Energy
The Environment
National Security / Defense
Infrastructure & Transportation
Health / Medicine
Computers & Electronics
Nano Science & Technology

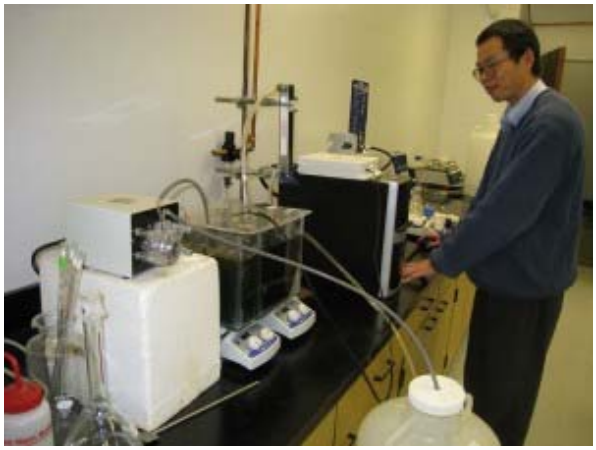
Mizzou Engineer Magazine
Giving Back
Academic Departments
Students

facebook
twitter

Engineering researchers developing portable water recycling system

By Vicki Hodder | Published 11/ 3 / 2008

University of Missouri engineering researchers are developing a portable wastewater treatment system for military bases that they believe ultimately will produce water pure enough to drink.



Engineering Assistant Professor Zhiqiang Hu is working to adapt the microbial fuel cell shown above so that it can efficiently use bacteria to produce electricity from wastewater.

The portable treatment system will screen the wastewater with advanced membranes as well as disinfect it chemically, producing reusable water that would save what often is a scarce resource as well as considerable expense, said Zhiqiang Hu, a civil and environmental engineering assistant professor leading the Mizzou Engineering research team. Team members also are developing wastewater technology they hope to add to the system that would purify the water so well it would exceed Environmental Protection Agency standards for human consumption.

“We are working to devise a system that eventually will be capable of treating the wastewater sufficiently to make it usable for cooking, drinking and showering,” said Research Associate Professor Robert Reed, a team member helping develop the system’s prototype. “We hope ultimately to replace an estimated 40 percent of military base water use needs with recycled water.”

The Leonard Wood Institute (LWI), a non-profit research organization based in Fort Leonard Wood, Missouri, has awarded Hu’s team $832,699 to develop

a wastewater system prototype as well as training materials for its operation. LWI's funding, provided by the U.S. Army Research Laboratory, also supports team research into fuel cell technology that would use the treatment process to produce electricity.

Along with Hu and Reed, the Mizzou research team includes engineering's Associate Dean for Research Sam Kiger, civil and environmental engineering Professor Tom Clevenger and Assistant Professors Enos Inniss and Sarah Orton as well as soil, environmental and atmospheric sciences Associate Professor Randall Miles.

The team's portable wastewater treatment prototype initially will include two modules, each housing a system component and made of impact-resistant material. The first module will contain a treatment tank in which wastewater will be cleaned with microorganisms, including ammonia-destroying bacteria, Reed said.

But rather than discharging the water at that point as standard Army systems do, Reed said the Mizzou team's system will send the treated wastewater to the second module for storage and reuse in such tasks as vehicle washing.

Team members are slated to deliver and demonstrate the prototype along with a draft training manual to Leonard Wood Institute next September.

While Mizzou's portable system will be a first for Army camps that typically discharge rather than reuse treated wastewater, the research team is aiming for further water treatment technology advances that would produce pure drinking water as well as energy while reducing solid wastes.

Team plans envision a third module in which the water would undergo further filtering before heading for storage. In the additional module, the treated wastewater would go through one or two additional, smaller filters to remove any tiny particles that might still remain, Reed said.

Additional chemical disinfection would purify the water still more, he said. At that point, Reed said, the water will be "potable, or drinkable," exceeding EPA standards.

The wastewater treatment system would produce energy through the benign bacteria used to cleanse the wastewater, said Hu, who is heading up this research.

As bacteria feed and grow on foods or organics in the wastewater, they react

with oxygen and release electrons, Hu said. Those electrons can be channeled into fuel cell circuits that generate electricity, he said.

By redirecting those electrons, Hu said the fuel cell technology also would reduce the amount of bacteria left—commonly called sludge—at the end of the treatment process. The technology could cut sludge production by as much as 50 percent, significantly decreasing the Army's disposal costs, Hu said.

Hu is experimenting to see which strains of bacteria produce the best results, as well as with the types of "food"—such as sugar or milk—that best enhance electrical energy production. Different electrode materials in the microbial fuel cell also may enhance performance, he said.

Both improvements may be incorporated in the team's prototype or in future adaptations, team members said.

"Our goal is to be sure we can provide the military with something that's robust and workable, and maybe something that offers them new capabilities," Clevenger said.

Posted in:

- Research
- Health & Medicine
- National Security
- News
- The Environment
- Infrastructure & Transportation