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DEVELOPMENT OF A COSMETIC CREAM WITH BIOLOGICALLY ACTIVE SUBSTANCES OF PLANTS OF THE GENUS LINUM: COMPOSITION JUSTIFICATION, TECHNOLOGY DEVELOPMENT, AND QUALITY EVALUATION

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The results of creating a cosmetic cream using biologically active ingredients from plants in the genus Linum L. are presented in this article, along with an explanation of its composition, technological advancement, and quality assessment. 10% glycerin and aqueous extracts of Linum heterosepalum Rgl. were used as the active ingredients in the cosmetic cream's formulation, while oil from the seeds of common flax (Linum usitatissimum L.) served as the oily base. The DPPH and ABTS assays were used to assess the antioxidant activity of the plant extracts, which were obtained by ultrasonic extraction. Additionally, spectrophotometric analysis was used to determine the extracts' overall polyphenol and flavonoid content. The study's findings showed that Linum heterosepalum Rgl. extracts have strong antioxidant activity and are high in polyphenols and flavonoids. The plant extracts were added to a cosmetic emulsion based on the results, and the emulsification method was used to create a cosmetic cream. The following criteria were used to evaluate the developed

cosmetic cream's quality: stability, microbiological purity, heavy metal content, sensory attributes, and physicochemical properties. According to the conducted studies, the developed cosmetic cream satisfies the requirements of TR CU 009/2011 and GOST 31460–2012 "Cosmetic Creams. General Technical Specifications." It is a stable and safe cosmetic product with moisturizing, antioxidant, protective, and nourishing qualities, showing promising potential for cosmetic applications.

Keywords: *Linum usitatissimum* L, *Linum heterosepalum* L, plant substances, cosmetic cream, natural cosmetics

Main part

1. Introduction.

Currently, more people are interested in cosmetic products made from natural plant-based ingredients. This interest comes from the biologically active compounds in plants that can improve the skin's health, boost antioxidant protection, and encourage healing processes. One plant commonly used in pharmacy and cosmetology is the genus Linum. In particular, the oil from the seeds of common flax (*Linum usitatissimum* L.) is full of polyunsaturated fatty acids, such as omega-3 and omega-6 fatty acids. Flaxseed oil consists of about 9% saturated fatty acids, 18% monounsaturated fatty acids, and 73% polyunsaturated fatty acids. The primary fatty acid is linolenic acid, which makes up between 39% and 60.42%. Additionally, oleic, linoleic, palmitic, and stearic acids are also found in the oil. The ideal ratio of these fatty acids, approximately Omega-6 : Omega-3 = 3 : 1, helps restore the skin's lipid barrier, maintain skin hydration, and improve skin elasticity. Furthermore, the herb of *Linum heterosepalum* Rgl. has a high level of polyphenols and flavonoids and shows strong antioxidant activity. Antioxidant compounds protect the skin from the damaging effects of free radicals and help slow down the aging process. For this reason, creating new cosmetic products by combining biologically active substances from the genus Linum is both scientifically and practically important [1–4].

The goal of the study is to justify the composition of a cosmetic cream based on plant ingredients from the genus Linum, to design its production process, and to assess its quality.

2. Materials and Methods.

Extracts from the herb *Linum heterosepalum* Rgl. were obtained using the ultrasonic extraction method. Purified water and a 10% glycerin solution served as extraction solvents. The study evaluated the antioxidant activity of the extracts using DPPH and ABTS free radical scavenging assays. During the study, different concentrations of the extracts were investigated and their ability to neutralize free radicals was assessed. Spectrophotometric analysis determined the total content of polyphenols and flavonoids. The obtained extracts were added to a cosmetic

emulsion as active components. The cosmetic cream was made using an oil-in-water (O/W) emulsification method. Olivem 1000 emulsifier and flaxseed oil (*Linum usitatissimum* L.) made up the oil phase, while purified water and glycerin formed the aqueous phase. The oil and aqueous phases were heated separately in a water bath at 75 ± 2 °C. Then, the oil phase was gradually added to the aqueous phase while using a mechanical stirrer. The mixture was stirred until a smooth emulsion formed. After cooling the emulsion to 30 °C, the Ecoprev preservative system, lactic acid as a pH regulator, and the active components – extracts of *Linum heterosepalum* Rgl. herb – were incorporated. The quality of the cosmetic cream was evaluated according to GOST 31460–2012 "Cosmetic Creams. General Technical Specifications" [5]. The physicochemical parameters of the cream were determined. The pH value was measured with an Elmeiron pH meter. Viscosity was assessed using a Fungilab rotational viscometer, and density was measured with the pycnometer method. Additionally, the physical stability of the cream was studied using the centrifugation method. After centrifugation, phase separation, sediment formation, or structural changes in the cream were visually assessed [6]. Microbiological purity and heavy metal content were evaluated based on the requirements of TR CU 009/2011 [7]. Furthermore, sensory evaluation of the prepared cosmetic cream was conducted.

