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Extraction and Identification of Compounds From the Extract and Essential oil of Lavandula Angustifolia Plants

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Abstract
In this research, segments of flowering branches of Lavandula angustifolia were collected from the Khesroshahr region. The essential oil essence was extracted by steam distillation and dried in a stream of air for GC/MS analysis and identification. Four different types of essential oil essences were studied: the first main compound obtained from the complete essence of the plant is camphor, bornyl acetate, and cineole. The second main compound obtained from the essence of the stem of the plant is pizaylen, ducasane. The third main compound obtained from the complete essence of the plant is camphor, isobornyl acetate. The fourth main compound obtained from the ethanol residue of the plant is cineole, andro-diacetic acid.
Keywords*: Lavandula angustifolia, camphor, essence*

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I. Introduction

Iran, due to its unique geographical location and diverse climate and weather conditions, has facilitated the growth of various types of plants, making it rich in terms of traditional medicine and herbal remedies [1]. One such plant extensively used in traditional medicine is Lavandula angustifolia, commonly known as lavender. Lavandula angustifolia belongs to the Lamiaceae family.

The antimicrobial properties of essential oils have been known since ancient times, and numerous studies have reported on the effects of different plant species' essences or extracts on microorganisms [2]. Essential oils have a wide range of applications in various industries, including food, pharmaceuticals, cosmetics, health, and industrial sectors [3].

Lavender, according to ancient Iranian medicine, has warm and dry properties [3,4]. Alongside its pleasant fragrance, essential oils possess various therapeutic effects, such as antibacterial, antiseptic, antiviral, antifungal, analgesic, diaphoretic, antidepressant, treatment of alopecia, and promoting hair regrowth [5].

A project conducted on Lavandula officinalis and LAVANDULA officinalis by Melisa examined the chemical compounds of their essential oils and their antibacterial activities. Their essential oils were obtained through water distillation, and their chemical compositions were analyzed. The main components of these oils, as determined by GC/MS analysis, included cineole, 1,8-menthol, camphor, and alpha-pinene. The experiment showed that bacterial strains were sensitive to the studied essential oils, with menthol, thymol, and carvacrol exhibiting the highest antibacterial activity among the oil components tested. The essential oils of these two species demonstrated greater antibacterial activity than streptomycin and could be used as natural preservatives and fungicides [6].

In another research endeavor in1933, the use of lavender essence was found effective in relieving digestive discomfort associated with intestinal fermentation, infections, gastrointestinal disorders, and general fatigue [7].

The main compounds present in lavender essential oil, extracted using common industrial methods, include geraniol, alpha-pinene, camphor, linalyl acetate, cineole, ursolic acid, bornyl acetate, luteolin flavonoids, butyric acid, valeric acid, and linalool [8].

II. Materials and Methods

A. Plant Collection:

In this study, Lavandula species were collected from the Khesroshahr village. Sufficient amounts of stems and leaves of Lavandula were harvested for the investigation and were dried in the shade at room temperature.

Separation and Identification

For the extraction of essence from the leaves and stems of Lavandula angustifolia, the water distillation method was employed. This method is used for dry plants or plants that may be damaged by boiling in water. The distillation process significantly influences the quantity and composition of the essence. Distillation continues until the volume of the obtained essence remains constant and does not increase, ensuring that the essence is concentrated.

Working with a Clevenger

In two stages, 100 grams of leaves and stems, and 100 grams of stems, were subjected to steam distillation using 500 milliliters of distilled water for 4 hours in a Clevenger apparatus. The leaves and stems were separately placed in a balloon along with distilled water and transferred to the Clevenger apparatus. After 4 hours, the heater is turned off, and by opening the Clevenger valve, the hydrosol at the bottom of the apparatus and the essence at the top surface are separated from each other. The plant hydrosol is also collected as it contains a very small amount of essence, which is separated by hexane wash of the tube and then sodium sulfate anhydrous is added to it.

In this stage, the obtained solution is immediately poured into a balloon prepared in advance with filter paper and covered with small glass vials wrapped in aluminum foil to prevent light penetration in the cold refrigerator environment. It is stored until it reaches the GC/MS device.

For the extraction of essence from the obtained hydrosol from the Clevenger apparatus, one-third of the volume of the obtained hydrosol is poured into a separating funnel, chloroform is added, and then it is shaken several times. After settling, it is poured into a decanting funnel, and by opening the decanting funnel valve, the hydrosol is poured inside, ensuring the absence of water again through anhydrous sodium sulfate. The hydrosol is ready for injection into the device, and the identification of the constituent elements by GC analysis begins.

Working with GC/MS

A BD5 column with a temperature gradient at a rate of 4 degrees Celsius per minute and a hold time of 5 minutes at 260 degrees Celsius was used, with a splitless-split ratio of one to three and helium carrier gas at a flow rate of 1 milliliters per minute. Sample injection volume was 1 microliters.

III. Discussion

From every 100 grams of stem powder of the plant, approximately 0.4 milliliters of pure essence was obtained, in which a total of 18 compounds were identified, constituting 80.8 percent of the total essence. The most important compounds identified, in order, were Docosane (8%), p-xylene (9.8%), delta-cadinene (7.7%), Heptadecane (6.6%), and Tetradecane (6.2%).

In the complete extract of Lavandula angustifolia, a total of 8 compounds, constituting approximately 89.6% of the total extract, were identified. The most important of these compounds, in order, are: 1,8 Cineole, comprising 29% of the extract. Camphor, comprising 28.1 %. Iso-Borneol, comprising 14.5%. Cryptone, comprising 8.4%.

