Cell Activation and Permeability of Chitosan Nanoparticle Carriers Prepared by Spray Drying

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ABSTRACT

The studies were to evaluate the characteristics of chitosan hydrochloride nanoparticles cross-linked with a cross-linking reagent, genipin. These particles were prepared by an improved spray drying process. The size, surface morphology and the degree of cross-linking were investigated by FESEM, FTIR, and the Ninhydrin reaction. To further understand the cytotoxicity and cell permeability involved in these chitosan nanoparticles, the MTT test and the transepithelial electrical resistance (TEER) were performed using the Caco-2 cells, respectively. Results showed that the sizes (between 231 nm to 298 nm) and surface morphology of the nanoparticles were influenced by the crosslinking level. With increasing amount of genipin (less than 1 mg/mL) in the reaction, the average particle sizes were decreased. While these particle were prepared at higher genipin concentration (higher than 1 mg/mL), the particle size was increased with increasing the genipin concentration. The FTIR studies revealed that chitosan reacted with genipin. Both FTIR and the Ninhydrin reaction test showed that the degree of cross-linking was increased with increasing the genipin used. The MTT test revealed that the cells viability decreased as genipin concentration increased at the tests using 1000 ug/mL of nanoparticles concentration. With the nanoparticles concentration less than 100 ug/mL in the culture medium, MTT data showed that these nanoparticles were none-toxic. In TEER results, the nanoparticles were found to cause a reversible and time-dependent decrease in transepithelial electrical resistance. In the meantime, the trypan blue exclusion data showed that these nanoparticles had no deleterious effect to the cell monolayers. This suggested that the nanoparticles had effect on the cells junction. We concluded that the obtained nanoparticles are potent absorption enhancer. The potential use of these nanoparticles can be an important contribution towards the development of effective delivery systems for drugs and other molecules.

Keywords : chitosan, spray drying, cross-linking, cell activation, permeability

Table of Contents

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