

NOVEL RESORBABLE HYDROGELS AND ADHESIVES BASED ON LEVAN

ABSTRACT

Levan is a fructose polysaccharide available by fermentation or enzymatic transformation of sucrose. Currently, levan is mainly used as auxiliary material in food and cosmetic industry. Although high molecular-weight levan is known for its unique properties, only very few papers have been published about controlled chemical functionalization to generate new, functional biomaterials usable in hydrogels or adhesives.

For that reason, our aim was the introduction of different functional groups into levan forming cross-linkable macromers. We focused on two strategies, a chemical covalent cross-linking as well as a physical one.

For chemical cross-linking we studied the photo-crosslinking reaction of levan derivatives containing unsaturated groups. These levan derivatives were prepared by reacting levan with different reactive methacrylates (methacrylic anhydride, glycidyl methacrylate, isocyanatoethyl methacrylate). Different photo-initiation systems and irradiation conditions were used to study the cross-linking reaction.

Levan derivatives able to form physical cross-linkages can be prepared by introducing oligomeric lactide side chains of different length. Mixing of solutions of oligo-

D- and L-lactide-substituted levans lead to twisting of D- and L-lactide side chains resulting in the formation of hydrogels.

The obtained macromers were characterized using conventional analytical techniques (FT-IR, NMR). Application-relevant physical (swelling and mechanical behaviour) and biological (in vitro cytocompatibility and degradation, respectively) properties of the levan-based materials have been studied.

Finally, a series of cross-linkable levan derivatives containing methacrylate groups or D- and L-oligo lactide side chains, respectively have been prepared and characterized. Cross-linking of these macromers resulted in materials of diverse mechanical and swelling properties dependent mainly on the degree of substitution and the conditions of cross-linking. The hydrolytic in vitro degradation of photo-crosslinked hydrogels is relatively. All prepared hydrogels show a good cytocompatibility.

Levan-based macromers and their cross-linked hydrogel derivatives represent a new class of biopolymer-based macromers broadening the range of nature-based materials with adjustable properties. These materials have a high potential for adhesives, coatings, drug delivery formulations and matrices in soft tissue repair.