SUMMARY OF Ph.D. DISSERTATION

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Title

Development of Biomaterials Containing Novel Degradable Segments

Abstract

Tissue engineering has been attracted much attentions over past decade. It is inevitable to use biomaterials for tissue engineering, and the most commonly used biomaterials are based on polyesters and polyamides. These polymers, however, produce acidic degradation compounds *in vivo*, which induce inflammation and self-catalyzed degradation. Therefore, it is necessary to develop degradable biomaterials that do not produce these acidic degradation compounds. This thesis describes the syntheses and functionalization of novel degradable biomaterials containing cyclic acetal as a novel degradable segment.

In Chapter 1, tissue engineering, biomaterials, degradable polymers, hydrogels and polymeric micelles are explained as the introduction of this thesis.

In Chapter 2, the syntheses of cyclic acetal based hydrogels by crosslinking reaction of acrylates of cyclic acetal diacrylate and poly(ethylene glycol) diacrylate are introduced. The effects of composition of the hydrogels and the reaction conditions upon the physico-chemical properties of the hydrogels were investigated.

In Chapter 3 and 4, the syntheses of novel hydrogels (PECA hydrogel) that are based on polyethers consisting of cyclic acetal and poly(ethylene glycol), and their use for cell encapsulation matrices are introduced. It was confirmed that cells within the hydrogels maintained high viability after 2 weeks, and those that were incubated in osteogenic media expressed osteogenic differentiation. High utility of PECA hydrogels as cell encapsulation matrices that induce osteogenic differentiation was shown.

In Chapter 5, amphiphilic polymeric micelles were successfully prepared from triblock copolymers consisting of hydrophilic PECA segments and hydrophobic poly(trimethylene carbonate) units. It was confirmed from drug release study that the drug release rate was dependent on pH due to the degradation of cyclic acetal, indicating that these amphiphilic polymeric micelles can be utilized as pH- sensitive drug delivery carriers.

In Chapter 6, it was concluded that several types of biomaterials that contain cyclic acetal as a novel degradable segment were successfully synthesized and their high potentials as utilization for tissue engineering were shown.