Poly(N-Vinylcaprolactam-Co-Itaconic Acid-Co-Ethylene Glycol Dimethacrylate)-Based Microgels Embedded in Chitosan Matrix for Controlled Release of Ketoprofen

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Abstract : Stimuli responsive and biocompatible hydrogel nanoparticles have gained special attention as systems for potential applications in controlled release of drugs to improve their therapeutic efficacy while minimizing side effects. In this work, novel solid dispersions based on thermo- and pH-responsive poly(N-vinylcaprolactam-co-itaconic acid-co-ethylene- glycol dimethacrylate) hydrogel nanoparticles embedded in chitosan matrices were prepared via spray drying for controlled release of ketoprofen. Firstly, the hydrogel nanoparticles containing ketoprofen were prepared via precipitation polymerization and their stimuli-responsive behavior, thermal properties, chemical composition, encapsulation efficiency and morphology were characterized. Then, hydrogel nanoparticles with different particles size were embedded into chitosan matrices via spraydrying. Scanning electron microscopy (SEM) analyses were performed to investigate the particles size, dispersity and morphology. Finally, ketoprofen release profiles were studied as a function of pH and temperature. Chitosan/poly(NVCL-co-IAco-EGDMA)-ketoprofen microparticles presented spherical shape, rough surface and pronounced agglomeration, indicating that hydrogels nanoparticles loaded with ketoprofen modified the surface of chitosan matrix. The maximum encapsulation efficiency of ketoprofen into hydrogel nanoparticles was 57.8% and the electrostatic interactions between amino groups from chitosan and carboxylic groups from hydrogel nanoparticles were able to control ketoprofen release. The hydrogel nanoparticles themselves were capable to retard the release of ketoprofen-loaded until 48h of in vitro release tests, while their incorporation into chitosan matrix achieved a maximum percentage of drug release of 45%, using a mass ratio of chitosan: poly(NVCL-co-IA-co-EGDMA equal to 10:7, and 69%, using a mass ratio of chitosan: poly(NVCL-co-IA-co-EGDMA equal to 5:2. Keywords : hydrogel nanoparticles, poly(N-vinylcaprolactam-co-itaconic acid-co-ethylene- glycol dimethacrylate), chitosan,

ketoprofen, spray-drying

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