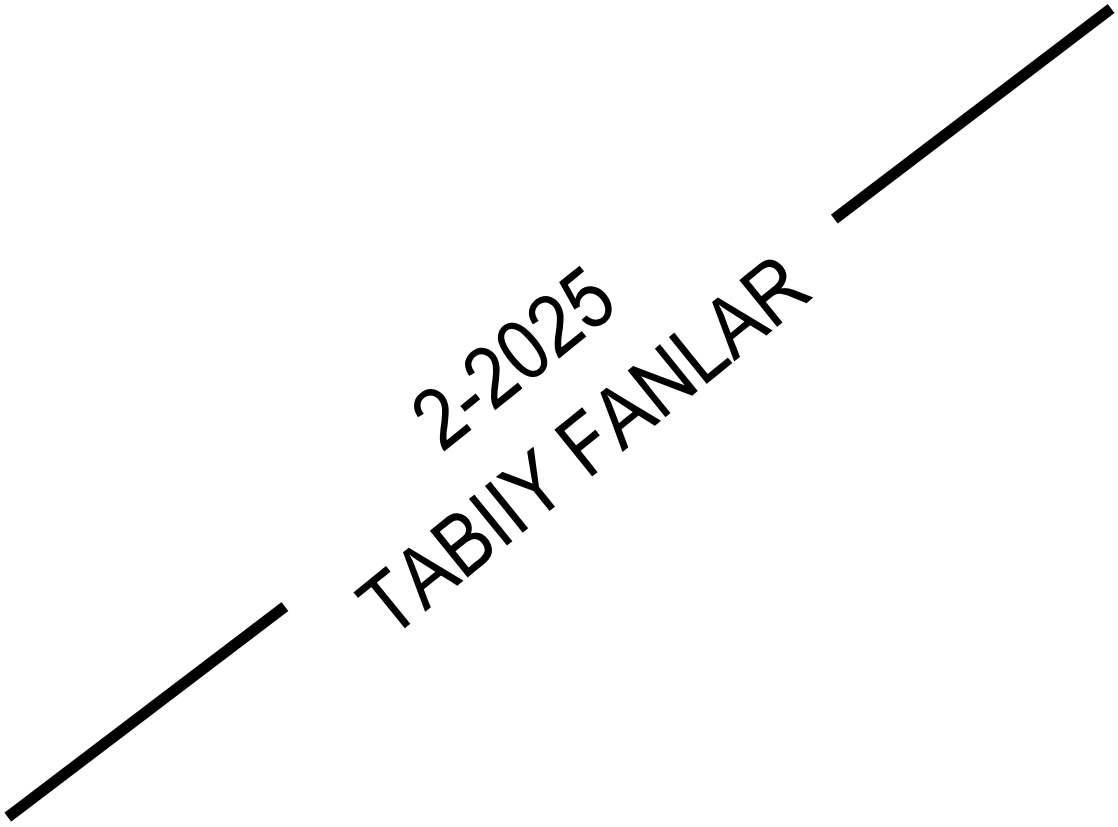
O‘ZBEKISTON RESPUBLIKASI

OLIY TA’LIM, FAN VA INNOVATSIYALAR VAZIRLIGI

FARG‘ONA DAVLAT UNIVERSITETI

FarDU. ILMIY XABARLAR

1995-yildan nashr etiladi
Yilda 6 marta chiqadi



НАУЧНЫЙ ВЕСТНИК. ФерГУ

Издаётся с 1995 года
Выходит 6 раз в год

KIMYO

I.R.Asqarov, O.Sh.Abdulloyev, Q.Q.Otaxonov, Z.N.Razzaqov
Analysis of the content of water-soluble vitamins in the food supplement AS-RAZZOQ 6
S.M.Ikramova, D.N.Shaxidova, H.G‘.Qurbonov, D.A.Gafurova
Nikel ionlarini sorbsiyalash uchun yangi ion almashuvchi materialning ishlatilishi 12
N.M.Qoraboyeva, D.A.Gafurova, B.T.Orziqulov, H.G‘.Qurbonov
Polikompleksonning olinishi va fizik-kimyoviy xossalari 18
M.A.Axmadaliyev, N.M.Yakubova, I.R.Xasanboyev
α,β –To‘yinmagan ketonlarni olish 25
A.X.Xaydarov, O.M.Nazarov, X.N.Saminov
Olma o‘simligi barglari efir moylarining kimyoviy tarkibini o‘rganish 30
M.N.Po‘latova, S.Y.Xushvaqtov, D.J.Bekchanov,
Tarkibida amino va karboksil guruh tutgan polikompleksonlarning olinishi va xossalar (sharhiy maqola) 36
D.A.Eshtursunov, A.Inxonova, D.J.Bekchanov, M.G.Muxamediyev
Magnit xossali polimer nanokompoziti yordamida farmatsevtika chiqindi suvlaridagi paratsetamolning fotokatalitik degradasiyasi 43
Y.S.Fayzullayev, D.J.Bekchanov, M.G.Muxamediyev, M.R.Murtozaqulov, X.U.Usmonova
Tarkibida amino va fosfon guruh saqlagan yangi avlod ion almashinuvchi materiali olish 53
V.U.Xo‘jayev S.S.Omonova
O‘zbekistonda keng tarqalgan *Heliotropium* turkumiga mansub ba’zi o‘simliklarning element tarkibini tadqiq qilish 56
SH.A.Mamajonov, N.B.Odilxo‘jazoda, S.S.G‘ulomova
Liridendron tulipifera L. o‘simligining alkaloid tarkibini o‘rganish 63
D.G‘.Urmonov, M.M.Axadjonov
Limonium otolepis ildiz po‘stlog‘idagi kondensirlangan tanninlarning miqdoriy va spektroskopik tahlili 66
