257d Preliminary Evaluation and Characterization of Acidophilic Methanogens for Increased Biological Methane Production

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Methanogens are a unique group of microorganisms able to obtain energy from a limited number of compounds including acetate and mixtures of carbon dioxide and hydrogen. This process is the terminal step in the decomposition of most organic matter and is often applied to municipal, agricultural, and industrial wastewater treatment. Increasing methane production is critical to sustaining and increasing the use of anaerobic digester systems to produce high-value biogas from these wastewater streams. Additionally, the biological conversion of H2/CO2 to methane could potentially be applied as a novel carbon dioxide sequestration concept for point-source emissions.

Until recently, it was widely accepted that methanogens require neutral pH conditions for optimum growth and methane production, and cell growth and methane production are inhibited at acidic pH values. However, previous research conducted by the author has shown that methane yields can be improved by as much as 30% in an acidic system. The overall objective of this research is to increase understanding regarding the function of acidophilic methanogens by testing the hypothesis that methane production from H2/CO2 is pH dependent. Research efforts focused on the following goals:

• Determining the optimum pH and corresponding gas composition for maximum methane production

• Evaluating how the carbon dioxide/bicarbonate distribution impacts methane production

Methane production was evaluated in a pH range of 4.0-6.0 utilizing H2/CO2 as the primary substrates and the results compared to those obtained at neutral pH to determine the extent to which methanogens utilize bicarbonate. Additional experiments contained varying concentrations of H2/CO2 as well as low concentrations of acetic acid (up to 2.0 g/L) and glucose (up to 1.0%) to determine if their presence was stimulatory to methanogenesis. This presentation will discuss the results of this experimentation and suggest an optimum substrate formulation for maximum methane production from acidophiles.