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Preparation of Composite Nanogel Carrier for Gentamicin Delivery

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Background and Aims: In the field of drug delivery and particulate carrier systems, hydrogel nanoparticles has gathered a considerable amount of interests among others by being advantageously useful in providing targeted delivery of drugs, improving bioavailability, solubilizing drugs for intravascular administration, offering sustain drug or gene effects in target tissue, decreasing the possibility of toxicity or side effects, improving the stability of therapeutic agents against enzymatic degradation, especially proteins, peptides, and nucleic acid drugs etc., owing to sub-micron size ranges of these delivery systems. thus a novel method has been developed for preparation of composite nanogeles loaded by gentamicin.
Methods: A method of nanoparticle preparation called 'iontropic gelation' involving a polycation polymer (chitosan) and a polyanion (tripolyphosphate) was selected as our particle fabrication approach in presence of gentamicin sulfate. Then, experimental design was carried out to determine the optimum conditions of nanoparticle generation. Finally, PVP (Poly vinylpyrolidone)was added as a physical reinforcement agent to improve the drug loading and to decrease the burst effect in drug release. Then gentamicin-loaded nanoparticles was characterized *in vitro* to evaluate various features of the nanoparticles including drug loading parameters, particle size distribution, zeta-potential, and *in vitro* drug release profile.
Results: nanoparticles with sizes of 450.1 ± 37.8 nm were obtained with +12.6 mV zeta potential. Values of loading efficiency varied between 10%-28% for prepared nanoparticles. Moreover, a nearly zero order drug release was found for the first 12 hours, including about 90 percent of the drug content of the nanoparticles.
Conclusions: Our nanoparticles had ideal monodispersed particle size of about 450 nm with no significant out-of-range particles , reasonable zeta potential of about +12.6 mv. Therefore, the resulting chitosan-gentamicin nanoparticles are proper candidates to enter the *in vivo* efficiency tests. To our best of knowledge, this is the first report employing the experimental design methodology for the development of chitosan-gentamicin nanoparticles.

Key words: Nanoparticles; Gentamicin; Chitosan; *Staphylococcus Epidermidis*