

UDC 66.017

INFLUENCE OF OXIDIZED PULLULAN CONCENTRATION ON THE PHYSICAL PROPERTIES OF CHITOSAN BASED HYDROGELS FOR BIOMEDICAL APPLICATIONS

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Introduction: In the biomedical fields, hydrogels play a crucial role for treating damaged tissues and organs. Hydrogels made of natural polymers have gained tremendous attention as effective biomaterials due to their potential for regeneration of many tissues in the human body. But their use is restricted in clinical applications due to their poor mechanical stability and degradability. Hence, specific chemical modifications have been employed to enhance the mechanical, degradable and adhesive properties of the polymer, by covalently crosslinking the polymer using nontoxic crosslinkers. [1,2]. These hydrogels are synthesized by crosslinking oxidized pullulan with chitosan, resulting in high water content that allows them to absorb and retain large volumes of fluids, which promotes wound repair.

Main body: In this study, we synthesized hydrogels with improved tissue adhesive and swelling properties. Pullulan was oxidized to aldehyde modified pullulan using sodium periodate in the mass ratio 1:0.6 (pullulan: sodium periodate). The aldehyde functionalized pullulan was prepared in different mass ratios (2,3,4 and 5 %w/v) and mixed with 3% chitosan (chitosan was prepared in 1% acetic acid) to obtain the chemically crosslinked gels. The physical properties of the gels such as swelling, bio-adhesion, water evaporation and mechanical strength were investigated in order to demonstrate how oxidized pullulan concentration affects the gels' properties. The tissue adhesive ability of the hydrogel is obtained through hydrogen bonds, electrostatic interactions and dynamic Schiff base cross-linking between the gels and the tissue. The results showed that pullulan concentration significantly affected the hydrogel properties. The prepared hydrogels demonstrated high swelling ratio, tissue adhesiveness and good storage modulus up to 1.4 kPa.

Conclusion: Thus, chemically crosslinked chitosan and oxidized pullulan hydrogels can be great candidates as biomaterials for biomedical applications such as medical adhesives, and wound dressings.

References:

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