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Dipstick test for toxic lead

01 February 2010

Scientists in the United States have produced a simple dipstick test for detecting lead levels in paints.

Easy-to-use biosensors are important for detection of highly toxic trace metal ions in the environment. Cross-linked gold nanoparticles modified with metal-specific DNAs have been used in solution to create highly sensitive and selective colorimetric metal sensors based on the colour change between aggregated (blue) and dispersed (red) gold nanoparticles. However, in solution the colour change can be difficult to distinguish and nanoparticle stability is poor, explains Yi Lu at the University of Illinois at Urbana Champaign.

Lu and colleagues have developed a sensor that uses non-cross-linked gold nanoparticle-DNA conjugates, bound to a lead-activated DNase mounted on a solid dipstick platform. Lead ions in paint samples catalyse the enzymatic cleavage of the DNA-nanoparticle conjugates which are captured on the dipstick by a complementary DNA sequence. If the levels of lead are present, a red line forms across the dipstick - similar to a pregnancy test kit.



The dipstick is designed to give a positive result for lead levels over 1 mg per cm² - the value the U.S. Department of Housing and Development classifies paint to be lead-based. Lu demonstrated that the dipstick test produced the correct results on paint taken from walls even if the lead-based paint had been coated several times, simulating conditions in many households.

Lu says that the detection range can be tuned to the exact threshold defined for lead in different materials like dust and water simply by using different DNA strands.

Duncan Graham at the University of Strathclyde, Glasgow, UK, an expert in nanoparticle sensor systems, says, 'this nanoparticle based approach offers advantages in terms of ease of use and performance. The design to generate a positive signal is highly innovative and the combination of nanoparticles and DNase is attractive for instrument-free quantitative analysis.'

'This technique makes bionanotechnology easy to use and applicable to everyday life,' concludes Lu. He adds that the team are interested in expanding on this technique to detect other metal ions and also bacterial viruses and other toxins in water.

Victoria Steven

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Link to journal article

Easy-to-use dipstick tests for detection of lead in paints using non-cross-linked gold nanoparticle-DNase conjugates

Debapriya Mazumdar, Juewen Liu, Geng Lu, Juanzuo Zhou and Yi Lu, *Chem. Commun.*, 2010, **46**, 1416

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