Microbial Activity Monitoring to Optimize Biogas Production during Anaerobic Digestion Processes

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Biomethane production through anaerobic digestion (AD) is a well-established method for treating municipal wastewater sludge and organics. The conversion of organic material into biomethane or biogas during its breakdown by anaerobic microorganisms has increased in recent years, given the versatility of this by-product as a source of electricity and heat. During the AD process, a key role player is methanogenic archaea, such as *Methanosarcina Barkeri* tasked with producing methane in the last stage of the anaerobic digestion. Therefore, the health of the methanogenic population has a direct effect on the overall methane volume produced by AD reactors, due to the sensitive nature of methanogens, changes in their environment can have an impact on their performance as seen during startup procedures where a steady biogas production can take up to twelve weeks. This research evaluates different AD startup scenarios through a series of batch and bench-scale pilot studies with a wide range of starting parameters including temperature, mixing, retention time and pH. The monitoring of microbial performance under experimental conditions with novel bioelectrode sensor technology aims to optimize the overall performance of anaerobic digesters during the startup and its potential for increased biogas yields. Improving the long-term effectiveness of the municipal wastewater sludge treatment through the optimization of AD processes can have significant economic, environmental and social benefits for municipalities looking to achieve greenhouse gas emissions targets and alternative revenue sources across Canada.