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Stimulus-responsive Hydrogels based on natural, endogenous Starting Material

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PURPOSE OF THE ABSTRACT

Hydrogels are three-dimensional polymer networks that are able to swell in water without dissolving themselves. The absorption of the hydrophilic liquid is reversible and closely related to the structure of the polymer network. The properties can be adjusted by varying the composition, the type of monomer and crosslinker, their electrical charge and also the synthesis method. These adjustable properties of the biomaterials resulting in a broad field of applications, especially in the medical field.

The main focus of this work is the synthesis of new, enzymatically degradable hydrogels based on natural and endogenous starting materials, like aspartic acid. Polyaspartic acid (PASP) was used as the basic building block, which can be crosslinked with various diamines to form biocompatible hydrogels.

After the successful elaboration of a laboratory-scale synthesis route in a kneading reactor for polysuccinimide, the polymeric starting material of the hydrogels, it has already been possible to produce the first PASP hydrogels with novel crosslinkers. The obtained hydrogels have been extensively characterized in form of swelling properties, mechanical investigations and drug delivery tests. It was possible to establish dependencies of these properties to the crosslinker structure and also to the untreated PSI- or hydrolysed PASP-structure. Additionally, the well-known stimulus-responsive properties of PASP hydrogels could be found in our new biomaterials.

Due to the unique bioinherent structure of the gels, a possible medical application of the hydrogels is very promising. The incorporation of other amino acids, such as glutamine or lysine, could also increase the biocompatibility enormously. Furthermore, the amino acid structure will be conducive for an enzymatic degradation of the gels which results in a further control function for possible drug delivery systems. It would also expand the field of application of the gels and be particularly interesting in the area of tissue engineering.

FIGURES

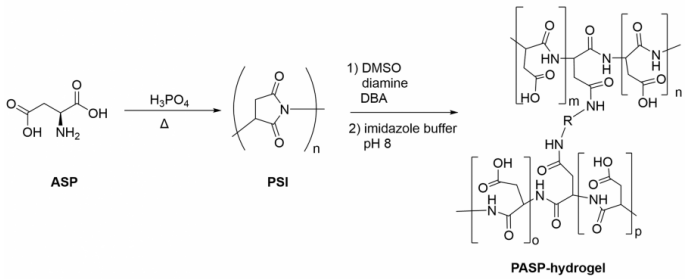

FIGURE 1

Figure 1

General synthesis pathway of PASP-diamine-hydrogels.

FIGURE 2

Figure 2

Example of PSI-diamine-hydrogel in dried state, here PSI-ethylenediamine-hydrogel.

KEYWORDS

hydrogel | biomaterials | tissue engineering | enzymatic degradation

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