Abstract

Polysaccharide is one of the biopolymers which has been attracted by tissue engineering application due to biodegradability, low toxicity, low manufacture costs [1]. Polysaccharide comprises a numerous of hydroxylic group which are suitable for derivatization and subsequent chemical and physical crosslinking. Malaprade oxidation is glycol cleavage reaction of vicinal diol by periodate ion. The carbon–carbon bond in a vicinal diol (glycol) is cleaved and replaced with two carbon–oxygen double bonds. Depending on the substitution pattern in the diol, either ketones or aldehydes may be formed [2]. In this thesis, I focused on oxidizing dextran and cellulose. Dextran is a bacterial polysaccharide, consisting of α1-,6 linked D-glucopyranose residue. For several years, dextran was oxidized with sodium periodate to investigation the degradation but no report about the mechanism of degradation or how oxidized dextran and other polysaccharide were degrade by Malaprade and Schiff base reaction. In chapter2, I reveal the degradation mechanism of oxidized dextran using 2D NMR technique and gel permeation chromatography. The results showed that the oxidation of polysaccharide was controlled by varying the concentration of periodate and primary amino acid. The degradation was started after adding amino acid which related which Schiff base reaction. Moreover, the degradation of oxidized polysaccharide is related with Maillard reaction due to the appearance of methyl group which is one component of deoxyosone in Maillard pathway. A second aspect of partially oxidized polysaccharides is the chemical properties of the oxidized residues, and in particular the hydrolytic ability, which may provide a basis for biomaterials with increased biodegradability. In chapter 3,

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I used the cellulose as non-soluble polysaccharide for fabricating the tissue engineering scaffold using NaCl leaching technique. The results indicated that the degradation of oxidized polysaccharide scaffold was controlled by varying the concentration of periodate. Furthermore, the degradation was initially started by adding the primary amino acid which correlated with oxidized dextran degradation in chapter 2. To further investigate the suitability of these scaffolds for tissue engineering applications, biocompatibility was checked using CCK-8 kit assay. In addition, scanning electron microscopy and *in vivo* experiment were demonstrated to show the ability of cells to attach to scaffold surfaces and a biocompatibility of matrices with cells, respectively. The result indicated that the oxidized cellulose scaffold showed good biocompatibility, cell viability and degradation which are important properties of scaffold for tissue engineering. In this thesis, I can explore the mechanism of oxidized polysaccharide by Malaprade oxidation via oxidized dextran which directly related with Schiff base and Maillard reaction. In addition, I use this mechanism for controlling the oxidized polysaccharide scaffold via cellulose scaffold for tissue engineering.

Keywords: polysaccharide, Malaprade oxidation, Schiff base reaction, Maillard reaction, tissue engineering.

References

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