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«Ә. Б. БЕКТҰРОВ АТЫНДАҒЫ  
ХИМИЯ ҒЫЛЫМДАРЫ ИНСТИТУТЫ»  
АКЦИОНЕРЛІК ҚОҒАМЫ

# ҚАЗАҚСТАННЫҢ ХИМИЯ ЖУРНАЛЫ

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## ХИМИЧЕСКИЙ ЖУРНАЛ КАЗАХСТАНА

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## **THERAPEUTIC AND COSMETIC AGENTS BASED ON BIOLOGICALLY ACTIVE SUBSTANCES OF *MATRICARIA CHAMOMILLA* L. AND *HYPERICUM PERFORATUM* L.**

**Abstract.** This article provides an overview of the literature and the results of our own research on the development of medical and cosmetic agents based on biologically active substances of *Matricaria chamomilla* L. and *Hypericum perforatum* L.

The results of a chemical study of *Matricaria chamomilla* L. and *Hypericum perforatum* L. are presented. The main components of the *Matricaria chamomilla* L. CO<sub>2</sub>-extract are bisabolol oxide A, bisabolol oxide B, en-ind-dicyclo ether, matricarin and chamazulene. The major flavonoid compounds hyperoside, quercetin and rutin were identified in the extract of *Hypericum perforatum* L.

On the basis of biologically active substances of *Matricaria chamomilla* L. and *Hypericum perforatum* L., therapeutic and prophylactic agents are being developed, such as ointments, creams, etc.

**Keywords:** medicinal and cosmetic agents, biologically active compounds, *Matricaria chamomilla* L., *Hypericum perforatum* L.

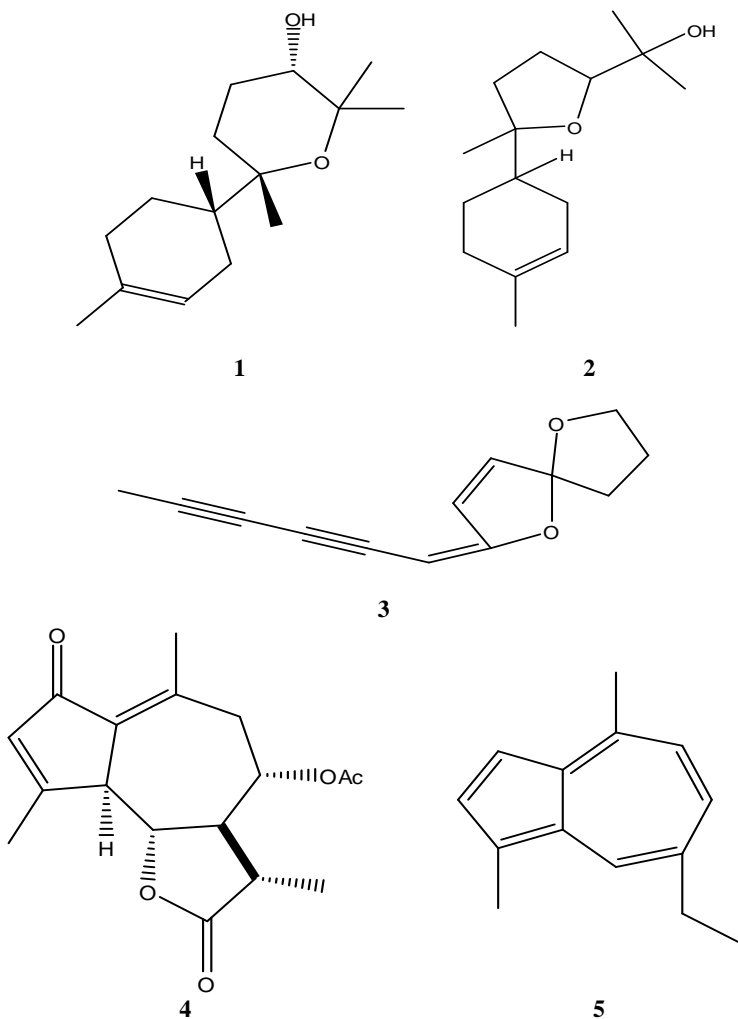
Recently, biologically active substances of plant, animal and mineral origin have been widely used in the production of medical and cosmetic agents. Biologically active substances of plants are very popular. They effectively affect the metabolic process in skin cells, have an antiseptic, anti-inflammatory, antimicrobial, soothing, astringent, tonic and softening effect. These substances have a varied composition and belong to different classes of chemical compounds: sugars, organic acids, essential and fatty oils, vitamins, phytoncides, mucous and tannic substances, saponins, alkaloids, flavonoids, etc.

In this regard, this work summarizes the literature and our own data on the use of biologically active substances of *Matricaria chamomilla* L. and *Hypericum perforatum* L. species in the production of medical and cosmetic agents.

