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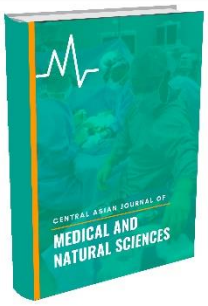

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GC-MS CHEMICAL ANALYSIS OF FERULA SUMBUL ESSENTIAL OIL

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ABSTRACT: In This article presents the results of GC-MS analysis of the chemical composition of Ferula essential oil Sumbul . It has been established that the composition of the essential oil consists of different classes of organic compounds, including monoterpenes, sesquiterpenes , oxygenated monoterpenes , oxygenated sesquiterpenes and others. 49 components were found from the composition of the essential oil. The main components of them are 1 S -α- Pinene (23.36%), β- Pinene (20.60%), (E)-Longipinene (12.48%), β- Myrcene (7.67%), Cis - sabinene (5.23%), Dioctyl terephthalate (3.94%), (-)- Spathulenol (2.59%), Caryophyllene oxide (1.86%), Anethole (0.84%), Terpinen -4- ol (0.77%), Spatulenol (1.37%), Phorbol (0.45%), Humulene (0.60%).

KEYWORDS: Ferula Sumbul , essential oil, GC-MS, chemical composition.

INTRODUCTION

Ferula Sumbul is an aromatic plant native to the Himalayas, including India, Pakistan, Afghanistan, and Uzbekistan [1-6]. The plant is known for its medicinal properties, and its roots are used to obtain essential oil [7,8]. Ferula essential oil Sumbul has been extensively studied for its various medicinal properties, including anticonvulsant, antifungal, and antioxidant properties [7,9,10]. The oil is widely used in medicine for the treatment of various diseases [10,12].

Gas chromatography-mass spectrometry (GC-MS) is a widely used analytical method for the identification and quantification of essential oil components [9,11]. GC-MS analysis of Ferula essential oil Sumbul was carried out to determine the main components of the oil and their therapeutic properties [13-19].

The purpose of the work is to study the chemical composition of the essential oil isolated from Ferula Sumbul by GC-MS.

MATERIALS AND METHODS

Material for extracting essential oil from the aerial part of Ferula Sumbul , collected on the territory of Altynsay district of Surkhandarya region in September 2022.

For GC/MS analysis of Ferula essential oil Sumbul oil was first extracted from the roots of the plant by steam distillation. The extracted oil was then analyzed by GC-MS, which separates the individual components of the oil based on their chemical properties.

Ferula essential oil sumbul was analyzed by GC-MS using a " YL 6900" chromatograph using a capillary column 30 m long, 0.32 mm inner diameter coated with 0.25 thick HP5 as the stationary phase. Chromatography conditions: column thermostat temperature - initial - 60 ℃ for 3 min (isothermal mode); heating at a rate of 15℃/min (temperature programming mode) up to 250℃ and at 250℃ (isothermal mode) 3 min. Injector temperature - 250℃, gaseous helium flow rate - 1 ml/min, SplitRatio - 1/100. Detector parameters - solvent delay - 3 minutes, emission current - 50 mA, scanning range - 30-350 amu , scanning speed - 1600 amu / s, ion source temperature - 230 ℃ , transfer temperature - 280℃. Analysis time - 30 min.

OBTAINED RESULTS AND THEIR DISCUSSION

A Chromatogram of essential oil isolated from Ferula Sumbul is shown in Fig.1.

Ferula Essential Oil Components Sumbul was performed on the basis of retention times and comparison of mass spectral components with databases of library mass spectra, and quantitative analysis by the method of internal normalization.

In table. 1 shows the results of the qualitative and quantitative analysis of the essential oil.

