Oral Controlled Drug Delivery of Theophylline Loaded Proniosome for Asthma Treatment

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Abstract

This study aims to formulate, optimize, and characterize Proniosome-based Niosomes for the oral-controlled delivery of theophylline in asthma treatment. Theophylline-loaded Proniosomes were successfully prepared by the slurry method. For the optimization of the formulations, four different surfactants (span 20, 40, 60, and 80) and three solid carriers (maltodextrin, lactose, and glucose) were selected and prepared by the slurry method, while the amount of cholesterol was kept constant in all formulations. The optimization of the drug loading was performed by varying the amount of theophylline (100, 200, and 300mg). Different formulated theophylline-loaded Proniosomes (FS20MD, FS40MD, FS60MD, and FS80MD) were evaluated for vesicle size analysis (by DLS), zeta potential, angle of repose, rate of hydration, drug entrapment efficiency, drug content, morphology (SEM) and *in-vitro* release. FTIR studies showed that there was no interaction between drug and other formulating ingredients. This study also showed that the maltodextrin was the best solid carrier for all four surfactants as the Proniosomes prepared using the maltodextrin showed a maximum number of Niosomal vesicles on hydration in all four cases of surfactants (span 20, 40, 60, and 80). On the other side, when using other carriers, the results showed the minimum Niosomal vesicle sizes (below the 1 µm) in all four cases of surfactants. Finally, it can be concluded that, out of the four formulations, FS60MD is the best formulation for the vesicle size (showing the smallest vesicle size of 1602.33 ± 315.01 through the particle size analysis using the DLS), drug entrapment (maximum drug entrapment of 74.24 ± 7.79 %), zeta potential (minimum zeta potential of -10.9 mV.), and drug content (maximum drug content of 93.02 ± 3.89 %). Besides, the *in-vitro* release data of all four Niosomal formulations also showed the retarded release of theophylline as compared to theophylline solution. Out of all four formulations, the FS60MD showed the best retarded release. In the *in-vitro* release data, when fitted to various release kinetic models, the highest regression coefficient and highest linearity were observed in the case of zero-order for all four formulations of Niosomes. Therefore, the FS60MD theophylline-loaded Proniosomal formulation can be used for oral-controlled drug release delivery of theophylline for antiasthmatic purposes.

Keywords: *Proniosome, Niosomes, Surfactants, Cholesterol, Maltodextrin, Slurry method, Oral controlled drug delivery*