	Observed %	Complies?
Limonene	0.5	3.5	0.4	No
6-Methyl-5-hepten-2-one	0.1	2.0	2.0	Yes
Neral	25.0	35.0	29.6	Yes
Geraniol	1.5	8.0	6.0	Yes
Geranial	35.0	47.0	37.5	Yes
Geranyl acetate	0.5	6.0	4.7	Yes
β-Caryophyllene	0.2	3.5	1.9	Yes
Refractive index	1.483	1.489	1.4825	No

### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard and corresponds to the expectations for this species.

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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Isobutyral	tr	tr	Aliphatic aldehyde
2-Methyl-3-buten-2-ol	0.04	0.03	Aliphatic alcohol
Isovaleral	0.02	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	0.01	Aliphatic aldehyde
2-Ethylfuran	0.01	0.01	Furan
Isoamyl alcohol	0.01	0.01	Aliphatic alcohol
Hexanal	0.01	0.01	Aliphatic aldehyde
(2E)-Hexenal	0.01	0.01	Aliphatic aldehyde
(3Z)-Hexenol	0.01	0.02	Aliphatic alcohol
4-Heptanone	0.02	0.02	Aliphatic ketone
Tricyclene	0.23*	0.23	Monoterpene
(E)-2,4-Dimethyl-2,4-heptadiene	[0.23]*	0.01	Alkene
α-Pinene	0.32	0.32	Monoterpene
Camphene	1.80	1.82	Monoterpene
Benzaldehyde	tr	0.01	Simple phenolic
Sabinene	0.02*	0.01	Monoterpene
β-Pinene	[0.02]*	0.01	Monoterpene
6-Methyl-5-hepten-2-one	1.99*	2.01	Aliphatic ketone
Dehydro-1,8-cineole	[1.99]*	0.03	Monoterpenic ether
Myrcene	0.11	0.11	Monoterpene
6-Methyl-5-hepten-2-ol	0.07	0.10*	Aliphatic alcohol
α-Phellandrene	0.01	0.01	Monoterpene
Octanal	0.10	0.10*	Aliphatic aldehyde
α-Terpinene	tr	0.01	Monoterpene
p-Menthatriene	tr		Monoterpene
para-Cymene	0.01	0.01	Monoterpene
Limonene	0.41*	0.35	Monoterpene
1,8-Cineole	[0.41]*	0.07*	Monoterpenic ether
β-Phellandrene	[0.41]*	[0.07]*	Monoterpene
(Z)-β-Ocimene	0.55	0.55	Monoterpene
(E)-β-Ocimene	0.32	0.31	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.02	0.02	Aliphatic aldehyde
γ-Terpinene	0.01	0.01	Monoterpene
cis-Sabinene hydrate	tr	0.22*	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	0.01	Monoterpenic alcohol
4-Nonanone	1.03	1.03	Aliphatic ketone
Terpinolene	0.09*	[0.10]*	Monoterpene
trans-Linalool oxide (fur.)	[0.09]*	[0.10]*	Monoterpenic alcohol
4-Nonanol	0.03		Aliphatic alcohol
Rosefuran	0.19*	0.11	Monoterpenic ether
Perillene	[0.19]*	0.02	Monoterpenic ether
Linalool	1.26	1.20	Monoterpenic alcohol
cis-Chrysanthemal?	[1.26]	0.09	Monoterpenic aldehyde
6-Methyl-3,5-heptadien-2-one	0.01	0.01	Aliphatic ketone
trans-para-Mentha-2,8-dien-1-ol	0.02	0.02	Monoterpenic alcohol
Unknown	0.02	0.01	Unknown
Unknown	0.01	0.01	Unknown
Unknown	0.16	[0.22]*	Unknown

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exo-Isocitral	0.41*	0.03	Monoterpenic aldehyde
<i>trans</i> -Chrysanthemal	[0.41]*	0.29	Monoterpenic aldehyde
Citronellal	0.39	0.40*	Monoterpenic aldehyde
Borneol	0.28	0.54*	Monoterpenic alcohol
Isoneral	1.05*	0.81	Monoterpenic aldehyde
$\alpha$ -Phellandren-8-ol	[1.05]*	0.05	Monoterpenic alcohol
Rosefuran oxide	0.05	0.04	Monoterpenic ether
Unknown	0.22*	0.04	Oxygenated monoterpene
Terpinen-4-ol	[0.22]*	0.20*	Monoterpenic alcohol
Unknown	1.52*		Unknown
Isogeranial	[1.52]*	1.26	Monoterpenic aldehyde
$\alpha$ -Terpineol	0.22	[0.54]*	Monoterpenic alcohol
<i>trans</i> -Isopiperitenol	0.04	1.46*	Monoterpenic alcohol
Unknown	0.03		Oxygenated monoterpene
Decanal	0.15	0.12	Aliphatic aldehyde
<i>cis</i> -Isopiperitenol	0.03	0.01	Monoterpenic alcohol
2,3-Epoxyneral?	0.03		Monoterpenic aldehyde
Nerol	0.11	0.18	Monoterpenic alcohol
Citronellol	0.12	0.13	Monoterpenic alcohol
Neral	29.53	29.64	Monoterpenic aldehyde
Piperitone	0.05	0.10*	Monoterpenic ketone
Geraniol	6.05	6.22	Monoterpenic alcohol
Geranial	37.47	37.80	Monoterpenic aldehyde
Unknown	0.09	0.05	Oxygenated monoterpene
2-Undecanone	0.01	[0.20]*	Aliphatic ketone
Geranyl formate	0.02	0.02	Monoterpenic ester
Unknown	0.06	0.09*	Unknown
$\alpha$ -Cubebene	0.01	0.01	Sesquiterpene
Citronellyl acetate	0.04	tr	Monoterpenic ester
Cyclosativene I	0.09	[0.22]*	Sesquiterpene
Cyclosativene II	0.17	[0.40]*	Sesquiterpene
$\alpha$ -Copaene	0.06	0.02	Sesquiterpene
Geranic acid	0.06	0.12	Aliphatic acid
$\beta$ -Bourbonene	0.02	0.02	Sesquiterpene
$\beta$ -Cubebene	4.73*	0.02	Sesquiterpene
Geranyl acetate	[4.73]*	4.79	Monoterpenic ester
$\beta$ -Elemene	0.10	1.94*	Sesquiterpene
$\beta$ -Caryophyllene	1.88	[1.94]*	Sesquiterpene
$\beta$ -Copaene	0.02	[1.94]*	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.02	0.02	Sesquiterpene
$\alpha$ -Humulene	0.80	0.20*	Sesquiterpene
( <i>E</i> )-Isoeugenol	[0.80]	0.59	Phenylpropanoid
<i>cis</i> -Muurola-4(15),5-diene	0.05	0.04	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.02	[0.20]*	Sesquiterpene
Germacrene D	0.37	0.37	Sesquiterpene
$\gamma$ -Amorphene	0.02	[0.54]*	Sesquiterpene
epi-Cubebol	0.11*	0.10	Sesquiterpenic alcohol
$\alpha$ -Selinene	[0.11]*	0.05*	Sesquiterpene
$\alpha$ -Muurolene	0.04	[0.05]*	Sesquiterpene
$\delta$ -Amorphene	0.09	[0.10]*	Sesquiterpene
$\gamma$ -Cadinene	1.42*	[1.46]*	Sesquiterpene
Cubebol	[1.42]*	0.34	Sesquiterpenic alcohol

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δ-Cadinene	0.23	0.10	Sesquiterpene
10-epi-Cubebol	0.13		Sesquiterpenic alcohol
(E)-γ-Bisabolene	0.14	[1.46]*	Sesquiterpene
Neryl butyrate	0.04		Monoterpenic ester
α-Elemol	0.08	0.07	Sesquiterpenic alcohol
Germacrene B	0.05	0.03	Sesquiterpene
Geranyl butyrate	0.13	0.15	Monoterpenic ester
Caryophyllene oxide	0.33*	0.31	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.33]*	[0.09]*	Sesquiterpenic ether
Humulene epoxide II	0.03	0.07	Sesquiterpenic ether
Selin-6-en-4α-ol	0.02		Sesquiterpenic alcohol
1-epi-Cubanol	0.02	0.02	Sesquiterpenic alcohol
Cubanol	0.02	0.05	Sesquiterpenic alcohol
Unknown	0.01	0.04*	Oxygenated sesquiterpene
Farnesal isomer	0.01		Sesquiterpenic aldehyde
(2E,6E)-Farnesal	0.01	0.02*	Sesquiterpenic aldehyde
Neophytadiene	0.04	0.01	Diterpene
meta-Camphorene	0.01	[0.04]*	Diterpene
para-Camphorene	tr	[0.02]*	Diterpene
Unknown	0.02		Unknown
Dicitral	0.07	0.04	Aliphatic alcohol
Unknown	0.13		Unknown
Unknown	0.01		Unknown
<b>Total identified</b>	<b>98.02%</b>	<b>97.90%</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	%
Isobutyral	0.42	543	tr	0.54	790	tr
2-Methyl-3-buten-2-ol	0.49	605	0.04	1.62	1020	0.03
Isovaleral	0.59	639	0.02	0.78	889	0.02
2-Methylbutyral	0.62	649	0.01	0.76	881	0.01
2-Ethylfuran	0.75	696	0.01	0.95	920	0.01
Isoamyl alcohol	0.94	727	0.01	3.52	1181	0.01
Hexanal	1.40	796	0.01	1.92	1050	0.01
(2E)-Hexenal	1.96	846	0.01	3.45	1176	0.01
(3Z)-Hexenol	2.05	853	0.01	5.87	1352	0.02
4-Heptanone	2.21	867	0.02	2.39	1096	0.02
Tricyclene	2.81*	915	0.23	1.27	974	0.23
(E)-2,4-Dimethyl-2,4-heptadiene	2.81*	915	[0.23]	1.58	1016	0.01
α-Pinene	3.00	927	0.32	1.39	995	0.32
Camphene	3.19	940	1.80	1.73	1031	1.82
Benzaldehyde	3.34	950	tr	7.43	1466	0.01
Sabinene	3.59*	967	0.02	2.31	1088	0.01
β-Pinene	3.59*	967	[0.02]	2.13	1070	0.01
6-Methyl-5-hepten-2-one	3.86*	985	1.99	5.14	1300	2.01
Dehydro-1,8-cineole	3.86*	985	[1.99]	3.15	1153	0.03
Myrcene	3.92	989	0.11	2.91	1136	0.11
6-Methyl-5-hepten-2-ol	3.98	993	0.07	6.98*	1432	0.10
α-Phellandrene	4.06	999	0.01	2.81	1128	0.01
Octanal	4.08	1000	0.10	4.49*	1246	0.10
α-Terpinene	4.25	1011	tr	3.00	1142	0.01
p-Menthatriene	4.28	1013	tr			
para-Cymene	4.37	1018	0.01	4.15	1224	0.01
Limonene	4.44*	1023	0.41	3.22	1159	0.35
1,8-Cineole	4.44*	1023	[0.41]	3.31*	1166	0.07
β-Phellandrene	4.44*	1023	[0.41]	3.31*	1166	[0.07]
(Z)-β-Ocimene	4.66	1037	0.55	3.82	1202	0.55
(E)-β-Ocimene	4.81	1047	0.32	4.02	1216	0.31
2,6-Dimethyl-5-heptenal (melonal)	4.87	1050	0.02	5.34	1314	0.02
γ-Terpinene	4.93	1054	0.01	3.84	1204	0.01
cis-Sabinene hydrate	5.05	1062	tr	6.95*	1430	0.22
cis-Linalool oxide (fur.)	5.15	1068	0.01	6.53	1399	0.01
4-Nonanone	5.20	1071	1.03	5.03	1282	1.03
Terpinolene	5.38*	1083	0.09	4.49*	1246	[0.10]
trans-Linalool	5.38*	1083	[0.09]	6.98*	1432	[0.10]



