

Pretreatment of Corn Stover by Ammonia Recycled Percolation

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Abstract

Corn stover was pretreated with 15 wt.% aqueous NH_3 at 175 °C in a flow-through column reactor for enzymatic hydrolysis, a process termed as Ammonia Recycled Percolation (ARP). This method is highly effective in delignification of the biomass, reducing the lignin content by 70-85%. Most of the lignin removal occurred within the first 20 minutes of the reaction. Removal of lignin by the ARP was further confirmed by FTIR analysis and lignin staining of treated biomass. The ARP process solubilizes 40-50% of the hemicellulose but leaves the cellulose content intact. The solubilized carbohydrate exists in oligomeric form. Decomposition of carbohydrates during the pretreatment is insignificant. Corn stover treated for 90 minutes exhibited enzymatic digestibility of 99% with 60FPU/g glucan of enzyme loading, and 92.5% with 10FPU/g glucan. The digestibility of the treated corn stover is substantially higher than those of α -cellulose. The enzymatic digestibility is correlated with the extent of lignin removal and hemicellulose removal perhaps due to increased surface area and porosity. The SEM pictures indicate that physical structure of the biomass is deformed and the fibers are exposed by the pretreatment. The crystallinity index has increased with the pretreatment as the amorphous cellulose is removed. No direct correlation is seen between the digestibility and the crystallinity.