SIGNIFICANCE OF BIOACTIVE SUBSTANCES OF ACHILLEA MILLEFOLIUM L.

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Abstract. *This study analyzed the bioactive substances contained in the widely used medicinal plant - yarrow (Achillea millefolium L.), their isolation by biotechnological methods, biological and pharmaceutical properties, and the prospects for their use as a medicinal agent in the form of an ointment.*

Keywords: *bioactive substances, Achillea millefolium, essential oil, flavonoids, biotechnology, medicinal ointment.*

INTRODUCTION. Common yarrow – *Achillea millefolium L*. is widespread in the temperate regions of the Northern Hemisphere in Asia and Europe and North America, and in the desert and mountainous regions of Uzbekistan. The genus *Achillea millefolium L*. has more than 115 species in the Northern Hemisphere and 110-140 in the world. It is a perennial plant with a height of 0.2-1 m and a flat growth habit. The Asteraceae family, which is widespread throughout the world, grows in America, southern and eastern Africa, the Mediterranean, Asia and Australia. This is a family with a very rich species diversity, which can grow in coastal and semi-coastal regions of subtropical regions, in low and moderate temperature regions, in mesic mountain environments and in oceanic climates. The leaves are arranged in a double-pinnate pattern, evenly distributed along the stem, 5-20 cm long, almost hairy, and composed of cauline, which is sticky. The flowers are in large, compact, spicate inflorescences at the top of the stem, each cluster consisting of 1 or more flower heads.

The inflorescence has 20-25 yellowish-white (rarely pink) ray flowers. The fruit is a flat, ovoid, gray achene. The widespread use of yarrow in folk and official medicine is associated with a complex of various biologically active substances contained in the plant. Currently, the chemical composition of common yarrow has been very well studied. Yarrow contains a large amount of essential oil, which includes azulene, thujol, cineole, camphor, caryophyllene, formic, and valeric acid. Its leaves contain resins, tannins, phytoncides, achillein alkaloid, aconitic and ascorbic acids, vitamins K, P, B1. The plant contains flavonoids, including artemethine. The medicinal raw material contains many micro and macro elements: K, Ca, B, Mg, Si, Cl, Co, P. Traditional medicine, the countries of Europe, Central Asia and the Far East have long used this plant as a wound healing and hemostatic agent for uterine and intestinal bleeding; dysentery, diarrhea, inflammatory diseases of the bladder, ovaries; gastritis, gastric and duodenal ulcers, etc. Infusion and extract of the plant are used as a hemostatic agent for uterine bleeding, as an appetite stimulant. It is recommended and widely used in herbal formulations for the complex treatment of hypertension, angina, atherosclerosis, asthenic conditions, and metabolic diseases [1].



Picture. Common yarrow – Achillea millefolium L.

METHODOLOGY. In cosmetology, the valuable fatty acids and plant sugars contained in yarrow give it excellent emollient and caring properties. The high content of flavonoids and tannins in yarrow extract gives it excellent antioxidant and soothing properties. In cosmetology, it is used in skin care and soothing, as an excellent antioxidant, and in skin care, since the fatty acids and plant sugars contained in yarrow give it excellent emollient and skin-caring properties. The chemical composition of ordinary yarrow (*Achillea millefolium*) includes biologically and chemically active substances: carotene, vitamins K and C, achillein and betonica alkaloids, up to 0.8% essential oil, matricarine isomer, millefin lactone, 0.31% choline, asparagine, resin, astringent, bitter (proxamazulen-achillin) and other substances. The essential oil contains up to 1-4% chamazulene (the main part is formed from prochamazulene during the extraction of the essential oil), thujone, camphor, borneol, caryophyllene, up to 10% cineole, formic, acetic and valeric acids. The plant contains a relatively high amount of potassium, calcium, copper and magnesium. The role of mineral elements in the human body is very diverse. They are components of organs and tissues, part of cellular and tissue fluids, as well as enzymes, participate in the molecular mechanism of muscle contraction, and in the transmission of nerve impulses.

Medicinal products made from yarrow are used to treat gastrointestinal diseases (gastric ulcers and gastritis, as well as inflammation of the mucous membrane), to stimulate appetite and as a hemostatic drug (intestinal, uterine and hemorrhoidal bleeding), and to stop bleeding from the nose, gums and wounds. Ibn Sino recommended a decoction made from the above-ground part of yarrow for colds, headaches, uterine ulcers, kidney stones and other diseases.

Yarrow reproduces by seed and vegetatively. It is recommended to plant yarrow in more irrigated areas. The land where yarrow is planted is plowed with a tractor to a depth of 25-30 cm in the fall, applying 20-30 tons of organic fertilizer and 70% of the annual norm of phosphorus fertilizer per hectare. The seeds are sown in late autumn and early spring (the most selected seeds). Seeds can be sown in vegetable seeders with a row spacing of 60 cm. The sowing depth is 5-1 cm, and 6-7 kg of seeds are used per hectare of land [2].

Since the yarrow is a perennial plant, it can be sown in late autumn and early spring. The plant is propagated both by seeds and vegetatively. The best quality seeds are used during the sowing period [3].

The plant *Achillea millefolium L*. and its bioactive substances obtained by biotechnological methods were selected as the objects of research. The biotechnological isolation of bioactive

substances by traditional hydrodistillation, ethanol extraction, and suspension and hairy root cultures was studied [4-7].

RESULTS AND DISCUSSION. The main bioactive components of yarrow were identified in the studies, which include terpenoids such as β-thujone (0.4-55.3%), camphor (0.6-25.5%), 1,8-cineole (1.2-19.8%), germacrene-D (2-20.6%) contained in the essential oil, as well as flavonoids such as apigenin, luteolin, and phenolic acids such as caffeic and chlorogenic. It was found that flavonoids and phenolic substances are effectively synthesized in suspension culture, and the synthesis of these substances can be enhanced by elicitors such as sorbitol.

The anti-inflammatory and antibacterial activity of the extract of the yarrow has been experimentally confirmed. In particular, the extracts of the yarrow have shown high activity against microorganisms such as *E. coli*, *Candida albicans* and *Bacillus cereus*. In addition, it has been scientifically proven that ointments based on this extract are highly effective in the treatment of diabetic ulcers.

Table

Main components of Achillea millefolium essential oil

Component	Amount range (%)
β-thujone	0,4 – 55,3
Germacrene-D	2 – 20,6
1,8-cineole	1,2 – 19,8
Isospathulenol	0,5 – 36,0
Camphor	0,6 – 25,5
Trans-nerolidol	0,4 – 48,1
Cubenol	0,1 – 42,9

CONCLUSION. Yarrow herb has anti-inflammatory and bactericidal effects. They are used in the form of tinctures and decoctions for various diseases of the gastrointestinal tract, stomach ulcers and gastritis. It is a component of stomach and appetite-stimulating teas. Along with nettle, the preparation of yarrow is prescribed as a hemostatic and sedative for internal and external bleeding.

It was shown that the effective extraction of biologically active substances contained in *Achillea millefolium* and their use in the production of ointments has high prospects. Ointments prepared on the basis of yarrow extracts have been proven to be effective in clinical trials, and the introduction of biotechnological methods in this direction is of great importance in the pharmaceutical industry.

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