Implication of Nanotechnology for Pulmonary Delivery of Docetaxel

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ABSTRACT

Docetaxel (Taxotere®) is a taxoid antineoplastic agent used in the treatment of various cancers. Docetaxel belongs to class IV drugs in the Biopharmaceutics Classification System (BCS), and their clinical use is limited due to their extreme hydrophobicity, low water solubility, low bioavailability, and high toxicity. This study aims to prepare nanoparticles for pulmonary delivery of Docetaxel with enhanced solubility and dissolution targeting pulmonary tissues. Accordingly, PLGA-Docetaxel nanoparticles (NPs) were prepared by nanoprecipitation method and coated with Carboxymethyl chitosan to investigate its effectiveness as inhaled anticancer therapy. Four formulations had been prepared to reach the highest loading capacity (LC%) and encapsulation efficiency (EE%) and to study the effect of the amount of Carboxymethyl chitosan on the drug release. The sizes, charges, homogeneity, surface morphology, LC% and EE% of the NPs were determined. The NPs were characterized using FTIR and XRD. In vitro release profiles of Docetaxel from PLGA NPs, at pH 5.5, 6.5, and 7.4 were determined. The sizes of the four formulations ranged between 227.7± 9.5 and 306.4 ± 27.4. All prepared formulations showed acceptable monodispersity with positive charges. The EE% was above 99% and the LC% ranged between 31-63%. The in vitro release of Docetaxel show an inverse relation to the amounts of Carboxymethyl chitosan used and the pH of the dissolution medium. In conclusion, coating PLGA NPs with Carboxymethyl chitosan may be used as a good carrier for pulmonary delivery of Docetaxel