

435m An Environmental Friendly Pretreatment of Biomass for the Production of Xylooligosaccharide and Other Value-Added Products

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Biomass provides a unique resource for sustainable production of clean and affordable biofuels, biopower, and high-value bioproducts. Xylooligosaccharide, a newly developed functional food ingredient, is usually produced from xylan by enzymatic hydrolysis. Xylan, which is abundant in biomass, exists in the form of xylan-lignin complex. One of the key steps in the lignocellulosic biomass-to-fermentable sugars conversion is pretreatment. The goal of a pretreatment is to alter or remove structural and compositional impediments to hydrolysis in order to improve the rate of enzyme hydrolysis and increase yields of sugars from cellulose or hemicellulose. Many current pretreatment methods (i.e., dilute acid, ammonia fiber explosion, ammonia recycle percolation, hot water, and lime pretreatment) have limitations such as capital-intensiveness, the tendency to form inhibitors, as well as low yields.

In this study, a new pretreatment concept, using acidic and alkaline electrolyzed water to treat biomass was explored. Electrolyzed water is a technique first developed in Japan in the 1990's. The acidic water from the anode of an electrolysis chamber normally has a pH of ≈ 2.7 and an oxidation reduction potential (ORP) of $> 1,100$ mV. The water produced from the cathode side has a pH of > 11.4 and ORP of < -795 mV. Because of its high hydrogen ion concentration, the acidic electrolyzed water could be used as an environmentally friendly alternative to the sulfuric acid. Likewise, the alkaline electrolyzed water would play the role of the bases used in alkali pretreatments. For defractionating carbohydrate components in biomass, a combined treatment of acidic and alkaline electrolyzed water was tested. The two-stage percolation enhanced yields of total sugars and improved the digestibility of biomass.