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New technology may rid drinking water of arsenic

Researchers have developed molecules that trap and immobilize the poison in an affordable manner

BY THOMAS MUNRO
DAILY EMERALD FREELANCE REPORTER

A group of University researchers has made a step toward effective, affordable technology to treat arsenic poisoning and lower arsenic levels in the world's drinking water. The researchers developed molecules that trap and immobilize atoms of the heavy metal.

Assistant professor of chemistry Darren Johnson and doctoral student Jake Vickaryous published their work in the Nov. 5 issue of *Angewandte Chemie International Edition*, the world's leading chemistry journal, according to a University press release.

Johnson said he was attracted to the arsenic problem by the lack of basic research into the heavy metal.

"Arsenic is synonymous with poison, but we don't have great ways to treat it," Johnson said.

When Johnson joined the University faculty a year and a half ago, he said he was eager to fight this health hazard. According to a 2001 Environmental Protection Agency report, arsenic in drinking water has been conclusively linked to bladder and lung cancer. It may also increase the risk of high blood pressure and diabetes.

Removal of this dangerous heavy

metal has proved a difficult technological problem. Important work was done at Sandia National Laboratories in New Mexico, which announced in 2001 the development of "new chemicals with flypaper-like arsenic-trapping properties," according to a Sandia press release. However, prohibitive costs and other concerns held back this technology.

Johnson, like his Sandia predecessors, began his molecule design on a computer. He aimed to find a "design strategy to specifically interact with arsenic ions." He was aided by Rainer Herges, a computational chemist at the University of Kiel in Germany.

Johnson said doctoral student Vickaryous was responsible for most of the research work. He described him as "a fantastic graduate student who has really taken this project in the direction he wanted to go."

The two created molecules known as chelators, a word that derives from the Greek for "crab claw." Chelators wrap themselves around heavy metal atoms, in this case forming a pyramid-like molecule, according to the University press release.

Johnson and Vickaryous created an effective arsenic trap that also promised to be relatively inexpensive.

"The reason our molecule is fairly effective is we use this tool of self-assembly," Johnson said.

Self-assembly is compared in the University press release to "a puzzle that puts itself together." This means that there is no need to directly assemble each molecule.

This groundbreaking basic research will have application in the study of the other heavy metals, including mercury, Johnson said.

The next step in Johnson's research will be to create a water-soluble version that could have medical applications. He can also look into integrating the molecules into an extraction agent for use in groundwater.

"It would be great if someone could develop a better drug for arsenic or a better way to remove it from the environment," Johnson said.

Much work lies between Johnson and Vickaryous' paper and a useable technology. Research must be done to determine the health effects of the molecules produced by the chelation. The relative speed and effectiveness of absorption of the new chelators and the tissues of the human body must also be investigated, Johnson said.

According to the University press release, "Roughly 10 percent of U.S. groundwater contains arsenic concentrations above 10 ppb," the maximum level allowed by the EPA. The work of Johnson and Vickaryous may someday improve this dangerous situation.

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