Scientists hone technique to safeguard water supplies

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A method to detect contaminants in municipal water supplies has undergone further refinements by two Oak Ridge National Laboratory researchers whose findings are published on line in *Water Environment Research*.

The new work demonstrates that the technology that uses algae as sentinels has broader applications than previously reported, according to authors Miguel Rodriguez Jr. and Elias Greenbaum of the Department of Energy's ORNL. For example, under real-world operating conditions, the sensitivity of the algae to toxins has a natural daily cycle that tracks the sun.

"When the sun is overhead and shining brightly, the algae are less sensitive to the toxins," Greenbaum said. "The new work shows that keeping the water sample in darkness for about 30 minutes prior to testing for toxins restores full sensitivity to the test."

The new results also show that the technology can be applied to many different water quality environments such as when the algae are starved for nutrients.

"Our key result is that despite real-world conditions that create challenges, free-living microalgae combined with 'work-around' strategies can be used as broad-spectrum automated biosensor systems for continuous monitoring of source drinking water," Greenbaum said.

The process uses a fluorometer to measure the fluorescence signal of algae that grow naturally in source water such as Tennessee's Clinch River, which was used in this study. Researchers exploit the known characteristics of Photosystems I and II, which convert light energy into chemical energy, to detect any changes in the process of photosynthesis.

"Recent advances in optoelectronics and portability make this a powerful technology for monitoring the in situ physiology of aquatic photosynthetic organisms such as green algae and cyanobacteria," the authors wrote. Even low levels of toxins alter fluorescence patterns within minutes.

Another significant aspect of this work is the reporting of statistically reliable data on the threshold detection levels for broad classes of toxins such as blood and nerve agents and agrochemicals. These levels are at or near Environmental Protection Agency regulatory guidelines, Greenbaum said.

For this study, the researchers looked at five classes of chemical agents in water: Diuron, atrazine, paraquat, methyl parathion and potassium cyanide. All are known to be harmful to human health. In the case of Diuron, used in agriculture for 50 years, Greenbaum and Rodriguez were able to detect 1 part per million. This was indicated by a 17 percent decline in the algae's Photosystem II efficiency.

"We have shown that microalgae in source drinking water can be used as broad-spectrum, robust sentinel sensors to detect relatively low concentrations of toxins," Greenbaum said. "We have also shown that the microalgae do not need to be in an optimized state for this technology to be effective."

Source: Oak Ridge National Laboratory (news : web)