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Chemical Composition of the Essential Oil of Lavandula angustifolia from Syria

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Abstract
Chemical composition of the essential oil of the flowers of ***Lavandula angustifolia*** (Lamiaceae), grown in Syria was determined by GC/MS. The oil obtained by hydrodistillation, It was found that the essential oil yield is about (0,2462%), was found to contain 66 chemical compounds the main ones are linalool(34.70%),Alcanfor(12.77%) , Eucalyptol (11.50%) , Borneol (9.82%) , Linalyl anthranilate (4.51 %) , Geranyl butyrate(3.02%)**.**

INTRODUCTION

Lavender genus is an important member of the Lamiaceae family. Lavandula species are widely distributed in the Mediterranean region and cultivated in France, Italy and Spain[1,2].Lavender grows to a height of 40–60 cm and forms compact, regular clumps The lower part of stem is woody, while the upper part is green. Lavender has linear or lanceolate leaves with curled edges and a highly branched fibrous root system. Silver-green lavender leaves are covered with tomentum, which protects them from strong sunshine, wind, and excessive water loss. Lavender flowers grow in spikes, arranged in circles (3–5 flowers per circle) in the top part of the stem. They are of pale violet color, although, varieties with white flowers (Alba and Nana Alba) and pink flowers (Rosea) have also been bred[3].

Figure 1. photo of *Lavandula angustifolia*

Taxonomy: Kingdom: Plantae, Clade: Angiosperms ,Clade: Eudicots Clade: Asterids ,Order: Lamiales, Family: Lamiaceae ,Genus: Lavandula, Species: *L. angustifolia***,** Binomial name ***:****Lavandula angustifolia*

Common Names: Common Lavender, English Lavender, *Lavandula latifolia, Lavandula stoechas, Priyangku* and *Khuzama*[4,5].

The *Lavandula augustifolia* Mill. specie is well known among people as a powerful aromatic and medicinal herb.The plant is used in traditional and folk medicines of different parts of the world for the treatment of several gastrointestinal[1,2]. Lavender oil is known for its excellent aroma and is extensively used in the perfumery, flavor and cosmetic industries. The oil is known to possess sedative, carminative, anti-depressive and anti-inflammatory properties [6] Lavender (L. angustifolia) contains essential oil, anthocyanins, phytosterols, sugars, minerals, coumaric acid, glycolic acid, valeric acid, ursolic acid, herniarin, coumarin and tannins[7]

2. Experimental

2.1. Plant material

The flower of *Lavandula augustifolia Mill*. were collected in apryl 2017, at the homs in Syria, The samples were dried in shad ventilated place.

2.2. Oil isolation

The flowers were cut into small pieces and separately hydrodistilled for 2 h in a Clevenger-type apparatus with

water cooled receiver, in order to reduce hydrodistillation overheating artifacts. The essential oil was taken up in n-Hexan and dried over sodium sulphate and reduced at room temperature under vacuum on rotatory evaporator. The oil obtained was stored at (+4 °C) until analysis.

Gas chromatography–mass spectrometry analysis

Analysis of oils were carried out by GC-MS chromatography (GC-agilent 7986, indictor: inert-MS) in Atomic Energy Commission(AECS)- Damascus, Syria. This instrument was fitted with HP-5MS capillary column (30cm×0.25mm i.d., film thickness 0.25µm). The temperature injector and indictor 250 °C .The oven temperature program was 60-270°C (2.5°C per min.). The identity of components was ascertained based on the spectra and compared with library and literature data. Also, the identification of each compound was confirmed by comparison of its retention index with those of authentic compounds.

