



It is the goal of the Environmental Research and Education Foundation (EREF) to fund far reaching, impactful and high quality research that can be used by the solid waste industry and the public it serves to achieve greater sustainability, sound environmental stewardship, improved process efficiency and increased knowledge.

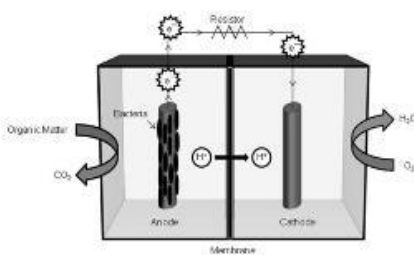
Following are briefs on two projects funded by EREF that have recently been completed. The final reports for these projects are available on the EREF Web site at [www.erefndn.org](http://www.erefndn.org).

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## Microbial Fuel Cells in Landfill Applications

*Grantee: University of New Hampshire (Dr. Jenna Jambeck)*  
*Award Amount: \$121,516*

Microbial fuel cells (MFCs) harness the conversion of bacterial energy to electrical energy. By using electrodes, electrons from bacteria can be collected and used to produce electrical current through an electrical configuration resembling that of a battery. For this study, MFCs were researched utilizing landfill leachate as the substrate. Leachate is a well-matched substrate for use in a MFC because it contains relatively high amounts of organics, is electrically conductive, is well buffered to resist changes in pH and yet has minimal solids that might interfere with the technology.



Leachate characterization was completed to evaluate treatment for a number of constituents; electricity and power production were also monitored. At the inception of this research, there was no other published work that utilized an MFC to treat landfill leachate with no inoculation of bacteria beyond those that were already in the leachate itself. This research provides the first in-depth analysis of leachate constituents and the treatment that will occur within an MFC system.

The specific goals of this research were to:

- Design and operate a single chamber MFC to evaluate how the characteristics of the leachate change while producing electricity;
- Determine the power density and efficiency of using landfill leachate as a substrate in a single chamber MFC;
- Verify that no outside inoculation of anaerobic bacteria will be needed when using landfill leachate; and
- Create a larger scale MFC system that will help begin to evaluate the applicability of this technology at field scale.

The results of this research are promising for future developments in using leachate as a substrate in MFCs for simultaneous leachate treatment and electricity generation. The larger scale MFC in this study showed that the technology can be scaled-up to treat larger volumes of substrate without decreasing treatment efficiencies. While power production did not increase on a one to one basis with the volume of leachate treated, power production was higher than the small-scale cells and was maintained longer (over 52 days versus the typical 14-20 days for small scale cells). The removal of major constituents such as biochemical oxygen demand (BOD), total organic carbon (TOC) and ammonia suggest that this technology could be a viable option for leachate treatment.

An MFC system could be utilized as a pre-treatment for recirculation or to reduce energy use of further treatment. It could also be used as a standalone treatment process. For landfills in the post-closure monitoring period of operation, an MFC could be an option for a low operation and maintenance system to treat leachate to levels acceptable for direct discharge into surface water or groundwater.

In regards to power production, in the case of the landfill that produced 100,000 gallons of leachate daily, if new MFC designs were created based on this research that enabled amounts and rates of electricity to be captured that were comparable to those measured in this study, then up to 2,000 kW-hr per month could be produced. To put this in perspective, this is enough electricity to power about two average American homes or could likely satisfy most of the non-industrial electrical needs (e.g. scale house, office) at a landfill. While it remains to be seen if this kind of design and electricity output is truly possible when scaled up, research and design improvements have increased power production in MFCs six orders of magnitude in only the past ten years.

[Click here for more information](#), including the full report.

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### **Beyond Disposables: Eco-Clamshell Reusable To-Go Program**

*Grantee: Eckerd College (Dr. Alison Ormsby, Audrey Copeland)*

*Award Amount: \$32,000*

Concerned about the millions of disposable styrofoam containers that end up in landfills after only one use, researchers at Eckerd College (Saint Petersburg, Florida), developed a reusable to-go system and container via a \$32,000 grant from EREF. The project was led by Alison Ormsby, Associate Professor of Environmental Studies, and Audrey Copeland, Grant Research and Development Coordinator.

The initial prototype container for research use was created by G.E.T. Enterprises, a producer of melamine and plastic food service products. The prototype Eco-Clamshell was heat resistant, stackable, durable, had a hinged-lid and was made of BPA-free plastic.



The first batch of Eco-Clamshells that was developed went into circulation using the Eckerd College campus as a trial environment. Surveys conducted to gather student feedback found that while those participating in the program continued to use disposable containers on occasion, they were motivated to use the new containers because they were more environmentally friendly. Students also appreciated the sturdiness of the Eco-Clamshells. As the project progressed the Eco-Clamshell program, including a handbook describing the implementation stages, was marketed to institutions across the country. To

date, the program has been adopted by more than 200 colleges/universities, including Syracuse University, the University of Texas at Austin and the University of Virginia. The project findings show that not only does the program provide an environmentally friendly solution by minimizing food packaging waste, which is difficult to recycle, but it saves money.

[Click here for more information](#), including the full report.



## Environmental Research & Education Foundation

*Lighting a path to sustainable waste management practices*

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