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Insight into phosphate adsorption on lanthanum hydroxide nanoparticle: influence of lanthanum/hydroxide molar ratio, performance, and mechanism study

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ABSTRACT

In this study, lanthanum hydroxide adsorbent was synthesized through a simple hydrothermal method and applied for removing phosphate from water. The optimal adsorbent was obtained at the La/OH molar ratio of 4:1. The adsorbent showed rapid adsorption of phosphate within the first 4 h in which approximately 84% of the equilibrium adsorption capacity can be achieved. The phosphate uptake was highly dependent on solution pH. The better fit of the Langmuir isotherm model to experimental data indicated that the monolayer adsorption occurred and the maximum adsorption capacity of 193.9 mg/g was accomplished at pH 7.0. The presence of fluoride could significantly retard the uptake of phosphate. X-ray photoelectron spectroscopy analysis indicated that hydroxyl groups on the adsorbent surface played the most key role in the adsorption. The phosphate ions were adsorbed on the adsorbent through the formation of inner-sphere complexes.

Keywords: Adsorption; Phosphate; Eutrophication; Lanthanum hydroxide nanoparticle; Hydrothermal synthesis

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