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oxide (fur.)						
4-Nonanol	5.49	1089	0.03			
Rosefuran	5.57*	1095	0.19	6.06	1365	0.11
Perillene	5.57*	1095	[0.19]	6.12	1369	0.02
Linalool	5.63†	1098	1.26	8.14	1519	1.20
<i>cis</i> -Chrysanthemal	5.67†	1101	[1.26]	6.07	1366	0.09
6-Methyl-3,5-heptadien-2-one	5.72	1104	0.01	8.22	1525	0.01
<i>trans</i> -para-Mentha-2,8-dien-1-ol	5.89	1115	0.02	8.98	1584	0.02
Unknown [m/z 81, 79 (19), 41 (12), 92 (8), 77 (8)...]	5.91	1116	0.02	6.28	1381	0.01
Unknown [m/z 95, 67 (86), 41 (68), 82 (64), 123 (62)...]	6.12	1130	0.01	7.65	1482	0.01
Unknown [m/z 81, 70 (98), 67 (63), 82 (53), 41 (46), 69 (46), 109 (43)...]	6.15	1132	0.16	6.95*	1430	[0.22]
exo-Isocitral	6.32*	1143	0.41	7.50	1471	0.03
<i>trans</i> -Chrysanthemal	6.32*	1143	[0.41]	7.31	1456	0.29
Citronellal	6.44	1150	0.39	7.07*	1439	0.40
Borneol	6.56	1158	0.28	9.86*	1654	0.54
Isoneral	6.63*	1162	1.05	7.92	1502	0.81
α-Phellandren-8-ol	6.63*	1162	[1.05]	10.30	1690	0.05
Rosefuran oxide	6.75	1170	0.05	8.64	1558	0.04
Unknown [m/z 84, 83 (74), 137 (56), 41 (47), 93 (43), 108 (40)... 152 (2)]	6.78*	1172	0.22	9.65	1638	0.04
Terpinen-4-ol	6.78*	1172	[0.22]	8.67*	1560	0.20
Unknown [m/z 69, 41 (65), 109 (36), 67 (16), 84 (11), 43 (10), 55 (9)...]	6.91*	1181	1.52			
Isogeranial	6.91*	1181	[1.52]	8.28	1530	1.26
α-Terpineol	6.97	1185	0.22	9.86*	1654	[0.54]
<i>trans</i> -Isopiperitenol	7.11	1194	0.04	10.45*	1703	1.46
Unknown [m/z 84, 41 (83), 83	7.20	1200	0.03			

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(79), 91 (76), 93 (67), 119 (64), 137 (63), 109 (54), 108 (54)... 152 (4)]						
Decanal	7.26	1203	0.15	7.35	1460	0.12
<i>cis</i> - Isopiperitenol	7.39	1212	0.03	10.37	1696	0.01
2,3-Epoxyneral	7.50	1219	0.03			
Nerol	7.63	1229	0.11	11.15	1762	0.18
Citronellol	7.70	1233	0.12	10.81	1733	0.13
Neral	7.84	1242	29.53	9.61	1634	29.64
Piperitone	7.92	1248	0.05	9.98*	1664	0.10
Geraniol	8.10	1260	6.05	11.73	1812	6.22
Geranial	8.32	1274	37.47	10.25	1686	37.80
Unknown [m/z 43, 69 (77), 41 (70), 109 (54)... 152 (6)]	8.37	1278	0.09	13.08	1932	0.05
2-Undecanone	8.60	1293	0.01	8.67*	1560	[0.20]
Geranyl formate	8.71	1301	0.02	9.94	1661	0.02
Unknown [m/z 82, 59 (44), 41 (43), 95 (31), 43 (29), 81 (24)...]	9.16	1333	0.06	12.75*	1902	0.09
$\alpha$ -Cubebene	9.33	1345	0.01	6.86	1424	0.01
Citronellyl acetate	9.45	1353	0.04	9.48	1624	tr
Cyclosativene I	9.50	1357	0.09	6.95*	1430	[0.22]
Cyclosativene II	9.54	1360	0.17	7.07*	1439	[0.40]
$\alpha$ -Copaene	9.61	1365	0.06	7.17	1446	0.02
Geranic acid	9.68	1370	0.06	17.41	2366	0.12
$\beta$ -Bourbonene	9.78	1377	0.02	7.54	1474	0.02
$\beta$ -Cubebene	9.89*	1385	4.73	7.84	1496	0.02
Geranyl acetate	9.89*	1385	[4.73]	10.63	1718	4.79
$\beta$ -Elemene	9.92	1387	0.10	8.46*	1543	1.94
$\beta$ - Caryophyllene	10.25	1411	1.88	8.46*	1543	[1.94]
$\beta$ -Copaene	10.39	1421	0.02	8.46*	1543	[1.94]
<i>trans</i> - $\alpha$ - Bergamotene	10.50	1429	0.02	8.54	1550	0.02
$\alpha$ -Humulene	10.68†	1442	0.80	9.33*	1612	0.20
( <i>E</i> )-Isoeugenol	10.70†	1444	[0.80]	16.60	2279	0.59
<i>cis</i> -Muurolo- 4(15),5-diene	10.84	1454	0.05	9.38	1616	0.04
<i>trans</i> -Cadina- 1(6),4-diene	11.00	1466	0.02	9.33*	1612	[0.20]
Germacrene D	11.08	1473	0.37	9.82	1652	0.37
$\gamma$ -Amorphene	11.21	1482	0.02	9.86*	1654	[0.54]
epi-Cubebol	11.27*	1487	0.11	12.04	1839	0.10
$\alpha$ -Selinene	11.27*	1487	[0.11]	10.09*	1673	0.05
$\alpha$ -Muurolene	11.34	1493	0.04	10.09*	1673	[0.05]

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δ-Amorphene	11.38	1496	0.09	9.98*	1664	[0.10]
γ-Cadinene	11.53*	1506	1.42	10.45*	1703	[1.46]
Cubebol	11.53*	1506	[1.42]	12.60	1889	0.34
δ-Cadinene	11.67	1518	0.23	10.53	1709	0.10
10-epi-Cubebol	11.75	1524	0.13			
(E)-γ-Bisabolene	11.79	1527	0.14	10.45*	1703	[1.46]
Neryl butyrate	11.83	1530	0.04			
α-Elemol	11.98	1543	0.08	14.10	2028	0.07
Germacrene B	12.04	1547	0.05	11.28	1773	0.03
Geranyl butyrate	12.21	1560	0.13	12.21	1854	0.15
Caryophyllene oxide	12.36*	1572	0.33	12.82	1909	0.31
Caryophyllene oxide isomer	12.36*	1572	[0.33]	12.75*	1902	[0.09]
Humulene epoxide II	12.68	1598	0.03	13.48	1969	0.07
Selin-6-en-4α-ol	12.78	1606	0.02			
1-epi-Cubebol	12.95	1619	0.02	13.85	2004	0.02
Cubebol	13.12	1634	0.02	13.75	1995	0.05
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79 (58)... 204 (48), 220 (2)]	13.28	1647	0.01	15.48*	2163	0.04
Farnesal isomer	14.03	1710	0.01			
(2E,6E)-Farnesal	14.35	1737	0.01	15.89*	2205	0.02
Neophytadiene	15.51	1840	0.04	12.70	1897	0.01
meta-Camphorene	16.68	1949	0.01	15.48*	2163	[0.04]
para-Camphorene	16.96	1976	tr	15.89*	2205	[0.02]
Unknown [m/z 93, 69 (95), 135 (76), 107 (53), 41 (53), 109 (50)... 235 (10)...]	17.91	2070	0.02			
Dicitral	18.23	2101	0.07	16.94	2315	0.04
Unknown [m/z 94, 43 (85), 93 (81), 69 (76), 137 (76), 95 (60), 134 (51)...]	18.83	2164	0.13			
Unknown [m/z 93, 69 (79), 43 (70), 137(53), 41 (41), 119 (37)... 289 (33)...]	19.51	2236	0.01			
<b>Total</b>		<b>98.02%</b>			<b>97.90%</b>	