N.M.Yuldasheva, B.J.Komilov K.A.Eshbakova, SH.A.Sulaymonov, B.D.Mamarasulov
Inula rhizocephala gul qismi efir moyining kimyoviy tarkibi va mikroblarga qarshi faolligi 70
A.M.No‘monov, S.R.Mirsalimova, A.B.Abdikamalova, D.A.Ergashev
Log‘on bentonitini boyitish va uni modifikatsiyalab olingan organobentonitlarni skanerlovchi elektron mikroskop yordamida tahlil qilish 76
M.Sh.Muxtorova, V.U.Xo‘jayev, U.V.Muqimjonova
Lonicera nummularifolia o‘simligi bargi, ildizi va poyasi tarkibidagi aminokislotalar tahlili 83
Z.M.Chalaboyeva, M.J.Jalilov, S.R.Razzoqova, Sh.A.Kadirova, Sh.Sh.Turg‘unboyev
N-(1h-1,2,4-triazol-ll) asetamidni rux (II) xlorid bilan kompleks birikmasining sintezi va tadqiqoti .. 88
D.A.Eshtursunov, I.I.Abdujalilov, D.JBekchanov, A.T.Xasanov
Ppe-1/Nio nanozarrachalari orqali asetamiprid (pestitsid)ning fotokatalitik parchalanishi 94
I.R.Askarov, Ch.S.Abdujabborova
Analysis of the biological activity of the food additive "As lupinus" 100
X.X.Usmonova, M.G.Muxamediev
AN-31 Anion almashinuvchi materialga Cu(II) ionlari sorbsiyasi 104
I.I.Abdujalilov, D.A.Eshtursunov, D.J.Bekchanov, M.G.Muxamediyev
Metal oksid zarrachalarini saqlagan funksional polimer kompleksining olinishi va uning spektroskopik tahlili 109
I.R.Askarov, M.M.Khojimatov, D.S.Khojimatova
Methods for determining the acute poisoning and cumulative properties of a natural remedy “As-Sultan” 115
F.X.Bo‘riyev, E.M.Ziyadullayev, G.Q.Otamuxamedova, F.Z.Qo‘shboqov, O.E.Ziyadullayev
Atsetilen spirtlarining oksidlanish jarayonlariga katalizatorlar ta'siri 120

BIOLOGIYA

M.A.Masodikova, G.M.Zokirova, I.I.Zokirov
First recorded geographical distribution and biology of *Euproctis chrysorrhoea* (Lepidoptera: Erebidae) in the Fergana valley, Uzbekistan 127