3. Results of the study.

The research determined the best formula and production process for a cosmetic cream. The cream forms through an oil-in-water emulsion. The oil phase contains Olivem 1000 as emulsifier plus flaxseed oil as lipid. The aqueous phase contains purified water, glycerin, preservative and lactic acid to adjust pH. Extract from *Linum heterosepalum* Rgl. serves as the active ingredient - this extract holds large amounts of polyphenols but also flavonoids and shows strong antioxidant action.

Tests on the finished cream showed the following - physicochemical analysis confirmed a stable structure. The pH lies between 5.2 and 5.6, close to the natural skin pH. Viscosity reaches about 21 000–22 000 mPa·s, which shows the emulsion remains intact. Density across all samples falls between 0.887 and 0.904 g/cm³.

Temperature stability studies have revealed no phase separation, sediment formation or emulsion destabilization when stored at 4°C, 25° and 40° Celsius. The cream's high physical stability was also validated by centrifugation tests. Based on the findings of the work, the cosmetic cream developed met the standards of regulatory documents regarding the microbiological purity of the product. There was no presence of pathogenic or conditionally pathogenic microorganisms. Heavy metal contents were also in compliance with the state standards.

A special evaluation procedure was done to determine the sensory properties of the cream. Some of the parameters considered during the assessment were the consistency, spreadability on the skin surface, rate of absorption, adhesion, oiliness, and homogeneity. The cosmetic cream with extracts of the *Linum heterosepalum* Rgl.

herb and the oils of the seeds of *Linum usitatissimum* L. was defined by a good spreadability on the skin, homogeneous structure, and a pleasant consistency. The plant extract enhanced the adhesive and emollient characteristics of the cream, whereas flax seed oil provided easy distribution and homogenous format of the product. Overall, the cream with the substances of the plants belonging to the genus Linum portrayed balanced sensual properties and created a nice impact when rubbed onto the skin.

4. Conclusion.

Consequently, a cosmetic cream containing biologically active substances of plants of the genus Linum L. was created as a result of the research that was conducted. The cream preparation contained *Linum usitatissimum* L. seed oil and *Linum heterosepalum* Rgl. extracts. A synergistic effect was possible because of the combination of flaxseed oil (*Linum usitatissimum* L.) and extracts of *Linum heterosepalum* Rgl. in a single cosmetic product. Specifically, flaxseed oil helped to restore the lipid barrier of the skin and bring nourishing and emollient action, but *Linum heterosepalum* Rgl. extracts lessened free radicals effects and contributed to the inhibition of the oxidative stress processes.

This kind of a combination improved the antioxidant, nourishing, and regenerative qualities of the cosmetic cream, which made it have more the biological and cosmetological value. The quality of the cream developed was considered in relation to the requirements of TR CU 009/2011 and GOST 314602012 Cosmetic Creams. General Technical Specifications, which attest to it being a stable and a safe cosmetic product [5–7]. The results achieved suggest that the proposed cream can be used in the field of cosmetology.

Therefore, the findings of the implementation research indicate the high potential of applying the substances of plants belonging to the genus Linum to create cosmetic creams. Thanks to the use of such plant raw materials, it is possible to increase the range of cosmetic products, depending on the local natural materials, and fully aligned with the existing trends in phytocosmetics development.

