Waste Drinks to Biofuel: Using Glucose and Fructose in Fermentation and Anaerobic Digestion for the Production of Ethanol and Methane

Nallanagulagari, Vishal

Current ethanol production methods offer impractical and expensive long-term solutions that would cause dramatic increases in food prices and require extensive areas of land. This research offers a solution by utilizing commonly wasted substances, commercial drinks, for the production of ethanol and methane through fermentation and anaerobic digestion, respectively. The feasibility of producing ethanol from the glucose and fructose in commercial drinks, without the use of expensive pre-treatment and hydrolysis procedures was investigated. The commercial drinks, yeast, and minimal nutrients underwent fermentation and High Performance Liquid Chromatography analyses displayed that large quantities of ethanol were produced. The measured carbon dioxide losses showed that the process was completed within 20 hours, which is significantly faster than current methods, and with an average of 95% sugars to ethanol conversion efficiency. Then, materials such as ammonia and urea were utilized and it was determined that the use of inexpensive inputs did not affect ethanol production or efficiency. The effects of concentrating the drinks through both boiling and use of a Rotavapor (to decrease the boiling temperature) were then examined. The results displayed that equally proportional amounts of ethanol could be produced through concentration, with potentially lower capital costs. The production of methane was also investigated using inoculum (bacteria and archaea), and commercial drinks. Gas Chromatography analyses showed that, on average, 65% of the volume of gas produced was methane. Thus, this research offers a more efficient, significantly faster, and considerably cheaper alternative for biofuel production by using the billions of gallons of wasted commercial drinks each year.

Awards Won:

Third Award of $1,000