DILUTE ACID AND ORGANSOLV PRETREATMENT OF LOBLOLLY PINE AND SWEETGUM

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Forest and agricultural biomass serves as a renewable and abundant source for advanced biofuels and bio-based chemicals production. However, the recalcitrant structure of cellulose, when combined with the lignin and hemicellulose matrix, forms a lignocellulosic substrate that is highly resistant to enzymatic hydrolysis. Therefore, lignocellulosic substrates must either be physically or chemically pretreated to improve accessibility to enzymes for hydrolysis while ensuring maximum recovery of the original material. Various pretreatment methods including steam explosion, dilute acid, ammonia fiber explosion, and organosolv processes are currently being assessed for their ability to improve enzymatic hydrolysis. Dilute acid pretreatment is one of the most thoroughly investigated pretreatment methods for lignocellulosic bioconversion. Organosolv is another pretreatment process that has shown potential for producing a substrate readily hydrolyzed by cellulases while producing potentially valuable lignin-based co-products. The solubilized lignin from this process can be used to produce valuable products such as strand binder and polyurethane. In this study, dilute acid and organosolv pretreatments on softwood (loblolly pine) and hardwood (sweetgum) were compared. The residual lignin in both loblolly pine and sweetgum after dilute acid pretreatment were much higher than that from the organosolv process, but the hemicellulose content was much lower with dilute acid pretreatment. Dilute acid pretreatment removes a significant portion of hemicellulose, whereas organosolv removes much lignin out of both loblolly pine and sweetgum. The interaction between residual lignin/hemicellulose and cellulase is expected to play a major role in limiting the enzymatic hydrolysis of pretreated biomass.