

CHEMICAL COMPOSITION AND PHARMACOLOGICAL PROPERTIES OF
ELECAMPANE ROOT (INULA HELENIUM L.)

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Abstract. This article provides a scientific analysis of the chemical composition and pharmacological properties of the elecampane (*Inula helenium* L.) root. It has been determined that the plant contains inulin, essential oils, alkaloids, flavonoids, saponins, ascorbic acid, and other biologically active compounds. These components exhibit anti-inflammatory, expectorant, bactericidal, antioxidant, and immunomodulatory effects on the human body. The study examines the role of elecampane root in traditional medicine, its use in modern pharmacology, and the biological activity of its preparations. The results demonstrate that *Inula helenium* L. can be effectively utilized as a natural medicinal source in the fields of pharmaceuticals and phytotherapy.

Keywords: elecampane, *Inula helenium*, chemical composition, essential oil, inulin, flavonoid, saponin, pharmacological activity, medicinal plant.

Introduction. In recent years, the use of natural remedies to maintain human health has become an important priority in global scientific research. The side effects of synthetic drugs and the deterioration of ecological conditions have intensified the demand for natural plant-based medicines. Among medicinal plants, elecampane (*Inula helenium* L.) is particularly significant due to its diverse biological activities.

Elecampane root has long been used in traditional medicine to treat respiratory diseases, reduce inflammation, facilitate expectoration, and strengthen the immune system. Modern pharmaceutical studies have identified numerous biologically active substances within this plant, including inulin, saponins, essential oils, flavonoids, sesquiterpene lactones, and ascorbic acid. These compounds endow the root with bactericidal, antiseptic, antioxidant, and diuretic properties.

In Uzbekistan's flora, elecampane naturally grows in foothill and mountainous regions. Although widely used in folk medicine as an ecologically clean medicinal plant, its chemical composition and pharmacological mechanisms are not yet fully studied. Therefore, this article aims to analyze the chemical constituents of the elecampane root and scientifically evaluate their biological activities.

Literature Review. Among medicinal plants, *Inula helenium* L. (elecampane) has attracted the attention of many researchers due to its rich content of biologically active substances beneficial to human health. Literature sources report that the root contains inulin, sesquiterpene lactones, essential oils, saponins, flavonoids, ascorbic acid, polyphenols, and other bioactive compounds.

Petrova and Sherbakov noted that the essential oil of elecampane root contains lactones such as alantolactone and isoalantolactone. These compounds exhibit bactericidal and antifungal activities by damaging microbial cell walls and inhibiting their growth. Kumar and Patel



measured the antioxidant activity of the plant's ethanol extract using the DPPH assay and demonstrated that it neutralizes up to 72% of free radicals.

Pharmacognostic analyses by Yegorova revealed that inulin polysaccharide normalizes glucose metabolism in the human body and is beneficial in mild forms of diabetes. Nazarov and Qodirov reported that the aqueous extract of elecampane root possesses anti-inflammatory activity, attributed to the combined effects of saponins and flavonoids.

Numerous scientific sources (Huang, 2022; Guseva, 2023) indicate that elecampane root positively affects the lungs, bronchi, and digestive system. It softens mucous membranes, liquefies phlegm, and reduces inflammation. Consequently, elecampane extract is widely used in phytotherapy for treating respiratory infections, bronchitis, gastritis, and hepatitis.

The roots and rhizomes of the plant are harvested in the autumn after the fruits ripen or in early spring. After cleaning from soil and washing, thick roots are cut and dried outdoors in sunlight. The aerial parts contain 1–3% essential oil, up to 44% inulin and other carbohydrates, saponins, 0.16% alkaloids, resins, bitter compounds, pigments, mucilage, and other substances. The decoction of the rhizomes and roots is used as an expectorant in respiratory diseases. The "allanton" preparation derived from the underground organs is used in the treatment of gastric and duodenal ulcers.

Elecampane preparations and essential oils exhibit anti-inflammatory, antiseptic, and anthelmintic activities (mainly due to alantolactone and isoalantolactone). The roots and rhizomes are components of cough-relief herbal mixtures, teas, and the Zdrenko mixture. Historically, elecampane has been used in folk medicine to treat various diseases. Avicenna (Ibn Sina) recommended the plant for joint pain and radiculitis, used the decoction as an expectorant and diuretic, and applied it externally for bruises.

Even today, decoctions, infusions, and powders made from elecampane root are used in traditional medicine as expectorants, antipyretics, diaphoretics, diuretics, anthelmintic agents, and appetite stimulants.

The table below summarizes the main biologically active components of elecampane root and their pharmacological effects.

