UDC 677.494

PROSPECTS OF USING HYALURONIC ACID IN SOLUTIONS FOR OBTAINING NANOFIBERS COSMETIC MATERIALS

ПЕРСПЕКТИВЫ ИСПОЛЬЗОВАНИЯ ГИАЛУРОНОВОЙ КИСЛОТЫ В СОСТАВЕ РАСТВОРОВ ДЛЯ ПОЛУЧЕНИЯ НАНОВОЛОКНИСТЫХ КОСМЕТИЧЕСКИХ МАТЕРИАЛОВ

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Key words: electrospinning, nanofiber, polyamide, hyaluronic acid, web.
Ключевые слова: электроформование, нановолокно, полиамид, гиалуроновая кислота, покрытие.

Abstract. The objective of the investigation was determination of the possibility of using hyaluronic acid for cosmetics effect in solution for fibers molding.

Solution was used with the PA6 (high-viscosity granulate), the formic acid – as solvent. The research results confirmed that drops consist of hyaluronic acid and polyamide-6. Further obtained materials can be used in cosmetology.

Аннотация. Цель работы - определение возможности использования гиалуроновой кислоты в растворе для формования волокон для придания косметического эффекта.

Использовался раствор полиамида-6 (высоковязкого гранулята), муравьиная кислота – растворитель. Результаты исследований подтвердили, что капли состоят из гиалуроновой кислоты и полиамида-6. В дальнейшем полученные материалы могут быть использованы в косметологии.

Method of nanofibers electrospinning is one of the most prospective technologies of up-to-date materials development for different applications. Electrospinning is a fiber production method which uses electric force to draw charged threads of polymer solutions or polymer melts up to fiber diameters in the order of several tens nanometers [1, 2].

Hyaluronic acid is used in cosmetics as the widespread component of skin care products: creams, lipsticks, lotions, etc. The active substance is capable of binding moisture, as a result of which the rejuvenating effect is achieved.

Hyaluronic acid is poly- (2-acetamido-2-deoxy-D-gluco) -D-glucuronoglycan. It is a polymer consisting of the residues of D-glucuronic acid and DN-acetylglucosamine,

alternately linked β-1.4- and β -1.3-glycosidic bonds. This is a composition of the acid atoms of carbon (C), oxygen (O), hydrogen (H) and nitrogen (N). A hyaluronic acid molecule can contain up to 25,000 disaccharide units (figure 1). Molecular weight of natural hyaluronic acid is 5,000 to 20,000,000 Da.

Using of low molecular hyaluronic acid leads to the following effects:

- increasing internal tissue volume;
- activating the action of fibroblasts;
- stimulating effect on cell division, increasing their migration;
- accelerating the penetration of active substances;
- promoting reduction of wrinkles.

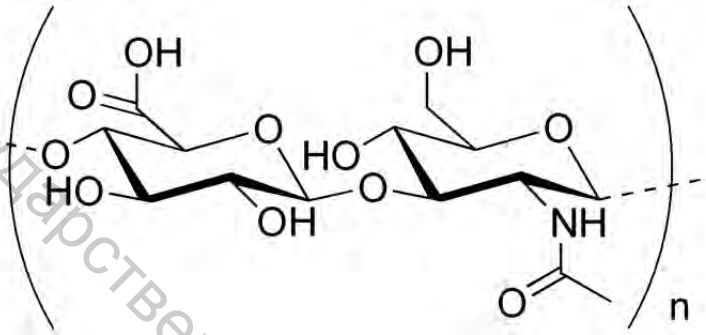

Figure 1 – Structural formula of hyaluronic acid

Solution of high-viscosity polyamide-6 was used as the raw material for nanofibers web production. In the first stage 11% solution of polyamide-6 in formic acid was obtained. Low-molecular hyaluronic acid was dissolved in warm water with thorough mixing until uniform gel-like substance was obtained. The substance was added to the polyamide solution. The percentage of hyaluronic acid was 0.4% of the weight of the resulting solution. The nanofiber web was applied to a polypropylene nonwoven. Experimental research of the technological process of electrospinning was carried out using the equipment Nanospider.

The SEM (scanning electron microscope) images of electrospun webs from solutions are obtained (figure 2). They showed frozen drops of the solution (defects in the form of glob). Their amount significantly exceeds the number of drops observed in the structure of the web that were obtained without the addition of hyaluronic acid in the composition. It was decided to conduct additional researches, including temperature-humidity processing of the obtained samples. Two variation of treatment were used: the sample conditioning with hot steam for 30 seconds and immerse of the sample into warm water for 30 seconds. Analysis measurements were made using program «ImageJ». After treatment the sizes of drops were increased. This fact showed that the drops consisted not only of polyamide, some of them are formed from a substance obtained by dissolving hyaluronic acid in water.

It was proved that hyaluronic acid does not turn out to be an isolated polyamide-6 inside frozen drops and nanofibers. It can interact with the human skin during the use of the obtained materials in cosmetology.

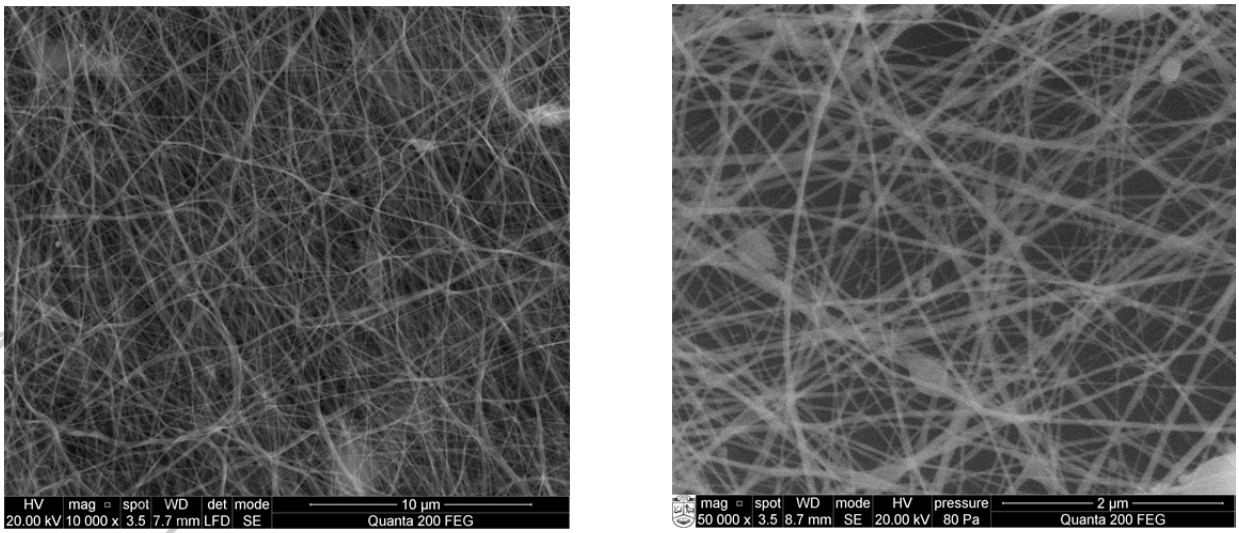

Figure 2 – Images of electrospun webs

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