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DEVELOPMENT OF A COSMETIC PRODUCT FOR THE FACE BASED ON HYALURONIC ACID AND HONEY

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We developed facial hydrating serum with the following composition of components (wt.%): hyaluronic acid 2.5, honey 4.5, alpha-hydroxy acids 1.5, propolis 0.5, chitosan 1.5 and bergamot hydrolate 89.5 (the bergamot content is 1−2%). The composition of the cosmetic was optimized using regression and sensory analysis. The effect of the concentrations of hyaluronic acid and honey on the kinematic viscosity of the solution was determined by the method of a full factorial experiment. Using the profile method of sensory analysis, the characteristics of serum consistency were evaluated according to such indicators as gel-likeness, homogeneity, turbidity and transparency. It was determined that the mixing of honey and hyaluronic acid in a ratio of 1.8:1 provides the required cosmetic effect and serum consistency. The moisture content of the facial skin of volunteers aged 20−60 was measured with a BBS-3000A cosmetology analyzer. After two weeks of using the developed moisturizer three times a day, it was recorded that the moisture content of the volunteers' facial skin increased to an average of 43%. According to the conducted quality control, when storage at temperatures of 5−25^{0}C for 12 months, the serum remains transparent, homogeneous without sediment, colloidal and thermally stable, pH=5.00±0.15. It was concluded that the face serum contains natural components that are safe for the skin, and contribute to intensive moisturizing and nutrition of the skin. It should be noted that the face serum is available in terms of components and economically beneficial. The technological scheme was proposed for the industrial production of the developed serum for the face.

Keywords: hyaluronic acid, cosmetic serum, honey, viscosity, regression analysis, sensory analysis.

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Introduction

Currently, there are relatively many cosmetic products for improving the appearance of facial skin on the market of cosmetic products. In this diversity, facial hydrating serums occupy not the last places due to the ease of their production and use and the possibility of widely varying their composition.

Serum is a concentrated cosmetic product that is an additional skin care product. At the same time, the concentration of active components in the serum is several times higher than in any effective cream. Unlike creams, serums are not selected based on the type of skin, but depending on the problems to be solved or the age of the person. In addition, such cosmetic products differ by time and season of use: day and night, summer and winter. There are also serums for both professional and home use. According to their effect, serums are divided into hydrating, whitening, renewing, soothing, with a lifting effect or with the effect of Botox, with a vitamin complex [1].

Depending on the composition, serums can be transparent or opaque emulsions, and despite the fact that the formulations of such cosmetics are generally quite diverse in their composition, most of them

contain hyaluronic acid, aloe vera gel and glycerin [2,3].

Recently, the interest in the use of hyaluronic acid in a wide range of industries, such as cosmetics, pharmaceuticals, medicine and biomedicine, has not faded, and at the moment more than 42500 articles on this topic have been published [4–8]. A thorough review of the literature has shown that hyaluronic acid-based facial cosmetics (i.e., gels, creams, intradermal filler injections, dermal fillers, facial fillers, lotions, serums, etc.) exhibit excellent space-filling and facial rejuvenation properties that prevent the appearance of wrinkles and slow down the aging of the skin. This effect is achieved by increasing soft tissues, improving skin hydration, stimulating the synthesis of collagen and elastin fibers, and restoring the volume of the face. The analysis of literature data shows that the application of hyaluronic acid demonstrates outstanding nutricosmetic effectiveness and, therefore, is justified for use as the main component of cosmetic products [9,10].

To find new recipes of serums, a harmonious selection of active components with certain functions that will work in synergy is considered. At the same time, one of the most urgent aspects is the issue of developing a cosmetic product to combat excessive skin dryness. Dry skin is a very common problem that occurs when there is a lack of moisture in the top layer of the skin, which causes it to break down and lead to the appearance of microcracks. The complex of organic substances that covers the upper layer of the epidermis and prevents skin dehydration is called natural moisturizing factor (NMF). NMF consists of almost half of free amino acids (their content is up to 40–48%). It also includes mineral components: sodium, potassium, magnesium, calcium and phosphates (18.5%), lactic acid salts (12%), urea (5–7%), glucosamine/creatinine (1.5%), as well as glycerol, complexes of sugars, organic acids and peptides (all together about 8.5%) [11].