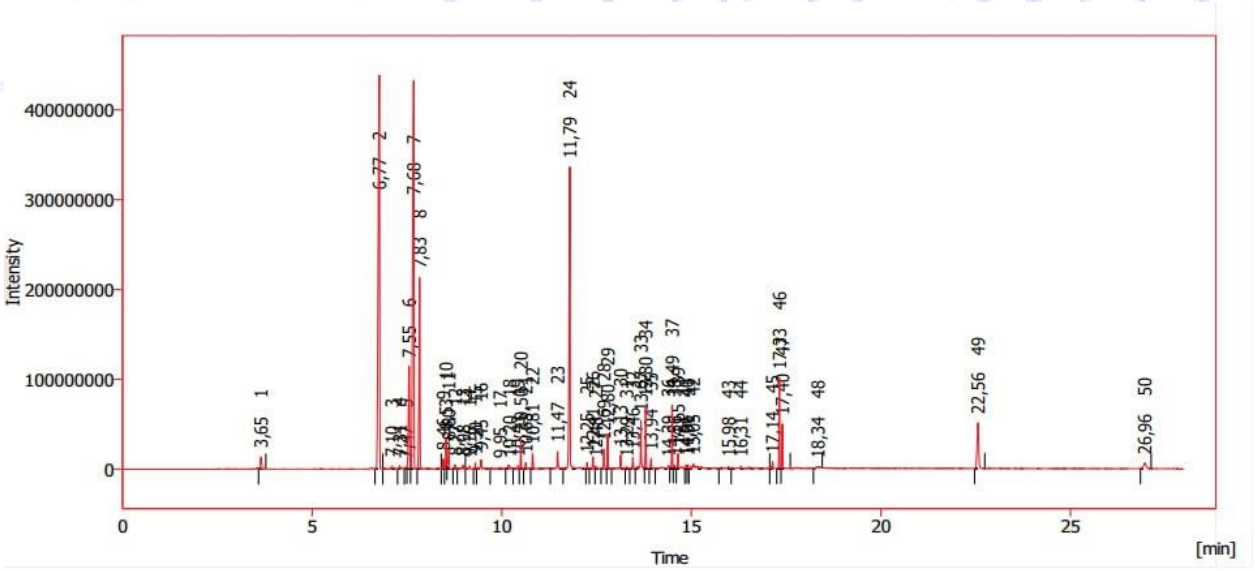

Figure 1. Chromatogram of essential oil isolated from Ferula Sumbul

Table 1. Ferula Essential Oil GC/MS Results Sumbul

	Compound	Reten. time [min]	content, %
1	1 S - α- Pinene	6.769	23.36
2	Camphene	7.102	0.26
3	Benzene, 1-ethyl-3-methyl-	7.306	0.20

4	1,3-Cyclohexadiene, 1,3,5,5-tetramethyl-	7.475	0.09
5	Cis-sabinene	7.554	5.23
6	β- Pinene	7.676	20.60
7	β-Myrcene	7.83	7.67
8	o- Cymol	8.457	0.33
9	Limonene	8.528	1.84
10	trans - βOcimene	8.6	0.86
11	p- cis - Ocimene	8.768	0.13
12	γ-Terpinene	8.976	0.18
13	2-Heptenoic acid, 3-methyl-, methyl ester	9.155	0.11
14	Fenchone	9.302	0.17
15	α-Campholenal	9.453	0.46
16	1-Oxaspiro[2.5] octane , 2,4,4-trimethyl-8-methylene-	9.954	0.16
17	Pinocarvone	10.202	0.25
18	(3E,5Z)-1,3,5-Undecatriene	10.428	0.17
19	Terpinen-4-ol	10.503	0.77
20	Benzaldehyde , 4-methoxy-	10.632	0.28
21	Anethole	10.811	0.84
22	2-Dodecanone	11.474	0.75
23	(E) Longipinene	11.793	12.48
24	α-Copaene	12.248	0.19
25	Germacrene D	12.406	0.41
26	Caryophyllene	12.481	0.14
27	Humulene	12.692	0.60
28	Germacrene D	12.796	0.95
29	γ- Elemene	13.133	0.55
30	trans-Cadina-1(6),4-diene	13.291	0.11
31	7-Oxabicyclo[4.1.0]heptane, 1-(1,3-dimethyl-1,3-butadienyl)-2,2,6-trimethyl-, (E)-	13.459	0.43
32	Spatulenol	13.67	1.37
33	caryophyllene oxide	13.796	1.86
34	γ-Gurjunenepoxide-(2)	13.936	0.39
35	Aristol-1(10)-en-9-yl isovalerate	14,394	0.41
36	(-)- Spathulenol	14.491	2.59
37	Ylangenol	14.556	0.21
38	Isoaromadendrene epoxide	14.649	0.65
39	Saussurea lactone	14.86	0.13
40	Callitrisin	14.91	0.12

41	Dihydrodehydrocostus lactone	15.046	0.99
42	Dehydrocostuslactone	15.982	0.22
43	Phorbol	16.308	0.45
44	Diisooctyl phthalate	17.143	0.27
45	Dioctyl terephthalate	17.325	3.94
46	unidentified	17.401	1.37
47	unidentified	18.34	0.18
48	unidentified	22.561	3.00
49	unidentified	26.957	0.60

Table 1 shows the composition of Ferula essential oil. Sumbul determined by GC-MS analysis. In total, the analysis revealed 49 compounds, which accounted for 99.96% of the total oil.

It has been established that the main component of the essential oil is 1S-α- pinene with a content of 23.36%. Pinene - bicyclic monoterpene , widely distributed in the essential oils of many plants. It is reported to exhibit various biological activities including antibacterial, antifungal, anti-inflammatory, and antioxidant properties.

The second most abundant compound in the oil was β- pinene , which accounted for 20.60% of the total oil. β- pinene is also a bicyclic monoterpene , commonly found in the essential oils of many plants. It has been reported to have a wide range of pharmacological activities, including antibacterial, antifungal, anti-inflammatory, and antitumor properties.

