

Impact of cultivation duration sludge inoculum on the production of methane-rich biogas through anaerobic digestion

Anaerobic digestion (AD), a widespread microbial process used to convert organic matter into renewable biofuel, is intricate and depends on the microbial communities introduced to the process as inoculum. However, little research has focused on the effect of the cultivation duration of the inoculum itself. Three different inocula were cultivated at three different durations and digested in batch reactors with garden waste collected from the local waste management facility for a period of 30 days. Through this experiment, we found that the dynamics of the microbe populations have a large influence on each stage in the process of AD.

Abstract

Anaerobic digestion (AD) is a widespread microbial process that can be used to convert organic matter into renewable biofuel. AD process is intricate and depends on feedstock characteristics, the microbial communities introduced to the process as inoculum, and environmental conditions such as temperature, pH, buffers, and other chemicals used as supplemental nutrients. Inoculum has been widely used to improve the production of biomethane when added to waste, but little research has focused on the effect of cultivation duration of the inoculum itself. Since the AD process occurs in four main stages with different microbes responsible for each stage, the dynamics of the microbe populations have a large influence on each stage in the process of AD. Three different inocula were cultivated at durations of 7-day, 14-day, and 21-day and digested in batch reactors with garden waste collected from the local waste management facility for a period of 30 days. We found that the biomethane production rate from the 7-day inoculum sample peaked 2 days earlier than the other samples, but the peak was also 193.74 mL/day lower. Acetic acid for all groups peaked on day 5, with the 7-day group having the lowest peak. Butyric and propionic acid concentrations were highest at the start and continued to fall throughout the experiment. No measurable differences were seen between the 14-day and 21-day samples due to their microbial populations of the inocula already transitioning to the latest stage before addition to the reactors.