

Injectable Cross-linked Chitosan Hydrogel for Controlled Drug Release Applications

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Hydrogels are 3dimensional polymeric networks that are able to absorb a significant amount of water or any biological fluid. Hydrogels have shown unique biometric properties that make them desirable for biomedical applications such as tissue engineering, medical devices and drug delivery. Hydrogel networks are divided into two types based on the crosslinking process: *i*) physical gels that are formed by physical interactions between the polymeric chains, and *ii*) the chemical gels that formed via covalent bonding. In-situ forming hydrogels can be injected into the body as a fluid and form gel within the body tissue through physical or chemical crosslinking. These injectable hydrogels have gained significant attention as one of the promising classes of drug delivery systems with the potential for controlled release behavior. One of the main advantages of using injectable hydrogels is that they do not require medical surgeries for the replacement. Moreover, various therapeutic agents can be incorporated by simple mixing. The controlled release of the therapeutic drugs reduces the dose of the drug needed compared to the conventional injection methods, and since the drug is not circulated through the whole body, the side effects would be lesser. Various types of natural and synthetic polymeric materials have been formulated as an injectable hydrogels for drug delivery applications. Biocompatibility and biodegradability are the major necessity of a successful controlled release drug delivery system.

Chitosan is a natural polysaccharide structure which is a product of partial deacetylation of chitin, and the second most abundant natural polymer on the earth. Chitosan shows great biodegradability, biocompatibility, immunological, antibacterial and wound-healing properties which makes it a suitable biomaterial for variety of applications including tissue regeneration and drug delivery. In this study, 1-ethyl-3-(3-dimethylaminopropyl)-Carbodiimide (EDC) was used as the cross-linker to form an injectable chitosan/EDC hydrogel as a potential in-situ drug delivery system. The crosslinking behavior was characterized using Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscope (SEM). Also cytotoxicity of the cross-linked chitosan has been evaluated. The FTIR and SEM results confirmed the crosslinking of chitosan and EDC. The results from the cytotoxicity confirmed the biocompatibility, as well.