449d Enzyme Synergies in the Hydrolysis of Afex Pretreated Biomass

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The concept of synergistic enzymatic hydrolysis of cellulosic biomass has been extant for the past fifty years. Much research has been dedicated to studying the synergy between various cellulase enzymes on cellulose. However, little work has been directed to understanding the nature of synergy between cellulases, hemicellulases and other accessory enzymes on complex lignocellulosic substrates. In addition, most past research has focused on pretreatment technologies, such as acid hydrolysis, that emphasize recovering hemicellulose-derived sugars in the chemical pretreatment step itself. With additional attention now being paid to alkaline pretreatments such as ammonia fiber explosion (AFEX) technology, the need to develop efficient enzyme systems that hydrolyze the xylans as well as the glucans becomes apparent. The efficacy by which these mixed enzyme systems hydrolyze the biomass substrate is inextricably linked to the innate structural characteristics (on multiple structural levels) of the AFEX pretreated substrate and enzyme related factors as well. In these results, we attempt to understand the role of AFEX pretreatment on enzyme synergy and to optimize the tailored mixture of hemicellulases/cellulases that are necessary and sufficient for biomass conversion. The ultimate goal is to develop economic process options effective in producing high sugar yields at the lowest enzyme loading (cellulase plus hemicellulase).