Synthesizing Ethanol From Recycled Cardboard Sludge Using a Cellulase Enzyme Blend and Yeast

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Waste material from cardboard recycling (sludge) was evaluated for its glucose contents and potential for ethanol production. This research shows that ethanol plants would be able to process cardboard sludge without the need for pretreatments other than particle size reduction via enzymatic hydrolysis with a cellulase enzyme and a citric acid buffer. Cardboard sludge was obtained from a local cardboard recycler. It was autoclaved under 1.2 atmospheric pressure and 120 degrees Celsius for 60 minutes. It was then dried, yielding 56% dry weight. This dry biomass was treated with a citric acid buffer and a cellulase enzyme blend and incubated at 37 degrees Celsius and 100 RPMs for seven days. One sample of hydrolysate was filtered out and tested on the HPLC to determine glucose content. Yeast fermentation was performed on the remaining hydrolysate by proofing the yeast with 20 mL warm water for thirty minutes. This yeast solution was mixed with the hydrolysate and incubated at 37 degrees Celsius under anaerobic conditions. Samples in triplicate were taken at 0 minutes, 30 minutes, 60 minutes, 120 minutes, 180 minutes and 300 minutes. All samples were processed using identical equipment and the same procedure. The samples were filtered into HPLC vials using syringes and micro-filters, and then frozen immediately. The samples were analyzed on the HPLC to determine ethanol content and conversion efficiency. It was concluded that utilizing cardboard sludge with enzymatic hydrolysis and anaerobic fermentation produces sufficient ethanol to be pursued commercially.

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