THE RESEARCH OF PHYSICAL AND MECHANICAL PROPERTIES OF PLASTICIZED CHITOSAN FILMS


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In the article the influence of ethylene glycol and 1,2-propylene glycol on physical and mechanical properties of chitosan films is considered. It was shown that both compounds have a plasticizing effect on chitosan and brings to the increase of an explosive extension in 10 times.

Keywords: chitosan, plasticization, relative extension, wound coverings

Introduction

Nowadays one of the most actual trend in medicine is the creation of effective protective wound and burn coverings with the use of chitosan polymer as the basis. However, chitosan films are not characterized by high physical and mechanical qualities as they are rather fragile and brittle. Thus, the aim of the research work is the study of plasticization of chitosan films with the purpose of improvement of physical and mechanical characteristics.

Experimental part

Chitosan polymer produced by «Bioprogress» company (Russia) with the molecular weight of 334000, was made by alkaline deacetylation of crab chitin. Chitosan films were received by the method of sprinkling of polymer solution in 1 percent acetic acid on the surface of Petri dish. In this case, we get acetate of chitosan. Weight concentration of polymer in the initial solution was 1 percent. Ethylene glycol and 1,2-propylene glycol were introduced in the film in the process of preparation in the amount from 10 to 50 percent (of weight), related to the chitosan weight. The thickness of films was stable and equal to 0.1 mm. Physical and mechanical tests were held on an explosive machine (SHIMADSU firm) (AUROGRAPH AGS-X). The results of an explosive extension were calculated as arithmetic average of three parallel dimensions.

Results and discussion

The results of the conducted tests show, that chitosan made in the film without additions, represents itself as a fragile destructive glass-formed polymer (curve 1). The result of an explosive extension doesn’t exceed 6–7%. Introduction of ethylene glycol and 1,2-propylene glycol in the formation process of the film provides a significant improvement of film elasticity. To be more precise, the results of an explosive extension increases nearly in 10 times (curves 2–4). The results of an explosive tension decreases in 4 times. However, still they remain at the proper level and corresponds to the demands of protective coverings. Further increase of addition content provides a critical reduction of film endurance and its destruction.

Fig. 1. Tension – distortion dependence for film samples in the lack of plasticizer (1) and chitosan system – plasticizer (2–4) with the content of 40% of ethylene glycol (2) and 1,2-propylene glycol (3) and (50% of 1,2–propylene glycol (4) in the weight related to the weight of chitosan.

Thus, we can consider, that ethylene glycol and 1,2-propylene glycol have a plasticizing effect on chitosan films, because their introduction (about 50% of weight) in chitosan films gives an opportunity to increase film elasticity.

REFERENCES


Received 15.05.2016.