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## INTERNATIONAL GROUP

identified		
<b>Total reported</b>	<b>98.54%</b>	<b>98.01%</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

# VITAL'S™

INTERNATIONAL GROUP

**Date :** June 12, 2020

**Lot #:** OO10218

## *CERTIFICATE OF ANALYSIS – GC PROFILING*

### *SAMPLE IDENTIFICATION*

**Customer identification :** Orange Oil - 1105 - 190275287

**Type :** Essential oil

**Source :** *Citrus sinensis*

### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

# VITAL'S™

## INTERNATIONAL GROUP

### PHYSICOCHEMICAL DATA

**Physical aspect:** Bright yellow liquid

**Refractive index:** 1.4723 ± 0.0003 (20 °C)

*ISO 3140:2011 - OIL OF SWEET ORANGE, OBTAINED BY PHYSICAL EXTRACTION OF THE PEEL*

<b>Compound</b>	<b>Min. %</b>	<b>Max. %</b>	<b>Observed %</b>	<b>Complies?</b>
β-Sinensal	0.01	0.06	0.03	Yes
Geranial	0.05	0.20	0.09	Yes
Valencene	0.01	0.40	0.04	Yes
Neral	0.03	0.10	0.06	Yes
Linalool	0.15	0.70	0.40	Yes
Decanal	0.1	0.7	0.2	Yes
Nonanal	0.01	0.06	0.05	Yes
Octanal	0.1	0.4	0.3	Yes
Limonene	93.0	96.0	94.8	Yes
Myrcene	1.5	3.5	1.9	Yes
Sabinene	0.2	0.8	0.3	Yes
β-Pinene	0.02	0.15	0.03	Yes
α-Pinene	0.4	0.8	0.5	Yes
<b>Refractive index</b>	1.4700	1.4760	1.4723	Yes

### CONCLUSION

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

# VITAL'S™

## INTERNATIONAL GROUP

### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
$\alpha$ -Thujene	tr	0.01	Monoterpene
$\alpha$ -Pinene	0.51	0.50	Monoterpene
Camphene	0.01		Monoterpene
Sabinene	0.32*	0.29	Monoterpene
$\beta$ -Pinene	[0.32]*	0.03	Monoterpene
Myrcene	1.86	1.86	Monoterpene
$\alpha$ -Phellandrene	0.32*	0.04	Monoterpene
Octanal	[0.32]*	0.27	Aliphatic aldehyde
$\Delta^3$ -Carene	0.13	0.12	Monoterpene
para-Cymene	0.01	0.01	Monoterpene
Limonene	94.77*	94.23*	Monoterpene
1,8-Cineole	[94.77]*	[94.23]*	Monoterpenic ether
$\beta$ -Phellandrene	[94.77]*	[94.23]*	Monoterpene
( <i>E</i> )- $\beta$ -Ocimene	0.02	0.02	Monoterpene
<i>cis</i> -Sabinene hydrate	0.01	0.01	Monoterpenic alcohol
Octanol	0.03	0.03	Aliphatic alcohol
Terpinolene	0.03	0.03	Monoterpene
Linalool	0.40	0.41	Monoterpenic alcohol
Nonanal	0.05	0.05	Aliphatic aldehyde
<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.01	0.01	Monoterpenic alcohol
<i>cis</i> -Limonene oxide	0.01	0.01	Monoterpenic ether
<i>trans</i> -Limonene oxide	0.01	0.01	Monoterpenic ether
Citronellal	0.05	0.05	Monoterpenic aldehyde
Terpinen-4-ol	0.01	0.02*	Monoterpenic alcohol
$\alpha$ -Terpineol	0.05	0.05	Monoterpenic alcohol
Decanal	0.23	0.23	Aliphatic aldehyde
Octyl acetate	0.01	0.01	Aliphatic ester
<i>trans</i> -Carveol	0.01		Monoterpenic alcohol
Nerol	0.01	0.01	Monoterpenic alcohol
Neral	0.06	0.07	Monoterpenic aldehyde
Perillaldehyde	0.01	0.02	Monoterpenic aldehyde
Geranial	0.09	0.10	Monoterpenic aldehyde
Decanol	0.01	0.01	Aliphatic alcohol
Limonen-10-ol	0.01	0.02	Monoterpenic alcohol
Undecanal	0.02	[0.02]*	Aliphatic aldehyde
$\alpha$ -Copaene	0.02	0.03	Sesquiterpene
Geranyl acetate	0.02	0.02	Monoterpenic ester
$\beta$ -Elemene	0.01	0.04*	Sesquiterpene
Dodecanal	0.05	0.04	Aliphatic aldehyde
$\beta$ -Caryophyllene	0.03	[0.04]*	Sesquiterpene
$\beta$ -Copaene	0.03	0.03	Sesquiterpene
$\alpha$ -Humulene	0.01	0.01	Sesquiterpene
Germacrene D	0.02	0.03	Sesquiterpene
Valencene	0.04	0.04	Sesquiterpene
$\gamma$ -Cadinene	0.01	0.03	Sesquiterpene
$\delta$ -Cadinene	0.03	0.03	Sesquiterpene
$\alpha$ -Elemol	0.01	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.01	0.01	Sesquiterpenic ether

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β-Sinensal	0.03	0.05	Sesquiterpenic aldehyde
α-Sinensal	0.02	0.02	Sesquiterpenic aldehyde
Myristic acid	0.03	0.04	Aliphatic acid
Palmitic acid	0.10	0.12	Aliphatic acid
Linoleic acid	0.02		Aliphatic acid
Oleic acid	0.01		Aliphatic acid
Stearic acid	0.14	0.24	Aliphatic acid
<b>Total identified</b>	<b>99.70%</b>	<b>99.27%</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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## INTERNATIONAL GROUP

### FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
α-Thujene	3.13	924	tr	1.48	1002	0.01
α-Pinene	3.20	928	0.51	1.42	994	0.50
Camphene	3.43	944	0.01			
Sabinene	3.81*	968	0.32	2.35	1084	0.29
β-Pinene	3.81*	968	[0.32]	2.17	1067	0.03
Myrcene	4.15	990	1.86	2.96	1134	1.86
α-Phellandrene	4.31*	1001	0.32	2.87	1127	0.04
Octanal	4.31*	1001	[0.32]	4.50	1256	0.27
Δ <sup>3</sup> -Carene	4.38	1005	0.13	2.67	1112	0.12
para-Cymene	4.57	1017	0.01	4.18	1231	0.01
Limonene	4.79*	1031	94.77	3.39*	1169	94.23
1,8-Cineole	4.79*	1031	[94.77]	3.39*	1169	[94.23]
β-Phellandrene	4.79*	1031	[94.77]	3.39*	1169	[94.23]
(E)-β-Ocimene	5.06	1048	0.02	4.08	1223	0.02
cis-Sabinene hydrate	5.30	1063	0.01	6.94	1423	0.01
Octanol	5.47	1073	0.03	8.24	1522	0.03
Terpinolene	5.64	1084	0.03	4.38	1246	0.03
Linalool	5.88	1099	0.40	8.11	1513	0.41
Nonanal	5.93	1102	0.05	5.95	1349	0.05
trans-para-Mentha-2,8-dien-1-ol	6.15	1116	0.01	9.14	1593	0.01
cis-Limonene oxide	6.33	1128	0.01	6.50	1390	0.01
trans-Limonene oxide	6.40	1132	0.01	6.66	1402	0.01
Citronellal	6.69	1151	0.05	7.08	1433	0.05
Terpinen-4-ol	7.02	1172	0.01	8.77*	1565	0.02
α-Terpineol	7.24	1186	0.05	9.83	1650	0.05
Decanal	7.52	1204	0.23	7.39	1457	0.23
Octyl acetate	7.65	1213	0.01	7.17	1440	0.01
trans-Carveol	7.72	1217	0.01			
Nerol	7.86	1227	0.01	11.10	1757	0.01
Neral	8.01	1237	0.06	9.52	1625	0.07
Perillaldehyde	8.45	1267	0.01	10.78	1730	0.02
Geranial	8.47	1268	0.09	10.16	1677	0.10
Decanol	8.57	1275	0.01	10.75	1727	0.01
Limonen-10-ol	8.76	1288	0.01	13.16	1941	0.02
Undecanal	9.03	1303	0.02	8.77*	1565	[0.02]
α-Copaene	9.96	1368	0.02	7.30	1450	0.03
Geranyl acetate	10.17	1383	0.02	10.62	1716	0.02
β-Elemene	10.21	1386	0.01	8.55*	1547	0.04
Dodecanal	10.47	1405	0.05	10.10	1672	0.04
β-Caryophyllene	10.54	1410	0.03	8.55*	1547	[0.04]
β-Copaene	10.68	1420	0.03	8.50	1543	0.03
α-Humulene	11.00	1444	0.01	9.41	1616	0.01

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Germacrene D	11.38	1472	0.02	9.90	1656	0.03
Valencene	11.54	1484	0.04	10.03	1666	0.04
γ-Cadinene	11.82	1505	0.01	10.50	1705	0.03
δ-Cadinene	11.96	1516	0.03	10.55	1710	0.03
α-Elemol	12.29	1542	0.01	14.10	2030	0.01
Caryophyllene oxide	12.64	1570	0.01	12.85	1912	0.01
β-Sinensal	14.12	1690	0.03	15.50	2168	0.05
α-Sinensal	14.77	1746	0.02	16.46	2266	0.02
Myristic acid	14.99	1765	0.03	20.00	2661	0.04
Palmitic acid	17.16	1963	0.10	21.68	2868	0.12
Linoleic acid	18.85	2130	0.02			
Oleic acid	18.92	2137	0.01			
Stearic acid	19.17	2163	0.14	23.28	3075	0.24
<b>Total identified</b>		<b>99.70%</b>			<b>99.27%</b>	
<b>Total reported</b>		<b>99.70%</b>			<b>99.27%</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

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INTERNATIONAL GROUP

**Date :** June 9, 2020

**Lot #:** PO14619

## *CERTIFICATE OF ANALYSIS – GC PROFILING*

### *SAMPLE IDENTIFICATION*

**Customer identification :** Patchouli Oil- 191840604

**Type :** Essential oil

**Source :** *Pogostemon cablin*

### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS.