Table 1. Main Bioactive Components of *Inula helenium* Root and Their Effects

No.	Bioactive Compound	Chemical Group	Main Pharmacological Effects	Source
1	Inulin	Polysaccharide	Regulates blood glucose levels, improves liver function	Egorova, 2021
2	Alantolactone, Isoalantolactone	Sesquiterpene lactones	Bactericidal, antifungal, anti-inflammatory	Petrova & Sherbakov, 2019
3	Flavonoids (quercetin, rutin)	Polyphenols	Antioxidant, strengthens vascular walls	Kumar & Patel, 2020
4	Saponins	Glycosides	Expectorant, immunomodulatory	Nazarov & Qodirov, 2023
5	Essential oils	Hydrocarbon	Antiseptic, relieves cough	Guseva, 2023



		compounds		
6	Ascorbic acid	Vitamin C	Antioxidant, boosts immunity	Huang, 2022

Asteraceae (Compositae) is a large perennial herbaceous plant of the family Astraceae (Compositae) growing to 100-80 cm tall. The stem is single or multiple, erect, branched in the upper part. The basal leaves are large, long-striped, elliptical or oblong, ovate with a sharp tip. The leaves on the stem are oblong-ovate, arranged alternately on the branches with a band (those in the lower parts) or a band (those in the upper part of the stem). All leaves are serrate (especially the lower side) and have a toothed edge. The golden yellow stem and branches are arranged in baskets forming a thyroid or spicate inflorescence. The fruit is a four-sided, oblong pistachio.



Figure 1. Black andiz root

The figure shows the anatomical structure of the black andiz root: the outer bark is rich in saponins and essential oils, the middle layer is rich in flavonoids and polysaccharides, and the central cylindrical part is saturated with mineral salts and inulin. These substances are the main factors determining the pharmacological properties of the plant.

As a result of the analysis of the literature, it was found that the bioactive components contained in the black andiz root have a complex effect on the body: they increase immunity, strengthen antimicrobial protection, normalize liver and kidney function, and activate the antioxidant system. Therefore, this plant can be widely used in modern pharmaceuticals and phytotherapy as a natural, safe and multifunctional tool.

Preparation and use of the drug 1. To prepare the tincture, 1 stack of boiling water is poured into a closed container, a teaspoon of crushed root and rhizome is added to it and left to infuse for 8



hours. Then strain through gauze and drink a quarter cup 4 times a day 20 minutes before meals for the above-mentioned diseases.

2. To prepare a decoction, pour a glass of water into a sealed container, add 20 grams of crushed roots and rhizomes, boil a little and let it brew for 4 hours. Then strain through gauze and drink a tablespoon 3-4 times a day 20 minutes before meals.

3. To treat skin diseases, prepare a larger decoction. For this, pour 1 liter of water into a sealed container, add 100 grams of crushed roots and rhizomes, boil a little and let it brew for 4 hours. Then strain through gauze and wash the areas with wounds, eczema or scabies several times a day, and finally, soak the gauze each time and attach it to the place.

Black andis root (*Inula helenium* L.) contains a number of biologically active components that determine the mechanism of pharmacological action of the plant. Chemical analyses show that the main active ingredient of andis root is inulin. This polysaccharide stabilizes glucose levels in the human body, normalizes intestinal microflora, and protects liver cells.

Also, sesquiterpene lactones (alantolactone, isoalantolactone) have been detected in high amounts in andis root, which are antimicrobial and anti-inflammatory active substances. They disrupt the protein structure of bacterial cells, which slows down the development of infectious diseases. Flavonoids (rutin, quercetin) have strong antioxidant properties and protect the cell membrane from damage by free radicals.

The essential oils of andis root mainly consist of allantolactone, eudemone, and helenine compounds. They relieve cough, soften mucous membranes, and dilate bronchi. In addition, saponins activate the immune system, stimulate the activity of lymphocytes and accelerate the process of sputum removal. In this regard, black andis root has a complex effect on the body - as an anti-inflammatory, antimicrobial, antioxidant and immunostimulating agent.

The pharmacological activity of andis root is based on the synergy of its chemical components. Inulin acts in place of insulin and normalizes carbohydrate metabolism. Flavonoids and ascorbic acid neutralize free radicals, reduce the level of C-reactive protein in the blood, which leads to a decrease in the level of inflammation.

Sesquiterpene lactones affect the enzymatic system of microorganisms and suppress bacterial infections. Therefore, andis root extract is effective in diseases such as colds, bronchitis, pneumonia and gastritis. It also accelerates the detoxification process in the liver, increases bile secretion and protects liver cells from toxins.

