

Preparation and In vitro Evaluation of Intelligent Blood Glucose Regulating Nanonetwork Based on PLGA and Chitosan Nanoparticles

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Abstract

Introduction: Intelligent systems which release insulin in response to glucose level have been investigated thoroughly and many researches work in this area. In this work we present preparation and characterization of a novel Nano system composed of chitosan and PLGA nanoparticles, incorporating insulin, glucose oxidase and catalase.

Methods and Results: Chitosan nanoparticles were prepared through ionic gelation method. First chitosan solution (2 mg/ml) in acetic acid 1% (v/v) was prepared. 2 mg insulin was dissolved in 5 ml of this solution. TPP solution was added dropwise. Stirring the solution was continued for 1 hour. Chitosan nanoparticles were separated by ultracentrifugation. Size of these nanoparticles was found to be 180-200 nm. Preparation of PLGA nanoparticles containing glucose oxidase (GOx) and catalase (CAT) was done by double emulsification technique. PLGA was dissolved in ethyl acetate then aqueous solution of GOx and CAT were added to this organic phase. Sonication was performed to prepare w₁/o emulsion. Deionized water was added and by second sonication w₁/o/w₂ emulsion was formed. The organic phase was removed by vacuum rotary evaporator and nanoparticles were separated through filtration, in size range of 130-150 nm. Chitosan NPs were added to PLGA NPs and the Nano system was formed through an electrostatic attraction between two oppositely charged particles. In vitro insulin release from this Nano system was investigated through radiolabeling method at two different glucose concentrations of 70 and 400 mg/dl.

Conclusions: At high glucose concentration after glucose entrance into PLGA NPs it was converted to gluconic acid. Lowering of the Nano system microenvironment pH caused protonation and swelling of chitosan NPs and hence insulin release.

Key words: Insulin, PLGA, Chitosan, GOx, CAT, Nanoparticles

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