*Processes* • *Open Access* • Volume 11, Issue 3 • March 2023 • Article number 655

**Document type**
Article • *Gold Open Access*

**Source type**
Journal

**ISSN**
22279717

**DOI**
10.3390/pr11030655

**Publisher**
MDPI

**Original language**
English

View less

# Production of Biogas from Food Waste Using the Anaerobic Digestion Process with Biofilm-Based Pretreatment

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Full text options Export

Abstract

Author keywords

Sustainable Development Goals 2023

SciVal Topics

Metrics

Funding details

## Abstract

The production of biogas from food waste is a good approach to the minimization of food waste and increase in the production of renewable energy. However, the use of food waste as a feedstock for biogas production currently poses a difficulty due to an ineffective hydrolysis process, which is a pretreatment procedure and the initial step of the biogas conversion process. This restriction results from the food waste polymers' solubilization and breakdown. This has an impact on the volume of biogas produced during the methanogenesis stage. It is essential to increase the biodegradation of organic compounds (OC) during the hydrolysis process to increase biogas generation. This study focuses on the enhancement of biogas production by the anaerobic digestion (AD) of food waste (FW). FW was hydrolyzed by the immobilized biofilm and digested anaerobically in a semi-continuous digester. Four different digesters including the control were prepared. The control digester composed of no hydrolyzed food waste had no immobilized biofilm while the other three digesters had immobilized biofilm-hydrolyzed food waste with inoculum concentrations of 10%, 30%, and 50%. The results showed that the 50% digester had the highest biogas yield of about 2000 mL/500 mL. The 10%, 30%, and control digesters had a biogas yield of 1523 mL, 753 mL, and 502 mL respectively. Thus, the analysis of total volatile solid (TVS) reduction in the digesters with 10%, 30%, and 50% inoculum and the control have increased to 43.4% for the digesters with 30% and 10%, 60% for the digester with 50% inoculum, and only 29% for the control. Total chemical demand (TCOD) removal increased to 29%, 33%, 43%, and 56% for the control, and 10%, 30%, and 50%, respectively for the inoculum-to-feed ratio. From these results, the 50% inoculum-to-feed ratio has shown the highest biogas production and highest degradation based on TVS reduction and TCOD reduction. Based on this study, the biofilm pretreatment method can be considered a promising method for the enhancement of biogas volume and biodegradation. Biogas production was high (2000 mL) for hydraulic retention time (HRT = 20) days but the HRT = 15 days was also able to produce a significant amount (1400 mL) of biogas and the 50% inoculum-to-feed ratio has shown the highest volume of biogas production. © 2023 by the authors.

## Author keywords

anaerobic digestion (AD); biofilm; biogas; food waste (FW); hydraulic retention time (HRT); inoculum-to-feed ratio (I/F); total chemical demand (TCOD) removal; total volatile solid (TVS) reduction



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