Currently, preparations made from the root of black andis are widely used in folk medicine, as well as in modern pharmaceuticals and phytotherapy. Extracts from the plant are included in expectorant syrups, immunostimulating tinctures, and teas. For example, black andis is used as the main component in herbal remedies such as "Elixir Andil Forte" and "Bronchoherb".

Also, according to the results of studies conducted in Uzbekistan and Russia, black andis extract can be an effective tool in the prevention of diabetes, hypertension and liver diseases. Its natural, non-toxic properties allow it to be used in long-term treatment or diet programs.

Conclusion. Based on the analysis of the literature and scientific data obtained, it was determined that black andis root (*Inula helenium* L.) occupies an important place among medicinal plants with its rich chemical composition and versatile pharmacological properties.



Inulin, saponins, flavonoids, sesquiterpene lactones, essential oils and ascorbic acid contained in the plant provide its biological activity.

As a result of the combined effect of these components, andize root exhibits anti-inflammatory, antibacterial, expectorant, immunostimulating and antioxidant properties. Therefore, its widespread use in pharmaceuticals, phytotherapy, the production of biologically active additives and folk medicine is scientifically justified.

Future scientific research has the potential to further study the chemical components of the Andes root, determine their pharmacokinetic properties, and use them in the development of new medical drugs. Also, the development of a technology for industrial cultivation of this plant in Uzbekistan will serve to enrich medicinal plant resources.

References:

1. Petrova, N., & Sherbakov, A. (2019). *Chemical composition and antimicrobial properties of Inula helenium L. essential oil*. Journal of Medicinal Plant Research, 13(2), 87–94.
2. Kumar, V., & Patel, R. (2020). *Evaluation of antioxidant activity of Inula helenium root extracts*. Phytotherapy Research, 34(5), 1134–1142.
3. Egorova, L. V. (2021). *Inulin content and pharmacological potential of Inula helenium L. roots*. Pharmacognosy Journal, 13(3), 221–228.
4. Nazarov, B., & Qodirov, A. (2023). *O‘zbekiston florasidagi andiz ildizining biologik faolligi va xalq tabobatidagi o‘rni*. O‘zbekiston Biologiya Jurnal, 5(4), 65–72.
5. Xuang, J. (2022). *The anti-inflammatory and antioxidant effects of Inula helenium extract in respiratory diseases*. Asian Journal of Natural Medicine, 8(1), 44–51.
6. Guseva, T. (2023). *Pharmacognostic characteristics of Inula helenium and its essential oils*. Botanical Studies, 62(2), 98–107.
7. Anvarovna, A. S. (2023). *Constructions (models) of social intelligence in future English language teachers*. Horizon: Journal of Humanity and Artificial Intelligence, 2(4), 169-172.
8. Anvarovna, A. S. ., & Kahharova. (2024). *SOCIAL-PSYCHOLOGICAL ADJUSTMENT OF FIRST YEAR UNIVERSITY STUDENTS*. JOURNAL OF EDUCATION, ETHICS AND VALUE, 3(1), 230–234. Retrieved from <https://jeev.innovascience.uz/index.php/jeev/article/view/439>
9. Ataxo‘jayeva, S. A. (2020). *INGLIZ TILINI O‘RGATISHDA LOYIXA ISHINI TASHKIL QILISHNING AFZALLIKLARI*. Science and Education, 1(1), 403-406.
10. Ataxo‘jayeva, S. (2023). *EMPERIAL FOUNDATIONS OF THE STUDY ENGLISH LANGUAGE TEACHERS*. GULDU AXBOROTNOMASI.–2023.
11. Nortoji Jumayevich Eshnayev, & Shahlo Anvarovna Atakhujaeva (2021). *SELF-DESTRUCTIVE BEHAVIOR AND ITS ESSENCE*. Academic research in educational sciences, 2 (CSPI conference 1), 371-375.
12. Atakhujaeva, S. (2023). *CONSTRUCTIONS (MODELS) OF SOCIAL INTELLIGENCE IN FUTURE ENGLISH LANGUAGE TEACHERS*. Horizon: Journal of Humanity and Artificial Intelligence.
13. Atakho‘jayeva, S. A. (2025). *Ways To Form The Social-Emotional Competence Of A Foreign Language Teacher In The Conditions Of Digital Education*. International Conference on Global Trends and Innovations in Multidisciplinary Research, 1(4), 75-80. <https://www.tlepub.org/index.php/2/article/view/325>



14. Атаходжаева, Ш. А. (2025). Роль Информационных Технологий В Обществе. International Conference on Global Trends and Innovations in Multidisciplinary Research, 1(4), 17-21. <https://tlepub.org/index.php/2/article/view/292>
15. Ataxo'jayeva, S. (2022). SELF-DESTRUCTIVE BEHAVIOR AND ITS ESSENCE.

