Research in Pharmaceutical Sciences, 2012;7(5)
School of Pharmacy and Pharmaceutical Sciences
Isfahan University of Medical Sciences

Development and characterization of chitosan-dextran sulfate nanoparticles containing bioactive factors from human amniotic membrane for ocular delivery and corneal tissue engineering

H. Bakhshandeh[1,*], F. Atyabi[2], A. Shabani[2], S. Shah hosseini[3], M. Erfan[1],

[1]Department of Pharmaceutics, School of Pharmacy, Shaheed Beheshti Medical University, Tehran, Iran
[2]Nanotechnology Research Center, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran
[3]Noor Ophthalmology Research Center, Noor Eye Hospital, Tehran, Iran

Background and Aims: The aim of this study was preparation and characterization of chitosan-dextran sulfate nanoparticles containing amniotic membrane extract (AME). Human amniotic membrane (HAM) is the innermost layer of the fetal membrane that has many effective and beneficial factors. These factors can promote corneal epithelial healing, reduces scarring, suppresses inflammation, and inhibits angiogenesis. Therefore AM transplantation is used in ocular surface defects. Thus extraction and purification of these beneficial protein factors and preparation of controlled release nanoparticles from them can be very useful in ocular delivery, corneal tissue engineering and increasing the biocompatibility of artificial corneas.
Methods: AME was used in a novel controlled release drug delivery system such as nanoparticles consisted of chitosan and dextran sulfate prepared by polyelectrolyte complexation method (to improve the stability and durability of its factors) and evaluated its characteristics such as size, surface charge, morphology, encapsulation efficiency and release profile.
Results: Coacervation of the AME-bound dextran sulfate with chitosan, produced negative charged nanoparticles about 210 nm in diameter with high encapsulation efficiency [about 77% for HGF (Hepatocyte Growth Factor; as a marker of protein factors in AME) and 86% for total protein]. After 10 days, about 45% of entrapped total proteins with slow rate were released from these nanoparticles.
Conclusions: All results showed polyelectrolyte complexes composed of oppositely charged natural polymers to encapsulate effective proteins of AME can be a promising carrier to protect these factors and to control the rate of protein release in a good manner.

Keywords: Polyelectrolyte complexes (PEC); Chitosan, Dextran sulfate; Nanoparticle; Amniotic membrane extract (AME)