*Matricaria chamomilla* L. is an annual herb with a strong specific odor. Grows in fields, near dwellings, in ruderal places [1]. The pharmacological properties of *Matricaria chamomilla* L. depend on the biologically active substances contained in the plant. Inflorescences of *Matricaria chamomilla* L. contain nicotinic and salicylic acids, bitter principles, gums, essential oil, flavonoids, carotene, coumarins, glycosides, polysaccharides and organic acids. Dry anthodium contain from 0.1 to 0.8% of essential oil - the so-called chamomile oil. In addition, dry anthodium

contain tannins and mucous substances, vitamins (nicotinic and ascorbic acids), albuminous substances [2].

We have previously carried out a comparative gas chromatato-mass spectrometric analysis of the component composition of CO<sub>2</sub>-extracts of *Matricaria chamomilla* L., collected from different growing areas. As a result of the studies, it was revealed that the major components of the obtained CO<sub>2</sub>-extracts of *Matricaria chamomilla* L. are: bisabolol oxide A (**1**), bisabolol oxide B (**2**) and en-ind-dicycloether (**3**). Meanwhile, the quantitative content of matricarin (**4**) and chamazulene (**5**) predominates in the CO<sub>2</sub>-extract of *Matricaria chamomilla* L. collected at the site of medicinal plants of JSC "IRPH "Phytochemistry", so the content of matricarin is three times higher, and chamazulene is five and two times higher in comparison with extracts obtained from Belarusian and Almaty raw materials [3].



Cosmetic formulations based on acai, chamomile and green tea extracts have been developed, which have a potential antioxidant effect, which is promising for their use in cosmetics [4].

Ingredients obtained from *Matricaria chamomilla* L. are mainly used in cosmetics as fragrances and skin care products. The expert group on the review of cosmetics concluded that essential oils and extracts from *Matricaria chamomilla* L. are safe in cosmetics under the use and concentration methods described in the safety assessment [5].

The work [6] studied the pharmacological action of *Matricaria chamomilla* L. components. Thanks to its properties, *Matricaria chamomilla* L. has found wide application in the cosmetic industry. In particular, the ability to eliminate irritation, as well as deodorant and bactericidal action. Particular attention is paid to the methods for determining flavonoids with antioxidant activity. Water-alcohol, water-glycerin and oil extracts of *Matricaria chamomilla* L. in various ratios were obtained. The content of flavonoids in them was determined by the method of thin layer chromatography. For use in cosmetics, according to the research results, the most optimal extract is the oil extract of *Matricaria chamomilla* L. in the ratio of raw material:oil = 1:10.

Local administration of antioxidants has proven effective in protecting skin from oxidative damage. The antioxidant potential of *Matricaria* extract has been studied, as well as the clinical effectiveness of hydration and mechanical action on the skin. *Matricaria* extract is effective in neutralizing free radicals and therefore is promising for inclusion in cosmetics formulations [7].

*Calendula officinalis* L. and *Melampodium divaricatum* DC. contain flavonoids. *Matricaria chamomilla* L. and *Achillea millefolium* L. contain sesquiterpene compounds called azulenes. The content of biologically active substances - sesquiterpenes and flavonoids in cosmetic creams with extracts of *Matricaria chamomilla* L., *Achillea millefolium* L., *Calendula officinalis* L. and *Melampodium divaricatum* DC. was studied. Microbiological safety for consumers and beneficial effects on skin due to the presence of flavonoids and sesquiterpenes was shown [8].

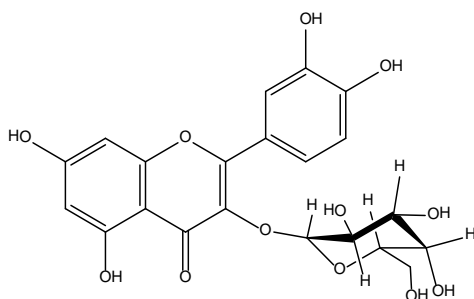
The paper provides an overview of *Matricaria* species, on the basis of which creams and ointments have been developed, and which are used as an active ingredient for the treatment of skin diseases [9].

The paper [10] presents a literary review of clinical studies of *Matricaria chamomilla* L. in various skin conditions: erythema, white spot disease, similar to eczema lesions, peristomal injuries, contact dermatitis, phlebitis, atopic eczema, radiodermatitis, induced contact, dermatitis, wound healing and eczema.

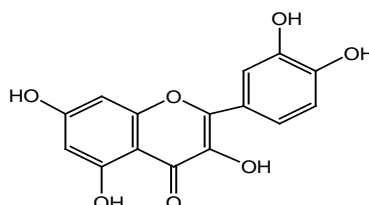
Thus, *Matricaria chamomilla* L. possesses anti-inflammatory, antispasmodic and moderate antimicrobial activity, tonic, analgesic and wound-healing activity.

