UDC 541.64

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Development of hydrogelic dressings formulation containing biologically active additive

Abstract

In article the development of the formulation of hydrogel dressings containing biological active food supplements for the treatment of burn wounds, and the results of the research.

Introduction

The skin is one of the important components of the human body and the protective coating from the influence of human and environmental factors. Skin disorders are widespread. One of the most common worldwide diseases of the skin – it burns. Burn – is damage to body tissues caused by the action of heat or the action of certain chemicals.

Burns – one of the most common traumatic injuries in the world. In general, in the Republic of Kazakhstan annually register approximately 17,000 patients with burn injuries. Every year about 200 people die from burn injuries.

Currently the most important effective way of treating disorders of the skin – the use of objects and materials to protect the affected area and to facilitate a cure. Close to the ideal treatment for damaged skin burns and other injuries they released transplantation of skin from other parts of the body of the same patient. However, it should also consider limiting factors such as location of the donor site, where you can take the graft with no harm to the body, as well as the area of the wound surface, and consequently, the amount of skin needed for transplant. That is a way of such a method is not always effective. Therefore, for the healing of the skin using a combination of materials is not harmful to the skin covering. But in the world of medical practice is still used cotton and bandages (gauze, cotton). But the sorption properties of these materials are very low, for example, sorption properties of cotton materials are 14 g / g. Dressings based on polymeric hydrogels can be used on burns of various degrees due to their special properties. They are soft, transparent, painless, and coincide with the structure of blood lymph. Therefore, the use of hydrogel dressings in clinical practice is very convenient and effective [1].

Along with the synthetic, of great importance in medical practice are drugs of plant origin. Suffice it to say that the World Health Organization needs 80% of the world's population in the primary health care provided by traditional medicine, including the use of extracts or active components of plants. Especially in recent years, a tendency toward increased use of herbal medicines, which is an advantage in their safety and high selectivity of action. This is facilitated by the presence of the same powerful raw material base of Kazakhstan.

The purpose of this paper is to develop a formulation of radiation-chemical method hydrogel dressings on the basis of «alhidin» and polyvinylpyrrolidone. An important feature of high polyvinylpyrrolidone is its high adsorptive capacity and tendency to form complexes. High molecular weight polyvinyl binds many substances, including drugs, toxins, organic and inorganic pigments, etc. Alhidin is a biologically active complex of camel thorn (Alhagi Kirgisorum Shrenk), containing polymeric proanthocyanidins, polysaccharides, flavonoids, amino acids, trace elements and has a broad spectrum of action: anti-inflammatory, hepatoprotective, wound healing, immune stimulating, astringent, and other properties [2].

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 Printed in Kazakhstan

The active principle of the drug is polymeric proanthocyanidins. Also, we used a microbiological agar-agar as a cross linking agent and polyethylene glycol (PEG) to improve the mechanical properties of the dressing. For the synthesis of hydrogel dressings, in a glass of 250 ml was added an aqueous solution of PVP, dissolved agar-agar, polyethylene glycol, respectively, and the desired concentration of the drug «Alhidin.» The resulting mixture is thoroughly mixed, packed in forms, an indoor film. Each form is placed in a sealed envelope of polyethylene film. Samples were sent an electronic accelerator ELV-4 located at the Institute of Nuclear Physics for radiation cross linking of the hydrogel.

In this paper we have investigated the condition of immobilization of the drug in a polymer gel. Since the drug «alhidin» is a complex containing several components, the sorption method of immobilization is not suitable for the occasion. Because, as the sorption capacity of components are different and the introduction of these components into a gel in the same quantities is almost impossible. Therefore, the only effective way is to introduce the drug in the polymer gel composition method, with the remains of the original drug.

It can be assumed that the binding of the drug with agar – agar is due to hydrophobic interactions between hydrocarbon radicals and intermolecular hydrogen bonds -OH, C = O, NH2 groups of agar-agar and polysaccharides, proanthocyanidins, and amino acids that make up the drug.

Complex formation between the agar and a drug becomes noticeable at higher temperatures. Thus, at a temperature of 320 K by adding the drug there is a noticeable decrease in the viscosity of the system, indicating that compaction of the polymer chain by complexation with the drug. This can be explained by increased hydrophobic interactions, leading to the formation of the complex.

As mentioned above, the drug «alhidin» is a complex and major components of the drug, depending on the molecular weight are as follows:

– polimerlik proanthocyanidins;

– flavonoids;

– polysaccharides;

– amino acids [2]. We have investigated the drug release pattern of the resulting hydrogel dressings, by paper chromatography. Because amino acids and a molecular weight polysaccharides below they are the first released from the hydrogel dressing.

As a result, it was determined that the temperature at 38±5^{0}C and 30-45 minutes of starting the release of amino acids and polysaccharides of hydrogel dressings.

Also, we have investigated the kinetics of swelling obtained hydrogels in water and saline. In Figures 1 and 2 show the kinetics of swelling of hydrogel dressings containing 5% and 7% of the concentration of the drug.

The results show the degree of swelling of hydrogels in NaCl solutions in more than water.