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Yellow liquid

**Refractive index:** 1.6045 ± 0.0003 (20 °C)

### ISO 4725:2004 – Patchouli Oil

Compound	Min. %	Max. %	Observed %	Complies?
a-Pinene	4	10	8	Yes
B-Pinene	0.2	2	1.2	Yes
Limonene	0.2	1.5	0.7	Yes
g-Elemene	48	66	53	Yes
B-Elemene	tr	4	0.9	Yes
Cycloseychellene	tr	30	1.7	Yes
<b>Refractive index</b>	1.5950	1.6250	1.6045	Yes

### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for Basil oil, and the oil features the characteristic composition for *Pogostemon cablin* oil.

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### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Isovaleral	tr	tr	Aliphatic aldehyde
2-Methylbutyral	0.01	0.05	Aliphatic aldehyde
2-Ethylfuran	0.01	tr	Furan
Isoamyl alcohol	0.16	0.16	Aliphatic alcohol
2-Methylbutanol	0.01	0.01	Aliphatic alcohol
β-Pinene	0.02	0.02	Monoterpene
Sabinene	0.02	tr	Normonoterpene
6-Methyl-5-hepten-2-one	0.01	0.01	Aliphatic ketone
Myrcene	0.05		Monoterpene
α-Phellandrene	0.01		Monoterpene
Δ3-Carene	0.03	0.04	Monoterpene
para-Cymene	0.02	0.03	Monoterpene
Limonene	0.01	0.02	Monoterpene
1,8-Cineole	0.02*	0.01	Monoterpene
para-Cymenene	[0.02]*	0.01	Monoterpene
α-Campholenal	0.01	0.01	Monoterpenic aldehyde
trans-Pinocarveol	0.05*	0.06	Monoterpenic alcohol
Camphor	[0.05]*	0.14*	Monoterpenic ketone
meta-Mentha-4,6-dien-8-ol	0.01	0.04	Monoterpenic alcohol
Pinocamphone	0.01	[0.14]*	Monoterpenic ketone
Pinocarvone	0.01	0.01	Monoterpenic ketone
Borneol	0.02	1.00*	Monoterpenic alcohol
α-Phellandren-8-ol	0.02	0.30*	Monoterpenic alcohol
Terpinen-4-ol	0.04	0.19*	Monoterpenic alcohol
meta-Cymen-8-ol	0.01	0.01	Monoterpenic alcohol
para-Cymen-8-ol	0.07*	0.14*	Monoterpenic alcohol
α-Terpineol	[0.07]*	[1.00]*	Monoterpenic alcohol
γ-Terpineol	0.03	0.14*	Monoterpenic alcohol
Myrtenol	0.05	0.07	Monoterpenic alcohol
Verbenone	0.05	0.16*	Monoterpenic ketone
trans-Carveol	0.01	0.01	Monoterpenic alcohol
Carvacrol methyl ether	0.03	[0.19]*	Monoterpenic ether
Carvenone	0.01	[0.14]*	Monoterpenic ketone
Bornyl acetate	0.01	0.49*	Monoterpenic ester
Carvacrol	0.03	0.10	Monoterpenic alcohol
α-Terpinyl acetate	0.06	0.21	Monoterpenic ester
African-1-ene	0.02	0.03	Sesquiterpene
β-Patchoulene	0.13*	0.03	Sesquiterpene
2-epi-α-Funebrene	[0.13]*	[0.14]*	Sesquiterpene
α-Duprezianene	0.36	0.27	Sesquiterpene
7-epi-Sesquithujene?	0.04*	0.07	Sesquiterpene
Isolongifolene	[0.04]*	0.01	Sesquiterpene
β-Elemene	0.37	0.59*	Sesquiterpene
α-Chamipinene	0.21*	9.15*	Sesquiterpene
Unknown	[0.21]*	0.04	Sesquiterpene
α-Cedrene	9.54	[9.15]*	Sesquiterpene
β-Cedrene	3.18*	2.45	Sesquiterpene
β-Funebrene	[3.18]*	0.22	Sesquiterpene

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Unknown	[3.18]*	0.49*	Sesquiterpene
β-Duprezianene	[3.18]*	[0.49]*	Sesquiterpene
cis-Thujopsene	35.56*	35.37	Sesquiterpene
β-Caryophyllene	[35.56]*	[0.19]*	Sesquiterpene
(Z)-β-Farnesene?	0.14	0.07	Sesquiterpene
Isobazzanene	0.05*	[0.19]*	Sesquiterpene
trans-α-Bergamotene	[0.05]*	[0.59]*	Sesquiterpene
Prezizaene	0.12	0.13	Sesquiterpene
α-Himachalene	0.61*	[0.49]*	Sesquiterpene
7,8-Dehydro-α-acoradiene?	[0.61]*	0.44*	Sesquiterpene
α-Humulene	0.10*	0.50*	Sesquiterpene
Cadina-4,11-diene	[0.10]*	0.06	Sesquiterpene
α-Acoradiene	0.24	[0.50]*	Sesquiterpene
(E)-β-Farnesene	1.05*	[0.44]*	Sesquiterpene
9-epi-β-Caryophyllene	[1.05]*	[0.50]*	Sesquiterpene
β-Acoradiene	[1.05]*	0.35	Sesquiterpene
Thujopsene isomer	[1.05]*	0.02	Sesquiterpene
β-Chamigrene	0.46	0.50	Sesquiterpene
Unknown	0.66*		Sesquiterpene
γ-Himachalene	[0.66]*	[0.16]*	Sesquiterpene
Widdra-2,4(14)-diene?	0.12	[0.14]*	Sesquiterpene
Unknown	0.44	0.16*	Sesquiterpene
ar-Curcumene	[0.44]	0.23	Sesquiterpene
Valencene	0.73	0.68	Sesquiterpene
α-Cuprenene	2.33*	[0.30]*	Sesquiterpene
Pseudowiddrene	[2.33]*	1.71	Sesquiterpene
α-Chamigrene	[2.33]*	[0.30]*	Sesquiterpene
β-Himachalene	[2.33]*	[1.00]*	Sesquiterpene
Cuparene	1.36	1.39*	Sesquiterpene
1,4-Dihydrocuparene	0.11	0.11	Sesquiterpene
α-Alaskene	0.33*	[0.16]*	Sesquiterpene
Unknown	[0.33]*	0.24	Sesquiterpene
γ-Cadinene	0.34	[0.71]*	Sesquiterpene
α-Dehydro-ar-himachalene	0.20*	[0.14]*	Sesquiterpene
β-Curcumene	[0.20]*	0.05	Sesquiterpene
δ-Cadinene	0.75*	[0.71]*	Sesquiterpene
γ-Dehydro-ar-himachalene	[0.75]*	0.05	Sesquiterpene
β-Sesquiphellandrene	[0.75]*	0.45*	Sesquiterpene
Unknown	0.53*		Oxygenated sesquiterpene
γ-Cuprenene	[0.53]*	[0.45]*	Sesquiterpene
(E)-γ-Bisabolene	[0.53]*	0.71	Sesquiterpene
ar-Himachalene	0.13	[0.14]*	Sesquiterpene
δ-Cuprenene epimer I	0.14	0.11	Sesquiterpene
δ-Cuprenene epimer II	0.18*	[1.39]*	Sesquiterpene
Unknown	[0.18]*	0.15*	Oxygenated sesquiterpene
8,14-Cedranoxide	[0.18]*	[0.14]*	Sesquiterpenic ether
Unknown	[0.18]*	0.02	Oxygenated sesquiterpene
Unknown	0.16		Oxygenated sesquiterpene
Caryophyllenyl alcohol	0.34*	0.17	Sesquiterpenic alcohol
Unknown	[0.34]*	0.05	Oxygenated sesquiterpene
Unknown	[0.34]*		Sesquiterpene
Caryophyllene oxide	0.13*	0.05	Sesquiterpenic ether

