Synthesis and characterization of YVO₄:Eu³⁺ nanoparticles: kinetics and isotherm studies for the removal of Cd²⁺ metal ion

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ABSTRACT

The prepared YVO₄:Eu³⁺ nanoparticle was successfully used for the removal of highly toxic Cd²⁺ metal ion. Batch experiments were performed as a function of various experimental parameters such as effect of pH (2–8), contact time (5–120 min), initial Cd²⁺ concentration (25–200 mg L⁻¹), and temperature (25–40°C). The equilibrium was established within 90 min where 82% Cd²⁺ was adsorbed using YVO₄:Eu³⁺ nanoparticles. Kinetic studies showed better applicability for pseudo-second-order model. Langmuir and Freundlich isotherm models were employed for fitting the equilibrium data, and it was found that the Langmuir model fitted the data better than the Freundlich model.

Keywords: YVO₄:Eu³⁺ nanoparticles; Adsorption; Toxic metal; Langmuir adsorption isotherm