Innovative operation of microbial fuel cell-based biosensor for selective monitoring of acetate during anaerobic digestion - DTU Orbit (24/08/2019)

Innovative operation of microbial fuel cell-based biosensor for selective monitoring of acetate during anaerobic digestion

Volatile fatty acids (VFAs) especially acetate concentration have been proved to be a sensitive and reliable indicator for many anaerobic processes such as anaerobic digestion (AD). Microbial fuel cells (MFC) have been demonstrated as a promising VFAs sensor due to simple reactor design and operating conditions among microbial electrochemical biosensors. However, the conventional MFC biosensors may fail to distinguish between VFAs and other organics as real digestates containing complex organics and microbes are fed into anode directly. In the present study, an MFC based biosensor was developed and operated in a smart way for selective acetate detection. In the biosensor, acetate ions contained in the AD sample was first fed into the cathode, and then acetate ion transferred through the membrane from the cathode to anode chamber where it was further used as the sole substrate by pre-enriched electroactive biofilm for the current generation. A linear correlation between the current density and acetate concentrations (0.5–20mM) at varied reaction time (1–5h) was established. Then, the interference from propionate, butyrate, isobutyrate, and glucose on the performance of the biosensor was evaluated. Furthermore, the influence of sample temperatures (37 and 55°C) was also studied. Finally, the VFAs content in real AD effluent with this biosensor was measured. The results corresponded well with gas chromatographic measurements. This simple, and reliable biosensor could serve as a promising alternative method for acetate detection in the AD process or any other acetate-rich fluids.

General information
Publication status: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering, Technical University of Denmark, Aarhus University, China Agricultural University
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Pages: 1439-1447
Publication date: 2019
Peer-reviewed: Yes

Publication information
Journal: Science of the Total Environment
Volume: 655
ISSN (Print): 0048-9697
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
Original language: English
Keywords: Bioelectricity, Acetate, Anaerobic digester, Microbial fuel cell, Biosensor, Current
DOIs:
10.1016/j.scitotenv.2018.11.336
Source: FindIt
Source-ID: 2441898905
Research output: Contribution to journal › Journal article – Annual report year: 2019 › Research › peer-review