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Caryophyllene oxide isomer	[0.13]*	0.01	Sesquiterpenic ether
allo-Cedrol	1.17	25.74*	Sesquiterpenic alcohol
Widdrol	27.17*	2.03	Sesquiterpenic alcohol
α-Cedrol	[27.17]*	[25.74]*	Sesquiterpenic alcohol
β-Himachalene oxide	[27.17]*	0.02	Sesquiterpenic ether
epi-Cedrol	1.26*	0.72	Sesquiterpenic alcohol
Unknown	[1.26]*	0.04	Oxygenated sesquiterpene
10-epi-Cubenol	[1.26]*	[0.15]*	Sesquiterpenic alcohol
Unknown	0.08*	0.06	Oxygenated sesquiterpene
2-epi-α-Cedren-3-one	[0.08]*		Sesquiterpenic ketone
Unknown	1.43*	0.15	Oxygenated sesquiterpene
α-Acorenol	[1.43]*	1.01	Sesquiterpenic alcohol
β-Acorenol	[1.43]*	0.22	Sesquiterpenic alcohol
Unknown	0.96*		Oxygenated sesquiterpene
Unknown	[0.96]*	0.24	Oxygenated sesquiterpene
Himachalol	0.86*	0.34	Sesquiterpenic alcohol
Unknown	[0.86]*		Oxygenated sesquiterpene
Unknown	0.61		Oxygenated sesquiterpene
Cedrenol analog	0.93*	0.10	Sesquiterpenic alcohol
Unknown	[0.93]*	0.43	Oxygenated sesquiterpene
14-Hydroxy-9-epi-(E)-caryophyllene	0.10	0.16	Sesquiterpenic alcohol
Cedr-8-en-13-ol	0.33	0.05	Sesquiterpenic alcohol
α-Cedrenol	[0.33]*	0.13	Sesquiterpenic alcohol
epi-α-Bisabolol	[0.33]*	0.20	Sesquiterpenic alcohol
Unknown	0.10		Oxygenated sesquiterpene
Mayurone?	0.07	0.05	Norsesquiterpenic ketone
Unknown	0.64*		Oxygenated sesquiterpene
Thujopsenal	[0.64]*	0.04	Sesquiterpenic aldehyde
Thujopsenal analog	0.04	0.03	Sesquiterpenic aldehyde
Unknown	0.06		Oxygenated sesquiterpene
Cedryl acetate?	0.12		Sesquiterpenic ester
Unknown	0.02	0.05	Oxygenated sesquiterpene
Unknown	0.02	0.02	Oxygenated sesquiterpene
Unknown	0.13	0.08	Oxygenated sesquiterpene
Nootkatone analog	0.02	0.03	Sesquiterpenic ketone
Manool	0.02		Diterpenic alcohol
7,13-Abietadiene	0.01		Diterpene
Toluene		0.01*	Simple phenolic
Unknown		[0.01]*	Normonoterpene
Thujopsadiene?		0.03	Sesquiterpene
1,7-diepi-α-Cedrenal?		0.04	Sesquiterpenic aldehyde
β-Acoradienol?		0.02	Sesquiterpenic alcohol
<b>Total identified</b>	<b>96.83%</b>	<b>97.00%</b>	

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

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

Note: no correction factor was applied

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## INTERNATIONAL GROUP

### FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Unknown [m/z 105, 79 (80), 91 (78), 77 (69), 78 (56), 93 (46), 120 (44)... 136 (4)]	2.84	916	0.02	2.63	1107	0.02
α-Pinene	3.02	928	0.19	1.42	991	0.20
Camphene	3.19*	940	0.04	1.77	1028	0.01
α-Fenchene	3.19*	940	[0.04]	1.70	1021	0.04
Thuja-2,4(10)-diene	3.31	947	0.03	2.38*	1085	0.03
Sabinene	3.64	969	0.01	2.38*	1085	[0.03]
α-Methylstyrene	3.78	978	0.02	5.05	1292	0.02
6-Methyl-5-hepten-2-one	3.90	986	0.01	5.22	1299	0.01
Myrcene	3.96	990	0.01			
α-Phellandrene	4.11	1000	0.01			
Δ3-Carene	4.19	1005	0.03	2.68	1111	0.04
para-Cymene	4.44	1020	0.02	4.23	1230	0.03
Limonene	4.50	1024	0.01	3.29	1158	0.02
Terpinolene	5.50*	1085	0.02	4.42	1244	0.01
para-Cymenene	5.50*	1085	[0.02]	6.48	1390	0.01
α-Campholenal	6.03	1118	0.01	7.16	1439	0.01
trans-Pinocarveol	6.25*	1133	0.05	9.29	1600	0.06
Camphor	6.25*	1133	[0.05]	7.37*	1455	0.14
meta-Mentha-4,6-dien-8-ol	6.40	1142	0.01	9.43	1612	0.04
Pinocamphone	6.54	1151	0.01	7.37*	1455	[0.14]
Pinocarvone	6.56	1152	0.01	8.08	1507	0.01
Borneol	6.73	1163	0.02	9.94*	1653	1.00
α-Phellandren-8-ol	6.80	1167	0.02	10.32*	1683	0.30
Terpinen-4-ol	6.89	1173	0.04	8.68*	1554	0.19
meta-Cymen-8-ol	6.96	1177	0.01	11.66	1796	0.01
para-Cymen-8-ol	7.11*	1187	0.07	11.71*†	1800	0.14
α-Terpineol	7.11*	1187	[0.07]	9.94*	1653	[1.00]
γ-Terpineol	7.16	1190	0.03	10.02*	1660	0.14
Myrtenol	7.21	1193	0.05	11.05	1745	0.07
Verbenone	7.30	1199	0.05	9.74*	1636	0.16
trans-Carveol	7.61	1219	0.01	11.60	1791	0.01
Carvacrol methyl ether	7.92	1239	0.03	8.68*	1554	[0.19]
Carvenone	8.05	1248	0.01	10.02*	1660	[0.14]
Bornyl acetate	8.47	1276	0.01	8.38*	1530	0.49
Carvacrol	9.11	1321	0.03	15.50	2153	0.10
α-Terpinyl acetate	9.44	1344	0.06	9.86	1646	0.21
African-1-ene	9.48	1347	0.02	7.01	1428	0.03
β-Patchoulene	9.81*	1369	0.13	7.10	1435	0.03
2-epi-α-Funebrene	9.81*	1369	[0.13]	7.37*	1455	[0.14]
α-Duprezianene	9.89	1375	0.36	7.60	1472	0.27



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Isolongifolene	9.95*	1379	[0.04]	7.67	1476	0.01
β-Elemene	10.04	1385	0.37	8.57*	1545	0.59
α-Chamipinene	10.13*	1392	0.21	8.17*†	1514	9.15
Unknown [m/z 107, 91 (86), 93 (83), 79 (81), 162 (74), 41 (73), 133 (72)... 204 (13)]	10.13*	1392	[0.21]	8.33	1527	0.04
α-Cedrene	10.28	1402	9.54	8.17*†	1514	[9.15]
β-Cedrene	10.38*	1409	3.18	8.50	1540	2.45
β-Funebrene	10.38*	1409	[3.18]	8.26	1522	0.22
Unknown [m/z 118, 69 (82), 91 (51), 117 (40)... 202 (25)]	10.38*	1409	[3.18]	9.08*	1584	0.49
β-Duprezianene	10.38*	1409	[3.18]	8.38*	1530	[0.49]
cis-Thujopsene	10.58*	1424	35.56	8.89	1570	35.37
β-Caryophyllene	10.58*	1424	[35.56]	8.68*	1554	[0.19]
(Z)-β-Farnesene?	10.61	1426	0.14	9.39	1609	0.07
Isobazzanene	10.66*	1430	0.05	8.68*	1554	[0.19]
trans-α-Bergamotene	10.66*	1430	[0.05]	8.57*	1545	[0.59]
Prezizaene	10.72	1434	0.12	8.94	1573	0.13
α-Himachalene	10.77*	1437	0.61	9.08*	1584	[0.49]
7,8-Dehydro-α-acoradiene?	10.77*	1437	[0.61]	9.72*†	1635	0.44
α-Humulene	10.84*	1443	0.10	9.50*	1617	0.50
Cadina-4,11-diene	10.84*	1443	[0.10]	9.35	1606	0.06
α-Acoradiene	10.95	1451	0.24	9.50*	1617	[0.50]
(E)-β-Farnesene	11.00*†	1455	1.05	9.72*†	1635	[0.44]
9-epi-β-Caryophyllene	11.00*†	1455	[1.05]	9.50*	1617	[0.50]
β-Acoradiene	11.05*†	1458	[1.05]	9.57	1624	0.35
Thujopsene isomer	11.05*†	1458	[1.05]	9.62	1628	0.02
β-Chamigrene	11.15	1466	0.46	9.78	1640	0.50
Unknown [m/z 91, 105 (93), 161 (77), 93 (73), 119 (71), 133 (69)... 204 (31)]	11.18*	1467	0.66			
γ-Himachalene	11.18*	1467	[0.66]	9.74*	1636	[0.16]
Widdra-2,4(14)-diene?	11.24	1472	0.12	10.02*	1660	[0.14]
Unknown [m/z 189, 91 (95), 105 (93), 133 (84), 119 (75), 41 (59), 93 (46)... 204 (33)]	11.30†	1477	0.44	10.10*	1666	0.16
ar-Curcumene	11.33†	1479	[0.44]	10.82	1725	0.23
Valencene	11.44	1486	0.73	10.06	1663	0.68
α-Cuprenene	11.50*	1491	2.33	10.32*	1683	[0.30]
Pseudowiddrene	11.50*	1491	[2.33]	10.21	1674	1.71
α-Chamigrene	11.50*	1491	[2.33]	10.32*	1683	[0.30]
β-Himachalene	11.50*	1491	[2.33]	9.94*	1653	[1.00]

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Cuparene	11.56	1495	1.36	11.22*	1759	1.39
1,4-Dihydrocuparene	11.61	1499	0.11	10.64	1710	0.11
$\alpha$ -Alaskene	11.66*	1503	0.33	10.10*	1666	[0.16]
Unknown [m/z 121, 123 (45), 91 (24), 107 (24), 122 (24), 95 (23)... 204 (11)]	11.66*	1503	[0.33]	10.47	1696	0.24
$\gamma$ -Cadinene	11.70	1506	0.34	10.58*†	1705	[0.71]
$\alpha$ -Dehydro-arhimachalene	11.72*	1508	0.20	11.71*†	1800	[0.14]
$\beta$ -Curcumene	11.72*	1508	[0.20]	10.42	1691	0.05
$\delta$ -Cadinene	11.86*†	1518	0.75	10.58*†	1705	[0.71]
$\gamma$ -Dehydro-arhimachalene	11.86*†	1518	[0.75]	12.08	1833	0.05
$\beta$ -Sesquiphellandrene	11.86*†	1518	[0.75]	10.78*†	1722	0.45
Unknown [m/z 91, 107 (97), 105 (93), 41 (92), 109 (78), 43 (78), 121 (76), 135 (75)... 220 (21)]	11.94*†	1525	0.53			
$\gamma$ -Cuprenene	11.94*†	1525	[0.53]	10.78*†	1722	[0.45]
( <i>E</i> )- $\gamma$ -Bisabolene	11.94*†	1525	[0.53]	10.55†	1702	0.71
ar-Himachalene	12.01	1530	0.13	11.76*†	1805	[0.14]
$\delta$ -Cuprenene epimer I	12.04	1532	0.14	11.13	1751	0.11
$\delta$ -Cuprenene epimer II	12.10*	1537	0.18	11.22*	1759	[1.39]
Unknown [m/z 43, 95 (81), 207 (61), 41 (55), 55 (50)... 222 (3)]	12.10*	1537	[0.18]	14.02*	2010	0.15
8,14-Cedranoxide	12.10*	1537	[0.18]	11.76*†	1805	[0.14]
Unknown [m/z 106, 41 (86), 43 (84), 149 (75), 69 (75), 91 (63), 93 (61)... 220 (1)]	12.10*	1537	[0.18]	11.59	1790	0.02
Unknown [m/z 91, 119 (98), 121 (91), 105 (85), 43 (82), 41 (76)... 205 (37), 220 (16)]	12.24	1547	0.16			
Caryophyllenyl alcohol	12.44*	1563	0.34	13.78	1986	0.17
Unknown [m/z 95, 191 (52), 107 (50), 121 (32), 81 (31)...]	12.44*	1563	[0.34]	14.33	2039	0.05
Unknown [m/z 95, 131 (96), 202 (64), 187 (61), 159 (55), 105 (50)... 202 (64)]	12.44*	1563	[0.34]			