FarDU. Ilmiy xabarlar – Scientific journal of the Fergana State University

Volume 31 Issue 2, 2025-yil DOI: 10.56292/SJFSU/vol31_iss2/a190

UO‘K: 547.918:547.926

INULA RHIZOCEPHALA GUL QISMI EFIR MOYINING KIMYOVIY TARKIBI VA MIKROBLARGA QARSHI FAOLLIGI

INULA RHIZOCEPHALA ХИМИЧЕСКИЙ СОСТАВ ЭФИРНОГО МАСЛА ЦВЕТОЧНОЙ ЧАСТИ И АНТИМИКРОБНАЯ АКТИВНОСТЬ

CHEMICAL COMPOSITION OF *INULA RHIZOCEPHALA* FLOWER ESSENTIAL OIL AND ANTIMICROBIAL ACTIVITY

Yuldasheva Nargiza Muratbayevna[1]
[1]Acad. S.Yu. Yunusov Institute of Chemistry of Plant Substances. Academy of Sciences of the Republic of Uzbekistan, Junior Researcher.

Komilov Bakhrom Jamoldinovich[2]
[2]Acad. S.Yu. Yunusov Institute of Chemistry of Plant Substances. Academy of Sciences of the Republic of Uzbekistan, Senior Research Fellow (PhD), Associate Professor.

Eshbakova Komila Alibekovna[3]
[3]Acad. S.Yu. Yunusov Institute of Chemistry of Plant Substances. Academy of Sciences of the Republic of Uzbekistan, Senior Research Fellow (PhD), Associate Professor.

Sulaymonov Sherali Abdupattayevich[4]
[4]Senior Lecturer, Namangan State University
ORCID ID 0009-0006-7370-334X

Mamarasulov Bohodir Dolikhonovich[5]
[5]Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan

Annotatsiya

Bu ishda respublikamizda o‘sadigan Inula rhizocephala o‘simligi gullaridan uchuvchi efirlarning kimyoviy tarkibi va biologik faolligi tahlil qilindi. Efir moylari o‘simliklarning barcha organlarida mavjud bo‘lib, o‘ziga xos hidga ega. Ular ko‘pchilik o‘simliklarda erkin uchraydi va bug‘da distillash yoki ekstraktsiya yo‘li bilan geksan fraksiyasidan ajratib olinadi va ularning tarkibi aniqlanadi va biologik faolligi o‘rganiladi. Ushbu tadqiqotning maqsadi Inula rhizocephala gulidan olingan efir moyining kimyoviy tarkibini aniqlash va uning mikroblarga qarshi faolligini baholash edi. Uning gullaridan olingan efir moyini gidrodistillash yo‘li bilan gaz xromatografiya-mass-spektrometriya (GC-MS) usulida tahlil qilish natijasida 61 ta birikma aniqlanib, ularning mikroblarga qarshi faolligi o‘rganildi.

Аннотация

В данной работе проанализированы химический состав и биологическая активность летучих эфиров из цветков растения Inula rhizocephala, произрастающего в нашей республике. Эфирные масла присутствуют во всех органах растений и имеют характерный запах. Они свободно встречаются в большинстве растений и выделяются из гексановой фракции путем паровой дистилляции или экстракции, после чего определяется их состав и изучается их биологическая активность. Целью данного исследования было определение химического состава эфирного масла, извлеченного из цветков девясила корнеголового, и оценка его антимикробного потенциала. В результате анализа эфирного масла, полученного из его цветков методом гидродистилляции, методом газовой хроматографии-масс-спектрометрии (ГХ-МС) идентифицировано 61 соединение и изучена их антимикробная активность.

Abstract

This paper analyzes the chemical composition and biological activity of volatile esters from the flowers of the Inula rhizocephala plant growing in our republic. Essential oils are present in all organs of plants and have a characteristic odor. They are found freely in most plants and are isolated from the hexane fraction by steam distillation or extraction, and their composition is determined and their biological activity is studied. The aim of this study was to

determine the chemical composition of the essential oil obtained from the flower of Inula rhizocephala and to evaluate its antimicrobial potential. As a result of the analysis of the essential oil obtained from its flowers by hydrodistillation using the gas chromatography-mass spectrometry (GC-MS) method, 61 compounds were identified and their antimicrobial activity was studied.

