

Novel CoCdFe₂O₄/Chitosan–PANi ternary nanocomposite for High-Efficiency Lead Removal

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Kolekcja

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Streszczenie

Heavy metal pollution, particularly lead (Pb^{2+}), poses a significant threat to the environment and human health. In this study, it was synthesized and analyzed a unique nanocomposite by preparing cadmium-cobalt in specific ratios with ferrite nanoparticles on a polymer. This resulted in the nanocomposite ($Co_{0.2}Cd_{0.8}Fe_2O_4/PANi-g-Chitosan$), which was used to remove lead ions efficiently. The nanocomposite consists of cobalt and cadmium ferrite nanoparticles with a chitosan and polyaniline polymer matrix, which was synthesized chemically. This novel nanocomposite exhibits exceptional removal efficiency, demonstrating remarkable performance. The properties of the nanocomposite were investigated using X-ray diffraction (XRD), scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), and UV–Vis spectroscopy. These tests confirmed the successful fabrication and structural integrity of the nanocomposite. The nanocomposite exhibited high adsorption and purification efficiency, achieving 97.8 % removal of lead ions at pH 5. The adsorption behavior was investigated by studying the reaction kinetics (using a pseudo-second-order reaction model) and analyzing the adsorption curve, providing valuable insights into the reaction mechanisms. Notably, the Taguchi method was employed to optimize the adsorption parameters. This analysis revealed that adsorption time and pH value are significant factors. The optimal conditions were: contact time of 90 min, a pH of 5, and a shaking speed of 200 rpm, based on Taguchi results. The removal of lead ions using this nanocomposite revealed great potential as an effective nanocomposite for purifying water.

Słowa kluczowe

adsorption, Nanocomposite, lead ions, ferrite-PANi, Water treatment

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