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Caryophyllene oxide	12.55*	1572	0.13	12.93	1909	0.05
Caryophyllene oxide isomer	12.55*	1572	[0.13]	12.88	1904	0.01
allo-Cedrol	12.70	1583	1.17	14.46*	2051	25.74
Widdrol	12.91*	1599	27.17	14.80	2084	2.03
α-Cedrol	12.91*	1599	[27.17]	14.46*	2051	[25.74]
β-Himachalene oxide	12.91*	1599	[27.17]	13.33	1945	0.02
epi-Cedrol	13.02*	1608	1.26	14.96	2100	0.72
Unknown [m/z 138, 110 (77), 137 (75), 107 (62), 91 (61), 93 (60), 109 (57)... 220 (34)]	13.02*	1608	[1.26]	13.61	1971	0.04
10-epi-Cubenol	13.02*	1608	[1.26]	14.02*	2010	[0.15]
Unknown [m/z 107, 41 (86), 123 (85), 82 (79), 95 (77), 93 (76), 91 (73), 69 (71)... 220 (13)]	13.13*	1618	0.08	14.84	2088	0.06
2-epi-α-Cedren-3-one	13.13*	1618	[0.08]			
Unknown [m/z 132, 175 (22), 119 (18), 91 (18), 157 (18)... 219 (10)]	13.22*	1625	1.43	15.80	2183	0.15
α-Acorenol	13.22*	1625	[1.43]	14.64	2069	1.01
β-Acorenol	13.22*	1625	[1.43]	15.04	2107	0.22
Unknown [m/z 132, 91 (24), 119 (22), 105 (21), 133 (17), 117 (16)... 219 (3)]	13.28*	1630	0.96			
Unknown [m/z 105, 93 (78), 95 (75), 131 (72), 119 (71), 132 (70), 91 (67), 120 (49)... 202 (39), 220 (9)]	13.28*	1630	[0.96]	16.00	2203	0.24
Himachalol	13.40*	1640	0.86	15.35	2139	0.34
Unknown [m/z 123, 81 (77), 95 (77), 107 (72), 41 (72), 93 (66), 55 (64)... 220? (13)]	13.40*	1640	[0.86]			
Unknown [m/z 41, 91 (96), 79 (88), 69 (82), 123 (80), 93 (80)... 220 (8)]	13.44	1643	0.61			
Cedrenol analog	13.55*	1652	0.93	16.66	2271	0.10
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79	13.55*	1652	[0.93]	15.58	2161	0.43

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(58)... 204 (48), 220 (2)]						
14-Hydroxy-9-epi-(E)-caryophyllene	13.62	1658	0.10	16.60	2266	0.16
Cedr-8-en-13-ol	13.89†	1680	0.33	17.11	2320	0.05
α-Cedrenol	13.94*†	1683	[0.33]	17.24	2333	0.13
epi-α-Bisabolol	13.94*†	1683	[0.33]	15.65	2168	0.20
Unknown [m/z 91, 105 (87), 123 (74), 135 (70), 107 (60), 79 (59)... 220 (13)]	13.99	1688	0.10			
Mayurone?	14.04	1692	0.07	17.30	2340	0.05
Unknown [m/z 105, 69 (77), 91 (66), 119 (65), 111 (56), 107 (45), 55 (45)... 220? (2)]	14.09*	1696	0.64			
Thujopsenal	14.09*	1696	[0.64]	16.06	2210	0.04
Thujopsenal analog	14.48	1729	0.04	17.65	2378	0.03
Unknown [m/z 105, 91 (83), 79 (78), 135 (67), 107 (56), 67 (53)... 220 (9)]	14.63	1742	0.06			
Cedryl acetate?	14.73	1751	0.12			
Unknown [m/z 91, 105 (74), 93 (67), 79 (59), 133 (54), 41 (47), 107 (46)...]	14.86	1762	0.02	18.57	2480	0.05
Unknown [m/z 189, 91 (48), 133 (40), 105 (40), 41 (34), 187 (34)... 220 (5)]	15.14	1786	0.02	18.79	2505	0.02
Unknown [m/z 121, 136 (53), 91 (22), 93 (19), 79 (15), 105 (13)... 220 (3)]	15.21	1792	0.13	18.73	2498	0.08
Nootkatone analog	15.43	1811	0.02	18.12	2429	0.03
Manool	17.94	2047	0.02			
7,13-Abietadiene	18.16	2068	0.01			
Toluene				1.52*	1004	0.01
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]				1.52*	1004	[0.01]
Thujopsadiene?				10.38	1688	0.03
1,7-diepi-α-Cedrenal?				15.32	2135	0.04
β-Acoradienol?				18.30	2449	0.02
<b>Total identified</b>		<b>87.41%</b>			<b>81.70%</b>	
<b>Total reported</b>		<b>95.14%</b>			<b>89.64%</b>	

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

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[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

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index

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## INTERNATIONAL GROUP

**Date :** June 11, 2020

**Lot #:** PPO10118

### *CERTIFICATE OF ANALYSIS – GC PROFILING*

#### *SAMPLE IDENTIFICATION*

**Customer identification :** Peppermint Oil - 180925830

**Type :** Essential oil

**Source :** *Mentha x piperita*

#### *ANALYSIS*

**Method:** PC-PA-014-17J19 - Analysis of the composition of an essential oil, or other volatile liquid, by FAST GC-FID; identifications validated by GC-MS

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Clear liquid

**Refractive index:** 1.4598 ± 0.0003 (20 °C)

*NF T 75-210:2008 - OIL OF PEPPERMINT - USA*

Compound	Min. %	Max. %	Observed %	Complies?
β-Caryophyllene	1.0	2.5	1.8	Yes
Menthyl acetate	3.0	6.5	5.3	Yes
Pulegone	0.5	2.5	0.7	Yes
Menthol	36.0	46.0	45.7	Yes
neo-Menthol	2.5	4.5	3.1	Yes
Menthofuran	1.5	6.0	2.0	Yes
Isomenthone	2.0	4.5	3.3	Yes
Menthone	15.0	25.0	20.4	Yes
cis-Sabinene hydrate	0.5	2.3	0.3	No
Limonene	1.0	2.5	2.1	Yes
1,8-Cineole	4.0	6.0	5.3	Yes
Octan-3-ol	0.1	0.4	0.1	Yes
<b>Refractive index</b>	1.459	1.465	1.460	Yes

*EUROPEAN PHARMACOPOEIA 9.0 - 07/2012:0405 - PEPPERMINT OIL*

Compound	Min. %	Max. %	Observed %	Complies?
Carvone		1.0	0.1	Yes
Pulegone		3.0	0.7	Yes
Menthol	30.0	55.0	45.7	Yes
Menthyl acetate	2.8	10.0	5.3	Yes
Isomenthone	1.5	10.0	3.3	Yes
Menthofuran	1.0	8.0	2.0	Yes
Menthone	14.0	32.0	20.4	Yes
1,8-Cineole	3.5	8.0	5.3	Yes
Limonene	1.0	3.5	2.1	Yes
Total isopulegol		0.20	0.17	Yes
<b>Refractive index</b>	1.457	1.467	1.460	Yes

### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the Eur. Ph. standard for peppermint oil, and marginally fails to comply with the ISO standard for US peppermint oil. This may indicate that the material originates from India.

