

Scientists design simple dipstick test for cocaine, other drugs

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Researchers at the University of Illinois at Urbana-Champaign have developed a simple "dipstick" test for detecting cocaine and other drugs in saliva, urine or blood serum. The test is based upon DNA-gold nanoparticle technology, and can be packaged in user-friendly kits similar to those used for home pregnancy tests.

"Building upon our earlier work with lead (Pb) sensors, we constructed colorimetric sensors that are based on the lateral flow separation of aptamer-linked nanostructures," said Yi Lu, a chemistry professor at the U. of I., and a researcher at the Beckman Institute for Advanced Science and Technology.

"The new sensors offer a quick and convenient test that can be utilized by first responders or emergency room staff to quickly screen individuals for a variety of drugs and other chemicals." Lu said.

Aptamers are single-stranded nucleic acids that can bind to specific molecules in three-dimensions. For each molecular target, such as cocaine, a corresponding aptamer can be selected from a large DNA library.

By using lateral flow devices as platforms to separate aptamer-linked nanoparticle aggregates, Lu, postdoctoral researcher Juewen Liu and graduate student Debapriya Mazumdar created highly sensitive and selective colorimetric sensors that mimic litmus paper tests. The researchers describe their work in a paper accepted for publication in the

journal *Angewandte Chemie International Edition*.

"Our lateral flow devices take advantage of the difference in size between dispersed and aggregated gold nanostructures," Lu said. "This provides critical control for the performance of the devices."

The lateral flow device consists of four overlapping pads – wicking, conjugation, membrane and absorption. The appropriate aptamer-linked nanoparticle aggregates are placed on the conjugation pad, streptavidin is applied as a thin line to the membrane pad, and the device is then dried.

When dipped into a solution, or swabbed with a sample, the wicking pad carries the fluid to the nanoparticle aggregates on the conjugation pad. The rehydrated aggregates then migrate to the edge of the membrane, which they cannot penetrate because of their large size.

The aptamers quickly bind to any targeted molecules that are present, freeing some of the gold nanoparticles. The red-colored nanoparticles then migrate along the membrane, where they are captured by the streptavidin and form a red line. The intensity of the line is an indicator of how much of the targeted molecule was in the sample solution.

So far, the researchers have successfully demonstrated their dipstick technology on both adenosine (a nucleotide consisting of adenine and ribose) and cocaine, in human blood serum.

"Our results show that the aptamer-based dipstick is compatible with biological samples, making applications in medicinal diagnostics possible," Lu said.

Source: University of Illinois at Urbana-Champaign

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