It has been experimentally proven [11] that moisturizing the skin with the help of cosmetic preparations effectively restores the NMF composition of the skin epidermis. Serums are best suited for this task. However, despite the fact that there is a wide variety of cosmetic products on the market, most of them contain only 2–3 natural components. In addition, industrial samples of cosmetic products contain several synthetic components to extend the shelf life. According to literature data [12], the use of beekeeping products as an antibacterial agent significantly extends the shelf life of cosmetic products and eliminates the need to use synthetic preserving agents. Therefore, the question of relevance remains of developing new formulations of cosmetic serums for the face, the basis of which are natural components that will be compatible with each other in the product and will not cause allergic reactions.

Therefore, the goal of the research was to develop a moisturizing serum for the face on a natural basis using hyaluronic acid and honey with optimization of the composition by regression and sensory analysis methods.

Experimental

In the experimental research, solutions of hyaluronic acid (Germany), liquid honey and water infusion of propolis (Ukraine), chitosan (USA), alpha-hydroxy acids (France) and hydrolate (Ukraine) were used.

The selection of the optimal ratio of the content of hyaluronic acid and honey was carried out based on measuring the viscosity of the solutions and determining such organoleptic indicators as gel-likeness, homogeneity, turbidity and transparency.

The kinematic viscosity of the solutions was measured using an Ostwald capillary viscometer. The calculations were carried out according to the formula:

$$\nu=\tau K,$$

where τ is the average time of liquid outflow (s); and K is the viscometer constant (0.2019 mm^2/s^2).

The time of solution leakage was measured at least 5 times, the average value, confidence interval and relative standard deviation were calculated, the value of which for all measurements did not exceed 2%.

The gel-likeness, homogeneity, transparency and turbidity of the developed serum samples were determined organoleptically. The gel-likeness of the serum was determined to the touch by lightly rubbing the sample on the skin of the face. Homogeneity was determined visually using a glass rod pulled from the serum solution. After removing the glass rod, the mixture should flow from it evenly, and there should be no lumps, grains, etc. on the surface of the stick. Clarity and turbidity were determined in identical flat-bottomed colorless clear neutral glass tubes with an internal diameter of 15 mm by comparing a 40 mm layer of serum and standard in diffused daylight, viewing the samples along the vertical axis of the tubes against a black background.

Determination of the optimal viscosity of a cosmetic product was carried out by the method of a multifactorial experiment, which allows quantitatively determining the influence of the components of a complex mixture on its properties based on the regression equation. The graphical interpretations of

the regression equation were built using the Statgraphics Centurion XVI.II software package.

According to literature data [12], the use of beekeeping products as an antibacterial agent significantly extends the shelf life of cosmetic products and eliminates the need to use synthetic preserving agents. Therefore, in order to increase the shelf life of the serum, as well as to prevent the growth of bacteria during the use of the cosmetic product, we chose a preserving agent, propolis infusion with a concentration of 0.5%.

The thermal stability of the serum was determined by the change in its consistency under conditions of a sharp temperature drop. Initially, it was the room temperature at which the cosmetic should be stored. Then the serum was heated to a temperature of 60^0C, at which no visible changes occurred in the solution. Lowering the temperature to approximately 0^0C did not lead to visible changes in the finished cosmetic product (i.e., we did not observe delamination, sedimentation, cloudiness, bubble formation, etc.).

