Glowing channels: Microanalysis system for rapid mercury detection

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(PhysOrg.com) -- Water contaminated with mercury is very dangerous for both people and the environment, as mercury is one of the most toxic heavy metals. Though laboratory analyses do deliver precise quantitative measurements, they require expensive equipment, take a long time, and cannot be carried out on-location.

Real-time measurements would be preferable for pollution events of short duration, such as the release of mercury by flooding of contaminated soils in sites such as former chemical plants or waste sites during heavy rains. In rivers, previously deposited contaminants can also be picked up and swept downstream during high-water events, which is assumed to have been the cause of the contamination in the Elbe River after the heavy flooding of 2002.

French scientists working with Gilles Marchand and Michel Vaultier have now developed a novel microsystem to carry out mercury analyses in real time. As the team reports in the journal *Angewandte Chemie*, their test selectively and reliably detects mercury down to a concentration of only 50 ppb (parts per billion).

For their test, the team of scientists from CEA-LETI-MINATEC in Grenoble and the Molecular Chemistry and Molecular Photonics Laboratory of the CNRS in Rennes combined microfluidic technology and a smart ionic liquid. Ionic liquids are salts that exist as melts at room temperature; they can be used like a normal organic solvent, but have the advantage of not being volatile. It is thus possible to use tiny volumes of

these liquids in the open channels of microfluidic systems without any evaporation problems.

The microfluidic analysis system consists of a chip with a tiny channel that is divided in half down its center by a perforated line of tiny columns. The water sample to be tested flows down one half of the channel; the ionic fluid flows down the other. Both liquids come into contact with each other, but the columns prevent them from flowing into each other.

The analytical system hinges on a tailored ionic liquid that simultaneously acts as an extraction agent and a detection reagent for mercury: its ions bind fast to the mercury ions like a pincer. This makes it easy to extract the mercury from the water sample. As soon as one of the solvent ions has bound to a mercury ion, it begins to fluoresce. The higher the mercury concentration, the brighter it glows.

More information: Gilles Marchand, Towards an Efficient Microsystem for the Real-Time Detection and Quantification of Mercury in Water Based on a Specifically Designed Fluorogenic Binary Task-Specific Ionic Liquid, *Angewandte Chemie International Edition* 2010, 49, No. 2, 424-427, dx.doi.org/10.1002/anie.200905037

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