Z-Scheme Microbial Photoelectrochemical System (Mps) For Wastewater-To-Chemical Fuel Conversion

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BACKGROUND

With the drastic increase of human population, there is an ever-growing demand for energy and clean water. Distinct strategies have been used to address these two needs separately; the municipal wastewater is collected by local wastewater plants for purification and subsequent reuse as reclaimed water, while energy is produced largely by burning hydrocarbons.

Millions of tons of wastewater is produced from industrial and agricultural operations each year and about 25 billion US dollars are spent annually for wastewater treatment in the United States alone. Meanwhile, the use of natural gas/petroleum generates greenhouse gases and toxic chemicals. There is urgent need to employ energy-efficient processes for wastewater treatment, and simultaneously recover the energy stored in organic matter in wastewater.

TECHNOLOGY DESCRIPTION

The device combines a biophotoanode with a semiconductor photocathode. When light shines on the photocathode, a sufficient voltage is produced to facilitate electrohydrogenesis by electrogenic bacteria in the biophotoanode that generate electrons from organic waste. The photocathode and biophotoanode are separated by a photon exchange membrane. The device directly interfaces the biophotoanode with the photocathode forming what is known as a Z-scheme microbial photoelectrochemical system.

A proof of concept of the device was able to achieve 1% solar conversion efficiency as well as a soluble chemical oxygen demand (SCOD) removal rate of 200 mg/L/day and conversion of near opaque wastewater to nearly clear water.

APPLICATIONS

- Bioproduction of hydrogen gas
- Water bioremediation

ADVANTAGES

INVENTORS

- Li, Yat

OTHER INFORMATION

KEYWORDS

Hydrogen generation, Wastewater remediation, Bioremediation, Solar energy, Z-scheme, Microbial photoelectrochemical system, Wastewater Treatment, Biophotoanode, Semiconductor photocathode, Electogenic bacteria

CATEGORIZED AS

- **Biotechnology**
  - Industrial/ Energy
- **Energy**
  - Hydrogen
  - Solar

RELATED CASES

2015-377-0, 2013-222-1

Efficiently produces hydrogen gas from solar energy while in turn remediating organic waste from wastewater.

INTELLECTUAL PROPERTY INFORMATION

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,683,218	06/16/2020	2015-377
United States Of America	Published Application	20210351427	11/11/2021	2015-377

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Carbon-Doped NiO Catalyst For Hydrogen Evolution Reaction
- Zinc-Iodine Battery with improved Coulombic efficiency
- Hydrogen-Treated Semiconductor Metal Oxides For Photoelectrochemical (PEC) Water Splitting
- Self-Biased and Sustainable Microbial Electrohydrogenesis Device
- Three-Dimensional Hierarchical Porous Carbon Foams For Supercapcitors

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