To compare the organoleptic indicators of experimental samples of cosmetic serums (gel-likeness, homogeneity, turbidity, transparency), the profile method of sensory analysis was used. The essence of this test is that difficult organoleptic concepts of properties are presented in the form of simple components, which are evaluated by experimenters participating in the test on a 5-point scale of intensity. To assess the intensity of consistency characteristics, a verbal scoring scale was used using the profile method: 0 – no sign; 1 – the sign is not intense; 2 – weak intensity; 3 – moderate intensity; 4 – strong intensity; and 5 – very strong intensity.

To determine the NMF factor, a cosmetic skin moisture analyzer BBS-3000A (South Korea) was used. This device measures the bioelectrical resistance of the surface layer of the skin using a low-level electric current and allows determining the moisture content of the skin in the range of 0–70%.

The serum was prepared by sequentially adding and mixing the solutions of hyaluronic acid and bergamot hydrolate according to the recipe (mixing was carried out until the hyaluronic acid was completely dissolved). Next, solutions of chitosan, ANA-acid complex, honey and propolis infusion were added to the glass according to the recipe. Propolis infusion was prepared from 5 g of raw material, which was crushed, transferred to a heat-resistant flask with 25 ml of distilled water and withstand in a water bath at a temperature of 50^0C for 60 min.

Selection of the composition of the cosmetic serum and characteristics of its components

The main requirements of a facial serum [1] are as follows: it should provide skin hydration, have optimal viscosity, be transparent (not cloudy), and have a shelf life at room temperature of at least 3 months. The composition of this cosmetic should also include components that have gel-forming ability, moisturizing effect and antibacterial properties, and should also be quickly absorbed by the skin and provide lightness when applied to the skin.

In order to meet the stated requirements, we analyzed a number of cosmetic moisturizers and gelling agent. Currently, beekeeping products (honey and propolis) are actively used in the cosmetic industry [12]. Accordingly, propolis infusion was used as a preserving agent and liquid honey to enhance the moisturizing effect.

During the research, 10 formulations of cosmetic products were prepared, the components of which varied in a wide range. A comparison of their properties according to the indicators described above showed that the best formulations are those presented in Table 1.

Table 1

Composition of the proposed formulations of the serum for the face

Components	Content, %		
	No. 1	No. 2	No. 3
bergamot hydrolate (bergamot content of 1–2%)	86.5	85.0	89.5
honey	9.0	9.0	4.5
hyaluronic acid	2.0	2.5	2.5
chitosan	1.0	1.5	1.5
ANA-acid complex	1.0	1.5	1.5
propolis infusion	0.5	0.5	0.5

Hyaluronic acid (INCI: hyaluronic acid). It is a derivative of glycosaminoglycan, which is an important component of the human skin structure: it fills the intercellular space and protects cells from mechanical damage. This component has gel-forming properties and penetrates well into the skin [13].

Hydrolate is a by-product of the production of essential oils, it contains prepared water and a small amount of dissolved essential oil; it performs the function of a solvent in the recipe. After using 5 different hydrolats, it was decided to keep the bergamot hydrolat because, in addition to its main function, it also gives a pleasant aroma to the cosmetic product and there is no need to use an additional flavoring agent. Moreover, bergamot hydrolate nourishes and moisturizes the skin and has the ability to penetrate deeply into the skin.

Chitosan (*INCI*: chitosan). It is an amino sugar derived from a linear polysaccharide, macromolecules

consist of randomly linked b-(1-4) D-glucosamine units and N-acetyl-D-glucosamine. Chitosan is used in cosmetics as a moisturizer, which, when applied to the skin, helps to restore the natural moisturizing factor.

The AHA-acid complex (alpha-hydroxy acids: citric, glycolic, tartaric, lactic, and malic) is a natural biological substance found in fruits, sugar cane, milk and wine. They facilitate the penetration of any cosmetics into the skin, thereby increasing their effectiveness.

Honey (INCI: honey) is a natural component of natural origin. Honey contains a set of various mineral salts, vitamins of the B group, vitamins A, C, PP, H, E and K, macro- and microelements (phosphorus, iron, iodine, magnesium, sodium, calcium, chlorine, copper, sulfur, zinc, and lead). In addition, a high content of antioxidants was found in it. Honey is used as an antiseptic, takes an active part in the metabolic processes of the body[1].