Kalit so'zalar: *Inula rhizocephala; Efir moyi; Antibakterial faollik; Antifungal faollik; GC-MS.*

Ключевые слова: *Inula rhizocephala цветки; Эфирное масло; Антибактериальная активность; Противогрибковая активность; ГХ-МС.*

Key words: *Inula rhizocephala; flowers; Essential oil; Antibacterial activity; Antifungal activity; GC-MS*.

INTRODUCTION

Inula (family *Asteraceae*) includes about 100 species of plants growing in Europe, Asia and Africa. Nine species are widespread in Uzbekistan. [1]. Some of them are known as plants used in folk medicine. Literature review has shown that *Inula* plants are a rich source of biologically active compounds, mainly triterpenoids and flavonoids. Little information is available on the composition and biological activity of *Inula* essential oils. The composition of *Inula rhizocephala* essential oil has not yet been studied.

Inula rhizocephala grows on mountain slopes and lowlands, on rocky soils at the foot of mountains. Large natural reserves of *Inula rhizocephala* have been noted in some mountainous areas of Tashkent region. Sterols, terpenoids, coumarins, flavonoids, polysaccharides and esters have been isolated from the aerial and root parts of many *Inula* species and their biological activity has been studied.

LITERATURES ANALYSIS

Inula species are used to treat digestive, respiratory, cardiovascular, and central nervous system dysfunctions, as well as asthma, diabetes, cancer, skin diseases, liver diseases, and fungal and bacterial infections. In India, the dried root of *I. rhizocephala* is used to treat colds, coughs, and chest diseases [3,4]. The composition of the essential oil collected during the flowering period of the flower part of *Inula rhizocephala* has been studied to search for biologically active compounds.

Inula rhizocephala is a perennial plant that grows near Katta Chimyan in Tashkent region [1,2].

A plant belonging to the *Inula (Asteraceae)* family. Nine species are widespread in Uzbekistan. Some of them are known as plants used in folk medicine. A study of the literature has shown that *Inula* plants are a rich source of biologically active compounds, mainly triterpenoids and flavonoids. Little information is available about the composition and biological activity of *Inula* essential oils. The composition of *Inula rhizocephala* essential oil has not yet been studied [5].

Inula rhizcoephala grows on mountain slopes and lowlands, on rocky soils at the foot of mountains. Large natural reserves of *Inula rhizocephala* have been noted in some mountainous areas of the Tashkent region. Sterols, terpenoids, coumarins, flavonoids, polysaccharides, and esters have been isolated from the aerial and root parts of many *Inula* species and their biological activity has been studied. Objective: The composition of the essential oil collected during the flowering period of the flower part of *Inula rhizocephala* was studied in order to search for biologically active compounds.

MATERIALS AND METHODS

Collection and Identification of *Inula rhizocephala*

Inula rhizocephala flowers were collected during the flowering period from Chimyon Mountain in Tashkent region in June 2022.

Extraction of *Inula rhizocephala* essential oil

The volatile essential oil was obtained by hydrodistillation at atmospheric pressure for 3 hours from 100 g of wet flowers.

GC-MS Analysis of *Inula rhizocephala* essential oil

The essential oil dissolved in CH_2Cl_2 was dried over anhydrous Na_2SO_4 and stored at 4°C before analysis. The oil content was 0.4%. The quantitative composition of the essential oil was determined on an Agilent 5975c Inert MSD / 7890 A GC-MS instrument. (Agilent Technologies, USA). The analytical conditions of GC-MS were similar to those described in the literature. The

constituents were identified by comparing the mass spectral features with data in electronic libraries. Retention indices (RI) were determined by comparing the ratios of retention times of n-alkanes mixtures (C9-C30) and comparing them with literature data [6,7].