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LINUM ТУЫСЫ ӨСІМДІКТЕРІНІҢ БИОЛОГИЯЛЫҚ БЕЛСЕНДІ СУБСТАНЦИЯЛАРЫ НЕГІЗІНДЕ КОСМЕТИКАЛЫҚ КРЕМДІ ӘЗІРЛЕУ: ҚҰРАМЫН НЕГІЗДЕУ, ТЕХНОЛОГИЯСЫ ЖӘНЕ САПАСЫН БАҒАЛАУ

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Бұл мақалада Linum L. туысына жататын өсімдіктердің биологиялық белсенді субстанциялары негізінде косметикалық крем әзірлеу, оның құрамын негіздеу, технологиясын жасау және сапасын бағалау нәтижелері ұсынылған. Косметикалық крем құрамында майлы негіз ретінде кәдімгі зығыр (Linum usitatissimum L.) тұқымының майы, ал белсенді компонент ретінде алатостаған жапырақ зығыр (Linum heterosepalum Rgl.) өсімдігінің 10 % глицериндегі және тазартылған судағы сығындылары қолданылды. Өсімдік сығындылары ультрадыбыстық экстракция әдісімен алынып, олардың антиоксиданттық белсенділігі DPPH және ABTS әдістері арқылы зерттелді. Сонымен қатар сығындылардағы жалпы полифенолдар мен флавоноидтардың мөлшері спектрофотометриялық әдіспен анықталды. Зерттеу нәтижелері Linum heterosepalum Rgl. өсімдігінің сығындылары полифенолдар мен флавоноидтарға бай және жоғары антиоксиданттық белсенділікке ие екенін көрсетті. Алынған нәтижелер негізінде өсімдік сығындылары косметикалық эмульсия құрамына енгізіліп, эмульсиялық әдіс арқылы косметикалық крем дайындалды. Дайындалған косметикалық кремнің сапасы келесі көрсеткіштер бойынша бағаланды: физика-химиялық қасиеттері, тұрақтылығы, микробиологиялық тазалығы, ауыр металдар мөлшері және сенсорлық сипаттамалары зерттелді. Жүргізілген зерттеулер әзірленген косметикалық кремнің ТР ТС 009/2011, ГОСТ 31460-2012 "Косметикалық кремдер. Жалпы техникалық шарттар" талаптарына сәйкес, тұрақты, қауіпсіз және теріні қоректендіруші, қорғаныштық қызметін жақсартатын, ылғалдандыратын және антиоксиданттық әсері бар перспективалы косметикалық өнім екенін көрсетті.

Кілт сөздері: *Linum usitatissimum* L, *Linum heterosepalum* L, өсімдік субстанциялары, косметикалық крем, табиғи косметика

РАЗРАБОТКА КОСМЕТИЧЕСКОГО КРЕМА С ИСПОЛЬЗОВАНИЕМ БИОЛОГИЧЕСКИ АКТИВНЫХ СУБСТАНЦИЙ РАСТЕНИЙ РОДА LINUM: ОБОСНОВАНИЕ СОСТАВА, ТЕХНОЛОГИИ И ОЦЕНКА КАЧЕСТВА

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В данной статье представлены результаты разработки косметического крема на основе биологически активных субстанций растений рода Linum L., обоснования его состава, разработки технологии получения и оценки качества. В качестве жирной основы косметического крема использовалось масло семян льна обыкновенного (Linum usitatissimum L.), а в качестве активного компонента – 10 % глицериновый и водный экстракты растения лен разночашелистиковый (Linum heterosepalum Rgl.). Растительные экстракты получены методом ультразвуковой экстракции, а их антиоксидантная активность исследована методами DPPH и ABTS. Кроме того, содержание общих полифенолов и флавоноидов в экстрактах определяли спектрофотометрическим методом. Результаты исследования показали, что экстракты растения Linum heterosepalum Rgl. богаты полифенолами и флавоноидами и обладают высокой антиоксидантной активностью. На основании полученных результатов растительные экстракты введены в состав косметической эмульсии, после чего методом эмульгирования разработан косметический крем. Качество полученного косметического крема оценивали по следующим показателям: физико-химические свойства, стабильность, микробиологическая чистота, содержание тяжелых металлов и сенсорные характеристики. Проведенные исследования показали, что разработанный косметический крем соответствует требованиям ГОСТ 31460–2012 «Кремы косметические. Общие технические условия» и ТР ТС

009/2011 «О безопасности парфюмерно-косметической продукции», является стабильным и безопасным, а также представляет собой перспективный косметический продукт, обладающий питательным, защитным, увлажняющим и антиоксидантным действием на кожу.

Ключевые слова: *Linum usitatissimum* L., *Linum heterosepalum* Rgl., растительные субстанции, косметический крем, натуральная косметика