Cis-sabinene was found to be the third most abundant compound in oil at 5.23%. Sabinene is a bicyclic a monoterpene , which is commonly found in the essential oils of many plants. It has been reported to have a variety of biological activities, including antibacterial, antifungal, and antioxidant properties.

Betamyrcene has been identified as the fourth most abundant compound in oil, accounting for 7.67% of total oil. Myrcene is a monoterpenoid that is commonly found in the essential oils of many plants. It is reported to exhibit a number of pharmacological properties, including antibacterial, antifungal, anti-inflammatory, and analgesic properties.

Other Compounds Identified in Ferula Essential Oil Sumbul , included limonene , terpinen-4-ol, anethole, caryophyllene oxide, and spatulenol , among others . Limonene is a cyclic a monoterpene , which is commonly found in the essential oils of many plants. It is reported to exhibit a range of biological activities including antitumor, antioxidant, and anti-inflammatory properties.

Terpinen-4-ol is a monoterpene alcohol commonly found in the essential oils of many plants. It is reported to exhibit a number of pharmacological properties, including antibacterial, antifungal, and anti-inflammatory properties.

Anethole is a phenylpropene commonly found in the essential oils of many plants, including anise, fennel, and star anise. It has been reported to have a variety of biological activities, including antibacterial, antifungal, and antioxidant properties.

Caryophyllene oxide is a sesquiterpene oxide that is commonly found in the essential oils of many plants. It has been reported to have a number of pharmacological properties, including antibacterial, antifungal, and anti-inflammatory properties.

Spatulenol is a sesquiterpene alcohol commonly found in the essential oils of many plants. It is reported to exhibit a range of biological activities including antibacterial, antifungal, and antioxidant properties.

In addition to the identified compounds in Ferula essential oil Sumbul also had four compounds (unidentified) present. The total content of these unidentified compounds was 5.15% of the total amount of oil. Further studies are needed to identify these compounds and determine their biological activity.

In conclusion, GC-MS analysis of Ferula essential oil Sumbul identified a total of 49 compounds, of which 1S-α- pinene and β- pinene are the most common compounds.

The components listed in Table 1 belong to different chemical classes, including monoterpenes , sesquiterpenes , oxygenated monoterpenes , oxygenated sesquiterpenes and others.

Monoterpenes are the most common class of compounds, with α- pinene , β- pinene , and cis-sabinene being the main components . Monoterpenes are known for their characteristic odor and have been shown to have several biological activities such as antifungal, antibacterial, and anti-inflammatory effects.

Sesquiterpenes such as caryophyllene and humulene are also present in Ferula essential oil Sumbul . Sesquiterpenes are known for their strong aroma and have been found to exhibit a wide range of biological activities, including anti-inflammatory, antioxidant, and anti-cancer properties.

Oxygenated monoterpenes , such as terpinen-4-ol and anethole, are also present in the essential oil. These compounds are often responsible for the characteristic aroma of essential oils and have been found to have antimicrobial and antioxidant activity.

Oxygenated sesquiterpenes , such as caryophyllene oxide and spatulenol , are also present in the essential oil. These compounds are known for their strong aroma and have been shown to have various biological activities such as anti-inflammatory, antimicrobial, and antioxidant effects.

Other classes of compounds present in essential oil include lactones, phthalates , and benzene derivatives. These compounds have been found to have various biological activities such as antifungal, antibacterial and anti-inflammatory effects.

It is known that some components of the oil are chiral molecules, that is, they exist in two different forms that are mirror images of each other, called enantiomers .

For example, α- pinene , β- pinene and limonene are chiral monoterpenes , each of which exists as two enantiomers . Similarly, some sesquiterpenes that are present in oil, such as caryophyllene and humulene , are also chiral molecules with two enantiomers each.

It is important to note that the biological activity of a chiral compound can vary depending on the specific enantiomer present . Therefore, it is often necessary to analyze the enantiomeric composition of a chiral compound in order to fully understand its biological activity.

CONCLUSIONS

1. As a result of GC-MS analysis of the chemical composition of Ferula essential oil Sumbul found that the composition of the essential oil consists of different classes of organic compounds,

including monoterpenes, sesquiterpenes, oxygenated monoterpenes, oxygenated sesquiterpenes, and others.

2. 49 components were found from the composition of the essential oil. The main components of them are 1 S -α- Pinene (23.36%), β- Pinene (20.60%), (E)- Longipinene (12.48%), β- Myrcene (7.67%), Cis - sabinene (5.23%), Dioctyl terephthalate (3.94%), (-)- Spathulenol (2.59%), Caryophyllene oxide (1.86%), Anethole (0.84%), Terpinen -4- ol (0.77%), Spatulenol (1.37%), Phorbol (0.45%), Humulene (0.60%).

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