Thus, the cosmetic companies "Chistaya Liniya", "Nevskaya Kosmetika", "Belita", "Vitex", "Kamill", "Librederm" use biologically active substances of *Matricaria chamomilla* L. and produce a number of natural cosmetics products based on them.

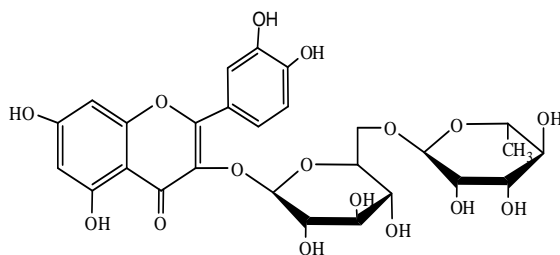
*Hypericum perforatum* L. – perennial herb, grows in dry meadows, forest sunny glades. The herb of *Hypericum*, as it is known, contains a whole spectrum of active substances, among which anthracene derivatives dominate, the content of which is associated with the pronounced antimicrobial activity of drugs. The major group of biologically active compounds of *Hypericum perforatum* L. herb are flavonoids (hyperoside (**6**), quercetin (**7**), rutin (**8**)), which have anti-inflammatory, capillary-strengthening, antispasmodic and angioprotective effects. In addition, *Hypericum* herb contains tannins, a small amount of essential oil, vitamins, etc. [11,12].



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We have carried out a comparative study of the content of the sum of flavonoids in *Hypericum perforatum* L. herb, collected in the Dzungarian Alatau of Almaty region and the Karaganda Botanical Garden at the site of medicinal plants. The content of the sum of flavonoids in terms of rutin in the air-dry raw material of *Hypericum perforatum* L. collected in the Almaty and Karaganda regions is 1.46% and 1.98%, respectively. Based on these data, *Hypericum perforatum* L. collected in the Karaganda region has a relatively high content of flavonoids in its composition than in *Hypericum perforatum* L. collected in the Almaty region.

Anti-collagenase, anti-elastase and anti-hyaluronidase effect, as well as anti-oxidant and antigenotoxic activity of ethanol extract of *Hypericum organifolium* Willd., collected in Turkey was studied. The results obtained show that *Hypericum organifolium* Willd. can be considered as a new natural source for the isolation of

anti-aging components in the formulations of medical and cosmetic skin care agents [13].

Extracts of *Lavandula officinalis* L. and *Hypericum perforatum* L., grown in Turkey, obtained by supercritical extraction with carbon dioxide (P =100 bar, T = 40 °C), have antibacterial and antioxidant properties, which made it possible to use them in cosmetic cream forms as protective agents. Effective results were also obtained when studying creams for antibacterial activity after 6 months [14].

Traditional prescription medications based on naturally occurring compounds offer new alternatives for the treatment of skin wounds. It has been proven that *Hypericum perforatum* L., *Liquidambar orientalis* Mill. and propolis contribute into wound-healing of skin. They all have a different effect on each phase of wound healing. The effects of wound healing of compounds mixtures of *Hypericum perforatum* L., *Liquidambar orientalis* Mill. and propolis in the form of mixture combinations were studied. Research results indicate that mixtures of *Hypericum perforatum* L., *Liquidambar orientalis* Mill. and propolis provide more stable wound healing [15].

The flowering aerial parts of the *Hypericum* species have traditionally been used to make ointments to treat cuts and burns. Sometimes even fruits (seeds) are used for these purposes. *Hypericum androsaemum* L. commonly known as St. John's wort, is a Mediterranean medicinal plant. It has been proven that the fruits of *Hypericum androsaemum* L. contain phytochemical substances that improve skin regeneration, therefore they can potentially be used in the composition of therapeutic and prophylactic skin care agents [16].

*Hypericum perforatum* L. (*Hypericaceae*), olive oil (*Oleaceae*), *Origanum Tourn ex* L. and *Salvia* L. (*Lamiaceae*) are used to treat inflammatory diseases and to heal skin wounds in traditional Turkish medicine. For effective wound healing, a new composition of ointment was developed based on the extract of the flowering aerial parts of *Hypericum perforatum* L., olive oil, an equivalent mixture of the essential oils of *Origanum majorana* L. and *Origanum minutiflorum* Schwrd. et Davis (*Origanum aetheroleum*), essential oil of *Salvia triloba* L. The potential of wound healing of this new composition of ointment was assessed using *in vivo* and *in vitro* models, as well as histopathological methods. The ointments (HPP crème mit Rotöl and *Hypericum perforatum* L.) have comparatively high activity on both wound models compared to the Madecassol® reference ointment, while the other ingredients did not show any discernible wound healing effect. The above-mentioned new composition of the ointment has wound healing activity, has an effective effect at different stages of the wound healing process [17].