Results and discussion

The oil was obtained from the *Lavandula augustifolia Mill* with a yield of (0,2462%) The specific and quantitative composition of lavender oil varies according to the genotype, growing location ,climatic conditions and morphological characteristic,

The chromatographic profile showed a complex mixture of components(Fig 2),

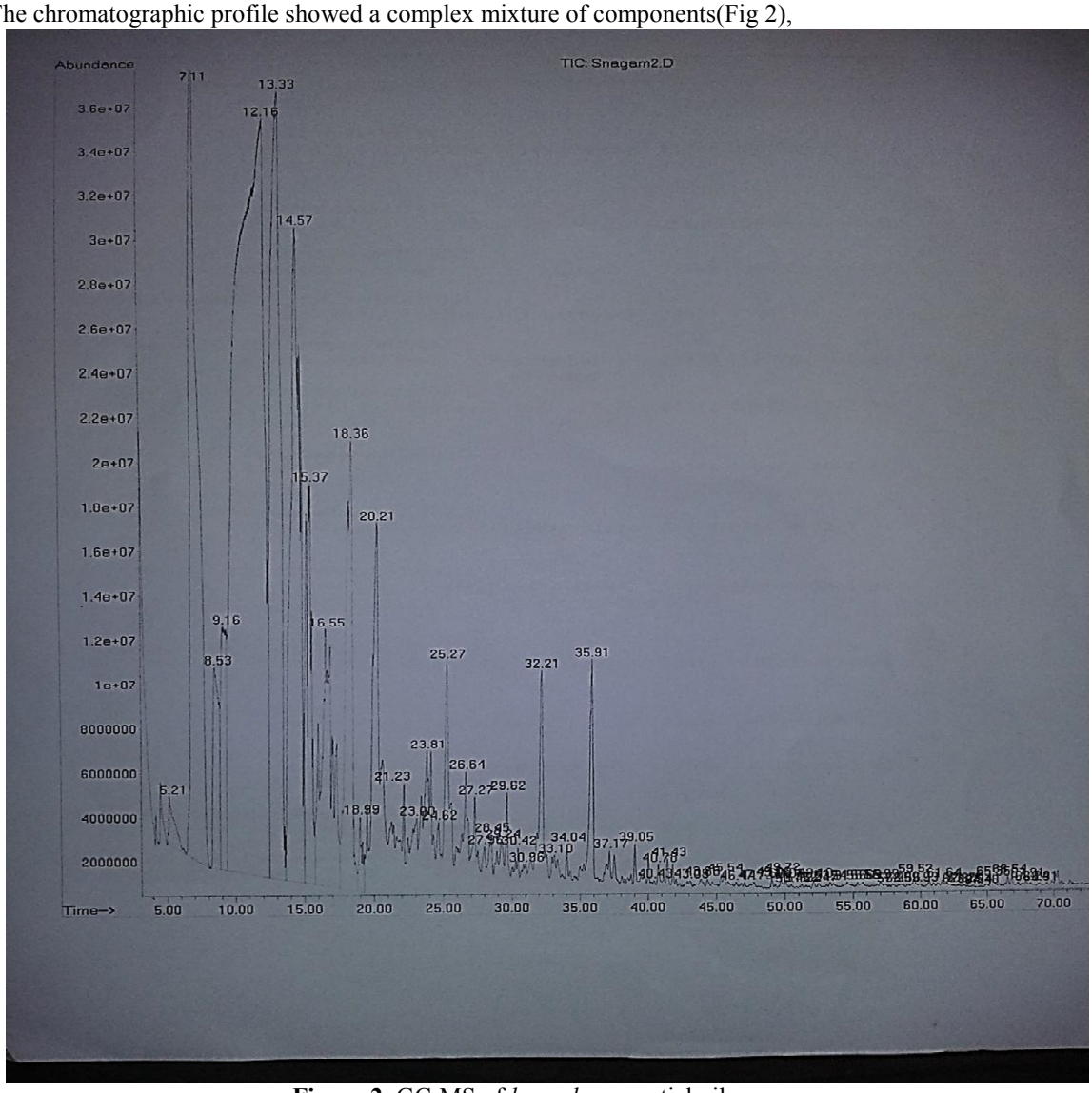

Figure 2. GC-MS of *lavender* essential oil.

