Preparation and adsorption of phosphorus by new heteropolyacid salt–lanthanum oxide composites

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ABSTRACT

In this article, we reported a new method in which molybdenum heteropolyacid salt was selected to mix with lanthanum oxide and bentonite, respectively, and the dipping method was used to prepare the new composites of heteropolyacid salt–lanthanum oxide, heteropolyacid salt–bentonite, and heteropolyacid salt–lanthanum oxide–bentonite. We observed that the composites have a better removal effect for phosphorus by control of the ratio and calcination temperature. The effect of quantity, adsorption time, phosphorus wastewater concentration, and pH value of composites on phosphorus adsorption was studied. We also found that the removal rate of phosphorus by the composite of heteropolyacid salt–lanthanum oxides increases up to 99.1% under the condition of 1:1 mass ratio and 500°C of calcination temperature. IR and XRD studies suggest that molybdenum heteropolyacid salt has been loaded to lanthanum oxide carrier successfully and heteropolyacid salt keeps the original Keggin structure. Heteropolyacid salt–lanthanum oxide has a good adsorption effect on phosphorus under the condition of 0.15 g of the composite, 90 min of adsorption time, phosphorus concentration of 50 mg L−1, and pH value of 3. The adsorption of phosphorus corresponds with the Langmuir isotherm model and Lagergren first-order kinetics equation. Therefore, the composite has excellent absorption ability and was competent in removing phosphorus with a low concentration from aqueous solution. It could be a great potential adsorbent for the removal of phosphorus in lakes, rivers, and reservoirs.

Keywords: Lanthanum oxide; Heteropolyacid salt; Phosphorus; Adsorption

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