Propolis is a resinous, viscous substance of brown or dark green shade of natural origin, produced by bees and modified by their enzymes. It has a dense structure that resembles plasticine, so propolis infusion is used in cosmetic products. The composition of propolis infusion includes macro- and microelements (calcium, magnesium, potassium, sulfur, zinc, chromium, iron, cobalt, zinc, and tin), vitamins (E, A, C, H, P, and vitamins of group B), amino acids (alanine, asparagine, lysine, and polyglutamic acid), and flavonoids (apigenin, acacetin, and ermanin). Propolis is used in cosmetology as an antibacterial, antifungal and regenerating agent.

Results and discussion

Preliminary research has shown that the solutions become excessively viscous and cloudy with too much content of hyaluronic acid and honey. Therefore, at the first stage of research, we had to determine the optimal ratio of the content of hyaluronic acid and honey in the cosmetic serum, at which the required cosmetic effect is achieved and the solution has the required consistency.

To determine the optimal ratio of components in the recipe, the method of a multifactorial experiment was used. The value of the selected factors (honey content and hyaluronic acid content in 50 cm^3 of solution) and the results of viscosity determination experiments are shown in Table 2.

To build a mathematical model of a multicomponent cosmetic product, a full factorial experiment of 2^2 was used, centered at C_{honey}=4.25 g/50 cm^3 and C_{HA}=3.0 g/50 cm^3.

Table 2

The value of factors in a natural scale and the results of experiments

No.	Honey content, g/50 cm^3	Hyaluronic acid content, g/50 cm^3	Kinematic viscosity, mm^2/s
1	0.50	1.00	1.10
2	8.00	1.00	1.52
3	0.50	5.00	2.07
4	8.00	5.00	2.54

Based on the obtained data, the following mathematical model of the process was determined in the form of a regression equation for a two-factor experiment, based on coded (Eq. (1)) and real variables (Eq. (2)):

$$Y=1.808+0.223X_1+0.498X_2+0.013X_1 \cdot X_2, \quad (1)$$

$$Y=0.830+0.054X_1+0.242X_2+0.002X_1 \cdot X_2, \quad (2)$$

where Y is the kinematic viscosity of the solution; X_1 is the honey content; and X_2 is the hyaluronic acid content.

The significance of the regression coefficients was assessed by comparing the experimental and theoretical value of the Student's test, and the statistical test of the obtained regression equation for adequacy was carried out using the Fisher's test at a confidence level of 95%. It was established that all found coefficients are significant, and the regression equation adequately describes the experimental data.

As follows from the regression equation, the coefficients for parameters X_1 and X_2 have a plus sign, that is, both factors increase the viscosity of the cosmetic product with an increase in their values. The X_2 parameter, i.e. hyaluronic acid content, has a relatively greater influence on viscosity. It can also be seen from the equation that the coefficient for $X_1ЧX_2$ has the same sign as the coefficients X_1 and X_2, and this indicates the synergism of the effect on the viscosity of both factors, i.e. each of the parameters when increased together has a stronger effect than if they are increased separately.

Figure 1 presents a graphical interpretation of the obtained regression equation. As can be seen, an increase in the concentration of hyaluronic acid and honey leads to an increase in the viscosity of the finished cosmetic that is disproportionate to their quantity. The resulting model allows to purposefully choosing the concentrations of these serum components to obtain a given index of its viscosity.

[1] Tykhonov O.I., Shpychak O.S. Med [Honey] // Derzh. Farm. Ukrainy. – 2014. – Vol.2. – P.436-439.

