

Researchers create low-cost, effective method for measuring exposure to toxic metals

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A picture of the device

(Phys.org) -- Two Colorado State University professors have developed a simple, low-cost method of determining levels of heavy metals in contaminated air using filter paper, water and a little chemistry.

A device built by Chuck Henry, a chemistry professor, working in tandem with John Volckens, associate professor in Environmental and Radiological Health Sciences, takes only minutes to determine whether someone has been exposed to high levels of airborne metals.

A new paper on the research appears this month in the journal *Analytical*

Chemistry.

“We hope to be able to understand what tasks and/or locations in a particular job have the highest exposure,” Henry said. “Millions of U.S. workers are exposed to [heavy metals](#), and if we can identify these exposures in a cost-effective manner, then we should be able to help mitigate the problem and protect the health of our industrial workforce.”

How it works: The researchers first collect an air sample onto a filter and then, using a hole punch, remove a small portion of the sample for analysis. This sample is placed onto their new technology, called a Paper-based Analytical Device (PAD), which tells them how much of a certain heavy metal was present. The PAD is roughly the size of a quarter and made using wax printed onto filter paper. The wax is patterned into a “circuit” that directs the collected sample through a series of channels and into various “reaction zones.” Each reaction zone contains a tiny amount of chemical reagent that changes color when specific metals are present. These color changes are detectable to the naked eye and can be quantified using a digital camera or a simple desktop scanner.

“Although our PADs are about the size of a quarter, they actually cost less than a nickel each,” Volckens said. “They’re simple enough that we can collect samples in the field and analyze them on site in a matter of minutes. Other methods take weeks to process samples and cost hundreds of dollars per measurement.”

Initial studies in industrial areas have focused on copper, nickel and iron, which can be toxic when inhaled or ingested at high levels. Next up are tests with lead and cadmium, Henry said.

The scientists are working with the CSU Research Foundation to commercialize the invention.

Henry is co-founder and CEO of Advanced MicroLabs LLC, which was formed to commercialize a low-cost, rapid “lab-on-a-chip” invention with biomedical and environmental applications. To date, AML has raised more than \$3 million in grant funding and is currently working to bring an innovative on-line monitoring sensor to the market in the industrial cleanwater field.

Volckens’ research is aimed at understanding air pollution impacts on human and environmental health and at developing engineering-based solutions to air pollution problems in communities and workplaces worldwide.

Provided by Colorado State University

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