Chitosan-coated mesoporous silica nanoparticles for controlled delivery of indomethacin

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Indomethacin (IDM) is a nonsteroidal anti-inflammatory drug with very effective antipyretic, analgesic, and anti-inflammatory activity. [1] Despite its therapeutic efficacy, its poor water solubility leads to limited oral bioavailability, [2] and its use is associated with irritation of the gastrointestinal mucosa. [3] A nanocarrier drug delivery system could be used to address both of these issues. A possible nanocarrier system to be used are mesoporous silica nanoparticles (MSN). MSN are a very attractive candidate for drug delivery due to their favorable properties, such as an ordered porous network with uniform pore size, large pore volume, and high specific surface area. [4] Preventing premature drug release is an important consideration in the design of nanocarrier drug delivery systems. One commonly employed strategy involves the incorporation of polymer layers onto nanoparticles via covalent linkage or adsorption. [5] A suitable candidate for this role is chitosan, a biocompatible and biodegradable polymer obtained by alkaline partial deacetylation of chitin. [6]

In this research, adsorption of IDM on MSN was studied under varying concentrations of indomethacin using UV-Vis spectrophotometry to determine optimal conditions for loading IDM on MSN. Subsequently, IDM-loaded MSN were prepared and further coated with chitosan with different molecular weights as well as some functionalized chitosans. Coated and uncoated IDM-loaded MSN were characterized by means of solid-state UV-Vis spectrophotometry, thermogravimetric analysis, differential scanning calorimetry, powder X-ray diffraction and scanning electron microscopy. Release of IDM from coated and uncoated particles was monitored using UV-Vis spectrophotometry to determine whether the chitosan coating slows down the release of IDM.

Graphical abstract

References:

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