Preparation and characterization of aFGF-loaded chitosan nanoparticles with two different methods.

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Background and Aims: Angiogenic factors like acidic fibroblast growth factor (aFGF) have great ability to induce angiogenesis for biomedical applications. Sustainable delivery of growth factors is largely required in the regenerative medicine. Chitosan is a biodegradable and biocompatible polysaccharide which has considerable interest in drug delivery systems. Chitosan nanoparticles (NPs) can be prepared by several processes. In this study ionic gelation and poly electrolyte complexation (PEC) methods has been investigated.

Methods: First chitosan NPs were prepared by ionic gelation of CS with sodium tripolyphosphate (TPP). CS was dissolved in acetic acid aqueous solution (1mg/ml) and adjusted to pH 5 according to the appropriate pH mentioned for the stability of aFGF. Then aFGF was loaded. The TPP solution at concentration of 0.5mg/ml was added to chitosan solution. After ultracentrifugation the chitosan NPs were resuspended in DI water. In PEC process we used heparin as a polyanion. Chitosan and heparin were dissolved in acetate buffer (0.1M, pH5.0). NPs were prepared by addition of heparin to chitosan. After stirring, the solution was centrifuged and the NPs were resuspended in DI water. Then aFGF was added. Size, size distribution and zeta potential of the resulted NPs were analyzed by Zetasizer Nano ZS. The aFGF loading efficiency of NPs was calculated from the following equation:

Loading efficiency=(total aFGF-free aFGF)/(weight of NPs)

Results: In ionic gelation method the mean particles diameter (114nm) is significantly smaller than PEC method (210nm) (P<0.01). Both methods had acceptable particle size distribution (<0.3). The zeta potential for PEC process was negative (-14.3) while surface charge for the other method was positive (13). The Loading efficiency was significantly higher in PEC method (p<0.05) which could be related to aFGF binding sequences on heparin.

Conclusions: This study demonstrated that PEC method for fabricating aFGF loaded chitosan NPs offers more efficient preparation process.

Keywords: aFGF; Chitosan nanoparticles; Ionic gelation method; Poly electrolyte complexation method