

Non-Confidential Description - PSU No. 3761 "Renewable Energy Method for Generating Hydrogen"

Keywords:

Microbial electrolysis cell (MEC), oxidation, H₂, salinity gradient, reverse-electrodialysis electrolysis cell (MREC)

Links:

[Inventor website](#)

[Published Patent Application](#)

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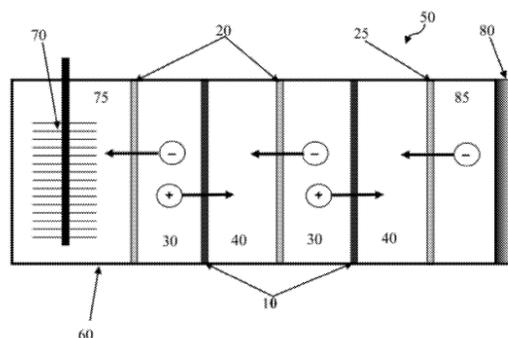


Fig 1: MREC Diagram

Background

Exoelectrogenic bacteria oxidize organic matter and can transfer electrons to electrically conductive materials, such as metal, making it possible to convert waste organic matter into useful energy. These exoelectrogens can also be used to drive electrochemical H₂ production in a microbial electrolysis cell (MEC). However the substrate oxidation is not large enough to drive electrochemical H₂ production, therefore additional energy is needed to overcome this barrier. This additional energy can be provided by a renewable source, such as solar, wind, or waste organic matter. No method has yet been developed to directly achieve hydrogen production in one process without an external voltage supply.

Invention Description

This invention provides a unique method of hydrogen production by integrating a very small (five membrane pairs) reverse electrodialysis (RED) stack into a microbial electrolysis cell, where oxidation of organic matter is driven by exoelectrogenic microorganisms. In this microbial reverse-electrodialysis electrolysis cell (MREC), H₂ production is achieved by two driving forces including a thermodynamically favorable oxidation of organic matter by exoelectrogens on the anode, and the energy derived from the salinity gradient between seawater and river water. The added salinity driven energy completely eliminates the need for an external power source for the MEC. Therefore the MREC represents a unique method for generating H₂ from renewable energy sources including domestic and industrial wastewaters, seawater, and river water.

Advantages/Applications

- Provides a renewable energy method for H₂ production
- Utilizes a salinity gradient between seawater and river water
- Eliminates the need for an external power source for the MEC