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U.S. Department of SunGrant INITIATIVE South Central Region

Project Title: *Improving Biofuel Conversion from Animal Waste*

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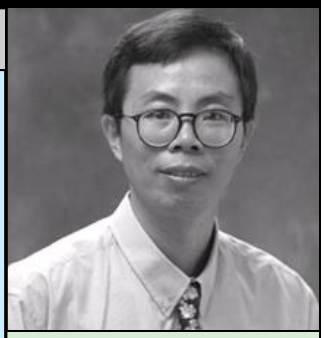

Project Goal

Animal waste and other agricultural waste streams are important biomass resources for renewable energy production. The current animal waste treatment and management systems are often inadequate. A common collection and disposal system in the United States is an anaerobic lagoon/spray irrigation system. Anaerobic digestion is the most common technology applied for sludge stabilization and is now an encouraged method for animal waste management. However, farmers are reluctant to use traditional anaerobic digestion systems due to the high construction costs and the skill and experience requirements in operation and management. A major technical problem involved in anaerobic digestion is the slow growth of methanogens that are susceptible to inhibition by a variety of factors. Of all known methanogens, aceticlastic methanogens such as Methanosaeta grow slowly by using only acetic acid as the electron donor and carbon source. For comparison, H_2-oxidizing methanogens have much faster growth rate and high affinity for hydrogen.

This research project aimed to use electrochemical and biological augmentation processes to improve biogas (both in yield and rate) production from animal waste. The objectives of this project are: 1) to use a robust electrochemically-assisted anaerobic digestion process to improve biogas production with less maintenance need and (2) to enrich fast-growing hydrogen-oxidizing methanogens for rapid and efficient methane production.

Project Outcomes

The propionic acid concentration profiles and the cumulative methane gas production curves showed significant difference in VFA production during anaerobic digestion and improved methane production in the MEC-based anaerobic digestion systems. This suggests that a hybrid system by combining a MEC with an anaerobic digestion system has the potential to produce more methane as a fuel gas. However it is still unclear as to whether the bioenergy in the form of methane being generated would offset the electric energy investigated. Further studies are needed to address issues such as energy balance, effect of different substrates, process complexity and stability before a complete success of the MEC-based anaerobic digestion can be achieved.

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