'Chemometer' offers easy way to test for dangerous pollutants

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Imagine being able to test air or water for the presence of toxic metals – and many other potentially dangerous pollutants – with a device as easy to use as a home pregnancy kit, and with on-the-spot results as simple to read as a United Way fund-raising thermometer. All for pennies on the dollar.

Four cents, to be exact.

John Volckens, Charles Henry and a team of fellow researchers imagined it. Then they built it.

The Colorado State University researchers have engineered a new paper-based analytical device unlike others in the burgeoning class: Similar to a thermometer, the device accurately quantifies a pollutant of interest by the distance red fluid travels up a tiny test channel. That means there's no need for additional instruments to calibrate results.

Start your engines, citizen scientists. Volckens thinks that, if his team can get the innovation to market, you'll be able to assess environmental health without the need for lengthy and expensive laboratory tests.

All with a little device called the "Chemometer."

"This is an empowering technology," said Volckens, an associate professor in the CSU Department of Environmental and Radiological Health Services. "It's a piece of paper that does complex chemistry for

you. It costs 200 times less than a laboratory test, the analysis takes 15 minutes at the site of interest, and to do the analysis you don't need more than your naked eye with minimal training."

The CSU team describes its invention in a paper recently published the journal Lab on a Chip, published by the Royal Society of Chemistry. They write that their innovation offers new capabilities.

"Paper-based analytical devices represent a growing class of elegant, yet inexpensive, chemical senor technologies designed for point-of-use applications," they write. "We describe here a simple technique to render PAD measurements more quantitative and straightforward using the distance of color development as a detection motif."

Collaborating with Volckens are Henry, professor in the Department of Chemistry; David Cate, a doctoral student in Biomedical Engineering; and Josephine Cunningham, an undergraduate student in Chemistry. Another collaborator is Wijitar Dungchai, of King Mongkut's University of Technology in Thailand, who developed the device's chemistry as a visiting scholar in Henry's laboratory.

Henry said the team's device will be especially useful in developing countries, where people could test for a range of widespread environmental pollutants on their own – and have the test data needed to call for action to improve safety.

"The shared knowledge this type of technology can bring could be game-changing," Henry said. "We can test for all kinds of metals, all kinds of chemicals, all kinds of biomarkers for personal healthcare. This could have far-reaching impacts."

The team hopes its paper-based analytical device can be commercialized through a new spinoff company, Access Sensor Technologies, LLC,

which Volckens and Henry co-founded this spring to help bring lab-on-a-chip innovations to market.

Think the new device sounds like a more sophisticated version of a home pregnancy test or litmus paper from science class? That's right, Volckens said. Those technologies are the forerunners of today's deceptively simple paper-based analytical devices.

"There's some pretty cool, nerdy chemistry going on in this little channel," he enthused. "All we have to do is change the reagents, and we can test for virtually anything."

Provided by Colorado State University