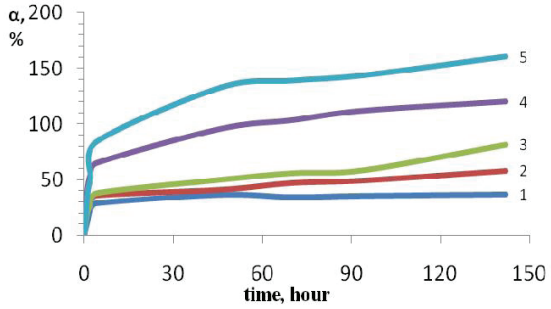

Figure 1 – Kinetics of swelling of the hydrogel containing 5% concentration in water and saline [NaCl],% = 0,45 (2), 0.9 (3) 1.8 (4) 2.7 (5). In water (1)

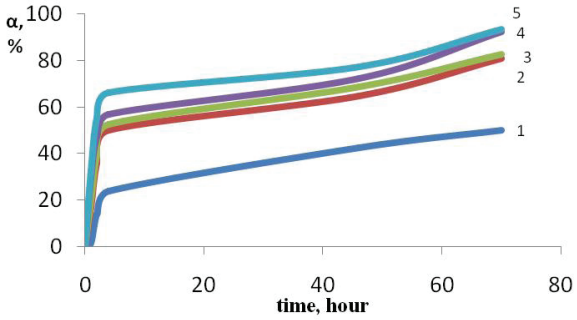

Figure 2 – Kinetics of swelling of the hydrogel containing 7% concentration in water and saline [NaCl],% = 0,45 (2), 0.9 (3) 1.8 (4) 2.7 (5). In water (1)

Also, while the swelling of hydrogels are shown in table 2.

Table 2 – Time of swelling of hydrogel dressings

[Alhidin], % in a sling	Swelling time, days	
	In water	In saline
5	6	6
7	3	2

As can be seen from the table during the swelling of hydrogels containing 7% of the drug «alhidin» low, because, especially in saline complexation so much that the complex is released in the form of flakes (figure 3).

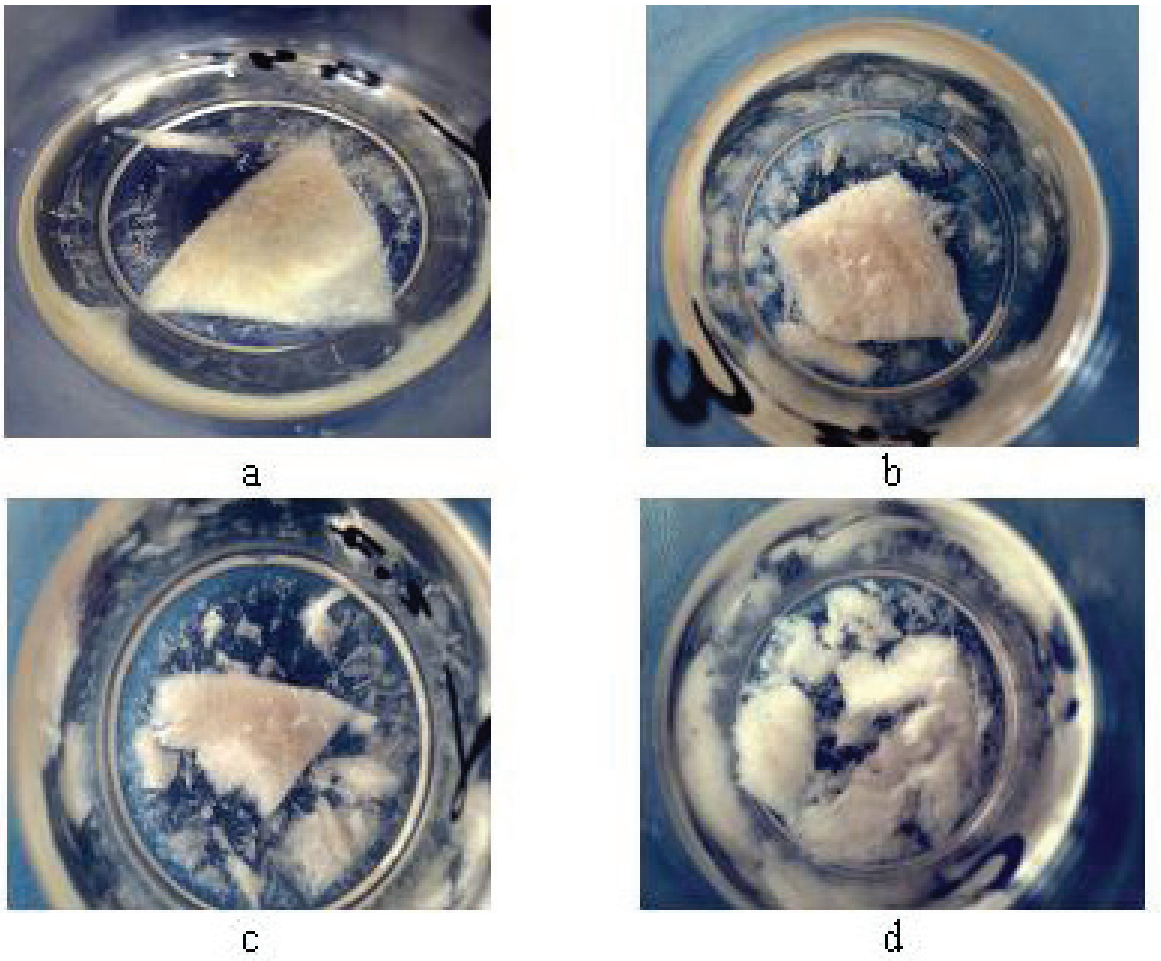

Figure 3 – Changing external conditions depending on the time
[Alhidin], % = 7;
Time, hour = 4 (a); 6 (b); 24 (c); 40 (d).

Thus, the development of technology-based dressings polymeric hydrogels allows you to implement in medical practice, a new method for effective and reliable treatment of burn wounds of varying degrees. These hydrogel dressings more effective than other materials in the treatment of large wounds.

Alhidin consists of several components. With paper-chromatographic method was to investigate the kinetics release of amino acids and carbohydrates. As a result, at 38^0C and 30-45 minutes started out amino acids and carbohydrates.

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Received 16 September 2012