

A New Use for DNA

Protecting public health by providing safe drinking water to citizens served by community water systems is and will always be a serious concern of government agencies, public water suppliers and private industry around the world. There is a growing need to make the onsite testing of these water supplies easier and more reliable to detect and assess contamination in a timely manner to shorten the harmful health effects of heavy metals in drinking water.

A completely new technology is now available that offers a new way to test water for contaminants and greatly reduces the time, effort, cost and complexity of testing water samples for contaminants such as lead in drinking water.

DNA sensor technology combined with a handheld fluorimeter platform tests water samples within two minutes, giving results at the push of a button. This method enables water testing and reporting to be accomplished in a fraction of the time and cost of traditional heavy metals testing methods, and requires no particular skill set or knowledge of chemistry.

DNA Science Becomes a Testing Mechanism

In the early 1980s, RNA molecules that can catalyze enzymatic reactions were discovered and named ribozymes. This discovery was followed by demonstrations in the 1990s that DNA also can act as enzymes, termed deoxy-ribozymes or DNAzymes. The fact that DNA/RNA are not only materials for genetic information storage and transfer, but also catalysts for a variety of biological reactions, and thus called catalytic DNA/RNA, (deoxy) ribozymes, or DNA/RNAzymes, meant that there were other potential uses for DNA beyond biological identification and gene identification.

Because metal ions play essential roles in the structure and function of DNAzymes, the study and application of these new metalloenzymes has become a new frontier in bioinorganic chemistry. The core research on which

this technology is based was developed in Dr. Yi Lu's lab at the University of Illinois. From this science, and with support from supplemental grant funding from the U.S. Environmental Protection Agency, engineers have created a product for detecting and quantifying heavy metals in water based on the recent discovery of these catalytic properties of DNA.

Laboratory to Field Testing

Putting the technology in the form of a workable and reliable platform that offers simple, fast, inexpensive and reliable detection of trace metals and other target chemicals was key to offering the industry a new and more effective solution. Measuring the metal ions is done through a reaction that occurs when a water sample containing a target metal ion contaminant such as lead is introduced to a sensor unit specific for that contaminant. This produces fluorescence (light) in direct correlation to the amount of metal ion present. The amount of light is measured by a handheld fluorimeter. The fluorimeter reading relates directly to the amount of metal contaminant in the water solution.

New Tool Against Lead Contamination

As water quality professionals know, lead is rarely found in source water but enters tap water through corrosion of plumbing materials. The source of lead in your home's water is most likely from pipes or solder in your plumbing.

With this in mind, the detection of lead must take place at all the end

points of the water delivery system. Although laboratory testing methods for this purpose are very accurate and reliable, they have limitations. Lab tests create time delay, are high cost and have more process steps. The new DNAzyme testing method serves as a front-line testing method that augments proven laboratory testing methods and provides an accurate, reliable, portable and cost-effective tool that can be widely deployed on site by a range of testing professionals that includes government agency inspectors, local water resource authority technicians, home inspectors, plumbers and private testing services.

"Using DNA to test water contamination levels in real time changes the way the water industry will look at testing. This technology is not only a less expensive way to get testing done, but more importantly it is a powerful new tool that can be widely deployed helping community water supply operations around the world protect people from dangerous contaminants in their drinking water," said Bill Thalheimer, CEO of ANDalyze Inc., the company that developed the technology.

Beyond Tap Water and Heavy Metals

This technology and its derivatives are not limited to metal ions or even inorganic materials. The science is progressing to enable contaminants such as organic compounds and biological contaminants to be detected using the same product platform.

This new approach to testing promises to evolve testing methods for water and provide the industry with a new tool to effectively identify sources of contamination. *wqp*

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By Marty Dugan

Detecting heavy metals in drinking water