

Removal of Excess Phosphate Ions in Water using 1-D Magnesium Oxide Nanowires

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In the recent few decades, the rate of phosphorous cycling has been increased because of rapid development in agriculture and industries causing more wastewater generation. When untreated wastewater containing phosphate is discharge into water bodies such as lakes and, tanks it can cause eutrophication, which leads to harmful effects on the ecosystem and human health. Hence, phosphate removal is important in the control of eutrophication. Adsorption is one of the effective and economical methods for the removal of phosphates. This study focuses on a simple, low-cost and a novel approach towards the removal of excess phosphate ions from aqueous solution by adsorbing on to one dimensional (1D) Magnesium Oxide Nanowires (MONWs). The nanowires were synthesized via hydrothermal method using urea and magnesium acetate at 180 °C for 2 h. The synthesized MONWs were characterized using X-ray diffraction, Fourier transform infrared spectroscopy, particle size analyzer and scanning electron microscopy. Additionally, the phosphate removal efficiency was studied using ion chromatography technique. The optimum removal percentage (99.5%) was obtained with 50 ml of 3 mg L⁻¹ phosphate solution and 0.075 g of synthesized MONWs. Phosphate adsorption is found to be less sensitive to the pH variations. Moreover, adsorption data were fitted with Freundlich isotherm with an R² value of 0.952. Adsorption kinetic data were fitted to the pseudo second-order model and yield an R² value of 0.995 suggesting that the adsorption process is chemisorption. Furthermore, phosphate removal efficiency influenced by the presence of competitor ions. This study found that MONWs have a potential application for wastewater treatment.

Keywords: Adsorption, Magnesium oxide nanowires, Phosphate, Removal