Tabl 1-Sixty-six oil compounds were identified as 83.53% of total oil, while 16.47% of oil was not identified. The essential oil consists of 66 chemical compounds, the main ones are linalool(34.70%),Alcanfor(12.77%) , Eucalyptol (11.50%) , Borneol (9.82%) , Linalyl anthranilate (4.51 %) , Geranyl butyrate(3.02%).

Table 1:The percentage composition of the total oil from Lavandula angustifolia by GC/MAS chromatography

NO	Compound	Area%	Qual
1	camphene	0.15	95
2	Bete-Pinene	0.43	90
3	Eucalyptol	9.61	98
4	Cis-linaloloxide	1.65	86
5	1,2-Oxolinalool	2	91
6	Linalool	28.91	87
7	Champhor	10.67	98
8	Borneol	8.21	64
9	2-cyclohexene-1-one, 4-(1-methylrthyl)-	1.27	93
10	terpineol	1.84	96
11	3,7- octadiene2,6-diol, 2,6dimethyl-	0.60	64
12	Propanal, 2-methyl-3-phenyl-	0.51	95
13	1,6-octadien-3-ol, 3,7dimethyl-,2-amineobnzoate	3.77	91
14	2-isopropenyl-5-methylhex-4-enal	0.24	78
15	Acetic acid, 1,7,7-trimethyl-bicyclo[2.2.1]hept-2-yl ester	0.17	98
16	Butanoic acid, 3,7-dimethyl-2,6-octadienyl ester, (E)-	2.53	91
17	Ethanone, 1-[2-hydroxy-5-methlphenyl]-	0.16	64
18	3-thiophenecarboxaldehyde	0.48	64
19			
20	2,6-octadien-1-ol, 3,7-dimethyl-,propanoate, (z)	0.46	86
21	Tricycle[2.2.1.0(2,6)heptane,1,7-dimethyl-7-(4-methyl-3-pentenyl)- , (-)-	0.53	96
22	.beta.-Myecene	0.48	49
23	8-Hydroxycarvotanacetone	0.26	90
24	Butanoic acide, 3,7-dimethyl-2,6-oc	0.30	86
25	2,6-octadien-1-ol,3,7-dimethyl-propanoate, (Z)-	1.37	80
26	Methyl 2-methylsulphonyl-alpha.-d-xylofuranoside	0.08	90
27	Caryophyllene oxide	1.16	91
28	Cis-Z-.alpha.-Bisabolene epoxide	0.06	62
29	longipinocarvone	0.07	45
30	Cis-Z-.alpha.-Bisabolene epoxide	0.06	70
31	Bicycle[4.4.0]dec-1-ene, 2isopropyl-5-methyl-9-methylene-	0.17	95
32	Alloaromadendrene oxide	0.09	70
33	longifolenaldehyde	0.09	92
34	Cyclohexene, 1methyl-5-(1-methylethenyl)- (R)-	0.14	62
35	(2,2,6-trimethyl-bicyclo[4.1.0]hept-1-yl)-methanol	0.06	70
36	Cyclohexane, 1 methyl-2,4-bis(1-methylethenyl)-	0.15	62
37	Cis-Z-.alpha.-bisabolene epoxide	0.07	91
38	Humulane-1,6-dien-3-ol	0.13	84
39	2(1H)-Naphthalenone, octahydro-4a,7,7-trimethyl-, trans-	0.06	78
40	4-(2,2-dimethyl-6-methylenecyclonexyl) butanal	0.06	60
41	2-Heptane, 6-methyl-6-[3-methyl-3-(1-methylethenyl)-1-cyclopropen-1-yl]-	0.08	70
42	2,2,6,7-tetramethyl-10-oxatricyclo[4.3.1.0(1,6)]decan-5-ol	0.10	64
43	Trans-Z-.alpha.-bisabolene epoxide	0.15	60
44	3,5,9-trimethyl-deca-2,4,8-trien-1-ol	0.11	70
45	levomenol	0.09	52
46	Cis-Z-.alpha.bisabolene epoxide	0.09	60
47	Spiro[4.5]decan-7-one, 1,8-dimethyl-8,9-epoxy-4-isopropyl-	0.38	80
48	3-buten-2-one, 3-methyl-4-(1,3,3-trimethyl-7-oxabicyclo[4.1.0]heptane-1-yl)-	0.14	66
49	3-buten-2-one, 3-methyl-4-(1,3,3-trimethyl-7-oxabicyclo[4.1.0]heptane-1-yl)-	0.06	64
50	Isoaromadendrene epoxide	0.16	64
51	2-pentadecanone,6,10,14-trimethyl	0.17	66
52	Cis-Z-.alpha.- bisabolene epoxide	0.13	64

