Electrifying new way to clean dirty water

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(PhysOrg.com) -- University of Utah researchers developed a new concept in water treatment: an electrobiochemical reactor in which a low electrical voltage is applied to microbes to help them quickly and efficiently remove pollutants from mining, industrial and agricultural wastewater.

The patented electrobiochemical reactor (EBR) process replaces tons of chemicals with a small amount of electricity that feed microbes with electrons. Tests have shown that the electrons accelerate how quickly the microbes remove pollutants such as arsenic, selenium, mercury and other materials, significantly reducing the cost of wastewater cleanup.

The research is now being used by a University of Utah startup company named INOTEC, which was honored at the 2010 Cleantech Open competition in San Jose, Calif. INOTEC and its EBR technology won the $40,000 Rocky Mountain regional award in what is nicknamed the "Academy Awards of Clean Technology." INOTECH was one of 18 teams that became finalists out of 271 in the event.

Metallurgical engineer Jack Adams of the College of Mines and Earth Sciences pioneered the process. He and graduate student Mike Peoples, who co-founded INOTEC, say the award is validation that their research can save the wastewater industry money.

"It is great to be recognized for an innovative clean technology," says Adams, president of INOTEC and a research professor in the Department of Metallurgical Engineering. "We're currently in the early

stages of growing the company, and every bit of recognition and support we get fits in with our go-to-market model. It will open new opportunities for securing partnerships and investor funding that will allow us and a partner to take the technology further faster."

Adams says the new method can enhance just about any type of wastewater treatment. It now is being tested primarily for removing metals from mining wastewater, but also could be used for other industrial and agricultural wastes, he adds.

INOTEC has received support and an exclusive license to the EBR technology from the University of Utah's Technology Commercialization Office, which protects and manages the university's intellectual property and helps faculty members create startup companies. INOTEC is working with the office's new Energy Commercialization Center to secure business partners and funding.

In conventional wastewater treatment, microbes or chemicals alter or remove contaminants by adding or removing electrons. The electrons come from large excesses of nutrients and chemicals added to the systems to adjust the reactor chemistry for microbial growth and contaminant removal. Those large excesses must be added to compensate for changes in water chemistry and other factors that limit the availability of electrons to remove pollutants.

The electrobiochemical reactor or EBR system overcomes these shortcomings by directly supplying excess electrons to the reactor and microbes using low voltage and no current, unlike other systems that provide large electrical currents. One volt supplies about one trillion trillion electrons (note: trillion twice is correct). These electrons replace the electrons normally supplied by excess nutrients and chemicals, at a considerable savings and with greater efficiency.

The electrons needed for a full-scale facility can easily be supplied by a small solar power grid. "The provided electrons make reactors more efficient, stable and controllable," Adams says.

The researchers, through INOTEC, have successfully completed five laboratory tests of waters from various metal and coal mines in North America containing selenium, arsenic, mercury and nitrates.

INOTEC recently completed its first on-site, pilot-scale contract, treating wastewater containing arsenic and nitrate from an inactive gold mine. This demonstration was partially funded through a University of Utah Virtual Incubator Program grant.

INOTEC has also secured its own contract for a second pilot-scale test at a mine for silver and other metals in the Yukon in spring 2011.

More information: More information about INOTEC can be found at www.inotec.us

Provided by University of Utah