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Study of aqueous calcium ion adsorption competence by core-shell adsorbent granules engineered from sand/graphene oxide nanocomposite

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In water treatment, sand unit processes are frequently used to remove turbidity. In order to enhanced the performance of the sand, a surface modification was done using graphite oxide. The core-shell granules were fabricated using graphite oxide coated river sand. Graphite oxide was derived from high purity vein graphite in Sri Lanka. Repeated coating of graphite oxide on the sand followed by low temperature (110 °C) thermal pyrolysis yield hierarchical core-shell structure where several layers of graphite oxide covered the sand particulates. Mineralogical and physicochemical characterization of the novel adsorbent was carried out by Energy Dispersive X-Ray attached to Scanning Electron Microscopy (SEM-EDX), Fourier-Transform Infrared Spectrometry (FTIR), and X-ray Powder Diffraction (XRD). The operational parameters such as contact time, initial calcium ion concentration, adsorbent dose and initial pH of the solution were evaluated in batch procedures at room temperature (26±2 °C) using Five time GO/sand combination which observed as the most effective combination for calcium ion removal from hard water. Characterization studies reveal that uneven coatings of graphene oxide present on the surface of Nanocomposite is containing oxygen-based functional groups (C-O, C=O, O-H) in addition to C-C groups. Optimization studies showed that, the most effective dosage of the adsorbent is 5.0 g with initial calcium ion concentration 50 mg/L. It appears that there was no significant effect on the calcium ion removal over a wide range of pH 4-10 and the process began to reach equilibrium after 20 minutes. Finally, super sand granules show high partiality towards calcium ions and it will be important for the treatment of the hard water and the multiple coated GO/sand combination can be used to regulate excess water calcium and turbidity simultaneously.

Keywords: Graphene oxide, Hardness, Sand, Adsorption

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