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ABSTRACT

The effect of the functionalization of porcine gelatin, cross-linker amount and environmental pH and salt concentration on the network structure and behaviour of gelatin-based hydrogels prepared using the Diels-Alder click reaction in aqueous media was studied. The amount of cross-linker employed and the swelling media proved to have an effect on the porosity and the maximum swelling ratio was related to the amount of hydrophilic cross-linker used. Release studies showed that the microstructure of the network was crucial for the drug uptake and delivery. Finally, the release mechanism was related to the porosity of the network and hydrophilicity of the cross-linker.

Keywords: cross-linked hydrogel, gelatin, drug release

1. INTRODUCTION

Hydrogel-based drug delivery devices are considered ideal controlled drug delivery systems due to their microstructure which allows loading of drugs and their subsequent controlled release. Hydrogels are three-dimensional hydrophilic polymeric networks which can imbibe large amounts of water while maintaining their structure [1]. Hydrogels are smart, environmentally sensitive, and compatible with biological systems and can be made degradable and responsive to various stimuli such as pH, ionic strength or temperature, resulting in the release of the entrapped drug in a controlled manner [2-4].

Hydrogels are characterized for their morphology, swelling properties and elasticity [5]. The morphology is indicative of the porosity while swelling determines the release mechanisms of the drug from the swollen network. Finally, elasticity influences the mechanical strength of the material and the stability of the drug carrier. Solute transport within hydrogels occurs primarily through the water-filled regions and, thus, any factor which reduces the size of these spaces will have an effect on the movement of the solute [6,7].

Biopolymeric hydrogels from natural polymers such as gelatin, a protein derived from the partial hydrolysis of collagen, are particularly interesting due to their renewable character, low cost, biocompatibility and biodegradability [2,7,9]. Due to its unique gelling properties, gelatin represents an ideal candidate for hydrogel formation. Moreover, the presence of a large number of functional groups in the gelatin backbone facilitates chemical cross-linking [9,10].