Nanotech coatings produce 20 times more electricity from sewage

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Engineers at Oregon State University have made a significant advance toward producing electricity from sewage, by the use of new coatings on the anodes of microbial electrochemical cells that increased the electricity production about 20 times.

The findings, just published online in *Biosensors and Bioelectronics,* a professional journal, bring the researchers one step closer to technology that could clean biowaste at the same time it produces useful levels of electricity - a promising new innovation in wastewater treatment and renewable energy.

Engineers found that by coating graphite anodes with a nanoparticle layer of gold, the production of electricity increased 20 times. Coatings with palladium produced an increase, but not nearly as much. And the researchers believe nanoparticle coatings of iron - which would be a lot cheaper than gold - could produce electricity increases similar to that of gold, for at least some types of bacteria.

"This is an important step toward our goal," said Frank Chaplen, an associate professor of biological and ecological engineering. "We still need some improvements in design of the cathode chamber, and a better understanding of the interaction between different microbial species. But the new approach is clearly producing more electricity."

In this technology, bacteria from biowaste such as sewage are placed in an anode chamber, where they form a biofilm, consume nutrients and

grow, in the process releasing electrons. In this context, the sewage is literally the fuel for electricity production.

In related technology, a similar approach may be able to produce hydrogen gas instead of electricity, with the potential to be used in hydrogen fuel cells that may power the automobiles of the future. In either case, the treatment of wastewater could be changed from an energy-consuming technology into one that produces usable energy.

Researchers in the OSU College of Engineering and College of Agricultural Sciences, including Hong Liu, an assistant professor of biological and ecological engineering, are national leaders in development of this technology, which could significantly reduce the cost of wastewater treatment in the United States. It might also find applications in rural areas or developing nations, where the lack of an adequate power supply makes wastewater treatment impractical. It may be possible to create sewage treatment plants that are completely self-sufficient in terms of energy usage.

The technology already works on a laboratory basis, researchers say, but advances are necessary to lower its cost, improve efficiency and electrical output, and identify the lowest cost materials that can be used.

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"Recent advances in nanofabrication provide a unique opportunity to develop efficient electrode materials due to the remarkable structural, electrical and chemical properties of nanomaterials," the researchers wrote in their report. "This study demonstrated that nano-decoration can greatly enhance the performance of microbial anodes."

Provided by Oregon State University