The expert group on the review of cosmetic ingredients has provided a safety assessment of 7 ingredients obtained from *Hypericum perforatum* L. used in cosmetics as skin care agents with antimicrobial activity. Experts have concluded that ingredients produced from *Hypericum perforatum* L. are safe for use in cosmetics [18].

A new phytotherapeutic ointment based on *Hypericum perforatum* L. extract was developed and characterized. The medicinal properties of the ointment in rats

were studied on the model of wounds of linear incision, circular excision and thermal burn *in vivo*. Experimental results show that the new ointment has a significant wound healing effect on skin lesions and is safe to use [19].

Modern wound treatments include the use of antibiotic creams. Hyperforin and Hypericin are important phytochemicals found in *Hypericum perforatum* L. that have antimicrobial, antiviral and anti-inflammatory properties. The wound healing activity of oil on the basis of *Hypericum perforatum* L. in excised wounds of male white rats was studied. According to the results of the study, in animals that received this oil emulsion, a decrease in the area of the wound by 97% was observed [20].

Cosmetic companies such companies as "Apivita", "Chistaya Liniya", "Ersag" use biologically active substances of *Hypericum perforatum* L. in the production of medical and cosmetic agents.

Thus, the analysis of the available literature data and the results of our own studies indicates that the biologically active substances of *Matricaria chamomilla* L. and *Hypericum perforatum* L., which have an extensive spectrum of biological activity, can be used in medical and cosmetic production for the production of ointments, creams and other forms of therapeutic and cosmetics agents.

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**Резюме**

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**ДӘРІЛІК ТҮЙМЕДАҚ ПЕН ШІЛТЕРЖАПЫРАҚТЫ ШАЙҚУРАЙДЫҢ  
БИОЛОГИЯЛЫҚ БЕЛСЕНДІ ЗАТТАРЫ НЕГІЗІНДЕГІ  
ЕМДІК-КОСМЕТИКАЛЫҚ ҚҰРАЛДАР**

Осы мақалада дәрілік түймедақ пен шілтержапырақты шайқурайдың биологиялық белсенді заттары негізінде емдік-косметикалық құралдарды жасау жөніндегі өз зерттеуіміздің нәтижелері және әдеби мәліметтерге шолу келтірілген.

Дәрілік түймедақ пен шілтержапырақты шайқурайды химиялық зерттеу нәтижелері келтірілген. Дәрілік түймедақ СО<sub>2</sub>-сығындысының негізгі компоненттері бисаболоксид А, бисаболоксид Б, ен-ин-дициклоэфир, матрикарин және хамазулен болып табылады. Шілтержапырақты шайқурай сығындысында мажорлы қосылыстар – гиперозид, кверцетин және рутин флавоноидтары сәйкестендірілді.

Дәрілік түймедақ пен шілтержапырақты шайқурайдың биологиялық белсенді заттары негізінде жақпамайлар, иісмайлар және т.б. сияқты емдік-профилактикалық құралдар жасалады.

**Түйін сөздер:** емдік-косметикалық құралдар, биологиялық белсенді қосылыстар, дәрілік түймедақ, шілтержапырақты шайқурай.

**Резюме**

*А.И. Макубаева, Айгерім С. Адекенова, А. Рахатаева, Х. Мамырхан*

**ЛЕЧЕБНО-КОСМЕТИЧЕСКИЕ СРЕДСТВА НА ОСНОВЕ  
БИОЛОГИЧЕСКИ АКТИВНЫХ ВЕЩЕСТВ РОМАШКИ АПТЕЧНОЙ  
И ЗВЕРБОЯ ПРОДЫРЯВЛЕННОГО**

В настоящей статье представлен обзор литературных сведений и результаты собственных исследований по разработке лечебно-косметических средств на основе биологически активных веществ ромашки аптечной и звербоя продырявленного.

Приведены результаты химического изучения ромашки аптечной и звербоя продырявленного. Основными компонентами СО<sub>2</sub>-экстракта ромашки аптечной являются бисаболоксид А, бисаболоксид Б, ен-ин-дициклоэфир, матрикарин и хамазулен. В экстракте звербоя продырявленного идентифицированы мажорные соединения-флавоноиды гиперозид, кверцетин и рутин.

На основе биологически активных веществ ромашки аптечной и звербоя продырявленного разрабатываются лечебно-профилактические средства, такие как мази, крема и т.д.

**Ключевые слова:** лечебно-косметические средства, биологически активные соединения, ромашка аптечная, звербой продырявленный.