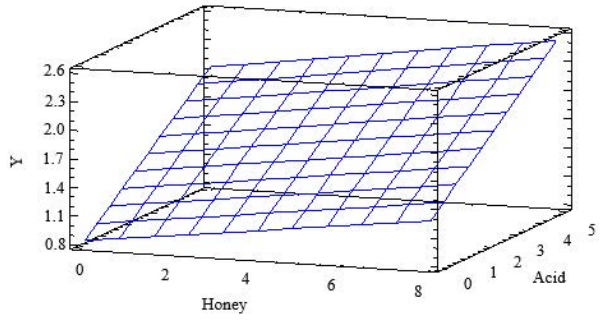

Fig. 1. Graphic interpretation of the regression equation of a two-factor experiment to determine the effect of the content of hyaluronic acid and honey on the kinematic viscosity of solutions

Organoleptic studies have shown that the optimal content of hyaluronic acid from the point of view of ensuring the necessary consistency of the cosmetic serum (namely, not to run off the surface of the skin and to be completely absorbed by the skin in a short period of time) varies in the range of 2–2.5%.

The profile method was used to identify the best of the proposed recipes (Table 1). When performing it, scoring scales were used to assess the intensity of individual signs. With the help of a group of 10 volunteers, they consistently determined the manifestation of sensation by such indicators as gel-likeness, homogeneity, turbidity and transparency of the developed serum solutions. Figure 2 shows an example of the obtained profilogram from the consistency of the developed serum samples.

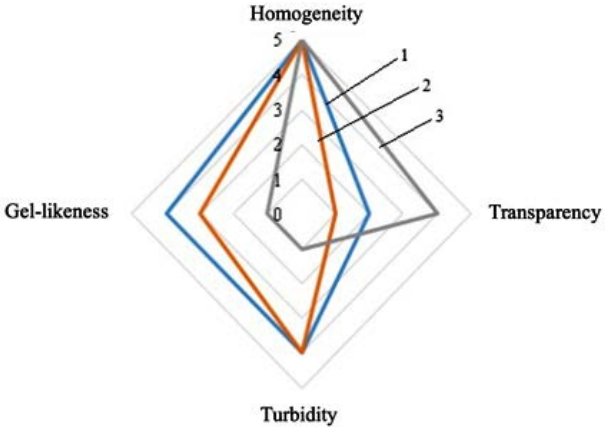

Fig. 2. Profilogram of the consistency of the face serum for the researched recipes No. 1, 2 and 3

Sensory analysis confirmed our assumptions about the effect of hyaluronic acid on the fluidity of the cosmetic serum. It was confirmed that with an increase in the concentration of hyaluronic acid, the cosmetic becomes excessively gel-like, and with a decrease in its concentration, the opposite effect is manifested. In addition, it was noticed that an excessive amount of honey makes the cosmetic product cloudy, which will call into question its effectiveness and shelf life.

Analysis of the consistency profilogram showed that the best characteristics of the consistency of the water-based serum are inherent to the sample made according to formulation No. 3 based on 4.5% honey and 2.5% hyaluronic acid. That is, mixing these components in a ratio of 1.8:1 provides the required cosmetic effect and serum consistency. At the same time, swatches No. 1 and No. 2 are overly cloudy and have a strong gel-like feel that makes application uncomfortable.

Due to the use of propolis infusion with a concentration of 0.5% as a preserving agent, the shelf life of the developed cosmetic serum is 12 months (at a temperature of 5–25^{0}C), and at the same time it does not have side effects such as redness, irritation or allergy (provided there is no allergy to beekeeping products).

All received samples were checked for compliance with the state standards. Quality control was carried out according to State Standard of Ukraine DSTU 4093-2002 «Cosmetic lotions and tonics. Specifications»[2]. The following indicators were determined for the serum, which are listed in Table 3.