NO	Compound	Area%	Qual
53	Cyclohexane-1-methanol,3,3-dimethyl-2-(3-methyl-1,3-butadienyl)-	0.12	78
54	ledol	0.11	64
55	1-propyl-3-(propen-1-yl)adamantane	0.15	60
56	5-isopropenyl-2-methyl-7-oxabicyclo[4.1.0]heptane-2-ol-3-oxobutel)	0.14	86
57	2-cyclohexen-1-one,4-(3-hydroxybutyl)-3,5,5-trimethyl	0.11	86
58	Benzene,1-nitro-2-(1,1,2,2-tetrafluoroethoxy)-	0.07	90
59	Diepicedrene-1-oxide	0.30	78
60	Sclareoloxide(Cis-A/B)	0.14	60
61	n-benzhydrialidene-1-(2,4,6-trimethylphenyl)ethylamine N-oxide	0.30	72
62	thunbergol	0.42	81
63	N´-(2,4,6(1H,3H,5H)-Trioxopyrimidine-5-ylidenemethyl)-2-nitrobenzhydrazide	0.23	90
64	11,13-dimethyl-12-tetradecen-1-ol acetate	0.24	90
65	Hexadeca-2,6,10,14- tetraen-1-ol, 3,7,11,16-tetramethyl-,(E,E,E)-	0.20	62
66	8-Decenoic acid,5-ethenyl-3,5,9-trimethyl-,methyl ester	0.21	62

In our study, we find that the main compound is linalool(34.70%), This is consistent with studies of the essential oil of *Lavandula augustifolia* in both France and Poland, And the absence of Linalyl acetate in the essential oil of *Lavandula augustifolia* from Syria , while the presence of large quantities and a major compound in the lavender in France, Italy and Bulgaria [8, 9, 10]

Table 2 :Main compounds in essential oils *of lavandula augustifolia*

No	. Compound	Bulgaria[%]	Italy[%]	France[%]	Poland[%]	syria	[%]
1	Ocimene	6.8–7.7	-	0.2–18.1	1.9–2.9	-	
2	Cineol	2.1–3.0	0.02–0.2	0–3.4	0.2–0.5	11.5	
3	Camphor	< 0.5	0.3–0.6	0–0.5	0.2–0.3	12.77	
4	Linalool	30.1–33.7	33.3–42.2	9.3–68.8	27.3–34.7	34.70	
5	Linalyl acetat	35.2–37.6	37.8–41.2	1.2–59.4	19.7–22.4	-	
6	Terpinen-4-ol	4.5–5.8	2.8–3.6	0.1–13.5	1.1–2.0	2.20	
7	Lavandulol	-	-	0–4.3	0.6–0.8	0.33	
8	Lavandulol acetate	-	-	0.3–21.6	4.5–5.7	-	

