Research & Development Program
New York State Pollution Prevention Institute

A Low Cost Bioreactor for Treatment of Food Wastes and Simultaneous Electricity Production

In microbial fuel cell output evaluation, different substrates were compared including pretreated Laminaria saccharina (kelp) and glucose. Additional pretreatment using hydrolysis and a fermentation bioreactor using glucose was also tested.

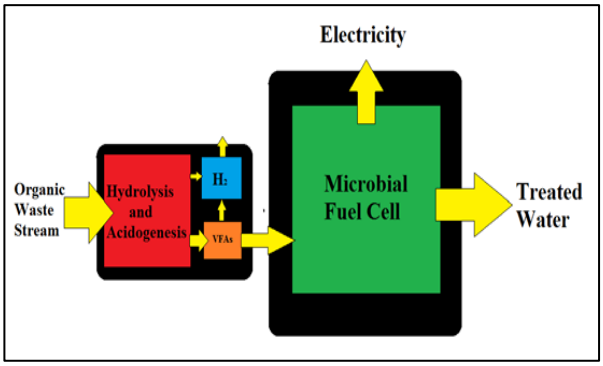
Keywords: microbial fuel cell, food waste, hydrolysis, bioreactor, Laminaria saccharina

Process Implementation Readiness

Basic Research | Proof of Concept | Early-stage Tech Dev | **Product Dev** | Production

Background and Technology Description

A microbial fuel cell provided by MICROrganic Technologies, Inc. was used as the test fuel cell in comparing glucose power generation against L. saccharina after autoclave, microwave, and untreated powder (control) treatments. The best L. saccharina treatment was autoclave with 12x higher peak power and 5x higher current density compared to the untreated control. Overall, COD removal ranged from 10-13mg/L-hr. The open circuit voltages were similar for the glucose test and various L. saccharina materials.



Pretreatment of glucose using a hydrolysis and fermentation bioreactor followed by a low pH microbial fuel cell resulted in a COD removal rate of 59mg/L-hr, which was almost a 5x increase over the glucose tests without hydrolysis.

A novel high surface area, cylindrical Nafion microbial fuel cell was also designed along with a graphene electrode made by chemical vapor deposition of graphene over a porous nickel foam.

Further development has shown that municipal wastewater could be treated in the microbial fuel cell system with ultrafiltration polishing to meet water quality criteria for thermal power plant cooling water. More recent work has focused on developing a novel air breathing cathode membrane assembly based on an inexpensive sulfonated poly(sulfone) proton exchange membrane.

Technology Benefits and Value

- Preprocessing of food waste can contribute significantly to the effectiveness of energy production and COD removal.
- New and better reactor designs with high surface area are possible to make the fuel cell process more amenable for production-scale use

Target Customers

Developers of microbial fuel cells and eventually facilities that generate high COD wastewater.

Intellectual Property

This process is currently not under patent.

Opportunity

NYSP2I and RPI are interested in working with qualified parties for continued technology and product development of this process.

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Funding provided by the Environmental Protection Fund as administered by the New York State Department of Environmental Conservation.