IIT-G develops state-of-the-art nanomaterial for mercury detection in cells and environment

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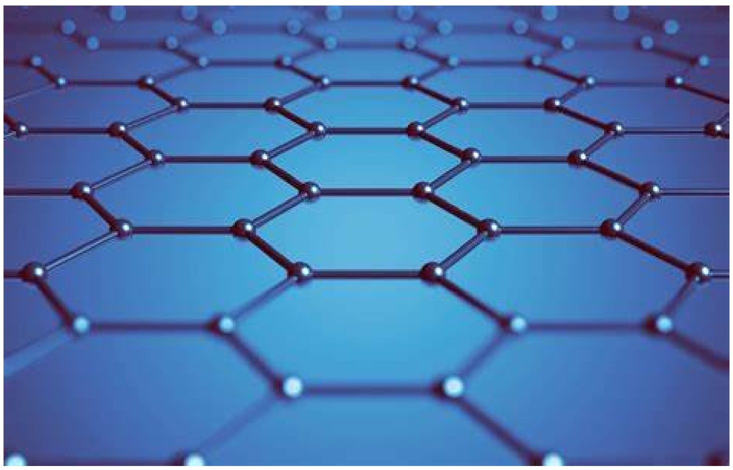
Mercury exposure through contaminated food, water, air, or skin contact can lead to serious health issues



A team of researchers at the Indian Institute of Technology Guwahati (IIT-G) has developed an innovative approach to detecting harmful metals in living cells and the environment.

Led by Prof. Saikat Bhaumik, Assistant Professor, Department of Physics,in collaboration with Prof. Chandan Goswami, Associate Professor, NISER Bhubaneswar, the team has introduced a cost-effective method for identifying toxic metals like mercury in human cells. This innovation could revolutionise disease diagnostics and environmental monitoring by improving the detection and management of metal toxicity in biological systems.

Central to this research are perovskite nanocrystals, cutting-edge materials known for their exceptional properties, making them ideal for detecting metal ions. These nanocrystals, about 100,000 times smaller than a human hair, interact with light in significant ways, enabling them to serve as fluorescent probes inside living cells. However, their quick degradation in water has previously limited their applications.

To address this, the researchers encapsulated the perovskite nanocrystals in silica and polymer coatings, significantly enhancing their stability and luminescent intensity in water. This modification ensures the nanocrystals maintain their functionality over extended periods, making them highly effective for practical use.

The enhanced nanocrystals emit a bright green light under specific wavelengths, enabling precise detection of mercury ions, which are hazardous even in minute concentrations. Mercury exposure, whether through contaminated food, water, inhalation, or skin contact, poses severe health risks, including nervous system damage, organ dysfunction, and cognitive impairments. The team's nanocrystals demonstrated remarkable sensitivity, detecting mercury levels as low as a few nanomolar concentrations. Moreover, when tested on live mammalian cells, the nanocrystals were found to be non-toxic, preserving cell function while effectively monitoring mercury ions.

The potential applications of this research extend beyond mercury detection. These nanocrystals could play a pivotal role in identifying other toxic metals in biological systems and could also be adapted for drug delivery, enabling real-time monitoring of treatment efficacy.