Experiment part:

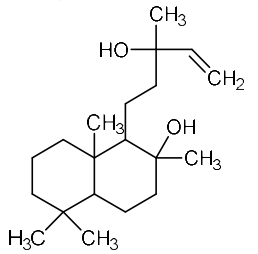
Antimicrobial Activity of *Inula rhizocephala* Essential Oil

Antibacterial activity. Test strains (*S. aureus-91, B. subtilis-5, P. aeruginosa-225, E. coli-221 C. albicans-247*) were used to determine the antimicrobial activity of the flower part of the plant *Inula rhizocephalan* essential oils. The disc diffusion method was used to determine the antimicrobial activity of essential oils[19].

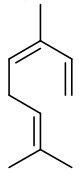
RESULTS AND DISCUSSION

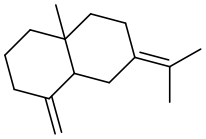
Essential oil analysis: GC-MS identified 61 components in the essential oil of the floral part of the plant *Inula rhizocephala*. This is 99.59% of the total ether. The ether contains monoterpene hydrocarbons (28.23%), oxidized monoterpenes (4.82%), sesquiterpene hydrocarbons (16.64%), oxidized sesquiterpenes (3.01%), diterpene hydrocarbons (5.42%), oxidized diterpene hydrocarbons (1.96%), and other substances predominate (39.51%) have significantly present concentrations.

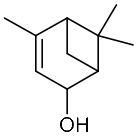
Main components of essential oil: Sclareol (18.3%), (Z)-*β*-ocimene (12.8%), *γ*-selinene (4,8%), (-)-(Z)-Verbenol (4,8%), d-3-Carene (4,4%), Cyclopropane (3.82%), 1,1-dimethyl-2-(3-methyl-1,3-butadienyl) (3,8%), Aromadendrene (3%), 2-Anilinonaphthalene (2,8%), 9-Geranyl-p-cymene (2,7%), Retene (2,7%), Terpinolen (2,5%), Bicyclo [6.1.0] non-1-ene (2,2%), 2-Pentadecanone (2,05%), Dehydroabietic acid (1,9%), (Z)-*β*-Caryophyllene (1,7%), *β*-Myrcene (1,6%), Pentacosane (1,4%), Tricosane (1,3%).



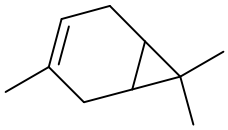
Sclareol

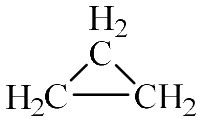

(Z)-*β*-ocimene


γ-selinene

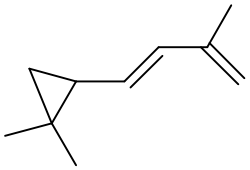


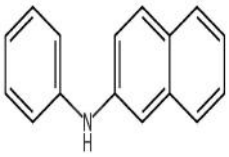
(-)-(Z)-Verbenol


d-3-Carene

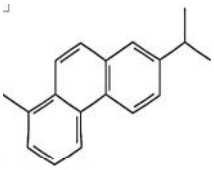


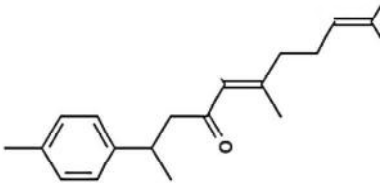
Cyclopropane


1,1-dimethyl-2-(3-methyl-1,3-butadienyl)

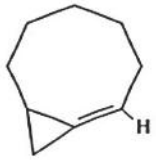


2-Anilinonaphthalene

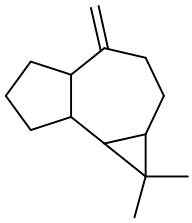

Retene



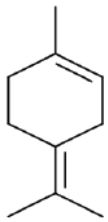
9-Geranyl-p-cymene



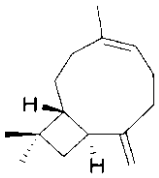
Bicyclo[6.1.0]non-1-ene



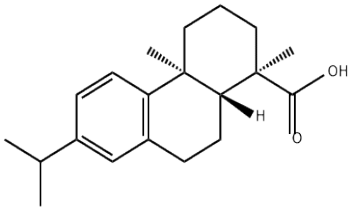
Aromadendrene



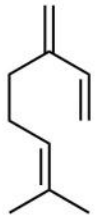
Terpinolen



(Z)-*β*-Caryophyllene



Dehydroabietic acid



β-Myrcene

CONCLUSION

The chemical composition of the essential oil of *Inula rhizocephala*, a flower growing in Uzbekistan, was studied for the first time using the GC-MS method and the main components were identified.

