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Investigation of fluoride adsorption capacity of characterized graphene oxide based super sand

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Sand is conventionally used in water treatment plants to control water turbidity. This research work was aimed for improving its performance using a chemical modification to remove other water contaminants as well. Thus improved substrate was designated as "Super Sand". Super sand has proven to be a better adsorbent for the removal of fluoride from water. Fluoride is an essential constituent for human health and toxicity of the fluoride depends on the concentration in the medium. The fluoride adsorption capacity of characterized super sand was determined. Graphene Oxide (GO) was synthesized using the modified Hummers method and then Graphene Oxide was coated with purified sand for the generation of super sand. Single Graphene Oxide coated super sand and multiple Graphene Oxide coated super sand were synthesized for the investigation of fluoride adsorption capacity. Graphene Oxide and super sand were characterized using Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectrometry (EDXAS), Fourier Transform Infrared Spectroscopy (FTIR) and X-Ray Diffraction (XRD) analysis and surface titration. Surface titration curve depicted that surface charge of super sand vary with pH value of the medium. Between pH 4 to 7 it has a total positive charge and above pH 7 it has a total negative charge. In order to determine the fluoride adsorption process, isotherm studies were done for both single coated and multiple coated super sand. According to the isotherm studies single coated super sand has the maximum fluoride adsorption capacity at 2 ppm fluoride concentration and multiple coated one has maximum fluoride adsorption capacity at 3 ppm fluoride concentration. Further optimization studies were also performed and finally it was proved that fluoride adsorption by the super sand follows the Freundlich isotherm model. Further, FTIR analysis of super sand and fluoride adsorbed super sand depicted that adsorption process is a physisorption process. Hence, it can be concluded that surface modified super sand is suitable for the fluoride removal from the fluoride contaminated drinking water.

Key words- Fluoride, Super sand, Adsorption isotherms