Waste No More: A Study of the Net Energy Gain of Cellulosic Ethanol from Recycled Matter

Walling, Abby

The need for alternative fuel sources is becoming increasingly evident due to the climate changing effects of gasoline. One popular alternative, corn, may not be better due to the energy required producing it. However, in this experiment, grass, newspaper, and paper towels were fermented into ethanol. The energy content of the solid byproducts was then tested to determine if the biomass could be burned to distill the ethanol created. Thus, the net energy gain of the cellulosic ethanol was found. After fermenting the samples, paper towels created the highest yield of ethanol (0.084 %), compared to grass (0.021 %) and newspaper (0.024 %). By using a calorimeter, it was also determined that paper towels have the most chemical potential energy with 20,258 kJ per kg. Lastly, the net energy gain of the cellulosic ethanol was calculated by adding the energy in the ethanol to the leftover energy in the byproduct (after part of the biomass hypothetically distilled the ethanol). Paper towels have the greatest energy gain with 435.437 kJ per kg of cellulose fermented. Overall, paper towels can be fermented and the byproducts burned for distillation to result in over 400 % more energy than needed to create the ethanol.

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