Table 1

Chemical compositions of essential oil flowers of *Inula rhizocephala*

Constituent	RI	Content %	Constituent	RI	Content %
Pyridine	1160	0.26	Tricosane	2302	1.25
2-Hexenal	1200	0.35	Dehydro-abietin	2335	0.76
2-Butanone	1246	0.26	1,4a.*β*.-Dimethyl-7-isopropyl-1	2386	0.87
1-Hexene	1322	0.34	Tetracosane	2402	0.75
3-Hexen-1-ol	1348	0.25	*α*-copaene-8-ol	2454	0.49
2-Furancarboxaldehyde	1419	0.25	*γ*-Cadinene	2495	0.35
.*E*.-Chrysanthenol	1435	0.39	Pentacosane	2502	1.40
α-Cubebene	1464	0.98	(3E,5E,8Z)-3,7,11-Trimethyl-1,3,5,8,10-dodecapentaene	2529	0.56
δ-3-Carene	1516	4.42	Cembrene	2591	1.07
β -Ocimene	1522	12.82	Nonadecane	2603	0.57
Bicyclo [3.1.1] hept-2-en-4-ol	1528	4.82	1,2-Benzenedicarboxylic acid	2624	0.24
(Z)-*β*- Caryophyllene	1555	1.71	Methyl ester likel	2675	0.35
γ-Muurolene	1646	0.44	Heptacosane	2703	0.99
Terpinolene	1656	2.47	Junipene	2720	0.66
(-)-Germacrene D	1664	0.82	9-Demethylretinal	2778	0.51
4-Isopropenyl-1-methil-1-cyclohexene	1685	0.07	1,4-Methanonaphthalen-9-ol	2790	0.77
Bicyclo[6.1.0] non-1-ene	1697	2.20	1,3,5-Triazine-2,4-diamine	2803	0.75

δ -Cadinene	1711	0.31	Cyclohexanol	2819	0.45
Cyclopropane	1716	3.82	Myristinic acid	2850	3.05
m-Mentha-3 (8), 6-diene	1755	0.49	Celidoniol	2902	0.81
Hexanoic acid	1794	0.47	Phenanthrene	2925	0.41
β-Myrcene	1803	1.55	Dehydroabietic acid	2962	1.96
Benzeneethanol	1846	0.58	9-Ethyl-10-methylanthracene	3007	0.32
Aromadendrene	1918	3.01	Retene	3028	2.68
Rulepidadiene B	2067	0.91	1-(1-Naphthyl)-1-propanol	3032	18.27
2-Pentadecanone	2098	2.05	9,12-Octadecadienoic acid	3131	0.65
1,6-Cyclodecadiene	2113	0.40	2-Naphthalenamine	3475	2.78
(+)-Cycloisosativene	2129	0.24	Monoterpene hydrocarbons		28.23
γ-Maaliene;	2160	0.22	Oxidized monoterpenes		4.82
Selina-4(15),7(11)-diene	2162	4.84	Sesquiterpene hydrocarbons		16.64
α.-Amorphene	2170	0.68	Oxidized sesquiterpene		3.01
β-Selinene	2186	0.32	Diterpene hydrocarbons		5.42
4,10 (14) –Cadinadien-8.β.-ol	2225	0.47	Oxidized diterpene		1.96
Geranyl-p-cymene	2244	2.71	Predominates, and other substances		39.51
			Total		99.59

Essential oil of *Inula rhizocephala*, which grows in Uzbekistan, has antibacterial, antifungal properties and is used externally for external wounds.

Antimicrobial activity of essential oil of *Inula rhizocephala* flower: In medicine, essential oil of *Inula* plant has antibacterial, antifungal properties and is used as a topical ointment for external wounds.

Volatile essential oils of *Inula rhizocephala* flower part were tested in vitro for antibacterial and antifungal activity. (Table 2).

