Graphene Oxide: A Novel Material for Water Filtration

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Water pollution is a serious health and environmental issue which affects over 1/3 of the global population. In previous work, graphene oxide (GO) was synthesized and coated on sand. The versatility and feasibility of this medium in its use as a water filter was demonstrated. It was clear that a GO-coated sand medium is able to desalinate, demetalize (Pb removal), and decolor water. Adhesion of GO to sand proved to be an issue in the previous study as GO particles floating above the bed in the water were noticed during filtration. In this study, the problem of adhesion was addressed. A process to use Chitosan as a binding-layer between GO and sand to improve adhesion was shown to be effective. Filtration studies with a peristaltic pump ensured a consistent flow rate: an improvement over the gravity-driven experiments previously performed. Metal removal studies were expanded to include lead, mercury and arsenic. The efficiency in decontamination of lead was evident from batch adsorption studies as just one gram of GO was able to remove lead from 55 liters of water contaminated with levels of 90% of the homes in Flint, MI. Better adhesion of GO to sand (using chitosan) also translated in its improved ability to remove caramel colors from a Coca-Cola solution. A two-stage portable water filter was also developed: the first stage containing activated carbon and the second stage containing GO-coated sand. Combining the GO-coated sand with activated carbon makes for the effective filtration of organics, odor, taste, salts, metals, and color from water. This study takes a significant step in creating a more effective and versatile filtration system for removing water contaminants using a novel material, GO-coated sand, at the point of access.

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