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SYNTHESIS OF AN INORGANIC HYDROGEL BASED ON STARCH AND GELATIN VIA SCHIFF BASE REACTION

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Abstract: Polysaccharide-based hydrogels are remarkable materials for the biomedical fields because of its excellent biodegradation and biocompatibility. In this work, a novel polysaccharide-based hydrogel was fabricated by *in situ* crosslinking of starch and gelatin. Starch was oxidized with periodate to produce aldehyde groups. The reaction takes place through the formation of Schiff bases between aldehyde groups of starch and amino groups of gelatin. The effect of various process parameters such as reaction time, reaction temperature, starch concentration, gelatin content and periodic acid concentration on the efficacy of the crosslinking (aldehyde content) was investigated.

Keywords: Hydrogel; Starch; Gelatin; Schiff base.

1. INTRODUCTION

Hydrogel, as a hydrophilic polymer network with amounts of water, has been a promising material for biomedical applications because of its flexibility which was similar to soft tissue [1-2]. Hydrogel can be derivated from natural and synthetic polymers. The natural polymers are usually biocompatibility and biodegradation that do not produce adverse reproductive and developmental effects [3-4]. So, the hydrogel based on natural materials are being investigated for drug/protein delivery [5-6], tissue engineering [7] and biosensors [8].

In situ forming hydrogels are preferable for biomedical applications because they can be deployed by injection instead of surgicalim plantation. Generally, in situ hydrogels can be synthesized via physical or chemical approach [9]. Compare to physical pattern, the chemical approach may produce hydrogel with higher mechanical strength. The typical in situ chemical approach includes Schiff base reactions [10], Michael addition reactions [8], ionic interactions [11]) or photo-crosslinking reactions. Schiff base is synthesized from amine and carbonyl groups by nucleophilic addition to generate an imine group. It is biodegradable via hydrolysis, and the stability of these bonds decreases as the pH decreasing. So it is very suitable for use in the field of biomedical and tissue engineering.

2. EXPERIMENTAL OBSERVATIONS

2.1 Crosslinking of oxidized starch with gelatin

Oxidized pectin was synthesized according to an earlier procedure. Typically, sodium periodate solution (0.7 M, pH 1.5) was added to the solution of soluble starch (2.0 g in 100 mL deionized water) with proportion of sodium periodate to starch that is 1:1, under continuous stirring at 40 ^{o}C for 6 h. The product was then precipitated by addition of dry-acetone. The precipitate was further purified by washing three times with mixture of deionized water–acetone (1:1). Thereafter, the polymer was vacuum-dried at 40 ^{o}C for 24 h and kept under desiccators till use. Then, a known amount of gelatin was dissolved in50 mL deionized water. Subsequently, a solution of oxidized starch was prepared by dissolving a predetermined amount of material in deionized water. The two solutions were mixed and the reaction was allowed to take place under constant stirring for specific time periods at different temperatures. The pH was maintained using dilute hydrochloric acid