TEAM SNIFFS OUT A WAY TO LOCATE MERCURY IN ANY CONDITION

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Researchers from the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru, have developed a unique DNA-based system for detecting mercury under any condition, a technology which they say can be adapted anywhere, from laboratories to point-of-care devices. It can be used to detect extremely low concentrations of mercury in any form, a significant development as very low mercury levels can be readily absorbed by the human body and accumulate in the brain, heart, kidneys and lungs owing to tight binding to proteins, which can cause fatal diseases, said the research team.

According to lead researcher Dr T Govindaraju, associate professor at JNCASR, mercury has been listed as one of the top six environmental hazards by the United Nations and although the use of mercury has been restricted in developed countries, it still finds rampant use in India, leading to the inflow of this toxic element into the country. Hence, he said, the need to develop this technology, which can facilitate reliable and ultra-sensitive detection of mercury ions for toxicology assessment, environmental protection and human health.

With the developed technology, they were able to detect 0.02 ppb (parts per billion) of ionic and organic mercury in water, which is 100-fold lower than the allowed levels (that is, 2 ppb) in drinking water. Besides water, the technology can be fabricated to make a portable device to detect mercury in vegetables, fruits and even fish, said the research team.

"Monitoring ultra-low concentration levels of toxic heavy metal ions in the ecosystem is crucial owing to their widespread adverse impacts on human health and the environment. Mercury is one of the most predominant heavy metals in the environment, with both natural (volcanic and oceanic emissions) and anthropogenic (major industrial sources, such as coal and gold mining and fossil fuel combustion) sources and exists in multiple forms. Contaminated natural bodies of water, drinking water, and parts of the food chain, particularly fish, are considered some of the major sources of mercury exposure for humans. Despite its high toxicity, mercury has been widely used for decades as a chemical additive and energy source in many industrial applications, including cosmetics, thermometers, batteries, agricultural chemicals, and fluorescent lamps. Hence, development of a selective and ultra-sensitive detection method to monitor different forms of mercury in situations that involve matters of public health is of paramount importance," said Dr Govindaraju and his team in their findings.

Explaining the technology, he said that his team has been working on the concept of "bio-inspired nano-architectonics", where they employ molecules as building blocks to derive nano-architectures, with novel function and properties.

"We have been working on the concept of 'bio-inspired nano-architectonics', a modular research platform, wherein we use biomolecules such as amino acids, peptides, proteins, nucleobases, nucleic acids, sugars, lipids etc, along with designed functional-organic molecules to exploit novel and unforeseen properties and numerous applications. In this work, in particular, we adapted our bio-inspired nano-architectonics approach or templated DNA nanotechnology. We employed single-stranded DNA sequences containing only thymine units, which led to high selectivity and sensitivity," Dr Govindaraju told Bangalore Mirror.

"We can make use of this mechanism in the DNA-based technology to analyse mercury in any waterbody. Since it can be adapted anywhere and is suitable for use in all conditions, a portable, mobile-type device can be easily fabricated," he said.

This work was funded by the "special nanotechnology taskforce" initiative of the Department of Biotechnology (DBT), and nano-based initiatives and facilities at JNCASR. The findings have been published in the journal, 'ACS Applied Materials & Interfaces'.

The research team further said that the technique can be modified at will to develop ultra-sensitive detection systems or devices for any kind of toxic analytes or pollutants and the group is already working on various such applications. “Our future work in the is area involve developing a portable device for toxic mercury and several other pollutants,” he said.

http://bangaloremirror.indiatimes.com/bangalore/others/Team-sniffs-out-a-way-to-locate-mercury-in-any-condition/articleshow/55300594.cms

http://pubs.acs.org/doi/abs/10.1021/acsami.6b10527

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