Investigating Biogas Production Under Low-Moisture Conditions: A Kinetic Analysis of Anaerobic Digestion Performance

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Growing up in Iraq, infrastructure gaps and an unstable grid cause persistent power outages that directly impact quality of life. To meet demands, these regions tend to rely on environmentally harmful options like fossil fuels, creating an urgent need for sustainable alternatives. Biogas is a sustainable source of energy generated by the anaerobic digestion of organic waste. However, in arid environments like Iraq, low moisture serves as a key limitation to microbial activity in anaerobic digestion. My experiment was designed to simulate low moisture conditions, and determine whether increased slurry homogenization could compensate for reduced water availability. Three anaerobic digesters were constructed: a control with a 1:1 manure-to-water ratio, a low-moisture digester with a 2:1 manure-to-water ratio, and a low-moisture digester with the same ratio but with increased homogenization. Across each trial, cow manure was used as the feedstock, activated digester sludge as the inoculum, and by using a water bath, the slurries were incubated at a constant temperature of 37?. To measure biogas, the water displacement method was used. After a month of experimentation, the control flask (A) produced 1157 mL of biogas, the low moisture flask (B) produced 529 mL, and the finely homogenized low moisture flask (C) produced 396 mL. According to the results, reduced moisture inhibits biogas production by about 54%. Interestingly, flask C produced less biogas than flask B, suggesting that increased homogenization under low-moisture conditions may further suppress biogas production.

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