Table 2

Inula rhizocephala gulining efir moyining antibakterial va antifungal faolligi (mm, ± SD, P≤0.05)

Sample	Inhibition zone diameter, mm, ± SD, P ≤ 0.05				
	B.subtilis	*S.aureus*	*P.aeruginosa*	*E.cole*	*C.albicans*
Essential oil	11.06±0.13	12.04±0.10	9.06±0.13	7.13±0.04	15.08±0.13
Positive Control Canamycin (10μg/disk)	10.05±0.11	9.06±0.13	8.06±0.13	6.06±0.13	0±00
Negative control DMSO (10μg/disk)	4±0.13	3.06±0.13	4.06±0.36	0±00	5.06±0.14

Inula rhizomatous flower essential oil was tested for antibacterial activity using the disk diffusion method. Selected test strains (*Staphylococcus aureus-91, Bacillus subtilis-5, Gram-negative bacteria Escherichia coli-221, Pseudomonas aeruginosa-225,* microscopic fungi *Candida albicans-247*) were grown in a nutrient medium at ±37°C. 24°C. The inoculated test strains were diluted in 20 ml of sterilized distilled water. The turbidity level of the strains used for the test was set to 0.5 (0.5 × 108 CFU / ml) according to the McFarland standard. Then, the pathogenic test

bacterial strains were inoculated onto a pre-prepared nutrient agar medium (Hi Media Lab. Ltd., Mumbai, India) using a sterilized L-shaped glass rod. The crude plant extracts were soaked in sterile Whatman paper (6-8 mm thick). The culture medium was then placed in a petri dish containing the pathogenic bacterial strains grown in it. The antibiotic kanamycin was used as a positive control, and dimethyl sulfoxide (DMSO) solution was used as a negative control. The Petri dishes were kept in a thermostat at 37 ± 2^{o}C (Schutzart DIN EN 60529 - IP20, manufactured by Memmert, Germany) for 18-24 hours. After the expiration date, the inhibition zones around the discs impregnated with the extracts were measured and compared with the inhibition zone values of the antibiotic canamycin [8,9].

The results of antimicrobial tests showed that the essential oil of *Inula rhizocephala* flower is sensitive to the action of S*. aureus, B. subtilis, E. coli, C. albicans* microbes. The greatest antibacterial effect was found against *S. aureus* with a diameter of the zone of inhibition of 12.04±0.10 mm.

CONCLUSIONS

The chemical composition was studied by GC-MS and the main components of the essential oil were identified. (RKMUz-247). The results of in vitro screening showed that the essential oil of *Inula rhizocephala* flower has relative properties against all tested microbes. *Gram-positive bacteria B. subtilis and S. aureus* (12.04±0.10 mm) have a significant effect.

The composition of the specific components of the volatile essential oil isolated from the flower part of *Inula rhizocephala* was studied for the first time using the GC-MS method.

REFERENCES

1. Флора Узбекистан. Том. 6. Акад. Наук УзССР, Ташкент, 1955. С. 87.
2. S. Amin, Z. A. Kaloo, S. Singh, T. Altaf, *J. Cur. Res. Rev.,* **5** (2), 22 (2013).
3. Das, A. Shakya, S. K. Ghosh, U. P. Singh, H. R. Bhat. *Curr. Bioact. Compd,* **16** (5), 557 (2020).
4. В.А. Куркин. Фармакогнозия. Самара: Офорт Сам ГМУ, 2004. С.430.
5. O. Tashmatov, K. A. Eshbakova, Kh. M. Babakulov and N. D. Abdullaev, *Chem. Nat. Compd.,* **45,** 884 (2009)
6. Z. O. Tashmatov, K. A. Eshbakova K.A. and Kh. M. Bobakulov, Chem. Nat. Compd., **47,** 440 (2011).
7. D. Komilov and K. A. Eshbakova, Chem. Nat. Compd., 58, 746 (2022).
8. Zh. Komilov, K. A. Eshbakova, and H. A. Aisa, Chem. Nat. Compd., 51, 563 (2015)
9. B. D. Komilov, M. A. Agzamova, I. M. Isaev, and K. A. Eshbakova, Chem. Nat. Compd., 56, 814 (2020).