Title:
Design and Development of Interpenetrating Polymeric Network Hydrogel Beads as Delivery Carrier for Modified Release of Simvastatin

Abstract

The aim and objective of the present investigation describes the development and evaluation of chitosan based Interpenetrating polymeric network of hydrogel beads for modified release of simvastatin. A Box benhken design was employed to design Interpenetrating polymeric network of hydrogel beads of simvastatin by precipitation technique. Simvastatin has less solubility in water hence effort is to increase the solubility by forming an inclusion complex (1:1) with beta-cyclodextrin and then incorporate in to polymer bland. This effort also protects the drug from solvent and crosslinker effect during preparation. The effect of critical formulation variables namely amount of polymers, concentration of glutaraldehyde, and time of crosslinking on % drug entrapment, beads diameter, swelling and in-vitro % drug release was investigated using response surface methodology. The response parameters were statistically analyzed. The parameters were evaluated using the F test and mathematical models were generated for each response parameter using multiple linear regression analysis (MLRA) and analysis of variance (ANOVA). The three main factors studied had a significant effect (P<0.05) on response variables. The optimized formulation showed 91.12 cumulative percentage releases in duration of 12 h following zero order kinetics. The % drug entrapment, area increased after swelling study and beads diameter were found to be 78.51%, 35.0 mm2 and 1.22 mm2 respectively. The mechanism of drug release was characterized by Higuchi diffusion model. The experimental values of the response parameters were in agreement with those predicted by the mathematical models confirming the prognostic ability of MLRA and ANOVA. Optimized formulation further process for various instrumental study such as scanning electron microscopy (SEM) and trinocular optical microscopy to study surface morphology of beads. Fourier transform infrared spectroscopy (FTIR) study and differential scanning calorimeter (DSC) are used to confirms the crosslinking, stability of drug in the formulation, to confirm the formation of inclusion complex, characterization of drug and polymers as well as drug- excipients compatibility. Stability study on optimized formulation also performed as per ICH guideline for 6 week. It is concluded from results data that the prepared formulation fulfil the aim of the work.