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Due to increasing environmental concerns of using fossil fuels and decreasing in their reserves, the promotion of renewable energy technologies is crucial. Anaerobic digestion (AD), a well-developed technology converting organic waste into biogas, is gaining increased attention in recent years. Bioelectrochemical systems (e.g. MFC, MDC, MEC et al.) which transfer chemical energy to electricity by degrading organic waste have attracted great interest due to their environmental friendly and sustainability. In this study, to control and optimize AD process, a smart bioelectrochemical system (microbial desalination cell, MDC) was built to realize the on-line measuring the concentration of volatile fatty acid (VFA). The correlation between current densities of the biosensor and VFA concentrations was firstly evaluated with synthetic digestate. Two linear relationships were observed between current densities and VFA levels from 1 mM to 200 mM. The detection range was much broader than that of other existing VFA biosensors. The MDC biosensor had no response to protein and lipid which are frequently found along with VFAs in the organic waste streams from AD, suggesting the selective detection of VFAs. The current displayed different responses to VFA levels when different ionic strengths and external resistances were applied, though linear relationships were always observed. Finally, the biosensor was further explored with real AD effluents and the results did not show significance differences with those measured by GC. The simple MDC-based biosensor showed promising potential for online, inexpensive and reliable measurement of VFA levels. The outcomes offer a powerful tool for cost-effective monitoring and optimization of AD process and expand the application of bioelectrochemical system.

General information

State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Authors: Zhang, Y. (Intern), Jin, X. (Intern), Angelidaki, I. (Intern)
Number of pages: 1
Publication date: 2015

Host publication information

Title of host publication: DTU Sustain Conference 2015 : Book of Abstracts
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Main Research Area: Technical/natural sciences
Conference: DTU Sustain Conference 2015, Lyngby, Denmark, 17/12/2015 - 17/12/2015
Source: PublicationPreSubmission
Source-ID: 123096927
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016