Dipstick test detects lead in paint

U. ILLINOIS (US)—Yi Lu took another researcher’s discovery about a new way to achieve catalytic reactions and turned it on its head—developing a simple, low-cost lead paint detection method for home and official use.

In 1994, Lu read in Chemistry and Biology magazine a seminal work by Ronald Breaker and Gerald Joyce about a new method of using metal ions to turn DNA into an enzyme to catalyze chemical reactions.

He wondered what would happen if the process were reversed.

“We asked ‘can we actually turn DNazymes that bind to a metal ion like lead or mercury into “reporters” for the presence of metal ions?’” says Lu, a researcher at the University of Illinois’s Beckman Institute.

So Lu leveraged his laboratory’s previous work on how different metal ions can help DNA function and flipped the direction to see if the DNA enzymes, or DNAzymes (deoxribozymes) as they are called, can help detect metal ions. The research line proved so successful that it led to the creation of dipstick test prototypes for detecting toxic metals.

In a recent paper published in Chemical Communications, Yi Lu and his collaborators report that they have fashioned a viable, easy-to-use dipstick test that, unlike other methods, requires no instrumentation or laboratory work and that meets EPA guidelines for lead detection. The dipstick test shows a color change to red when lead is detected at one milligram per square centimeter and has been shown to be effective even if the lead-based paint has been repeatedly painted over. (Credit: U. Illinois)

The dipstick test shows a color change to red when lead is detected at one milligram per square centimeter and has been shown to be effective even if the lead-based paint has been repeatedly painted over.

The sensor is able to detect trace levels of lead that more than meets EPA requirements.

The researchers write: “Designing easy-to-use biosensors for trace metal ions in the environment is of considerable importance as these metal ions are large in number, small in quantity and high in toxicity.”

They add that their DNAzyme–gold nanoparticle non-cross-link method, as applied in a dipstick test, “will find wide use in household and other environmental applications.”
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