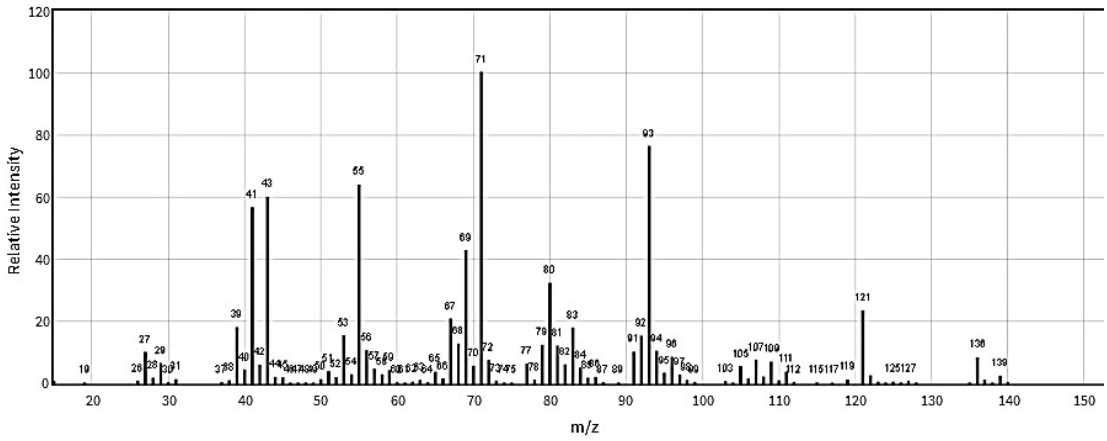

Figure 3 **.** linalool identified by the mass spectrometer detector

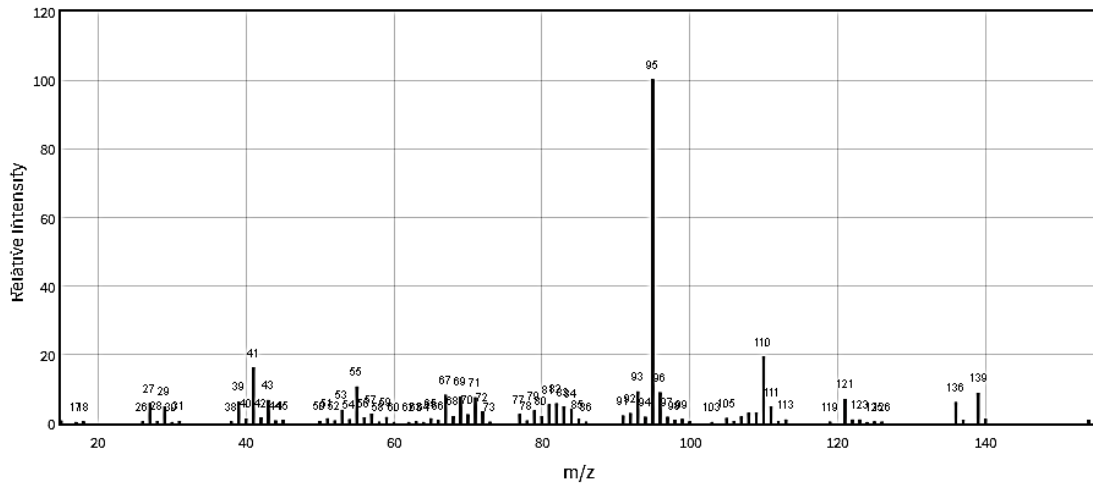

Figure 4. Borneol identified by the mass spectrometer detector

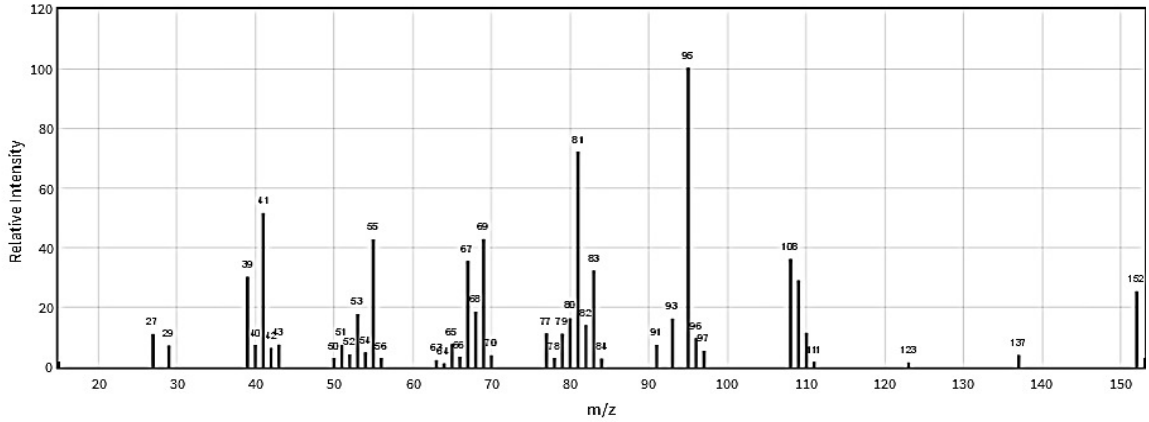

Figure 5. Alcanfor identified by the mass spectrometer detector

