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Development of a Novel Enzymatic Pre-treatment For Lignocellulosic Biomass

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ABSTRACT

Biofuels, fuels derived directly from living matter, present a renewable and environmentally friendly alternative to petroleum based fuels. Bioethanol produced from low input energy crops or agricultural waste is a promising fuel source because it does not interfere with the human food supply chain and the ethanol produced can be blended with gasoline. These potential sources of bioethanol are not yet commercially viable due to a polymer called lignin present in the plant's cell wall which impedes the conversion of cellulose to glucose and the eventual fermentation of glucose to ethanol. Developing new methods for the pretreatment of lignocellulosic biomass that increase cellulose conversion and require less energy inputs would make lignocellulosic biofuels more attractive for investors. This study uses genetically engineered yeast to secrete enzymes which degrade the lignin and make it easier for cellulose to be converted to glucose. The four chosen enzymes were identified from the genomes of termites and white rot fungus. Devices producing the desired enzymes were assembled via overlap PCR amplification or Gibson Assembly. Analysis using gel electrophoresis revealed that, the Manganese Peroxidase device and the Aldo-Keto Reductase device had assembled correctly. Transforming these devices into yeast and applying it as a pretreatment has the potential to reduce costs and improve bioethanol yields.

KEYWORDS

biofuel, yeast, lignin, cellulosic biomass, enzyme