Table 3

Quality indicators of cosmetic serums

Indicator	Characteristic and standard
appearance	colorless transparent homogeneous liquid without sediment
smell	pleasant, fresh
pH	5.00±0.15
colloidal stability	stable
thermal stability	stable

The use of the BBS-3000A skin moisture-measuring device made it possible to record changes in skin moisture after using the developed moisturizer. Ten volunteers aged 20 to 60 with dry and normal skin moisture at the level of 30–39% participated in the measurement of facial skin moisture. According

[2] Derzhavnyi standart Ukrainy 4093:2002. Losiony ta toniky kosmetychni. Tekhnichni umovy [State Standard of Ukraine 4093:2002 Cosmetic lotions and tonics. Specifications]. Valid from 10 Mar, 2002. Kyiv: Derzhstandart Ukrainy; 2002. 11 p.

to data shown in Table 4, it was established that after two weeks of using the proposed serum three times a day, the moisture content of the skin of volunteers has changed depending on the age categories. For volunteers aged 20–40 years, the moisture content of the skin was increased from 39% to 43% and the increase in skin hydration was from 7.3% to 9.7%. For volunteers aged 45–60, the moisture content of the skin was increased from 35% to 40%, and the increase in skin hydration was from 14.5% to 18.3%. Thus, after application, the cosmetic not only provides intensive hydration, but also complements the skin's natural moisturizing processes.

A technological scheme for the industrial production of facial serum has been developed. It includes the following main operations: dosing and adding water-soluble components (bergamot hydrolate, hyaluronic acid, honey and chitosan) to the reactor, mixing components and adding propolis infusion and ANA-acid complex to the solution, settling the liquid, filtration, and packaging.

Conclusions

Detailed researches of three formulations of cosmetic products showed that the best in terms of organoleptic indicators is a moisturizing serum for the face with the following composition of components (wt.%): hyaluronic acid 2.5, honey 4.5, alpha-hydroxy acids 1.5, propolis 0.5, chitosan 1.5 and bergamot hydrolate 89.5 (the bergamot content of 1–2%). The effect of the concentrations of hyaluronic acid and honey on the kinematic viscosity of the cosmetic product was determined using the method of a full factorial experiment based on the regression equation. The obtained results indicate the synergism of the effect on the viscosity of both factors; that is, each of the parameters, when increased together, has a stronger effect than if they are increased separately. Using the profile method of sensory analysis, the characteristics of serum consistency were evaluated according to such indicators as gel-likeness, homogeneity, turbidity and transparency. It was determined that at an excessive content of honey, the solution becomes cloudy, with low concentrations of hyaluronic acid, it is too liquid, drains quickly and therefore does not have time to be absorbed by the skin. With an increase in the content of hyaluronic acid, the solution gives excessive viscosity to the cosmetic product, which causes inconvenience during application. Thus, the content in the cosmetic serum of 4.5% honey and 2.5% hyaluronic acid (at the ratio of 1.8:1) provides the necessary cosmetic effect and consistency of the serum. It was shown that when the proposed serum was used for two weeks, intensive moisturizing of the facial skin of the volunteers was observed, namely, the skin moisture increased to an average of 43%, the increase in skin moisture ranged from 7.3% to 18.3%. It was established that the quality control indicators of the developed facial serum meet the requirements of the state standard DSTU 4093-2002 and, accordingly, can be recommended as a means for preventive skin care. The serum is available in terms of components and economically beneficial (3–4 drops of the product are enough for one procedure), contains natural components that have a pronounced moisturizing, toning effect and do not cause allergic reactions.

Table 4

Results of facial skin moisture measurements before and after applying serum samples (n=10; P=0.95; S_r=1.0–1.7%)

Hydration level, %	Person									
	10	10	10	10	10	10	10	10	10	10
	Age category									
	20	25	30	35	40	45	50	55	58	60
Before serum application, $X_{av.}\pm\delta$, %	39.7±0.3	37.7±0.4	38.0±0.3	36.8±0.4	37.3±0.5	34.6±0.4	33.0±0.4	32.5±0.3	32.1±0.3	30.1±0.4
After 14 days of use (three times a day), $X_{av.}\pm\delta$, %	43.4±0.3	40.5±0.3	41.0±0.5	39.5±0.4	40.9±0.5	39.6±0.4	38.3±0.4	37.8±0.4	37.3±0.3	35.6±0.4
Increase in skin hydration, %	9.4	7.4	7.9	7.3	9.7	14.5	16.1	16.3	16.2	18.3

