Opinion
Volume 12:3, 2022

Journal of Bioengineering & Biomedical Science

ISSN: 2155-9538 Open Access

Membrane Anaerobic Reactor System for Methane Fermentation

Caroline Donovan*

Department of Biotechnology, University of South Australia, Australia

Introduction

Anaerobic digestion is used in several biomass disposal demonstration projects. However, because a reduced anaerobic microbe population lowers methane fermentation efficiency, the extremely sluggish anaerobic microorganism growth rate is a disadvantage. This study used an anaerobic membrane bioreactor (AnMBR) for maintaining anaerobic microorganisms' development to ensure operation at larger loads, and this article introduces a series of changes to overcome the reactor's inadequacies. Finally, we decided to combine the internal biogas and use a hollow fiber AnMBR to execute the experiment [1].

- Introducing the design of an anaerobic membrane bioreactor that is both efficient and compact (AnMBR).
- After progressively increasing the load, introducing the initial OLR and variations in HRT, SRT, TS, and permeate flux in the AnMBR.
- Decomposition parameters of the gas meter connection are being monitored.

Anaerobic digestion technology has a number of economic and environmental advantages. Anaerobic digestion recycles organic materials and converts them to biogas, which has a lot of potential for large-scale energy production provided the right technology is used. Biogas may be used to generate heat and power in boilers and motors once it has been caught. Biogas can be converted to biomethane, which can then be fed into natural gas pipelines or utilized as a vehicle fuel [2].

Description

Anaerobic bacteria, on the other hand, develop very slowly. When the processing load is increased by increasing the feed volume, bacteria are lost, restricting the treatment of greater loads. Treatments based on traditional methods can only work if the hydraulic retention duration is quite lengthy (HRT). Extending the Solid Retention Time (SRT) while simultaneously shortening the HRT is difficult. Anaerobic membrane bioreactors (AnMBRs) have lately shown promise as feasible organic waste treatment alternatives to traditional anaerobic digesters. In AnMBRs, the membrane separation separates the SRT and HRT, allowing operations at longer SRTs. By adding a membrane unit reactor after the continuous stirred tank reactor, the AnMBR system can be operated at a larger load. However, their design necessitated the use of two reactors: a bioreactor for mixing and a membrane separation tank for membrane washing via biogas circulation [3].

We used a flat-sheet membrane and were able to complete the previous project with just one reactor. Despite advancements, this process still required biogas circulation to flush the membrane and the use of an impeller to mix the reactor. The flushing of the hollow fiber membrane only required one biogas spout beneath the membrane, but the flushing of the flat-sheet membranes required numerous spouts. Hollow fiber membranes have therefore been discovered to be useful for tiny reactors. Furthermore, a shortage of trace minerals in substrates has been shown to severely inhibit hydrogenotrophic and acetoclastic methanogen development and metabolism. This could result in an accumulation of Volatile Fatty Acids (VFAs), which are toxic to many of the species involved in biogas production [4].

Anaerobic membrane bioreactor

Because they keep all microorganisms in the reactor, membrane-coupled anaerobic bioreactors have been used as an alternative to traditional anaerobic digestion methods. The solid washout from wastewater is captured and returned to the reactor sludge in anaerobic membrane bioreactors using an external membrane filter placed either before or after the anaerobic reactor. The high quality of the effluent and the separation of the solid retention time from the HRT are two advantages of an Anaerobic Membrane Bioreactor (AMBr) over the conventional method. Organic fouling in the membrane owing to bacterial build-up and loss of anaerobic microorganisms in the recirculated effluent due to the high pump flow rate are two key downsides of this type of reactor.

Applications of anaerobic digestion systems

The technological systems (i.e. bioreactors) utilized in anaerobic digestion technology for biogas production are critical to its performance. The Continuously Stirred Tank Reactor (CSTR), Up-flow Anaerobic Sludge Blanket (UASB), Expanded Granular Sludge Bed (EGSB) Reactor, Internal Circulation (IC) Bioreactor, Fluidized-bed Reactor (FBR), and hybrid reactor are the six basic types of bioreactor systems now in use.

These bioreactors are divided into two categories: "low-rate systems" (CSTR or plug-flow) and "high-rate systems" (UASB, EGSB, IC, FBR attached biofilm system and hybrid system). Anaerobic membrane bioreactors (AnMBR) are a new type of bioreactor system that has recently been created and introduced to the market [5].

Conclusion

The basic anaerobic CSTR system is used to treat municipal sewage sludge as well as the organic portions of municipal solid wastes. It can manage an organic loading rate (OLR) of 1–4 kg chemical oxygen demand (COD)/m^3/d and has a detention time of about 25 days. The low biomass concentration, lengthy detention duration (i.e., big reactor capacity), and successful sludge retention or separation from the liquid stream are the key challenges of CSTR systems. Significant effort was invested into developing high-rate anaerobic treatment systems to overcome the limitations of sludge retention and low OLR. The UASB and EGSB systems are two key types of high-rate anaerobic systems that have been widely used in numerous sectors.

Anaerobic digestion is a well-established process for the long-term management of organic waste and the creation of biogas. Biogas production from municipal primary and secondary sludge, the organic part of MSW, farm manure, and industrial wastewater has been widely used. The biogas produced comprises roughly 55–75 percent bio-methane and 25–45 percent carbon

***Address for Correspondence:** Caroline Donovan, Department of Biotechnology, University of South Australia, Australia, E-mail: carolindonovan@gmail.com*

Received: 09 March, 2022, Manuscript No. Jbbs-22-61483; **Editor Assigned:** 11 March 2022, PreQC No. P-61483; **Reviewed:** 25 March, 2022, QC No. Q-61483; **Revised:** 30 March, 2022, Manuscript No. R-61483; **Published:** 06 April, 2022, DOI: 10.37421/2155-9538.22.12. 291

dioxide (CO_2), and can be used for heating, natural gas quality improvement, and electricity and heat cogeneration.

References

1. Sun, Jin, Yasunori Kosaki, Nobuhisa Watanabe, and Munetaka Ishikawa. "Production of methane-rich biogas and minimization of sludge by adopting ethanol fermentation for the pretreatment of biomethanation." *J Mater Cycles Waste Manag* 21 (2019): 258-264.

2. Seco, A., O. Mateo, Núria Zamorano-López, and Pau Sanchis-Perucho, et al. "Exploring the limits of anaerobic biodegradability of urban wastewater by AnMBR technology." *Environ Sci: Water Res Technol* 4 (2018): 1877-1887.

3. Zhang, Wanli, Bin Chen, Aimin Li, and Lei Zhang, et al. "Mechanism of process imbalance of long-term anaerobic digestion of food waste and role of trace elements in maintaining anaerobic process stability." *Bioresour Technol* 275 (2019): 172-182.

4. Cheng, Hui, Yutaka Hiro, Toshimasa Hojo, and Yu-You Li. "Upgrading methane fermentation of food waste by using a hollow fiber type anaerobic membrane bioreactor." *Bioresour Technol* 267 (2018): 386-394.

5. Lamb, Jacob J., Kristian M. Lien, and Dag Roar Hjelme. "Digitalization of colourimetric sensor arrays for volatile fatty acid detection in anaerobic digestion." *MethodsX* 6 (2019): 2584-2591.

How to cite this article: Donovan, Caroline. "Membrane Anaerobic Reactor System for Methane Fermentation." J Bioengineer & Biomedical Sci 12 (2022): 291.