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Removal of excess toxic mercury(II) and arsenic(III) from wastewater by fish scales waste materials

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In this work, fish scales waste remains (FSWR) was employed as an ecofriendly and readily available cheap adsorbent for the removal of toxic mercury(II) and arsenic(III) ions from wastewater. The research focused on the adsorption ability of FSWR as a cost-effective technology for treatment of mercury(II) and arsenic(III) contaminated industrial wastewater. A FSWR sorbent was prepared and its morphology evaluated. The sorbent had a round shape and rough surface with a particle size of ≤63 μm. Batch adsorption experiment was conducted to examine the effects of FSWR dosage, pH, initial concentration of metal ions and contact time on adsorption of Hg(II) and As(III) from the wastewater. The obtained results showed that, the adsorption of the selected metal ions was FSWR dosage, pH, initial concentration of metal ions and contact time dependent. The optimum FSWR dosage, initial concentration, contact time and pH for adsorption of Hg(II), were found to be at 76.99 mg/L, 22.63 mg/L, 74.48 min and 7.29, respectively, while the optimum FSWR dosage, initial concentration, contact time and pH for adsorption of As(III) were found to be 78.82 mg/L, 23.85 mg/L, 63.89 mg/L and 7.78 mg/L, respectively. Kinetic studies showed that pseudo-second-order reaction model best described the adsorption process. Using Langmuir isotherm model, the equilibrium data yielded the following ultimate capacity values for the FSWR: On a per gram basis of FSWR: 35.83 mg/g and 33.93 mg/g for As(III) and Hg(II), respectively. The thermodynamic study shows that the adsorption of the ions was endothermic in nature. The negative values of ΔG reveal the feasibility and spontaneous nature of the process. The study showed that FSWR can be efficiently used as low cost alternative for removal of metal ions.

Biography

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