The role of sugarcane bagasse lignin on the enzymatic hydrolysis of polysaccharides

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The hydrolysis of cell wall polysaccharides is strongly limited by the presence of lignin. Sugarcane bagasse was delignified in order to show the effect of lignin removal on the efficiency of the enzymatic hydrolysis. Selective chemical delignification provided samples in which cellulose conversion was significantly enhanced. Lignin can inhibit the saccharification mainly because the enzymes access to the polysaccharides is limited in lignified cell walls. On the other hand, hydrolytic enzymes can also bind unproductively to lignin, decreasing available cellulases. The release of low molecular mass compounds to the hydrolysis media can also inhibit the cellulases action. The objective of this work was to evaluate the effect of sugarcane bagasse lignin on the unproductive adsorption and inhibition of cellulases. For that, lignin-free bleached Kraft pulp from eucalyptus was used as a substrate and alkali-extracted lignin from steam-exploded sugarcane was used as a lignin model. To simulate a lignocellulosic material with 25% of lignin, 0.402 g of pulp and 0.134 g of lignin were mixed and suspended in 10 mL of 50 mM acetate buffer at pH 4.8. Evaluated enzyme loadings were 2, 4, 6, 8 and 10 FPU/g of polysaccharides for *T. reseei* ATCC 26921 cellulases. The previous hydrolysis medium were enhanced with 4, 8, 12, 16 and 20 UI/g of polysaccharides of *A. niger* β-glicosidase, respectively. The control reaction was conducted in the absence of lignin. Increasingly efficiencies for cellulose conversion were related to increased enzyme loads. However, the addition of lignin to the reaction media provided no-inhibitory effect. The results suggest that lignin removal from sugar cane cell walls improves the enzymatic digestibility, but only lignin addition to a lignin-free substrate was unable to limit the enzymatic hydrolysis of cellulose, suggesting that, at the evaluated enzyme loads, lignin was not a major constraint for cellulose conversion.

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