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## INTERNATIONAL GROUP

### ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Class
Isobutanol	tr		Aliphatic alcohol
Isovaleral	0.01	0.01*	Aliphatic aldehyde
2-Methylbutyral	0.01	0.01	Aliphatic aldehyde
2-Ethylfuran	tr	tr	Furan
Isoamyl alcohol	0.01	5.29*	Aliphatic alcohol
2-Methylbutanol	0.01	[5.29]*	Aliphatic alcohol
(2E)-Hexenal	tr	tr	Aliphatic aldehyde
(3Z)-Hexenol	0.01	tr	Aliphatic alcohol
Hexanol	tr	tr	Aliphatic alcohol
<i>trans</i> -2,5-Diethyltetrahydrofuran	0.02	0.02	Furan
Nonane	tr	[0.01]*	Alkane
Hashishene	tr	0.70*	Monoterpene
α-Thujene	0.03	0.03	Monoterpene
α-Pinene	0.70	[0.70]*	Monoterpene
Camphene	0.06*	0.03	Monoterpene
α-Fenchene	[0.06]*	tr	Monoterpene
3-Methylcyclohexanone	[0.06]*	0.03*	Aliphatic ketone
<i>trans</i> -3-Methylcyclohexanol	[0.06]*	0.01	Aliphatic alcohol
Thuja-2,4(10)-diene	0.01	0.34*	Monoterpene
Benzaldehyde	tr	0.02	Simple phenolic
Sabinene	1.29*	[0.34]*	Monoterpene
β-Pinene	[1.29]*	0.93	Monoterpene
<i>trans</i> -2-para-Menthene	0.01		Monoterpene
Octan-3-one	0.06	0.04*	Aliphatic ketone
Myrcene	0.17	0.16	Monoterpene
Pseudolimonene	0.20*	0.01	Monoterpene
α-Phellandrene	[0.20]*	0.03	Monoterpene
Octan-3-ol	[0.20]*	0.15	Aliphatic alcohol
Δ <sup>3</sup> -Carene	tr	tr	Monoterpene
α-Terpinene	0.17	0.17	Monoterpene
para-Cymene	0.18	0.19	Monoterpene
1,8-Cineole	7.40*	[5.29]*	Monoterpenic ether
β-Phellandrene	[7.40]*	[5.29]*	Monoterpene
Limonene	[7.40]*	2.09	Monoterpene
2-Ethylhexanol	0.02	0.01	Aliphatic alcohol
(Z)-β-Ocimene	0.14	0.13	Monoterpene
(E)-β-Ocimene	0.04	[0.04]*	Monoterpene
γ-Terpinene	0.32	0.31	Monoterpene
<i>cis</i> -Sabinene hydrate	0.26	0.26*	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.02	0.02*	Monoterpenic alcohol
Octanol	0.04	5.31*	Aliphatic alcohol
<i>trans</i> -Linalool oxide (fur.)	0.11*	[0.26]*	Monoterpenic alcohol
Terpinolene	[0.11]*	0.10	Monoterpene
para-Cymenene	[0.11]*	0.01	Monoterpene
Unknown	tr		Oxygenated monoterpene
<i>trans</i> -Sabinene hydrate	0.03	0.04	Monoterpenic alcohol
2-Methylbutyl isovalerate	0.01	[0.03]*	Aliphatic ester
Nonanal	0.18*	0.01	Aliphatic aldehyde



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2-Methylbutyl 2-methylbutyrate	[0.18]*	0.04	Aliphatic ester
Linalool	[0.18]*	0.12	Monoterpenic alcohol
Amyl isovalerate	0.03	0.02	Aliphatic ester
endo-Fenchol	0.01	0.26*	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.04	0.08	Monoterpenic alcohol
Octan-3-yl acetate	0.02	0.01	Aliphatic ester
cis-Limonene oxide	tr	[0.02]*	Monoterpenic ether
allo-Ocimene	tr	0.01	Monoterpene
Camphor	0.02*	0.01	Monoterpenic ketone
trans-para-Menth-2-en-1-ol	[0.02]*	0.02	Monoterpenic alcohol
trans-Sabinol	tr	0.02	Monoterpenic alcohol
neo-Isopulegol	0.17*	[5.31]*	Monoterpenic alcohol
Isopulegol	[0.17]*	[5.31]*	Monoterpenic alcohol
Menthone	20.44	20.41	Monoterpenic ketone
Isomenthone	5.25*	3.28	Monoterpenic ketone
Menthofuran	[5.25]*	2.00	Monoterpenic ether
Borneol	[5.25]*	0.34*	Monoterpenic alcohol
neo-Menthol	3.11	[5.52]*	Monoterpenic alcohol
δ-Terpineol	0.13	0.06	Monoterpenic alcohol
Terpinen-4-ol	0.08	[5.52]*	Monoterpenic alcohol
Menthol	47.36*	45.72	Monoterpenic alcohol
Isomenthol	[47.36]*	1.10*	Monoterpenic alcohol
para-Cymen-8-ol	[47.36]	0.02	Monoterpenic alcohol
α-Terpineol	0.14	[0.34]*	Monoterpenic alcohol
cis-Piperitol	0.26*	0.02	Monoterpenic alcohol
neoiso-Menthol	[0.26]*	0.33	Monoterpenic alcohol
Myrtenal	[0.26]*	0.02	Monoterpenic aldehyde
Methylchavicol	0.02*	0.07	Phenylpropanoid
trans-Isopiperitenol	[0.02]*	0.03*	Monoterpenic alcohol
Unknown	0.01		Unknown
trans-Piperitol	0.02	0.04	Monoterpenic alcohol
Unknown	0.04		Unknown
trans-Carveol	0.01	0.03	Monoterpenic alcohol
cis-Carveol	0.01		Monoterpenic alcohol
Citronellol	0.70*	0.02	Monoterpenic alcohol
Pulegone	[0.70]*	[1.10]*	Monoterpenic ketone
(3Z)-Hexenyl isovalerate	0.03		Aliphatic ester
Carvone	0.06	0.07	Monoterpenic ketone
Piperitone	0.34	0.68*	Monoterpenic ketone
neo-Menthyl acetate	0.33	0.32	Monoterpenic ester
Decanol	0.04*	0.04	Aliphatic alcohol
Unknown	[0.04]*		Unknown
2-Ethylmenthone?	0.04		Aliphatic ketone
Dihydroedulan I	0.02	0.07*	Terpenic ether
Menthyl acetate	5.34	[5.31]*	Monoterpenic ester
Isomenthyl acetate	0.20*	[0.26]*	Monoterpenic alcohol
Dihydroedulan II	[0.20]*	0.04	Terpenic ether
Dihydrocarvyl acetate	0.03	0.03	Monoterpenic ester
Bicycloelemene	0.01	0.01	Sesquiterpene
Piperitenone	0.01	tr	Monoterpenic ketone
α-Cubebene	0.02	0.01	Sesquiterpene
Evodone	0.02	0.01	Monoterpenic ketone

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Menthofuro lactone	0.01	0.01	Aliphatic alcohol
Eugenol	tr		Phenylpropanoid
$\alpha$ -Copaene	0.06	[0.07]*	Sesquiterpene
$\beta$ -Bourbonene	0.14	0.12	Sesquiterpene
$\beta$ -Elemene	0.06	[5.52]*	Sesquiterpene
Unknown	0.03		Unknown
Unknown	0.01		Sesquiterpene
Isocaryophyllene	0.03	[5.31]*	Sesquiterpene
$\beta$ -Caryophyllene	1.91*	[5.52]*	Sesquiterpene
$\beta$ -Ylangene	[1.91]*	0.14	Sesquiterpene
$\beta$ -Copaene	0.03	0.03	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.02	5.52	Sesquiterpene
Isogermacrene D	0.02	tr	Sesquiterpene
$\alpha$ -Humulene	0.08	0.14*	Sesquiterpene
( <i>E</i> )- $\beta$ -Farnesene	0.19*	0.19	Sesquiterpene
Muuro la-4,11-diene	[0.19]*	[0.14]*	Sesquiterpene
Germacrene D	0.72*	[0.68]*	Sesquiterpene
$\gamma$ -Muuro lene	[0.72]*	0.31*	Sesquiterpene
Menthallactone	tr		Monoterpenic lactone
Bicyclogermacrene	0.12*	0.10	Sesquiterpene
Viridiflorene	[0.12]*	[0.31]*	Sesquiterpene
5-Methyl-2,4-diisopropylphenol	0.03*		Terpene derivative
$\alpha$ -Muuro lene	[0.03]*	0.01	Sesquiterpene
$\gamma$ -Cadinene	0.02	[0.03]*	Sesquiterpene
$\delta$ -Cadinene	0.04	0.06	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.01	0.01	Sesquiterpene
( <i>E</i> )-Nerolidol	0.01	0.01	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.08*	0.02	Sesquiterpenic ether
Caryophyllene oxide	[0.08]*	0.05	Sesquiterpenic ether
Viridiflorol	0.07	0.07	Sesquiterpenic alcohol
Isospathulenol	tr	0.01*	Sesquiterpenic alcohol
$\alpha$ -Muuro lol	0.01	0.01	Sesquiterpenic alcohol
Unknown	tr		Sesquiterpenic alcohol
$\alpha$ -Cadinol	0.01	[0.01]*	Sesquiterpenic alcohol
Mint sulfide	0.01		Sesquiterpenic sulfide
Benzyl benzoate	0.01		Phenolic ester
<b>Total identified</b>	<b>99.50%</b>	<b>98.65%</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	%
Isobutanol	0.53	621	tr			
Isovaleral	0.58	640	0.01	0.76*	888	0.01
2-Methylbutyral	0.61	650	0.01	0.74	882	0.01
2-Ethylfuran	0.75	699	tr	0.92	922	tr
Isoamyl alcohol	0.96	731	0.01	3.38*	1170	5.29
2-Methylbutanol	0.98	734	0.01	3.38*	1170	[5.29]
(2E)-Hexenal	1.97	846	tr	3.45	1175	tr
(3Z)-Hexenol	2.10	856	0.01	5.84	1349	tr
Hexanol	2.27	870	tr	5.37	1315	tr
<i>trans</i> -2,5-Diethyltetrahydrofuran	2.54	894	0.02	1.59	1018	0.02
Nonane	2.62	900	tr	0.76*	888	[0.01]
Hashishene	2.81	913	tr	1.43*	1002	0.70
$\alpha$ -Thujene	2.96	922	0.03	1.48	1007	0.03
$\alpha$ -Pinene	3.04	927	0.70	1.43*	1002	[0.70]
Camphene	3.24*	941	0.06	1.76	1034	0.03
$\alpha$ -Fenchene	3.24*	941	[0.06]	1.67	1025	tr
3-Methylcyclohexanone	3.24*	941	[0.06]	4.77*	1272	0.03
<i>trans</i> -3-Methylcyclohexanol	3.24*	941	[0.06]	6.84	1421	0.01
Thuja-2,4(10)-diene	3.33	947	0.01	2.35*	1090	0.34
Benzaldehyde	3.42	953	tr	7.41	1464	0.02
Sabinene	3.66*	969	1.29	2.35*	1090	[0.34]
$\beta$ -Pinene	3.66*	969	[1.29]	2.17	1073	0.93
<i>trans</i> -2-para-Menthene	3.81	979	0.01			
Octan-3-one	3.88	984	0.06	4.06*	1221	0.04
Myrcene	3.98	990	0.17	2.94	1137	0.16
Pseudolimonene	4.13*	1000	0.20	2.90	1134	0.01
$\alpha$ -Phellandrene	4.13*	1000	[0.20]	2.86	1131	0.03
Octan-3-ol	4.13*	1000	[0.20]	6.05	1364	0.15
$\Delta^3$ -Carene	4.21	1005	tr	2.67	1116	tr
$\alpha$ -Terpinene	4.33	1012	0.17	3.04	1144	0.17
para-Cymene	4.47	1021	0.18	4.15	1228	0.19
1,8-Cineole	4.53*	1025	7.40	3.38*	1170	[5.29]
$\beta$ -Phellandrene	4.53*	1025	[7.40]	3.38*	1170	[5.29]
Limonene	4.53*	1025	[7.40]	3.28	1163	2.09
2-Ethylhexanol	4.67	1034	0.02	7.29	1454	0.01
(Z)- $\beta$ -Ocimene	4.74	1038	0.14	3.86	1207	0.13
(E)- $\beta$ -Ocimene	4.89	1048	0.04	4.06*	1221	[0.04]
$\gamma$ -Terpinene	5.02	1055	0.32	3.90	1210	0.31
<i>cis</i> -Sabinene hydrate	5.17	1065	0.26	6.89*	1425	0.26
<i>cis</i> -Linalool oxide (fur.)	5.23	1068	0.02	6.51*	1397	0.02
Octanol	5.36	1076	0.04	8.21*	1524	5.31
<i>trans</i> -Linalool oxide (fur.)	5.47*	1084	0.11	6.89*	1425	[0.26]
Terpinolene	5.47*	1084	[0.11]	4.37	1244	0.10

