Highly Efficient, Scalable Microbial Fuel Cell

UNIVERSITY OF COLORADO

TECHNOLOGY
TRANSFER
OFFICE

Boulder + Colo. Springs 4740 Walnut Street Suite 100 Campus Box 589 Boulder, CO 80309

(303) 492-5647

Denver + Anschutz Medical Campus 12635 E. Montview Blvd Suite 350 Campus Stop F411 Aurora, CO 80045

303-724-0221

www.cu.edu/techtransfer

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Patent pending; available for exclusive or nonexclusive licensing.

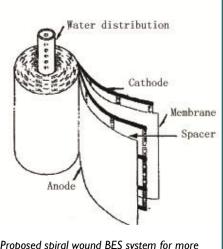
Case Manager:
Matthew Pink
matthew.pink@cu.edu
Ref. # CU2773D

Background

With present day environmental and energy concerns rising, the development of environmentally friendly energy sources is quickly becoming a top priority. One group of alternative energy sources that show great potential to meet future energy demands are bioelectrochemical systems (BES) or microbial fuel cells (MFC), which can be used to both treat waste water and produce energy. Current wastewater treatment processes are energy-intensive due to the power demand for aeration, sludge treatment, and membrane operations. However, the energy content embedded in the organic matter contained in wastewater is estimated to be approximately 2-4 times the energy used for wastewater treatment in the US, indicating that waste treatment could be self-sufficient and possibly net energy positive. BES's are one such approach to make wastewater treatment sustainable, and possibly even a positive power source.

Technology

A research team led by Jason Ren, a Gates Foundationfunded researcher who directs the University of Colorado's Environmental Biotechnology Lab, has developed a novel "spiral wound"-configured BES that exhibits much greater energy production than previous systems and functions reliably under largescale operating conditions. The spiral wound configuration comprises a tubular reactor which houses a central electrolyte collection tube along with the anode, cathode, and other associated materials. Instead of having the electrolytes flow through framed plate modules as in current microbial fuel cells, the electrodes, membrane sheets, and spacers are glued together to form a leaf, and multiple leaves are concentrically rolled around the electrolyte tube.



Proposed spiral wound BES system for more efficient waste treatment and energy

Advantages

One key advantage to this design is that spacer-directed electrolyte flow aids in minimizing the distance between the electrodes, thereby greatly reducing the internal resistance of the BES. Even more importantly, the manifold electrode/membrane layers **significantly increase the surface area to volume ratio**, resulting in greatly increased energy production. Additionally, spacers and the center electrolyte channel allow for a more evenly distributed water pressure, which can prevent leaks from forming.

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Key Documents

Modular Bioelectrochemical Systems and Methods. PCT filed Sep. 14, 2012. Sustainable Water Desalination Using a Capacitive Microbial Desalination Cell. Energy Environ. Sci. 2012 Mar.; DOI: 10.1039/C2EE03956F. PDF available upon request.