Production of Energy and Fertilizer from Ordinary Waste Materials through Micro-Scale Anaerobic Digestion

Halfon, Robert

This project seeks to solve two prevalent issues in our society, inefficient waste management and harmful nonrenewable energy sources, by means of micro-scale anaerobic digestion. The overall purpose of this project is to provide an affordable and effective alternative energy source through the utilization of wastes, including municipal solid waste, animal manure, and organic wastes, that would typically be sent to treatment plants and landfills. Other purposes are to analyze the effects of pH on overall biogas production, to determine the effects of codigestion on biogas production, and to reduce inhibitory byproducts and maximize efficiency through FeSO4 pretreatments. Moreover, this project seeks to find a cheap and effective way to treat the systems effluent for bacterial composition through CaO treatments, and to convert this treated wastewater into an alternative to chemical fertilizers. Lastly, this project intends to study 16S rRNA genomic sequencing to analyze the specific microbial population involved in biogas production. It was hypothesized that food substances with a neutral pH would yield the highest amounts of biogas, with the highest methane concentrations. It was also hypothesized that 70mM of FeSO4 would substantially increase biogas production, and that the methanogenic digestate left behind would be equally as effective as chemical fertilizers. In all, Neutral pH was found to be 417.00% more efficient than Acidic pH, and FeSO4 treatment was found to increase biogas production by 136.28%, and the liquid byproduct actually surpassed the efficacy of normal fertilizers. In all, with all variables controlled and implemented, biogas production was increased by a 976.05% with regards to ordinary methodologies, making this a very promising energy source.

Awards Won:
Second Award of $2,000