A novel method for preparing surface-modified fluocinolone acetonide loaded PLGA nanoparticles for ocular use: in vitro and in vivo evaluations

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Abstract

Our objective was to prepare nanoparticulate system using a simple yet attractive innovated method as an ophthalmic delivery system for fluocinolone acetonide to improve its ocular bioavailability. Poly(lactic-co-glycolic acid) (PLGA) nanoparticles were prepared by adopting thin film hydration method using PLGA/poloxamer 407 in weight ratios of 1:5 and 1:10. PLGA was used in 75/25 and 50/50 copolymer molar ratio of DL-lactide/glycolide. Results revealed that using PLGA with lower glycolic acid monomer ratio exhibited high particle size (PS), zeta potential (ZP) and drug encapsulation efficiency (EE) values with slow drug release pattern. Also, doubling the drug concentration during nanoparticles preparation ameliorated its EE to reach almost 100%. Furthermore, studies for separating the un-entrapped drug in nanoparticles using centrifugation method at 20,000 rpm for 30 min showed that the separated clear supernatant contained nanoparticles encapsulating an important drug amount. Therefore, separation of un-entrapped drug was carried out by filtrating the preparation using 20-25 εm pore size filter paper to avoid drug loss. Aiming to increase the PLGA nanoparticles mucoadhesion ability, surface modification of selected formulation was done using different amount of stearylamine and chitosan HCl. Nanoparticles coated with 0.1% w/v chitosan HCl attained most suitable results of PS, ZP and EE values as well as high drug release properties. Transmission electron microphotographs illustrated the deposition of chitosan molecules on the nanoparticles surfaces. Pharmacokinetic studies on Albino rabbit's eyes using HPLC indicated that the prepared novel chitosan-coated PLGA nanoparticles subjected to separation by filtration showed rapid and extended drug delivery to the eye

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