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ORIGINAL PAPER

Novel semi-interpenetrating network hydrogels based on monosaccharide oligomers with itaconic moiety: synthesis and properties

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Abstract Hydrogel-based drug delivery systems encounter great scientific attention nowadays. Semi-interpenetrating network systems with hydrogel features have been studied as potential drug carriers due to their water intake capacity, biocompatibility and biodegradability. One of the most important features of drug delivery systems is biocompatibility and as such materials derived from natural resources seem to be more appropriate to act as excipients. In this respect, two new semi-interpenetrating networks (semi-IPNs) with hydrogel features based on chitosan, two novel oligomers derived from monosaccharides and 2-hydroxyethylmethacrylate (HEMA) have been synthesized and characterized using FTIR, thermogravimetry, SEM/EDX and swelling behavior. The new sugar-derived oligomers (GI and MI) with double bonds available for further polymerization were obtained by polycondensation of 1,3-propanediol with dicarboxylic acids derived from glucose/mannose skeleton with itaconic anhydride moieties. GI and MI oligomers were characterized by FTIR, NMR spectroscopy and ESI–MS spectrometry, which showed molecular weights of about 7000 Da and linear polymerization chain structure. The new semi-IPNs show good thermal behavior and these hydrogels display a swelling tendency by loading significantly more water in an acid environment than in a neutral solution. Moreover, these superabsorbent hydrogels are able to load significant amount of hydrosoluble active principle (herein the antibiotic levofloxacin) and their releasing profile is marked by an important "burst effect".

Keywords Semi-IPN · Monosaccharide oligomer · Chitosan · HEMA · Levofloxacin

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Introduction

Drug delivery is the process of insertion of an active principle into a live entity to undertake its therapeutic effect as expected [1]. During the last decades there has been an increasing demand for new excipients that are able to increase the drug activity [2]. Controlled delivery systems might be a good alternative to the tailoring of the targeted action of therapeutic agents [3]. Therefore, the active principle is uploaded into a polymeric matrix which ensures transportation to a given location inside a living entity and release in a predefined manner [4–6].

Hydrogels are hydrophilic cross-linked polymeric networks capable of water or biological fluids intake while maintaining three-dimensional structures [7–10]. Hydrogels can load an active principle in their network and then release