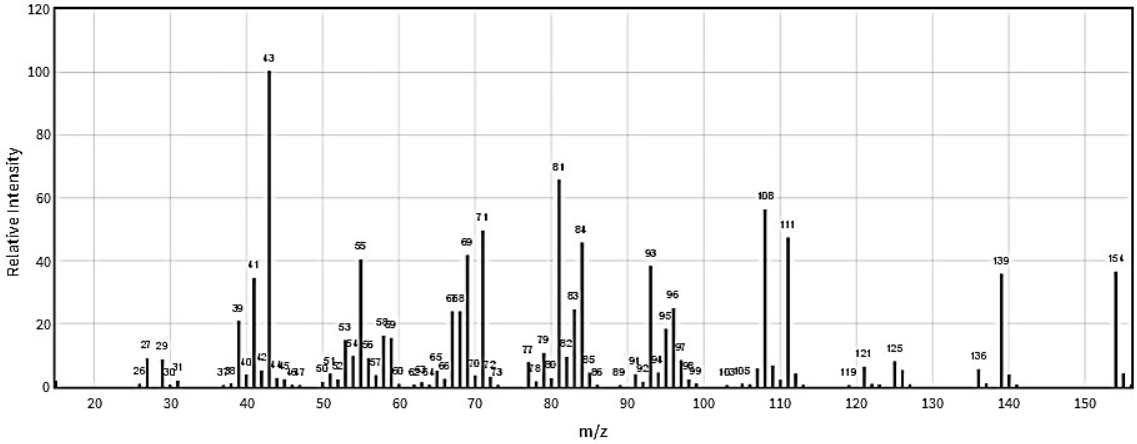

Figure 6. Eucaalyptol identified by the mass spectrometer detector

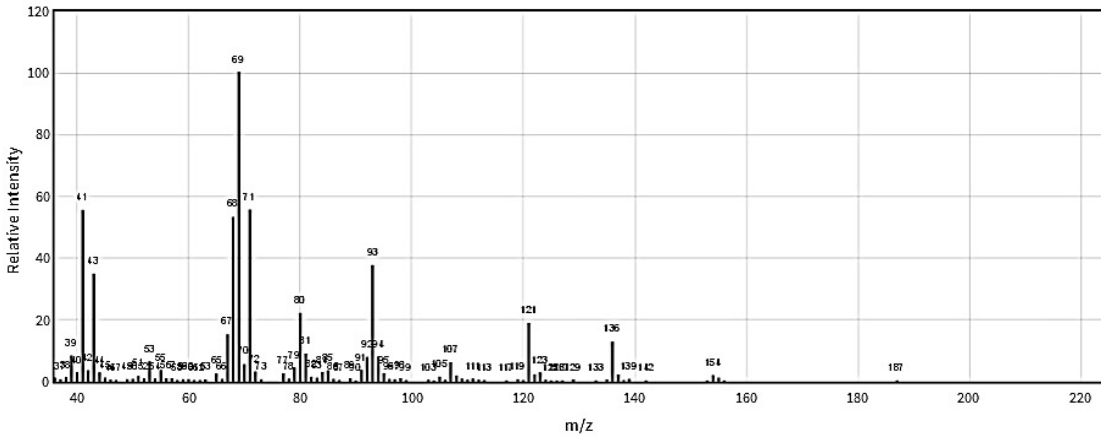

Figure 7 . Geranyl butyrate identified by the mass spectrometer detector

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