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para-Cymenene	5.47*	1084	[0.11]	6.35	1385	0.01
Unknown [m/z 81, 43 (78), 55 (47), 96 (46), 95 (31), 41 (23)...]	5.57	1090	tr			
<i>trans</i> -Sabinene hydrate	5.66	1096	0.03	8.02	1510	0.04
2-Methylbutyl isovalerate?	5.71	1098	0.01	4.77*	1272	[0.03]
Nonanal	5.77*	1102	0.18	5.93	1355	0.01
2-Methylbutyl 2-methylbutyrate	5.77*	1102	[0.18]	4.53	1255	0.04
Linalool	5.77*	1102	[0.18]	8.04	1511	0.12
Amyl isovalerate	5.84	1107	0.03	4.66	1264	0.02
endo-Fenchol	5.88	1110	0.01	8.36*	1535	0.26
<i>cis</i> -para-Menth-2-en-1-ol	6.04	1119	0.04	8.17	1521	0.08
Octan-3-yl acetate	6.12	1124	0.02	5.31	1311	0.01
<i>cis</i> -Limonene oxide	6.16	1127	tr	6.51*	1397	[0.02]
allo-Ocimene	6.19	1129	tr	5.67	1337	0.01
Camphor	6.29*	1135	0.02	7.27	1453	0.01
<i>trans</i> -para-Menth-2-en-1-ol	6.29*	1135	[0.02]	9.00	1586	0.02
<i>trans</i> -Sabinol	6.34	1138	tr	9.82	1651	0.02
neo-Isopulegol	6.40*	1142	0.17	8.21*	1524	[5.31]
Isopulegol	6.40*	1142	[0.17]	8.21*	1524	[5.31]
Menthone	6.54	1151	20.44	6.74	1413	20.41
Isomenthone	6.66*	1159	5.25	7.04	1436	3.28
Menthofuran	6.66*	1159	[5.25]	6.95	1429	2.00
Borneol	6.66*	1159	[5.25]	9.89*	1657	0.34
neo-Menthol	6.76	1165	3.11	8.61*†	1555	[5.52]
δ-Terpineol	6.81	1168	0.13	9.48	1624	0.06
Terpinen-4-ol	6.84	1170	0.08	8.61*†	1555	[5.52]
Menthol	7.01*†	1181	47.36	9.20	1601	45.72
Isomenthol	7.01*†	1181	[47.36]	8.95*	1581	1.10
para-Cymen-8-ol	7.06†	1184	[47.36]	11.60	1801	0.02
α-Terpineol	7.15	1190	0.14	9.89*	1657	[0.34]
<i>cis</i> -Piperitol	7.18*	1192	0.26	9.60	1634	0.02
neoiso-Menthol	7.18*	1192	[0.26]	9.44	1621	0.33
Myrtenal	7.18*	1192	[0.26]	8.76	1566	0.02
Methylchavicol	7.24*	1196	0.02	9.38	1616	0.07
<i>trans</i> -Isopiperitenol	7.24*	1196	[0.02]	10.51*	1708	0.03
Unknown [m/z 43, 99 (84), 81 (46), 986 (43), 126 (36), 71 (28)... 170 (12)]	7.32	1201	0.01			
<i>trans</i> -Piperitol	7.39	1206	0.02	10.39	1698	0.04
Unknown [m/z 146, 145 (94), 43 (72), 99 (41), 81 (29), 115 (25), 86 (24)...]	7.43	1208	0.04			
<i>trans</i> -Carveol	7.61	1220	0.01	11.44	1787	0.03
<i>cis</i> -Carveol	7.75	1230	0.01			

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Citronellol	7.80*	1233	0.70	10.81	1733	0.02
Pulegone	7.80*	1233	[0.70]	8.95*	1581	[1.10]
(3Z)-Hexenyl isovalerate	7.83	1234	0.03			
Carvone	7.88	1238	0.06	9.98	1664	0.07
Piperitone	8.02	1247	0.34	9.93*	1661	0.68
neo-Menthyl acetate	8.38	1271	0.33	7.77	1490	0.32
Decanol	8.46*	1276	0.04	10.73	1726	0.04
Unknown [m/z 119, 79 (94), 91 (0), 84 (80), 93 (68)...]	8.46*	1276	[0.04]			
2-Ethylmenthone	8.52	1280	0.04			
Dihydroedulan I	8.54	1282	0.02	7.21*	1449	0.07
Menthyl acetate	8.68	1291	5.34	8.21*	1524	[5.31]
Isomenthyl acetate	8.84*	1302	0.20	8.36*	1535	[0.26]
Dihydroedulan II	8.84*	1302	[0.20]	7.54	1473	0.04
Dihydrocarvyl acetate	9.24	1330	0.03	9.52	1627	0.03
Bicycloelemene	9.27	1332	0.01	7.10	1441	0.01
Piperitenone	9.35	1338	0.01	12.20	1854	tr
α-Cubebene	9.44	1344	0.02	6.80	1418	0.01
Evodone	9.46	1346	0.02	12.38	1870	0.01
Menthofuroolactone	9.59	1355	0.01	11.99	1836	0.01
Eugenol	9.62	1356	tr			
α-Copaene	9.79	1369	0.06	7.21*	1449	[0.07]
β-Bourbonene	9.90	1376	0.14	7.67	1483	0.12
β-Elemene	10.04	1386	0.06	8.61*†	1555	[5.52]
Unknown [m/z 107, 121 (79), 119 (66), 91 (58), 136 (55), 105 (49)... 194 (1)]	10.10	1390	0.03			
Unknown [m/z 106, 119 (99), 43 (78), 91 (74), 105 (60), 134 (55)... 204 (19)]	10.20	1398	0.01			
Isocaryophyllene	10.26	1402	0.03	8.21*	1524	[5.31]
β-Caryophyllene	10.38*	1410	1.91	8.61*†	1555	[5.52]
β-Ylangene	10.38*	1410	[1.91]	8.13	1518	0.14
β-Copaene	10.52	1421	0.03	8.53	1549	0.03
trans-α-Bergamotene	10.64	1430	0.02	8.57†	1552	5.52
Isogermacrene D	10.71	1435	0.02	9.07	1590	tr
α-Humulene	10.84	1444	0.08	9.28*	1607	0.14
(E)-β-Farnesene	10.97*	1454	0.19	9.68	1640	0.19
Muurola-4,11-diene	10.97*	1454	[0.19]	9.28*	1607	[0.14]
Germacrene D	11.22*	1472	0.72	9.93*	1661	[0.68]
γ-Muurolene	11.22*	1472	[0.72]	9.76*	1646	0.31
Menthylactone	11.38	1484	tr			
Bicyclgermacrene	11.42*	1488	0.12	10.20	1682	0.10
Viridiflorene	11.42*	1488	[0.12]	9.76*	1646	[0.31]
5-Methyl-2,4-diisopropylphenol	11.53*	1495	0.03			
α-Muurolene	11.53*	1495	[0.03]	10.09	1674	0.01
γ-Cadinene	11.68	1507	0.02	10.51*	1708	[0.03]

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δ-Cadinene	11.82	1518	0.04	10.57	1713	0.06
<i>trans</i> -Cadina-1,4-diene	11.89	1523	0.01	10.70	1724	0.01
( <i>E</i> )-Nerolidol	12.38	1561	0.01	13.80	2002	0.01
Caryophyllene oxide isomer	12.50*	1571	0.08	12.75	1904	0.02
Caryophyllene oxide	12.50*	1571	[0.08]	12.83	1911	0.05
Viridiflorol	12.67	1584	0.07	14.01	2022	0.07
Isospathulenol	13.22	1629	tr	15.48*	2167	0.01
α-Muurolol	13.39	1643	0.01	15.27	2146	0.01
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)]	13.43	1646	tr			
α-Cadinol	13.48	1650	0.01	15.48*	2167	[0.01]
Mint sulfide	14.35	1723	0.01			
Benzyl benzoate	14.72	1754	0.01			
<b>Total identified</b>		<b>99.50%</b>			<b>98.65%</b>	
<b>Total reported</b>		<b>99.60%</b>			<b>98.65%</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