In the ethanol residue of the Lavandula angustifolia plant obtained by the adhesion method, a total of 11 compounds were identified, constituting approximately 92.73% of the total ethanol residue. The most important of these compounds, in order, are:

13.63% of Anethoic Acid and 43.6% of 1.8 Cineole were identified. Additionally, Alpha-pinene was found at a rate of 7.2 % and Camphor at 5.4%.

Comparison of the major compounds obtained from the complete essence, stem essence, complete extract , and ethanol residue of Lavandula angustifolia:

In the ethanol residue of Lavandula angustifolia, Alpha-pinene is present at a rate of 7.2%, while in the complete essence, it is present at a rate of 0.83%.

Borneole is found only in the complete essence of Lavandula angustifolia at a rate of 18.2%, and the effect of this compound is in imparting fragrance and possessing antimicrobial properties.

Camphor is one of the most important compounds in Lavandula angustifolia. It is present in the complete essence of the plant at a rate of 20%, in the stem essence at 4%, in the complete extract at 28%, and in the ethanol residue at 5.4%. It possesses antimicrobial, anti-inflammatory, and analgesic properties.
Cryptone in the complete essence of Lavandula angustifolia is present at a rate of 3.3%. The percentage in the complete extract is present at a rate of 8.4%.
1,8 Sineol is one of the most important compounds in Lavandula angustifolia. It is present in the complete essence of the plant at a rate of 20%, in the stem essence at 4%, in the complete extract at 29%, and in the ethanol residue at 43.6%. The property of this compound includes its contribution to flavor, aroma, and antibacterial characteristics.
Delta-cadinene is found at a rate of 7.7% and Docosane at a rate of 8% exclusively in the stem essence of Lavandula angustifolia. P-xylene is found at a rate of 9.8% exclusively in the stem.
Iso-borneol is found at a rate of 14.5 % exclusively in the complete extract.
Undecanoic acid is found at a rate of 13.63% exclusively in the ethanol residue.
Comparing the results of complete essence extraction with stem essence, complete hydrosol, and ethanol residue of lavender, differences in the amounts of identified compounds were observed. For instance, the amount of Alpha-pinene in the ethanol residue was higher than in other extractions.
The significant compounds such as Borneole and Camphor have various effects including antimicrobial, anti-inflammatory, and analgesic properties.
Some of the major compounds were found only in one of the extractions. For example, Iso-borneol was only found in the complete hydrosol of lavender.
Overall, these results demonstrate that extracting essence from lavender plant using different methods can yield various compounds with different properties, which can be beneficial in various applications

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Table 1- The results of complete plant essence with chloroform

%	R.t	Name of the compound	Number
.9 %	22,255	Alpha – amorphen	١
.83 %	4,693	Alpha –pinene	2
.83%	5,648	Bête – pinene	3
18.2	11,142	Borneol	4
.98	13,029	Borneol acetate (endo)	5
20	10,452	(-) –camphor	6
3.3	11,736	Cryptone	7
34.5	7,113	1,8 – cineole	8
1.6	6,838	o-cymene	9
1.8	13,415	Cuminic aldehyde	10
.94	13,544	Carvone	11
1.1	12,031	Myrtenal	12
.9	11,851	Terpineol	13
1.2	10,257	Tras – verbenol	14
.86	6,951	Limonene	15
87.94 %	160,553	Total	16

Table 2- The results of the plant stem essential oil

%	R.t	Name of the compound	Number
5.5 %	11,572	Alpha – 4- dimethyl styrene	١
28.1	10,403	Camphor	2
1.1	11,852	3- careen	3
29	7,035	1.8 – cineole	4
14.5	11,063	Iso-Borneol	5
2.1	12,469	Verbenone	6
8.4	11,726	Cryptone	7
0.9	11,427	Terpinene	8
89,6 %	87,547	Total	9

Table 3- The results obtained from the whole extract of the lavender plant

%	R.t	Name of the compound	Number
3.2	27,560	5-bulyl decosane	١
4.0	10,425	Camphor	2
3.1	24,439	Caryophylene oxide	3
4.0	7,059	1.8 – cineole	4
4.3	12,129	Dodecane	5
8	24,741	Docosane	6
7.7	25,415	Delta – cadinene	7
1.8	3,408	Ethyl benzene	8
6.2	18,522	Tetradrcane	9
1.3	29,337	3-methylheneicosane	10
4.9	28,408	Nonadecane	11
2.9	27,619	Tricosane	12
2.1	27,709	Octacosane	13
3.9	3,927	o-xylene	14
9.8	3,528	p-xylene	15
6.6	27,049	Heptadecane	16
1.4	27,674	Heneicosane	17
5.6	22,235	Phenol ,2,4 – bis (1.1 –dimetlyethyl)	18
80.8 %	350,184	Total	١٩

Table 4- Results from S. D. ETHANOL LAVANDULA

%	R.t	Name of the compound	Number
7.2	4,710	Alpha – pinene	١
5.4	10,415	Camphor	2
3.2	5,676	Beta – pinene	3
43.6	7,054	1.8 – cineole	4
4.9	5,037	Camhene	5
2.8	6,963	Cyclobutane,methylene	6
2.6	6,851	Unknown	7
2.2	26,707	Decanoic acid	8
3.0	29,277	Octa decanoic acid	9
4.2	28,051	9 – tricosene	10
13.63	28,175	unde decanoic acid	11
92.73 %	158,916	Total	12

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