Graphene Sand Synthesis and Applications in Water Filtration and Desalination

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Graphene is a one-atom-thick allotrope of carbon that has a hexagonal lattice structure, and it has good adsorption and conduction characteristics. Graphene sand is a composite of sand coated with a graphene layer. In this experimental study, graphene sand was synthesized from a sand and sugar mixture. Water filters that utilize charcoal use activation to increase the surface area of charcoal, and thus further increase the adsorption capabilities. If this activation step is applied to graphene sand, then a filter that is equally as efficient, but more cost-effective compared to charcoal filters could be obtained. The purpose of this experiment was to determine the optimal activation solution needed to increase the adsorption characteristics of graphene sand for water filtration and desalination. For filtration, the effectiveness of the graphene sand filter was analyzed by comparing the concentration of heavy metals in an initial prepared water solution to the concentration left in the water after it was filtered. For desalination, the graphene sand was packed around the electrodes and its efficiency at adsorbing sodium and calcium ions during electrodialysis was analyzed. For both applications, various samples of graphene sand generated from the different activation solutions were analyzed and evaluated using statistical methods. This experiment showed that the activation of graphene sand using chemicals is an unnecessary process. By eliminating the activation step, extra costs and hazardous chemicals can be eliminated. As an extension to this study, CAD prototype illustrations of a gravity-fed water filter and desalination plant are presented.

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