

Mucoadhesive Nanospheres Based Ocular Delivery of Insulin

Mani BHARGAVA¹, *Saurabh BHARGAVA²

¹Pharmacy, GTB Hospital, India, ²Pharmacy, Himalayan University, India

Objectives : Diabetes mellitus was known in antiquity and remains today a worldwide and increasing health problem. It occurs because of lack of insulin, with or without factors that oppose the action of insulin. In present project, it is aimed to develop biocompatible, biodegradable mucoadhesive nanospheres for effective delivery of insulin through ocular route. As it is envisaged that chitosan is biocompatible mucoadhesive polymers, it is not only having mucoadhesive properties but it also enhances the permeability of the biological membrane. Being it positive in charge, it facilitates the mucoadhesion with the corneal surface and nasolacrimal duct and enhances the delivery of the entrapped drug molecule. Looking into the potentiality of the chitosan, it is aimed to design and develop chitosan based nanospheres bearing insulin for ocular administration.

Methods : The Chitosan Nanospheres were prepared by ionotropic gelation method under mild conditions and were characterized in-vitro for their shape, size by Scanning electron microscopy(SEM), percent drug entrapment and stability. The mean particle size was determined by photon correlation spectroscopy(PCS) using a Malvern Zetasizer. Structural integrity was confirmed by FTIR and Mucoadhesion studies were performed. Drug release study was done in stimulated artificial tear solution (ATS). In-vitro Drug permeation study was performed through mucosal membrane using modified franz diffusion cell. Ocular Irritation Test (HET-CAM Test) was also carried out. The in-vivo studies were done with periodic monitoring of blood glucose level and included in-vivo permeation study along with fluorescence microscopy.

Results : SEM micrographs show clustered spherical particles with smooth surfaces. FTIR confirmed ionic interactions between chitosan and TPP as well as between insulin and chitosan. Mucoadhesion studies reveal good adhesive property of chitosan. Release studies shows that insulin was released in sustained manner upto 24 hr with lower burst effect. Drug permeation studies reveal a well known transmucosal enhancer property of chitosan. Ocular irritation test results that formulation is non-irritant to mild irritant and is well tolerated. In-vivo studies shows, a much delayed but more prominent response in blood glucose reduction as compared with plain insulin.

KSN 2017 Abstract

Conclusions : Fluorescence microscopy confirms the penetration of the drug carrier in corneal membrane. Our finding should be helpful for possible exploitation of mucoadhesive nanospheres as the future delivery system for treatment of Diabetes.

Keywords : Diabetes, Insulin, Nanospheres