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РОЗРОБКА КОСМЕТИЧНОГО ЗАСОБУ ДЛЯ ОБЛИЧЧЯ НА ОСНОВІ ГІАЛУРОНОВОЇ КИСЛОТИ ТА МЕДУ

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Розроблена зволожуюча сироватка для обличчя з наступним складом компонентів (мас.%): гіалуронова кислота 2,5, мед 4,5, альфагідроксикислоти 1,5, прополіс 0,5, хітозан 1,5 та гідролат бергамоту 89,5 (вміст бергамоту 1–2%). Оптимізацію складу косметичного засобу проведено засобами регресійного та сенсорного аналізу. Методом повного факторного експерименту визначено вплив концентрацій гіалуронової кислоти і меду на кінематичну в'язкість розчину. Профільним методом сенсорного аналізу оцінено характеристики консистенції сироватки за такими покажчиками, як гелеподібність, однорідність, каламутність та прозорість. Визначено, що змішування меду і гіалуронової кислоти в пропорції 1,8:1 забезпечує одержання необхідного косметичного ефекту та консистенції сироватки. Виконано вимірювання вологості шкіри обличчя волонтерів віком від 20–60 років косметологічним аналізатором BBS-3000A. Після двотижневого використання тричі на день розробленого зволожуючого засобу було зафіксовано, що вологість шкіри обличчя волонтерів збільшилася в середньому до 43%. Відповідно до проведеного контролю якості, при зберіганні за температур 5–25^{0}C впродовж 12 місяців сироватка зістається прозорою, однорідною без осаду, колоїдно- та термостабільною, pH=5,00±0,15. Зроблено висновок, що сироватка для обличчя містить у своєму складі природні компоненти, які безпечні для шкіри, сприяють інтенсивному зволоженню та живленню шкіри. Варто зазначити, що сироватка є доступною за компонентами та економічно вигідною. Запропонована технологічна схема для промислового одержання розробленої сироватки для обличчя.

Ключові слова: гіалуронова кислота, косметична сироватка, мед, в'язкість, регресійний аналіз, сенсорний аналіз.

DEVELOPMENT OF A COSMETIC PRODUCT FOR THE FACE BASED ON HYALURONIC ACID AND HONEY

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We developed facial hydrating serum with the following composition of components (wt.%): hyaluronic acid 2.5, honey 4.5, alpha-hydroxy acids 1.5, propolis 0.5, chitosan 1.5 and bergamot hydrolate 89.5 (the bergamot content is 1−2%). The composition of the cosmetic was optimized using regression and sensory analysis. The effect of the concentrations of hyaluronic acid and honey on the kinematic viscosity of the solution was determined by the method of a full factorial experiment. Using the profile method of sensory analysis, the characteristics of serum consistency were evaluated according to such indicators as gel-likeness, homogeneity, turbidity and transparency. It was determined that the mixing of honey and hyaluronic acid in a ratio of 1.8:1 provides the required cosmetic effect and serum consistency. The moisture content of the facial skin of volunteers aged 20−60 was measured with a BBS-3000A cosmetology analyzer. After two weeks of using the developed moisturizer three times a day, it was recorded that the moisture content of the volunteers' facial skin increased to an average of 43%. According to the conducted quality control, when storage at temperatures of 5−25^{0}C for 12 months, the serum remains transparent, homogeneous without sediment, colloidal and thermally stable, pH=5.00±0.15. It was concluded that the face serum contains natural components that are safe for the skin, and contribute to intensive moisturizing and nutrition of the skin. It should be noted that the face serum is available in terms of components and economically beneficial. The technological scheme was proposed for the industrial production of the developed serum for the face.

Keywords: hyaluronic acid; cosmetic serum; honey; viscosity; regression analysis; sensory analysis.

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