Researchers discover key for converting waste to electricity

March 3 2008

Researchers at the University of Minnesota studying bacteria capable of generating electricity have discovered that riboflavin (commonly known as vitamin B-2) is responsible for much of the energy produced by these organisms.

The bacteria, Shewanella, are commonly found in water and soil and are of interest because they can convert simple organic compounds (such as lactic acid) into electricity, according to Daniel Bond and Jeffrey Gralnick, of the University of Minnesota's BioTechnology Institute and department of microbiology, who led the research effort.

"This is very exciting because it solves a fundamental biological puzzle," Bond said. "Scientists have known for years that Shewanella produce electricity. Now we know how they do it."

The discovery means Shewanella can produce more power simply by increased riboflavin levels. Also, the finding opens up multiple possibilities for innovations in renewable energy and environmental clean-up. The research is published in the March 3 issue of the *Proceedings of the National Academy of Sciences*.

The interdisciplinary research team, which included several students, showed that bacteria growing on electrodes naturally produced riboflavin. Because riboflavin was able to carry electrons from the living cells to the electrodes, rates of electricity production increased by 370 percent as riboflavin accumulated.

Scaled-up “microbial fuel cells” using similar bacteria could generate enough electricity to clean up wastewater or power remote sensors on the ocean floor.

“Bacteria could help pay the bills for a wastewater treatment plant,” Bond said.

But more ambitious applications, such as electricity for transportation, homes or businesses, will require significant advances in biology and in the cost-effectiveness of fuel cell materials.

Why do these bacteria produce electricity" In nature, bacteria such as Shewanella need to access and dissolve metals such as iron. Having the ability to direct electrons to metals allows them to change their chemistry and availability.

“Bacteria have been changing the chemistry of the environment for billions of years,” said Gralnick. “Their ability to make iron soluble is key to metal cycling in the environment and essential to most life on earth.”

The process could be reversed to prevent corrosion of iron and other metals on ships. Bond and Gralnick were each recently awarded funding from the U.S. Navy to explore this and other potential applications.

Source: University of Minnesota