Chemist develops biosensor that changes color when bacteria are present in water samples

June 28 2011

A team of chemists led by Vincent M. Rotello of the University of Massachusetts Amherst has developed a fast, simple and low-cost field test for detecting bacteria in low concentrations in drinking water using a biosensor made of gold nanoparticles, an enzyme and dye. The biosensor can detect harmful bacteria in concentrations as low as 100 cells per milliliter. Their report appears in the current online edition of the *Journal of the American Chemical Society*.

The new test could have a significant impact in developing countries where public health workers, physicians and water quality specialists are most in need of a quick, sensitive way to detect pathogens such as bacteria in a water supply. The time it takes to culture samples and wait for relatively expensive lab results severely hampers efforts to save the estimated 300 million people affected by bacterial illness each year. Estimates are that more than 2 million children die annually from bacteria-related disease.

Currently, there are many methods, some quite sophisticated for detecting harmful bacteria such as the killer *E. coli*. These include culturing, nucleic acid probes and microarrays. But clinics and environmental managers in developing nations often don't have access to them because of high cost or the need for skilled technicians to read the results.

To address this problem, the research team headed by Rotello with partners at the University of Puerto Rico and the Georgia Institute of Technology, developed a test strip suitable for field use that has a simple visual read out. This new uses enzyme-nanoparticle assemblies absorbed on paper strips. When the paper comes in contact with bacteria, the enzyme is activated and the strip turns from yellow to red, an easily observable change that takes place within 10 minutes.

Rotello also notes that very small amounts of the nanoparticles and enzyme are needed for the reaction, keeping the price of the test strips low. The team is now working to improve the sensitivity of the test strips to be able to detect even smaller amounts of bacteria.

The work is supported by the National Science Foundation through the UMass Amherst Center for Hierarchical Manufacturing.

Provided by University of Massachusetts Amherst