A Reusable Teabag for the Detection and Bioremediation of Arsenic From Drinking Water

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Arsenic contamination in groundwater is a global public health concern, with many areas across the globe exceeding the World Health Organization's maximum permissible limit of 10 µg/L. Health issues related to arsenic in groundwater impact over 230 million people globally, and arsenic is directly linked to cancer, heart disease, and developmental problems in children. There exists a need for new, cost-effective methods to detect and remove high-concentration arsenic in water. Currently, measurements of arsenic levels in water are most typically performed using expensive and complex machinery such as the ICPMS. I employed the dissociation reaction of sodium metarsenite (NaAsO2) to form {AsI3}, which can be easily observed optically by the yellow color formed after the reaction or UV-VIS spectrometry. Conventional methods to remove arsenic focus on wastewater treatment, and the few that focus on drinking water involve reverse osmosis, which only recovers 20-30% of water. I developed a reusable "teabag", a cost-effective and scalable way to effectively bioremediate arsenic from water at high concentrations (>1 mg/L). This teabag is produced through a novel process for the embedding of Bemliese teabags with iron oxide nanoparticles and is filled with 10 mg/L of mechanically ground uncharred eggshells, combined removing over 98% of arsenic from 100 mL of spiked solution at a high 35 mg/L concentration. Taken together, the combination of new methods for detection and removal provides scalable and cost-effective solutions to the global health challenges posed by arsenic contamination in drinking water.

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